

# EUTRA/LTE

## Digital Standard for

# R&S<sup>®</sup>Signal Generators

# Operating Manual



1171.5177.12 – 13

This document describes the following software options:

- R&S®AMU-K55/-K255/-K69/-K81  
1402.9405.02, 1402.9457.02, 1403.0501.02, 1403.0553.02
- R&S®SMATE-K55/-K69/-K81  
1404.7851.02, 1403.0501.02, 1404.8612.02
- R&S®SMBV-K55/-K255  
1407.9203.xx, 1415.8360.xx
- R&S®SMJ-K55/-K255/-K69/-K81  
1409.2206.02, 1409.2258.02, 1403.0501.02, 1409.3054.02
- R&S®SMU-K55/-K255/-K69/-K81  
1408.7310.02, 1408.7362.02, 1403.0501.02, 1408.8169.02
- R&S®AFQ-K255  
1401.5906.02
- R&S®SFU-K255  
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© 2010 Rohde & Schwarz GmbH & Co. KG

Muehldorfstr. 15, 81671 Munich, Germany

Phone: +49 89 41 29 - 0

Fax: +49 89 41 29 12 164

E-mail: [info@rohde-schwarz.com](mailto:info@rohde-schwarz.com)

Internet: <http://www.rohde-schwarz.com>

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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.

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

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

### Operating states and operating positions

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

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



### Electrical safety

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

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

## Basic Safety Instructions

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

### Operation

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

### Repair and service

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

### Batteries and rechargeable batteries/cells

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

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

### Transport

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

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

### **Waste disposal**

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

## Informaciones elementales de seguridad

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

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







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







## Informaciones elementales de seguridad

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

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

### Símbolos y definiciones de seguridad

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

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

## Palabras de señal y su significado

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



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



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



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



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

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

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

## Estados operativos y posiciones de funcionamiento

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

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

## Seguridad eléctrica

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

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

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

## Funcionamiento

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



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

### **Reparación y mantenimiento**

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

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

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

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

## Informaciones elementales de seguridad

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

### Transporte

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

### Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (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.

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# 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 ordered 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.
<i>Input</i>	Input to be entered by the user is displayed in italics.
<a href="#">Links</a>	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

## 2 Preamble

All supported features are in line with 3GPP Release 8 (April 2010), i.e. the following official 3GPP specifications are implemented:

- 3GPP TS 36.211, Version 8.9.0
- 3GPP TS 36.212, Version 8.8.0
- 3GPP TS 36.213, Version 8.8.0

## 3 Introduction

Currently, UMTS networks worldwide are being upgraded to high speed downlink packet access (HSDPA) in order to increase data rate and capacity for downlink packet data. In the next step, high speed uplink packet access (HSUPA) will boost uplink performance in UMTS networks. While HSDPA was introduced as a 3GPP Release 5 feature, HSUPA is an important feature of 3GPP Release 6. The combination of HSDPA and HSUPA is often referred to as HSPA.

However, even with the introduction of HSPA, the evolution of UMTS has not reached its end. HSPA+ will bring significant enhancements in 3GPP Release 7. The objective is to enhance the performance of HSPA-based radio networks in terms of spectrum efficiency, peak data rate and latency, and to exploit the full potential of WCDMA based 5 MHz operation. Important features of HSPA+ are downlink multiple input multiple output (MIMO), higher order modulation for uplink and downlink, improvements of layer 2 protocols, and continuous packet connectivity.

In order to ensure the competitiveness of UMTS for the next 10 years and beyond, concepts for UMTS long term evolution (LTE) have been investigated. The objective is a high-data-rate, low-latency and packet-optimized radio access technology. Therefore, a study item was launched in 3GPP Release 7 on evolved UMTS terrestrial radio access (EUTRA) and evolved UMTS terrestrial radio access network (EUTRAN). LTE/EUTRA will then form part of 3GPP Release 8 core specifications.

This introduction focuses on LTE/EUTRA technology. In the following, the terms LTE or EUTRA are used interchangeably.

requirements, e.g. targets for data rate, capacity, spectrum efficiency, and latency. Also commercial aspects such as costs for installing and operating the network were considered. Based on these requirements, technical concepts for the air interface transmission schemes and protocols were studied. Notably, LTE uses new multiple access schemes on the air interface: orthogonal frequency division multiple access (OFDMA) in downlink and single carrier frequency division multiple access (SC-FDMA) in uplink. Furthermore, MIMO antenna schemes form an essential part of LTE. In an attempt to simplify protocol architecture, LTE brings some major changes to the existing UMTS protocol concepts. Impact on the overall network architecture including the core network is being investigated in the context of 3GPP system architecture evolution (SAE).

### 3.1 Requirements for UMTS Long-Term Evolution

LTE is focusing on optimum support of packet switched (PS) services. Main requirements for the design of an LTE system are documented in 3GPP TR 25.913 [1] and can be summarized as follows:

- **Data Rate:** Peak data rates target 100 Mbps (downlink) and 50 Mbps (uplink) for 20 MHz spectrum allocation, assuming two receive antennas and one transmit antenna are at the terminal.

- **Throughput:** The target for downlink average user throughput per MHz is three to four times better than Release 6. The target for uplink average user throughput per MHz is two to three times better than Release 6.
- **Spectrum efficiency:** The downlink target is three to four times better than Release 6. The uplink target is two to three times better than Release 6.
- **Latency:** The one-way transit time between a packet being available at the IP layer in either the UE or radio access network and the availability of this packet at IP layer in the radio access network/UE shall be less than 5 ms. Also C-plane latency shall be reduced, e.g. to allow fast transition times of less than 100 ms from camped state to active state.
- **Bandwidth:** Scaleable bandwidths of 5 MHz, 10 MHz, 15 MHz, and 20 MHz shall be supported. Also bandwidths smaller than 5 MHz shall be supported for more flexibility.
- **Interworking:** Interworking with existing UTRAN/GERAN systems and non-3GPP systems shall be ensured. Multimode terminals shall support handover to and from UTRAN and GERAN as well as inter-RAT measurements. Interruption time for hand-over between EUTRAN and UTRAN/GERAN shall be less than 300 ms for realtime services and less than 500 ms for non-realtime services.
- **Multimedia broadcast multicast services (MBMS):** MBMS shall be further enhanced and is then referred to as E-MBMS.
- **Costs:** Reduced CAPEX and OPEX including backhaul shall be achieved. Cost-effective migration from Release 6 UTRA radio interface and architecture shall be possible. Reasonable system and terminal complexity, cost, and power consumption shall be ensured. All the interfaces specified shall be open for multivendor equipment interoperability.
- **Mobility:** The system should be optimized for low mobile speed (0 to 15 km/h), but higher mobile speeds shall be supported as well, including high speed train environment as a special case.
- **Spectrum allocation:** Operation in paired (frequency division duplex / FDD mode) and unpaired spectrum (time division duplex / TDD mode) is possible.
- **Co-existence:** Co-existence in the same geographical area and co-location with GERAN/UTRAN shall be ensured. Also, co-existence between operators in adjacent bands as well as cross-border co-existence is a requirement.
- **Quality of Service:** End-to-end quality of service (QoS) shall be supported. VoIP should be supported with at least as good radio and backhaul efficiency and latency as voice traffic over the UMTS circuit switched networks.
- **Network synchronization:** Time synchronization of different network sites shall not be mandated.

## 3.2 Long-Term Evolution Downlink Transmission Scheme

The downlink transmission scheme for E-UTRA FDD and TDD modes is based on conventional OFDM. In an OFDM system, the available spectrum is divided into multiple carriers, called subcarriers, which are orthogonal to each other. Each of these subcarriers is independently modulated by a low rate data stream.

OFDM is used as well in WLAN, WIMAX and broadcast technologies like DVB. OFDM has several benefits including its robustness against multipath fading and its efficient receiver architecture.

The following figure 3-1 shows a representation of an OFDM signal (3GPP TR 25.892 [2]). In this figure, a signal with 5 MHz bandwidth is shown, but the principle is of course the same for the other E-UTRA bandwidths. Data symbols are independently modulated and transmitted over a high number of closely spaced orthogonal subcarriers. In E-UTRA, downlink modulation schemes QPSK, 16QAM, and 64QAM are available.

In the time domain, a guard interval may be added to each symbol to combat inter-OFDM-symbol-interference due to channel delay spread. In E-UTRA, the guard interval is a cyclic prefix which is inserted prior to each OFDM symbol.

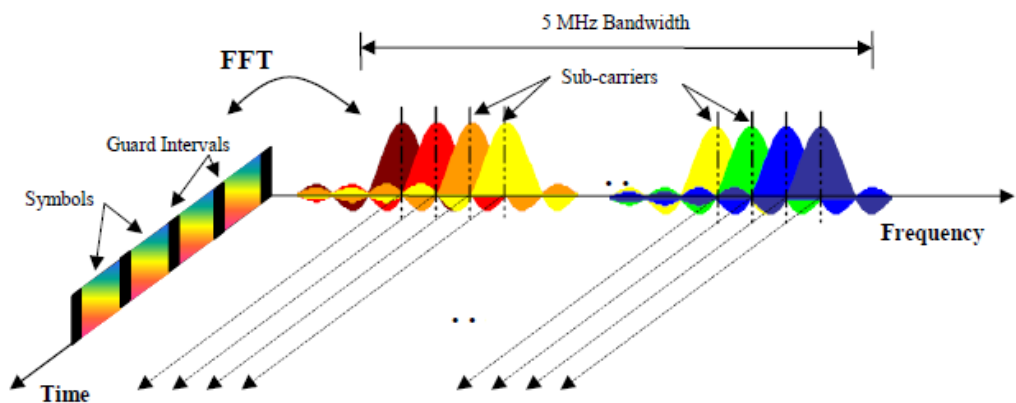


Fig. 3-1: Frequency-Time Representation of an OFDM Signal (3GPP TR 25.892 [2])

In practice, the OFDM signal can be generated using the inverse fast Fourier transform (IFFT) digital signal processing, as described in 3GPP TS 25.892, Feasibility Study for Orthogonal Frequency Division Multiplexing (OFDM) for UTRAN enhancement (Release 6). The IFFT converts a number N of complex data symbols used as frequency domain bins into the time domain signal. Such an N-point IFFT is illustrated in figure 3-2, where  $a(mN+n)$  refers to the  $n^{\text{th}}$  subchannel modulated data symbol, during the time period  $mT_u < t \leq (m+1)T_u$ .

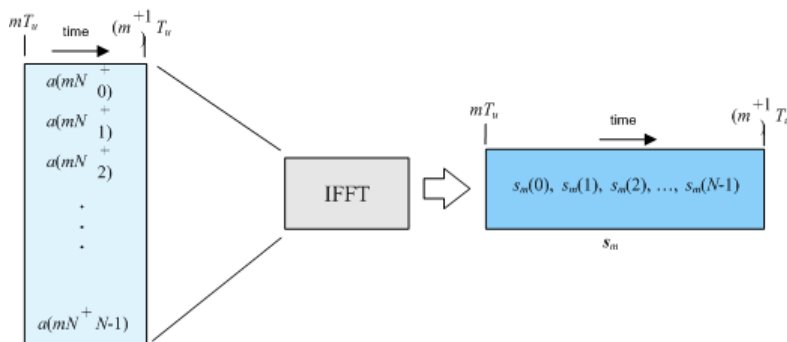


Fig. 3-2: OFDM useful symbol generation using an IFFT (3GPP TR 25.892 [2])

The vector  $s_m$  is defined as the useful OFDM symbol. It is the time superposition of the N narrowband modulated subcarriers. Therefore, from a parallel stream of N sources of data, each one independently modulated, a waveform composed of N orthogonal sub-



carriers is obtained, with each subcarrier having the shape of a frequency sinc function (see figure 3-1).

The figure 3-3 illustrates the mapping from a serial stream of QAM symbols to  $N$  parallel streams, used as frequency domain bins for the IFFT. The  $N$ -point time domain blocks obtained from the IFFT are then serialized to create a time domain signal. Not shown in the figure is the process of cyclic prefix insertion.

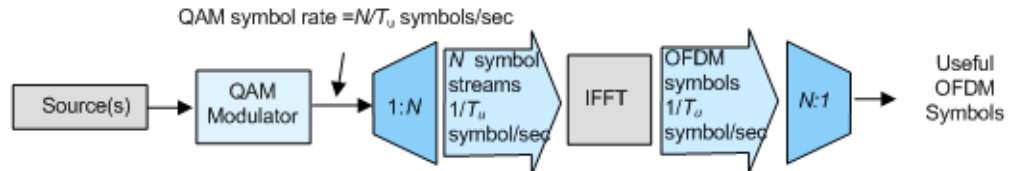


Fig. 3-3: OFDM Signal Generation Chain (3GPP TR 25.892 [2])

In contrast to an OFDM transmission scheme, OFDMA allows the access of multiple users on the available bandwidth. Each user is assigned a specific time-frequency resource. As a fundamental principle of E-UTRA, the data channels are shared channels, i.e. for each transmission time interval of 1 ms, a new scheduling decision is taken regarding which users are assigned to which time/frequency resources during this transmission time interval.

### 3.2.1 OFDMA Parameterization

Two radio frame structures, one for FDD (frame structure type 1) and one for TDD (frame structure type 2) mode are defined. These EUTRA frame structures are described in 3GPP TS 36.211 [3].

#### 3.2.1.1 Frame structure type 1 (FDD)

The FDD frame structures type 1 is based on a 10 ms radio frame that is divided into 20 equally sized slots of 0.5 ms. A subframe consists of two consecutive slots, so one radio frame contains 10 subframes.

The figure below illustrates frame structure type 1 ( $T_s$  is expressing the basic time unit corresponding to 30.72 MHz). Frame format 1 is applicable to both full and half duplex FDD.

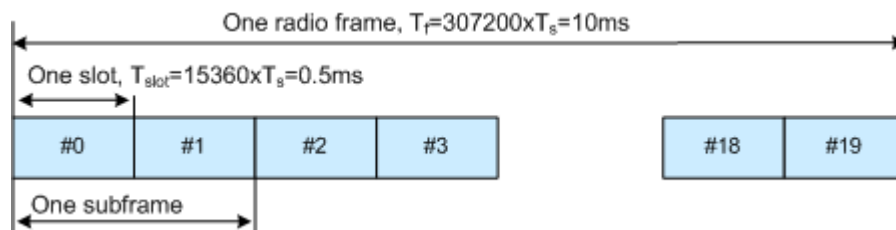


Fig. 3-4: Frame format 1 (FDD mode)

3.2.1.2 Frame structure type 2 (TDD)

The TDD frame format 2 is also based on a 10 ms radio frame, but the frame is divided into two half-frames, 5 ms each. Each half-frame consists of five 1 ms long subframes, which are reserved either for downlink or uplink transmission or are carrying special information (see figure below).

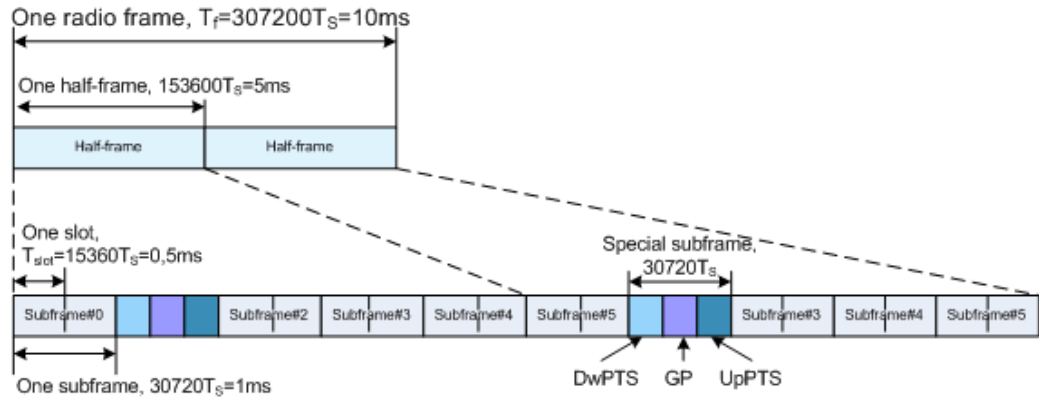


Fig. 3-5: Frame format 2 (TDD mode), 5 ms switching periodicity

All non-special subframes are divided into two 0.5 ms long slots. The special subframes consist of three fields DwPTS (Downlink Pilot Timeslot), GP (Guard Period) and UpPTS (Uplink Pilot Timeslot) which length can vary in specified limits so that the total special subframe's length is maintained constant (1 ms). The 3GPP specification defines nine special subframe configurations per cyclic prefix type that specified the allowed DwPTS/ GP/UpPTS lengths' combinations.

The 3GPP specification defines seven different uplink-downlink configurations, i.e. defines the downlink-to-uplink switch-point periodicity (5 ms or 10 ms) and the allowed combination of downlink, uplink and special slots. In all the uplink-downlink configurations and for any downlink-to-uplink switch-point periodicity, subframe 0, subframe 5 and DwPTS are always reserved for downlink transmission and UpPTS and the subframe following the special subframe are always reserved for uplink transmission.

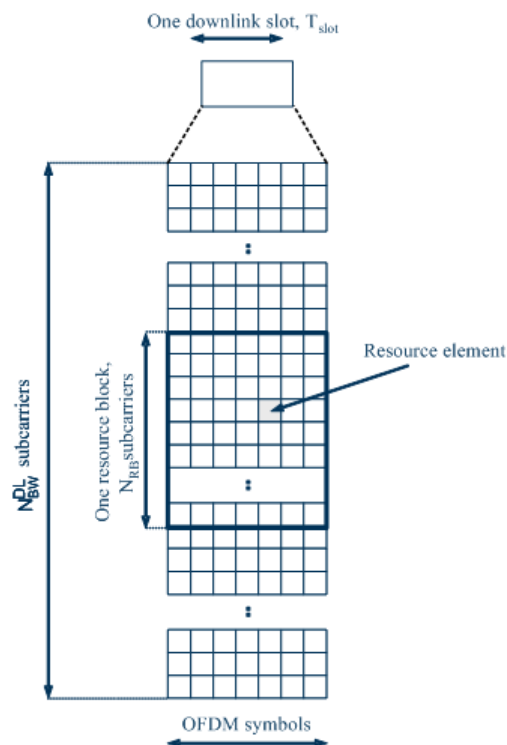
The table below shows the supported uplink-downlink configurations according to TS 36.211 [3], where "D" denotes a subframe reserved for downlink transmission, "U" denotes a subframe reserved for uplink transmission, and "S" denotes the special subframe.

UL/DL Configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

Fig. 3-6: Uplink-downlink configurations

### 3.2.2 Downlink Resource Grid

The [figure 3-7](#) shows the structure of the downlink resource grid for the duration of one downlink slot. The available downlink bandwidth consists of  $N_{\text{BW}}^{\text{DL}}$  subcarriers with a spacing of  $\Delta f = 15$  kHz. In the case of multi-cell MBMS transmission, a subcarrier spacing of  $\Delta f = 7.5$  kHz is also possible.  $N_{\text{BW}}^{\text{DL}}$  can vary in order to allow for scalable bandwidth operation up to 20 MHz. Initially, the bandwidths for LTE were explicitly defined within layer 1 specifications. Later on a bandwidth agnostic layer 1 was introduced, with  $N_{\text{BW}}^{\text{DL}}$  for the different bandwidths to be specified by 3GPP RAN4 to meet performance requirements, e.g. for out-of-band emission requirements and regulatory emission limits.



**Fig. 3-7: Downlink Resource Grid (3GPP TS 36.211 [3])**

One downlink slot consists of  $N_{\text{symbol}}^{\text{DL}}$  OFDM symbols. To each symbol, a cyclic prefix (CP) is appended as guard time, compare [figure 3-1](#).  $N_{\text{symbol}}^{\text{DL}}$  depends on the cyclic prefix length. The generic frame structure with normal cyclic prefix length contains  $N_{\text{symbol}}^{\text{DL}} = 7$  symbols. This translates into a cyclic prefix length of  $T_{\text{CP}} \approx 5.2 \mu\text{s}$  for the first symbol and  $T_{\text{CP}} \approx 4.7 \mu\text{s}$  for the remaining 6 symbols. Additionally, an extended cyclic prefix is defined in order to cover large cell scenarios with higher delay spread and MBMS transmission. The generic frame structure with extended cyclic prefix of  $T_{\text{CP-E}} \approx 16.7 \mu\text{s}$  contains  $N_{\text{symbol}}^{\text{DL}} = 6$  OFDM symbols (subcarrier spacing 15 kHz). The generic frame structure with extended cyclic prefix of  $T_{\text{CP-E}} \approx 33.3 \mu\text{s}$  contains  $N_{\text{symbol}}^{\text{DL}} = 3$  symbols (subcarrier spacing 7.5 kHz). The [table 3-1](#) gives an overview of the different parameters for the generic frame structure.

**Table 3-1: Parameters for Downlink Generic Frame Structure**

Configuration	Number of symbols $N_{\text{syml}}^{\text{UL}}$	Cyclic Prefix length, samples	Cyclic Prefix length, us
Normal cyclic prefix $\Delta f=15$ kHz	7	160 for first symbol 144 for other symbols	5.2 us for first symbol 4.7 us for other symbols
Extended cyclic prefix $\Delta f=15$ kHz	6	512	16.7 us
Extended cyclic prefix $\Delta f=7.5$ kHz	3	1024	33.3 us

### 3.2.3 Downlink Data Transmission

Data is allocated to the UEs in terms of resource blocks. A physical resource block consists of 12 (24) consecutive subcarriers in the frequency domain for the  $\Delta f=15$  kHz ( $\Delta f=7.5$  kHz) case. In the time domain, a physical resource block consists of DL  $N_{\text{syml}}$  consecutive OFDM symbols, see [figure 3-7](#).  $N_{\text{syml}}^{\text{DL}}$  is equal to the number of OFDM symbols in a slot. The resource block size is the same for all bandwidths, therefore the number of available physical resource blocks depends on the bandwidth. Depending on the required data rate, each UE can be assigned one or more resource blocks in each transmission time interval of 1 ms. The scheduling decision is done in the base station (eNodeB). The user data is carried on the physical downlink shared channel (PDSCH).

### 3.2.4 Downlink Control Information Transmission

Control Information is mapped to the resource elements in terms of resource elements groups (REG). A REG consists of four consequent resource elements within one resource block which are not used for cell-specific reference signals. Thus, there are two types of resource blocks, resource blocks containing three REGs and resource blocks containing only two REGs.

Two REGs are available within the OFDM symbols with allocated reference signals, i.e. the OFDM symbol 0 in the first slot in a subframe, as well as in the OFDM symbol 1 in case of four-antenna system. Three REGs are then available in the OFDM symbols 2, as well as in the OFDM symbol 1 in case of one- or two-antenna system (see [figure 3-8](#) and [figure 3-9](#)).

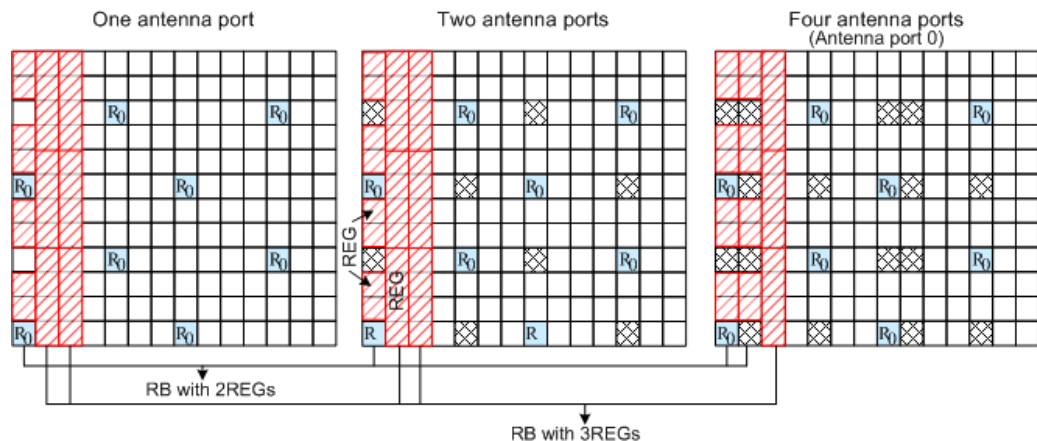


Fig. 3-8: Resource elements groups (REG)

Three physical DL channels are carrying the control information: the Physical Control Format Indicator Channel (PCFICH), the Physical Hybrid ARQ Indicator Channel (PHICH) and the Physical Downlink Control Channel (PDCCH).

- The **PCFICH** carries the information about the number of OFDM Symbols used for transmission of PDCCH in a subframe and is mapped to four REGs within the first OFDM Symbol.
- The **PHICH** carries the HARQ ACK/NACK messages and is transmitted in terms of PHICH groups. A PHICH group uses three REGs. For normal CP, a PHICH group consists of up to eight ACK/NACK messages. Four ACK/NACK messages are carried by one PHICH group if an extended CP is used.  
For frame format 1 and non-MBSFN transmission, the PHICH can be transmitted over only the first OFDM symbol (this is the so called normal PHICH duration) or in case of extended PHICH duration, over the first three OFDM symbols.
- Downlink control signaling on the Physical Downlink Control Channel (**PDCCH**) is used to convey the scheduling decisions to individual UEs. The PDCCH is located in the first OFDM symbols of a slot.  
The maximum number of OFDM symbols used for the transmission of a PDCCH is determined by the number of RB used, i.e. for channel bandwidth with less than or equal to 10 RBs, four OFDM symbols are necessary (OFDM symbol 0...3) and respectively for channel bandwidths greater than 10 RBs three OFDM symbols are sufficient (OFDM symbol 0...2).  
The minimum number of OFDM symbols used for the transmission of a PDCCH is determined by the PHICH duration and the channel bandwidth.  
The PDCCH is mapped to the REGs not used for PHICH and PCFICH and transmitted on one or several control channel elements (CCEs), where a CCE corresponds to 9 REGs.

### 3.2.5 Downlink Reference Signal Structure and Cell Search

The downlink reference signal structure is important for cell search, channel estimation and neighbor cell monitoring.

For the LTE downlink, three types of reference signals are defined:

- **Cell-specific downlink reference signals**  
The cell-specific reference signal are common signals in a cell, that are intended for all UE within this cell.
- **UE-specific reference signal**  
These reference signals are intended for a specific user and mapped to predefined PDSCH RBs of this particular user. The resource elements predefined for the UE-specific RS do not overlap with the resource elements reserved for the cell-specific reference signals.  
The UE-specific RS are intended to be used for channel estimation and demodulation instead of the common reference signals. One typical example of the application of UE-specific RS is the channel estimation and demodulation in case of beamforming transmission, also called transmission using antenna port 5.  
In contrary to the common RS that are not precoded, the UE-specific RS are precoded in the same way as the PDSCH they are mapped to.
- **MBSFN reference signals**  
These reference signals are used for channel estimation and demodulation of signals transmitted by means of MBSFN.

### 3.2.5.1 Cell-specific downlink reference signals

The [figure 3-9](#) shows the principle of the downlink reference signal structure for one-antenna, two-antenna, and four-antenna transmission. Specific predefined resource elements in the time-frequency domain carry the reference signal sequence. Besides first reference symbols, there may be a need for second reference symbols. The different colors in the figure represent the sequences transmitted from up to four transmit antennas.

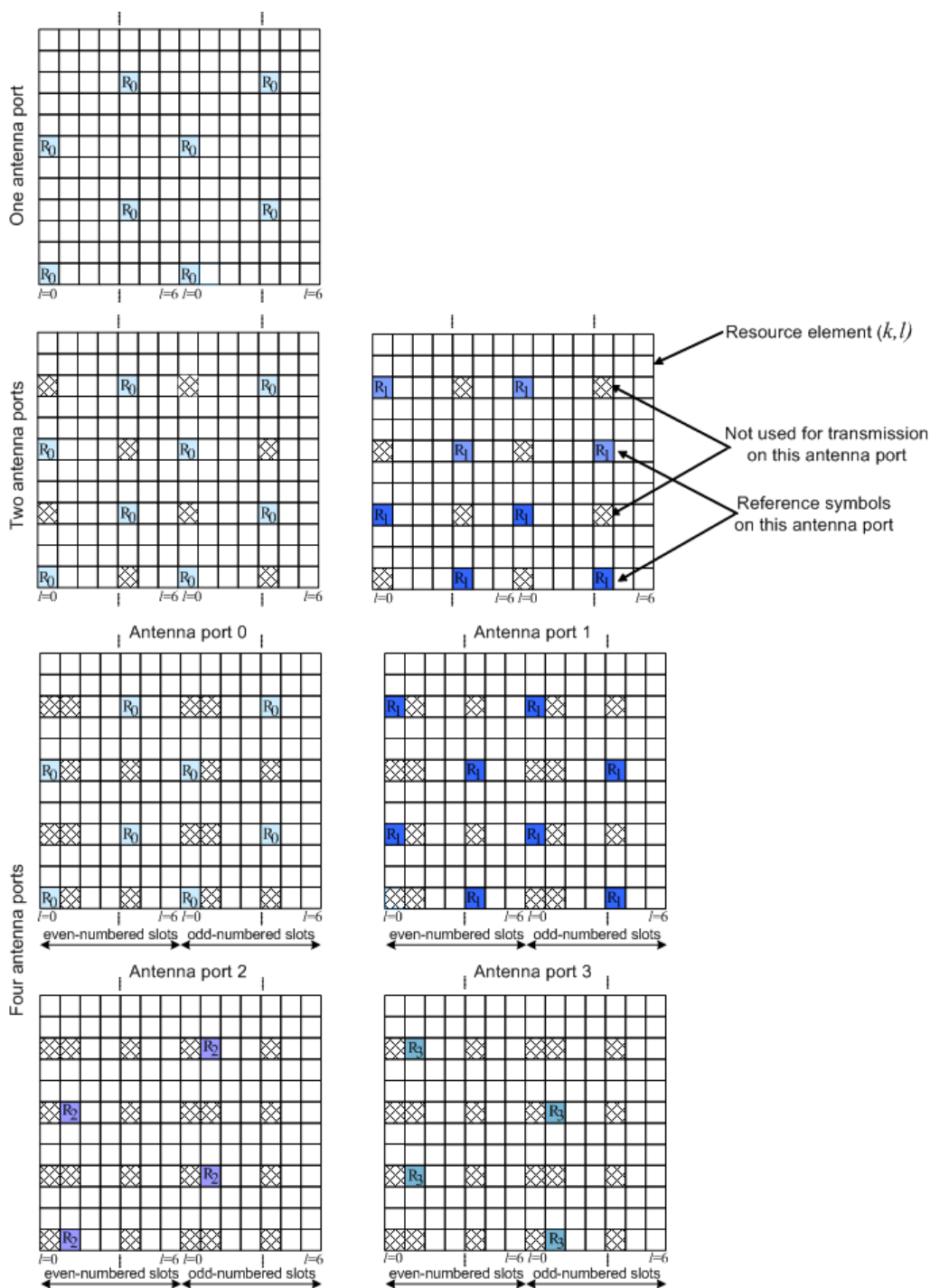


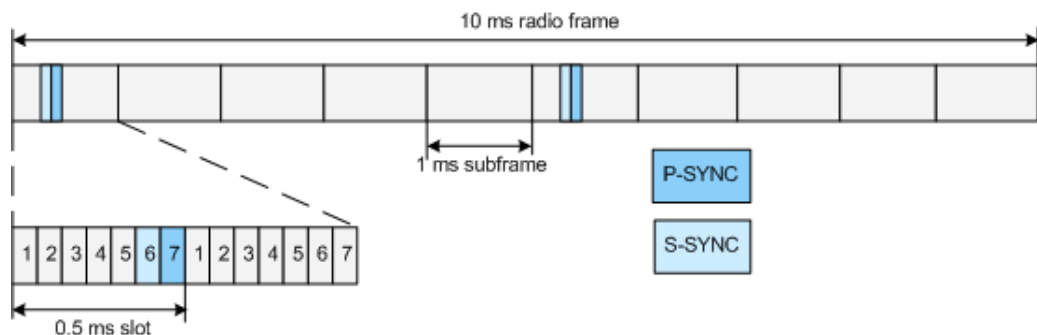
Fig. 3-9: Downlink Reference Signal Structure (Normal Cyclic Prefix)

The reference signal sequence carries the cell identity. There are 504 unique physical layer cell identities, grouped into 168 unique physical cell identity groups that contain three unique identities each. Each reference signal is generated as a pseudo-random sequence that depends on the physical layer cell identity.

Frequency hopping can be applied to the downlink reference signals. The frequency hopping pattern has a period of one frame (10 ms).

During cell search, different types of information need to be identified by the handset: symbol and radio frame timing, frequency, cell identification, overall transmission bandwidth, antenna configuration, and cyclic prefix length.

Besides the reference signals, synchronization signals are therefore needed during cell search. EUTRA uses a hierarchical cell search scheme similar to WCDMA. This means that the synchronization acquisition and the cell group identifier are obtained from different SYNC signals. Thus, a primary synchronization signal (**P-SYNC**) and a secondary synchronization signal (**S-SYNC**) are defined with a pre-defined structure. They are transmitted on the 72 center subcarriers (around DC subcarrier) within the same predefined slots (twice per 10 ms) on different resource elements, see [figure 3-10](#). This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).



**Fig. 3-10: P-SYNC and S-SYNC Structure (Normal CP; 1.25MHz bandwidth)**

As additional help during cell search, a common control physical channel (CCPCH) is available which carries BCH type of information, e.g. system bandwidth. It is transmitted at predefined time instants on the 72 subcarriers centered around the DC subcarrier.

In order to enable the UE to support this cell search concept, it was agreed to have a minimum UE bandwidth reception capability of 20 MHz.

### 3.2.6 Downlink Physical Layer Procedures

For E-UTRA, the following downlink physical layer procedures are especially important:

- **Cell search and synchronization**  
See above.
- **Scheduling**  
Scheduling is done in the base station (eNodeB). The downlink control channel PDCCH informs the users about their allocated time/frequency resources and the transmission formats to use. The scheduler evaluates different types of information, e.g. quality of service parameters, measurements from the UE, UE capabilities, and buffer status.
- **Link adaptation**  
Link adaptation is already known from HSDPA as adaptive modulation and coding. Also in E-UTRA, modulation and coding for the shared data channel is not fixed, but



rather is adapted according to radio link quality. For this purpose, the UE regularly reports channel quality indications (CQI) to the eNodeB.

- **Hybrid automatic repeat request (ARQ)**

Downlink hybrid ARQ is also known from HSDPA. It is a retransmission protocol. The UE can request retransmissions of incorrectly received data packets.

### 3.3 Long-Term Evolution Uplink Transmission Scheme

During the study item phase of LTE, alternatives for the optimum uplink transmission scheme were investigated. While OFDMA is seen optimum to fulfill the LTE requirements in downlink, OFDMA properties are less favorable for the uplink. This is mainly due to weaker peak-to-average power ratio (PAPR) properties of an OFDMA signal, resulting in worse uplink coverage.

Thus, the LTE uplink transmission scheme for FDD and TDD mode is based on SC-FDMA (Single Carrier Frequency Division Multiple Access) with cyclic prefix. SC-FDMA signals have better PAPR properties compared to an OFDMA signal. This was one of the main reasons for selecting SC-FDMA as LTE uplink access scheme. The PAPR characteristics are important for cost-effective design of UE power amplifiers. Still, SC-FDMA signal processing has some similarities with OFDMA signal processing, so parameterization of downlink and uplink can be harmonized.

There are different possibilities how to generate an SC-FDMA signal. DFT-spread-OFDM (DFT-s-OFDM) has been selected for EUTRA. The principle is illustrated in the figure below. This figure is taken from 3GPP R1-050584, "EUTRA Uplink Numerology and Design".

For DFT-s-OFDM, a size-M DFT is first applied to a block of M modulation symbols. QPSK, 16QAM and 64 QAM are used as uplink EUTRA modulation schemes, the latter being optional for the UE. The DFT transforms the modulation symbols into the frequency domain. The result is mapped onto the available subcarriers. In EUTRA uplink, only localized transmission on consecutive subcarriers is allowed. An N point IFFT where  $N > M$  is then performed as in OFDM, followed by addition of the cyclic prefix and parallel to serial conversion.

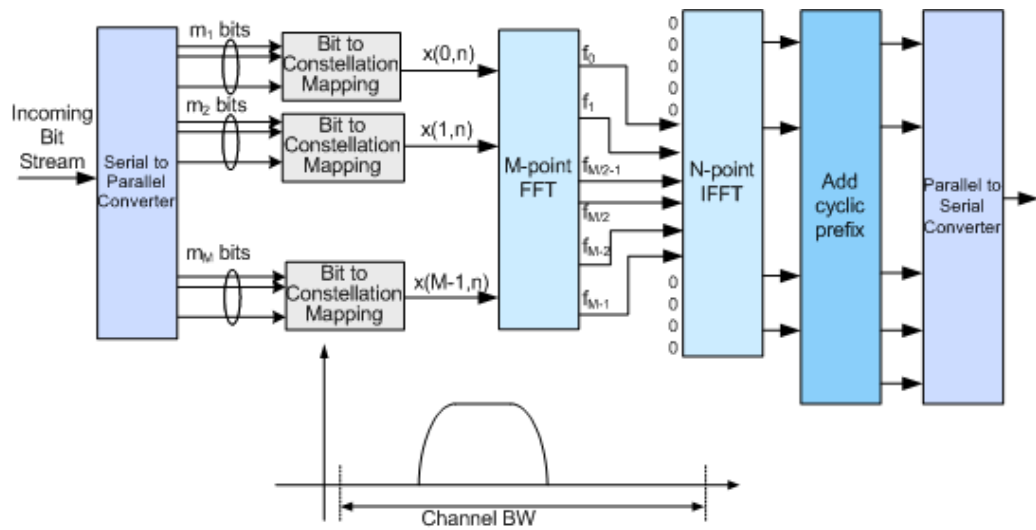


Fig. 3-11: Block Diagram of DFT-s-OFDM (Localized Transmission)

The DFT processing is therefore the fundamental difference between SC-FDMA and OFDMA signal generation. This is indicated by the term DFT-spread-OFDM. In an SCFDMA signal, each sub-carrier used for transmission contains information of all transmitted modulation symbols, since the input data stream has been spread by the DFT transform over the available sub-carriers. In contrast to this, each sub-carrier of an OFDMA signal only carries information related to specific modulation symbols.

### 3.3.1 SC-FDMA Parameterization

The EUTRA uplink structure is similar to the downlink. An uplink radio frame consists of 20 slots of 0.5 ms each, and 1 subframe consists of 2 slots. The slot structure is shown in the figure below. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

Each slot carries  $N_{\text{ymb}}^{\text{UL}}$  SC-FDMA symbols, where  $N_{\text{ymb}}^{\text{UL}} = 7$  for the normal cyclic prefix and  $N_{\text{ymb}}^{\text{UL}} = 6$  for the extended cyclic prefix. SC-FDMA symbol number 3 (i.e. the 4th symbol in a slot) carries the reference signal for channel demodulation.

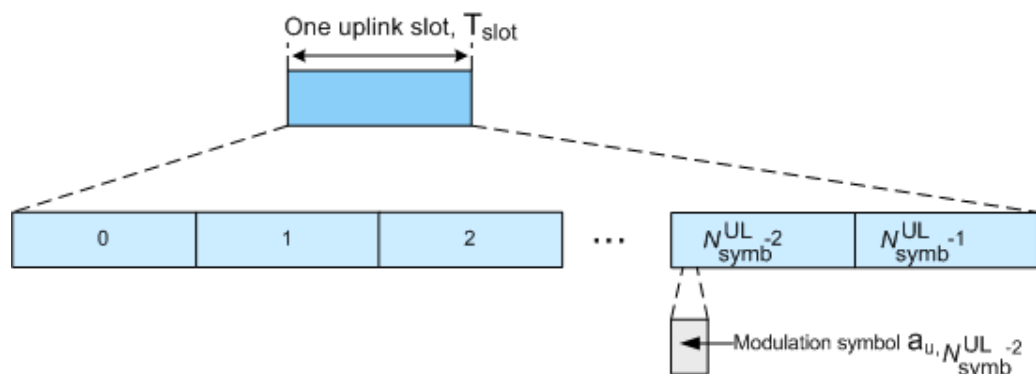


Fig. 3-12: Uplink Slot Structure

Also for the uplink, a bandwidth agnostic layer 1 specification has been selected. The table below shows the configuration parameters in an overview table.

Configuration	Number of symbols $N_{\text{symbol}}^{\text{UL}}$	Cyclic Prefix length in samples	Cyclic Prefix length in us
Normal cyclic prefix $\Delta f=15$ kHz	7	160 for first symbol 144 for other symbols	5.2 us for first symbol 4.7 us for other symbols
Extended cyclic prefix $\Delta f=15$ kHz	6	512	16.7 us

### 3.3.2 Uplink Data Transmission

In uplink, data is allocated in multiples of one resource block. Uplink resource block size in the frequency domain is 12 sub-carriers, i.e. the same as in downlink. However, not all integer multiples are allowed in order to simplify the DFT design in uplink signal processing. Only factors 2, 3, and 5 are allowed.

The uplink transmission time interval (TTI) is 1 ms (same as downlink).

User data is carried on the Physical Uplink Shared Channel (**PUSCH**) that is determined by the transmission bandwidth  $N_{\text{Tx}}$  and the frequency hopping pattern  $k_0$ .

### 3.3.3 Uplink Control Information Transmission

In uplink, the control information is carried by the Physical Uplink Shared Channel (PUSCH) or by the Physical Uplink Control Channel (PUCCH), depending on whether an uplink resource has been assigned to the user or not. PUSCH and PUCCH of the same user are never transmitted simultaneously.

Control information (CQI reports and ACK/NACK information related to data packets received in the downlink) is multiplexed with the PUSCH, if the user has been granted with UL-SCH transmission.

The PUCCH carries uplink control information, e.g. CQI reports, HARQ ACK/NACK information or Scheduling Requests (SR), in case the user has not been assigned an UL-SCH transmission. The PUCCH is transmitted on a reserved frequency region at the edges of the total available bandwidth in the UL. One PUCCH resource comprises a pair of resource blocks within slot 0 and 1 that are located in the upper and the lower part of the spectrum. Maximum number of 6 resource block can be allocated for PUCCH as shown in the figure below (taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8)).

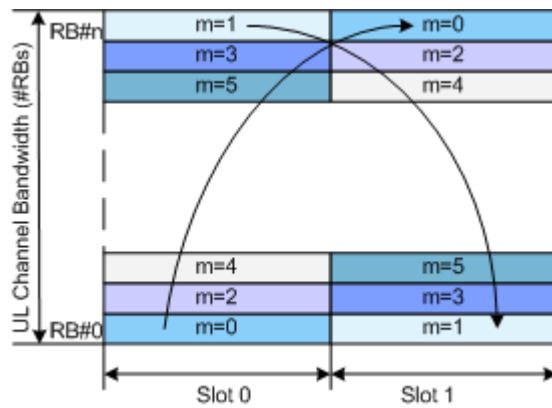


Fig. 3-13: PUCCH Mapping

According to 3GPP 36.211, six PUCCH formats are defined (see table below).

Table 3-2: PUCCH formats

PUCCH format	Description	Physical Bits	Modulation Scheme	ODFM Symbols used for DRS (normal CP)	ODFM Symbols used for DRS (extended CP)
1	Scheduling Request	0	-	2, 3, 4	2, 3
1a	ACK/NACK	1	BPSK	2, 3, 4	2, 3
1b	ACK/NACK for MIMO	2	QPSK	2, 3, 4	2, 3
2	CQI	20	QPSK	1, 5	3
2a	CQI and ACK/NACK	21	QPSK+BPSK	1, 5	-
2b	CQI and ACK/NACK for MIMO	22	QPSK+QPSK	1, 5	-

The different PUCCH formats are mapped to the reserved PUCCH region, so that there can be only one resource block per slot that supports a combination of PUCCH formats 1/1a/1b and 2/2a/2b.

For simultaneous transmission of multiple users on the PUCCH, different PUCCH resource indices are used. Multiple users are distinguished within one resource block by using different cyclic shifts (CS) of the CAZAC (Constant Amplitude Zero Auto-Correlation) sequence. For PUCCH formats 1/1a/1b additionally three different orthogonal cover sequences (OC) can be used. Hence, for PUCCH format 2/2a/2b a total number of 12 different PUCCH resource indices ( $N(2)_{PUCCH}$ ) are available within a resource block; for PUCCH format 1/1a/1b and for normal and extended CP, the number of the available PUCCH resource indices ( $N(1)_{PUCCH}$ ) within a resource block is 36 and respectively 24. The actual number of the used orthogonal sequences is additionally determinate by the parameter  $\Delta_{shift}$ , employed to support working by different channel conditions.

The orthogonal sequences are calculated according to R1-080035, "Joint proposal on uplink ACK/NACK channelization".

### 3.3.4 Uplink Reference Signal Structure

Uplink reference signals are used for two different purposes: on the one hand, they are used for channel estimation in the eNodeB receiver in order to demodulate control and data channels. On the other hand, the reference signals provide channel quality information as a basis for scheduling decisions in the base station. The latter purpose is also called channel sounding.

The uplink reference signals are based on CAZAC (Constant Amplitude Zero Auto-Correlation) sequences.

### 3.3.5 Uplink Physical Layer Procedures

For EUTRA, the following uplink physical layer procedures are especially important:

#### Non-synchronized random access

The random access may be used to request initial access, as part of handover, when transiting from idle to connected, or to re-establish uplink synchronization. The structure is shown in the figure below. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

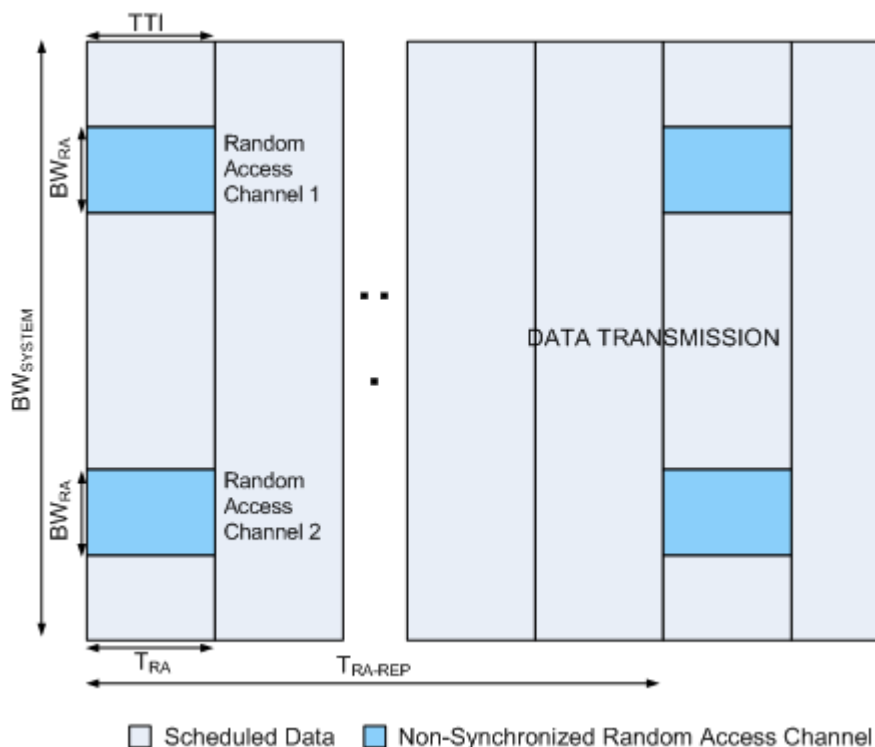


Fig. 3-14: Random Access Structure, principle

Multiple random access channels may be defined in the frequency domain within one access period  $T_{RA}$  in order to provide a sufficient number of random access opportunities.

For the random access, a preamble is defined as shown in the figure below. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8). The preamble length depends on the preamble format. The preamble bandwidth is 1.08 MHz (72 subcarriers). Higher layer signaling controls in which subframes the preamble transmission is allowed, and the location in the frequency domain. Per cell, there are 64 random access preambles. They are generated from Zadoff-Chu sequences.

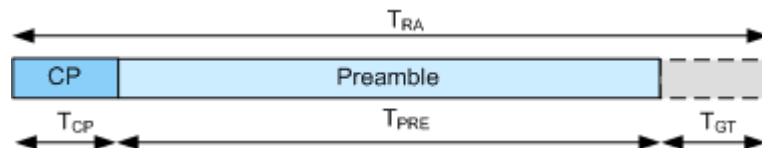


Fig. 3-15: Random Access Preamble

The random access procedure uses open loop power control with power ramping similar to WCDMA. After sending the preamble on a selected random access channel, the UE waits for the random access response message. If no response is detected then another random access channel is selected and a preamble is sent again.

### Uplink scheduling

Scheduling of uplink resources is done by eNodeB. The eNodeB assigns certain time/frequency resources to the UEs and informs UEs about transmission formats to use. Scheduling decisions affecting the uplink are communicated to the UEs via the Physical Downlink Control Channel (PDCCH) in the downlink. The scheduling decisions may be based on QoS parameters, UE buffer status, uplink channel quality measurements, UE capabilities, UE measurement gaps, etc.

### Uplink link adaptation

As uplink link adaptation methods, transmission power control, adaptive modulation and channel coding rate, as well as adaptive transmission bandwidth can be used.

### Uplink timing control

Uplink timing control is needed to time align the transmissions from different UEs with the receiver window of the eNodeB. The eNodeB sends the appropriate timing-control commands to the UEs in the downlink, commanding them to adapt their respective transmit timing.

### Hybrid automatic repeat request (ARQ)

The Uplink Hybrid ARQ protocol is already known from HSUPA. The eNodeB has the capability to request retransmissions of incorrectly received data packets.

## 3.4 LTE MIMO Concepts

Multiple Input Multiple Output (MIMO) systems form an essential part of LTE in order to achieve the ambitious requirements for throughput and spectral efficiency. MIMO refers to the use of multiple antennas at transmitter and receiver side.

### 3.4.1 Downlink MIMO

For the LTE downlink, a 2x2 configuration for MIMO is assumed as baseline configuration, i.e. 2 transmit antennas at the base station and 2 receive antennas at the terminal side. Configurations with 4 antennas are also being considered.

Different MIMO modes are envisaged. It has to be differentiated between spatial multiplexing and transmit diversity, and it depends on the channel condition which scheme to select.

#### 3.4.1.1 Spatial Multiplexing

Spatial multiplexing allows transmitting different streams of data simultaneously on the same downlink resource block(s). These data streams can belong to one single user (single user MIMO / SU-MIMO) or to different users (multi user MIMO / MU-MIMO). While SU-MIMO increases the data rate of one user, MU-MIMO allows increasing the overall capacity. Spatial multiplexing is only possible if the mobile radio channel allows it. The figure below shows the principle of spatial multiplexing, exploiting the spatial dimension of the radio channel which allows transmitting the different data streams simultaneously.

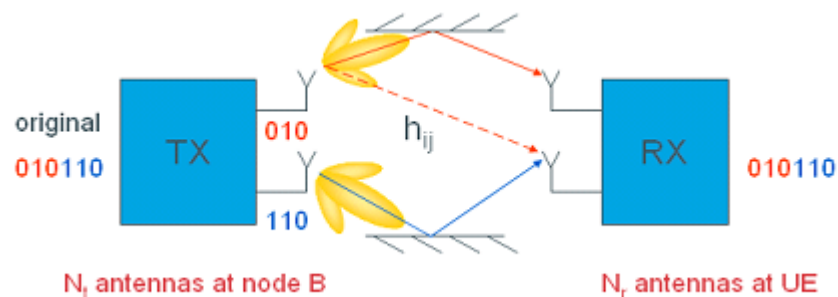


Fig. 3-16: Spatial multiplexing

In the figure above, each transmit antenna transmits a different data stream. Each receive antenna may receive the data streams from all transmit antennas. The channel (for a specific delay) can thus be described by the following channel matrix H:

$$H = \begin{matrix} & \xrightarrow{N_t} & & \\ \begin{matrix} h_{11} & h_{12} & \dots & h_{1N_r} \\ h_{21} & h_{22} & & h_{2N_r} \\ \vdots & & \ddots & \vdots \\ h_{N_t1} & h_{N_t2} & \dots & h_{N_tN_r} \end{matrix} & & & \begin{matrix} \uparrow \\ \downarrow \\ \leftarrow \\ \rightarrow \end{matrix} N_r \end{matrix}$$

In this general description,  $N_t$  is the number of transmit antennas,  $N_r$  is the number of receive antennas, resulting in a 2x2 matrix for the baseline LTE scenario. The coefficients  $h_{ij}$  of this matrix are called channel coefficients from transmit antenna  $j$  to receive antenna  $i$ , thus describing all possible paths between transmitter and receiver side.

The number of data streams that can be transmitted in parallel over the MIMO channel is given by  $\min\{N_t, N_r\}$  and is limited by the rank of the matrix  $H$ . The transmission quality

degrades significantly in case the singular values of matrix H are not sufficiently strong. This can happen in case the 2 antennas are not sufficiently de-correlated, for example in an environment with little scattering or when antennas are too closely spaced.

In LTE, up to 2 codewords can be mapped onto different so-called layers. The number of layers for transmission is equal to the rank of the matrix H. There is a fixed mapping between codewords to layers.

Precoding on transmitter side is used to support spatial multiplexing, see figure below. This is achieved by applying a precoding matrix W to the signal before transmission. The figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

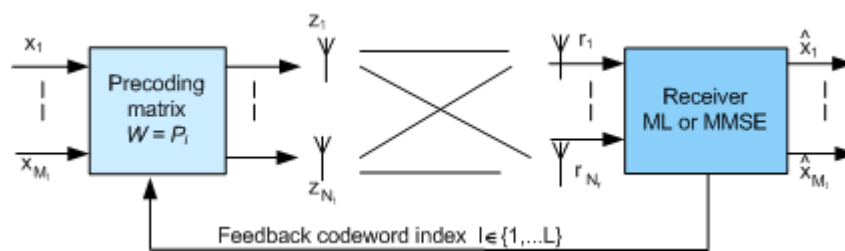


Fig. 3-17: Precoding principle

The optimum precoding matrix W is selected from a predefined "codebook" which is known at eNodeB and UE side. Unitary precoding is used, i.e. the precoding matrices are unitary:  $W^H W = I$ . The UE estimates the radio channel and selects the optimum precoding matrix. The optimum precoding matrix is the one which offers maximum capacity. The UE provides feedback on the uplink control channel regarding the preferred precoding matrix (precoding vector as a special case). Ideally, this information is made available per resource block or at least group of resource blocks, since the optimum precoding matrix varies between resource blocks. Figure below gives an overview of EUTRA downlink baseband signal generation including the above-mentioned steps relevant for MIMO transmission. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

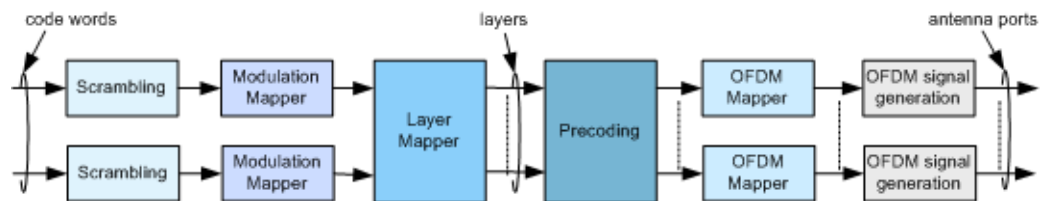


Fig. 3-18: Overview of downlink baseband signal generation

### 3.4.1.2 Transmit Diversity

Instead of increasing data rate or capacity, MIMO can be used to exploit diversity. Transmit diversity schemes are already known from WCDMA release 99 and will also form part of LTE as one MIMO mode. In case the channel conditions do not allow spatial multiplexing, a transmit diversity scheme will be used instead, so switching between these two MIMO modes is possible depending on channel conditions. Transmit diversity is used when the selected number of streams (rank) is one.



### 3.4.2 Uplink MIMO

Uplink MIMO schemes for LTE will differ from downlink MIMO schemes to take into account terminal complexity issues. For the uplink, MU-MIMO can be used. Multiple user terminals may transmit simultaneously on the same resource block. This is also referred to as spatial domain multiple access (SDMA). The scheme requires only one transmit antenna at UE side which is a big advantage. The UEs sharing the same resource block have to apply mutually orthogonal pilot patterns.

To exploit the benefit of two or more transmit antennas but still keep the UE cost low, antenna subset selection can be used. In the beginning, this technique will be used, e.g. a UE will have two transmit antennas but only one transmits chain and amplifier. A switch will then choose the antenna that provides the best channel to the eNodeB.

## 3.5 LTE MBMS Concepts

Support of MBMS (Multimedia Broadcast Multicast Services) is an essential requirement for LTE. The so-called E-MBMS will therefore be an integral part of LTE.

In LTE, MBMS transmissions may be performed as single-cell transmission or as multi-cell transmission. In case of multi-cell transmission the cells and content are synchronized to enable for the terminal to soft-combine the energy from multiple transmissions. The superimposed signal looks like multipath to the terminal. This concept is also known as Single Frequency Network (SFN). The EUTRAN can configure which cells are part of an SFN for transmission of an MBMS service. The MBMS traffic can share the same carrier with the unicast traffic or be sent on a separate carrier. For MBMS traffic, an extended cyclic prefix is provided. In case of subframes carrying MBMS SFN data, specific reference signals are used.

MBMS data is carried on the MBMS traffic channel (MTCH) as logical channel.

## 4 EUTRA/LTE Parameterization

### 4.1 OFDMA Parameterization

- OFDMA physical layer parameterization is based on a bandwidth agnostic layer 1. However, current 3GPP specifications focus on the channel bandwidth listed in [table 4-1](#).

Additionally, a user defined channel bandwidth can be configured. To configure the bandwidth of the signal to be generated, the desired number of resource blocks can be specified in a range from 6 to 110 resource blocks with a granularity of 1. This results in bandwidths from 1.095 MHz...19.815 MHz.

**Table 4-1: Channel Bandwidth for FDD mode according to 3GPP TS 36.804**

Channel Bandwidth	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Number of Resource Blocks Per Slot	6	12	25	50	75	100
Number Of Occupied Subcarriers	73	181	301	601	901	1201
FFT Size	128, 256, 512, 1024, 2048	256, 512, 1024, 2048	512, 1024, 2048	1024, 2048	1536, 2048	2048

- Both frame structure, frame structure type 1 for FDD and frame structure type 2 for TDD, are supported.
- For frame structure 2 (TDD mode), all special subframe configurations and all uplink-downlink configurations as defined in the 3GPP specification are supported.
- Both normal and extended cyclic prefix can be selected for a subcarrier spacing of 15 kHz. Parameterization of cyclic prefixes is according to 3GPP TS 36.211.

**Note:**

In this version, subcarrier spacing is 15 kHz. Subcarrier spacing of 7.5 kHz will be supported in a later version.

- Resource block size is 12 subcarriers in the frequency domain and, depending on the cyclic prefix length, 7 or 6 consecutive OFDM symbols in the time-domain.

**Note:**

Resource block size of 24 subcarriers will be supported in a later version.

### 4.2 Reference Signals

- R&S Signal Generator offers to select the antenna to simulate (1, 2, 3, or 4), and adjust the correct reference signal pattern accordingly. An example for the possible distribution of downlink reference signals for the normal cyclic prefix is shown in [figure 3-9](#). The reference signal pattern for the extended cyclic prefix is also done according to 3GPP TS 36.211.

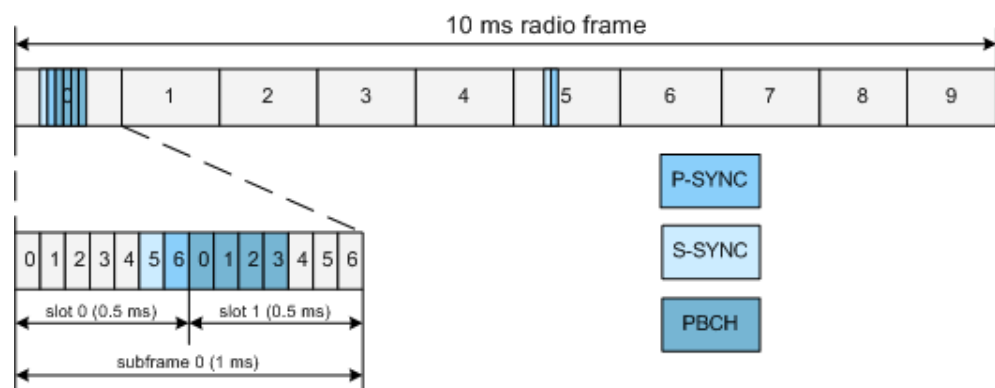
- Availability of secondary reference signal, subcarrier offset of the reference signal sequence in the frequency domain and existence of empty resource elements depend on the antenna selected.
- Reference signal sequences are generated as a pseudo-random sequence. This sequence is determinate by the cell ID, i.e. the combination of 168 physical cell identity groups and the 3 physical layer identities within each physical layer group.

### 4.3 Synchronization Signal (SYNC)

- Primary and secondary synchronization signal (P-SYNC and S-SYNC) are supported.
- In the FDD mode, the P-SYNC and S-SYNC are located on the last two OFDM symbols of slot (see [figure 3-10](#)). By default, the synchronization signals are transmitted in slots 0 and 10 of the radio frame.
- P-SYNC and S-SYNC are transmitted within the center 72/64 subcarriers. Resource blocks containing P-SYNC/ S-SYNC thus have less resource elements available for user data allocation.
- By default, P-SYNC and S-SYNC are enabled but the synchronization signals can be disabled independently in the signal generator.
- Power of the P-SYNC and S-SYNC can be set independently in the signal generator.

### 4.4 Physical Broadcast Channel (PBCH)

- By default, the PBCH is located over 4 consecutive OFDM symbols in the first four OFDM symbols (symbol number 0 .. 3) of slot 1 of subframe 0 for normal CP. The default location of the four PBCH symbols for extended CP start in the second OFDM symbol (symbol number 2..5) of slot 1 of subframe 0. The [figure 4-1](#) shows the default location of PBCH in case of normal CP.



**Fig. 4-1: Default location of PBCH for normal CP**

- PBCH repetition interval is once per frame of 10 ms. Position of PBCH within the subframe 0 is according to 3GPP TS 36.211. However, R&S Signal Generator allows

modification of the PBCH in terms of PBCH start symbol within the radio subframe (0..13 for normal CP) and length in symbols (1..14 for normal CP).

- PBCH is QPSK modulated; scrambling and channel coding can be additionally activated or deactivated.
- If channel coding is activated, one block of data (Transport Block Size of 24) is coded jointly and then spread over four frames. Hence, the ARB "Sequence Length" has to be set accordingly to be a multiple of four.
- PBCH is occupying the center 72 subcarriers around DC subcarrier.

## 4.5 Physical Control Format Indicator Channel (PCFICH)

- PCFICH is QPSK modulated; scrambling can be additionally activated or deactivated.
- PCFICH is layer mapped and precoded according to 3GPP TS 36.211.
- The power of the PCFICH is configurable.

## 4.6 Physical Hybrid ARQ Indicator Channel (PHICH)

- PHICH is BPSK modulated.
- PHICH is layer mapped and precoded according to 3GPP TS 36.211.
- Different orthogonal sequences are used for the PHICHs within the same PHICH group.
- The power of the PHICH is configurable.

## 4.7 Physical Downlink Control Channel (PDCCH)

- PDCCH is layer mapped, precoded and mapped to the resource elements (incl. permutation and cyclically shifting) according to 3GPP TS 36.211.
- The power of the PDCCH is configurable.
- All DCI formats are supported and can be configured with full flexibility.

## 4.8 Data Allocations

- The Physical Resource Block size is 12 subcarriers in the frequency domain for all bandwidth options.
- Localized transmission is assumed.  
For localized transmission, the numbering of resource blocks starts with the left-most (lower frequency) used subcarriers of the frequency band. The numbering starts with zero. With the FFT-shift, the DC carrier is moved to the first position, which is required to be conform to the standard IFFT input. This is illustrated in the [figure 4-2](#).

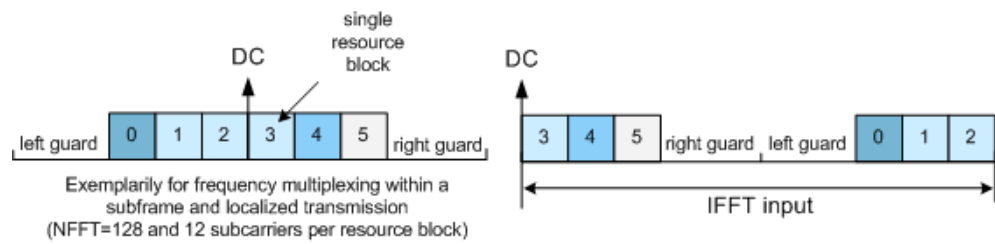


Fig. 4-2: Numbering of Resource Blocks

- According to 3GPP 36.211, the modulated data symbols are mapped onto the subcarriers first along the frequency axis starting with the lowest resource block number, then along the available OFDM symbols. This is true also for non-adjacent resource blocks for the same user. This is illustrated in the figure below.

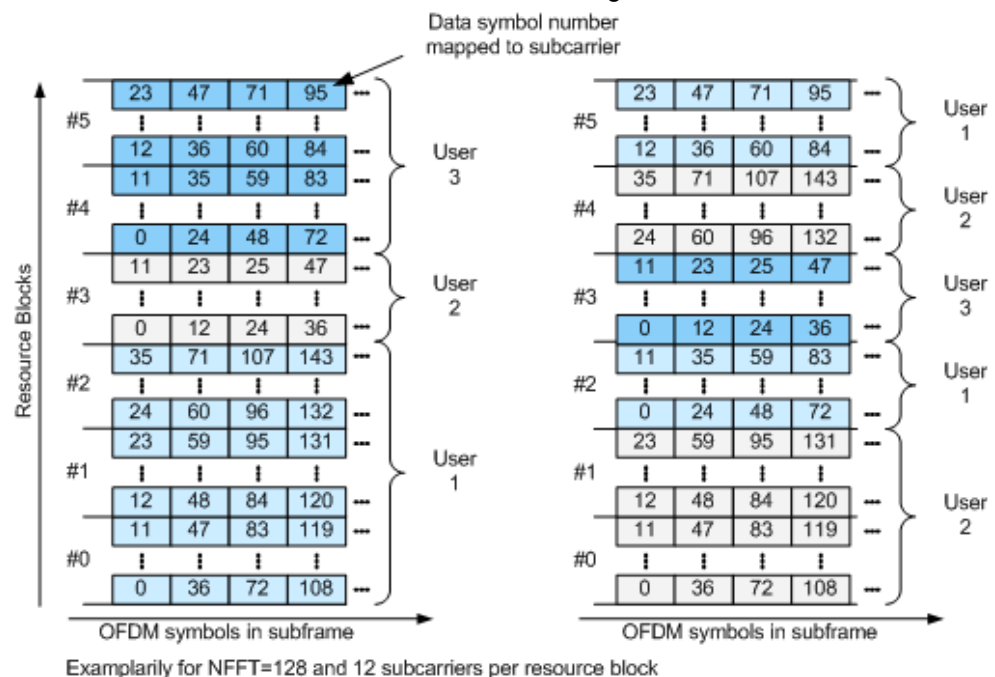


Fig. 4-3: Data symbol numbering

- In case pre-defined symbols (e.g. reference symbols, P-SYNC/S-SYNC, PBCH) are transmitted in a subframe, the number of available data symbols for user data allocation is reduced in a resource block.
- Data allocation can be changed for each subframe.
- PDSCH is scrambled, channel coded, precoded and layer mapped according to 3GPP TS 36.211. Additionally, channel coding configuration can be changed per PDSCH data allocations.

## 4.9 Modulation Mapping

The modulation mapping in downlink is done according to 3GPP TS 36.211, Release 8. All modulation schemes of 3GPP TS 36.211 are supported.

## 4.10 MIMO

- R&S Signal Generator supports all precoding schemes of 3GPP TS 36.211.
- R&S Signal Generator supports all layer mapping schemes of 3GPP TS 36.211.

## 4.11 SC-FDMA Parameterization

- SC-FDMA physical layer parameterization is based on a bandwidth agnostic layer 1. However, current 3GPP specifications focus on the channel bandwidth listed in [table 4-1](#).  
Additionally, a user defined channel bandwidth can be configured. To configure the bandwidth of the signal to be generated, the desired number of resource blocks can be specified in a range from 6 to 110 resource blocks with a granularity of 1. This results in bandwidths from 1.08 MHz...19.8 MHz.
- Both frame structures according to 3GPP TS 36.211 are supported.
- Both normal and extended cyclic prefix are supported.

## 4.12 Demodulation Reference Signal (DRS)

- If the uplink demodulation reference signal (DRS) is multiplexed with the PUSCH, the DRS is carried within the 3rd or 4th SC-FDMA symbol of a slot (i.e. symbol number  $l = 2$  or  $l=3$ ), depending on the cyclic prefix type. If the DRS is multiplexed with the PUCCH, the SC-FDMA symbol the uplink DRS is carried within depends on the PUCCH format and the cyclic prefix (see [table 3-2](#)).
- The demodulation reference signal (DRS) spans the same bandwidth as the data allocation.
- The generation of DRS sequence is according to 3GPP TS 36.211. A CAZAC sequence is used and the DRS is derived from a Zadoff-Chu (ZC) sequence using the extension method.

## 4.13 Sounding Reference Signal (SRS)

- The generation of SRS sequence is according to 3GPP TS 36.211.
- Orthogonality of the SRS signal can also be achieved when using different SRS cyclic shifts.
- No PUSCH is transmitted in the symbol where the sounding reference signal is transmitted.
- PUCCH and SRS are not transmitted in the same subframe, except the transmission of SRS and PUCCH format 1, 1a or 1b in the same subframe is explicitly enabled for a UE.

## 4.14 Physical Uplink Control Channel (PUCCH)



If R&S FSQ Signal Analyzer is used for signal analysis of signal generated by the R&S Signal Generator equipped with option Digital Standard EUTRA/LTE, be aware that up to Release 2.1 of the LTE Option FSQ-K101 the two resource blocks at each edge of the spectrum are not analyzed.

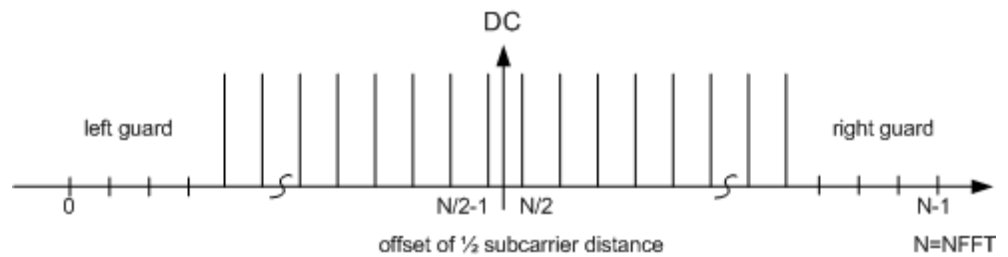
- Position of PUCCH can be configured in terms of PUCCH region.
- The content of PUCCH can be set individually for each TTI.
- All six PUCCH formats as defined in the 3GPP TS 36.211 are supported.
- One of 12 cyclic shifts and for PUCCH formats 1/1a/1b one of three orthogonal codes can be selected indirectly by choosing the appropriate PUCCH index.
- For configuration of multi user PUCCH tests according to 3GPPTS36.141, annex A9, set the n\_PUCCH parameter to the value defined in table A.9-1, column "RS orthogonal cover / ACK/NACK orthogonal cover". The R&S Signal Generator calculates and configures automatically the values defined in the columns "Cyclic shift index" and "Orthogonal cover index".

## 4.15 Physical Random Access Channel (PRACH)

- All PRACH configurations for random access preamble timing for preamble format 0-4 and frame format type 1 and 2 are supported.

## 4.16 Data Allocation

- Localized transmission on PUSCH is supported, i.e. only adjacent resource blocks can be allocated to the user.
- Frequency hopping is supported.
- Resource block size is 12 subcarriers in the frequency domain.
- A generation of uplink signals for up to 4 UEs is supported.
- Data can be allocated per subframe.
- Channel coding is performed according to 3GPP 36.212.
- TTI length is 1 ms.
- The modulated data symbols are mapped onto the resource elements according to 3GPP 36.211.
- Numbering of subcarriers is done according to the [figure 4-4](#).



**Fig. 4-4: Numbering of the subcarriers**

- The baseband signal is shifted in the frequency domain by half a subcarrier distance. According to 3GPP 36.211, the spectral shift is carried out symbolwise, i.e. per SC-FDMA symbol.

## 4.17 Modulation Mapping

- The modulation mapping in uplink is done according to 3GPP TS 36.211. All modulation schemes of 3GPP TS 36.211 are supported.



## 5 R&S Signal Generator Specific Information

The different topics discussed in the following give essential information for better understanding and effective work with R&S Signal Generator equipped with option Digital Standard EUTRA/LTE (R&S SMx/AMU-K55/-K255). The topics provide information about some specific functions of the R&S Signal Generator.

### 5.1 Conflict Handling in the R&S Signal Generator

In 3GPP TS 36.211 [3], physical signals and physical channels are defined for the EUTRA/LTE system. Therefore the available resources in the time-frequency domain are shared by the different signals and different kinds of allocations (comparable to the different channel types in the 3GPP FDD mode).

#### 5.1.1 Downlink

In the current R&S Signal Generator release, the following types of signals and channels for the downlink are supported:

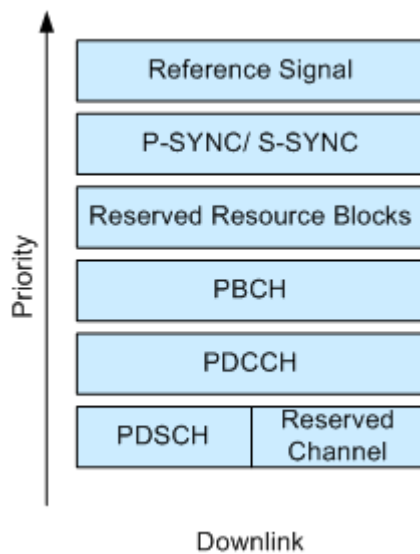
- Reference Signal
- Primary Synchronization Signal (P-SYNC)
- Secondary Synchronization Signal (S-SYNC)
- Physical Broadcast Channel (PBCH)
- Physical Downlink Control Channel (PDCCH), including PCFICH and PHICH
- Physical Downlink Shared Channel (PDSCH)
- Reserved channel

Due to the concept of the R&S Signal Generator different situations may appear that need clarification. If several signals and/or channels (of the same or different type) partly share the same resources, a decision has to be made what bits are really mapped to the affected subcarriers. The general rule here is that the signal or channel with the higher priority is transmitted completely while the affected subcarriers are stamped out of the lower priority signal or channel respectively. Note that this reduces the number of available physical bits of a signal/channel.



The actual size of a certain allocation is displayed in the column Physical Bits of the resource allocation table.

The following picture shows the priorities of the different signal and channel types.



**Fig. 5-1: Priority of different allocations, channels and signals in the downlink**

- Overlapping of signals and/or channels with different priorities  
In case signals and/or channels (e.g. P-SYNC and PDSCH) of different priorities overlap, no conflict is displayed in the resource allocation table, as the signal/channel with the higher priority is transmitted completely.
- Overlapping of allocations with the same priority  
If different allocations of the same priority are overlapping, the one with the lower allocation index (i.e. which comes first) in the resource allocation table is treated with higher priority. In this case the reduced allocation is marked in the conflict column of the resource allocation table.



There is no way to configure a signal with overlapping reference signal and P-SYNC/S-SYNC.

### 5.1.2 Uplink

In the uplink implementation of the R&S Signal Generator it is possible to configure different user equipments to use the same physical resources. The signals of the different UEs are simply added, but nevertheless a conflict is indicated in the resource allocation table.

Inside one UE it is not possible to provoke a conflict, as there will be no PUSCH (and also no demodulation reference signal) transmitted during a symbol that is used for sounding purposes, regardless of the used bandwidth of the sounding reference signal. However, a conflict can occur between the sounding reference signal of a certain UE and the PUSCH of another UE.

### 5.1.3 DCI Conflict Handling

The R&S Signal Generator allows you to configure multiple scheduling messages with their corresponding PDCCHs per subframe. Using the DCI table in the [Enhanced Channel Configuration](#) dialog, the position of the DCI/PDCCH inside the multiplexed bit stream can be freely configured by setting the appropriate CCE index.

There are, however, some restrictions about the allowed CCE indexes:

- Since the number of CCEs for each PDCCH may vary, the 3GPP specification TS36.211 [3], chapter 6.8.1 defines some restriction on the aggregation of CCEs. An aggregation of eight CCEs for instance can only start on CCE numbers evenly dividable by eight. The same principle applies to the other aggregation levels.
- In the R&S Signal Generator, the multiplexing of the DCIs/PDCCHs is performed in the order given by the DCI table. To prevent an overlapping between two consecutive DCIs/PDCCHs, the CCE index of the first CCE of a successive DCI/PDCCH has to be greater than the CCE index of the previous DCI/PDCCH and the following equation must be fulfilled:

$$\text{CCE index}_{n+1} \geq \text{CCE index}_n + \text{Number of CCEs}_n$$

If one of the restrictions about the CCE index is not fulfilled, a conflict is displayed for the DCI/PDCCH with the greater number. This DCI/PDCCH is not considered by the multiplexing, i.e. it is not transmitted.

The operations "Append", "Insert", "Delete", "Up" and "Down" are provided for flexibly configuration of valid DCIs and for resolving of conflicts.

**Example:**

In this example, the DCI table of a control channel with a total "Number of 26 Available CCEs" is configured.

The reason for the conflict displayed for the third DCI/PDCCH is that the equation given above is not fulfilled, i.e. the CCEs allocated for the third DCI/PDCCH are overlapping with the CCEs used by the second one. The third DCI/PDCCH is ignored by the multiplexing.

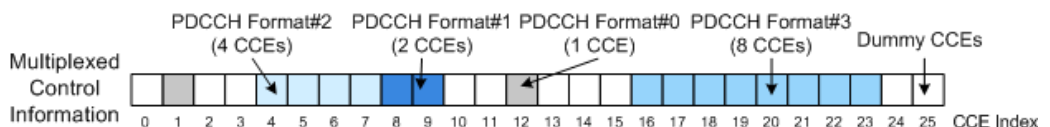
	User	UE_ID n_RNTI	DCI Format	Content	PDCCH Format	Number CCEs	Search Space	CCE Index	No.Dummy CCEs	C.
0	User1	9	0	Config...	0	1	Off	1	2	
1	RA_RNTI	9	2	Config...	2	4	Off	4	4	
2 >	SI-RNTI	65535	1	Config...	1	2	Off	7	-	●
3	User2	0	0	Config...	0	1	Off	12	3	
4	User1	0	3	Config...	3	8	Off	16	2	

To overcome this problem and to resolve the DCI conflict, the CCE index of the third DCI/PDCCH is set to 8.

	User	UE_ID n_RNTI	DCI Format	Content	PDCCH Format	Number CCEs	Search Space	CCE Index	No.Dummy CCEs	C.
0	User1	9	0	Config...	0	1	Off	1	2	
1	RA_RNTI	9	2	Config...	2	4	Off	4	0	
2 >	SI-RNTI	65535	1	Config...	1	2	Off	8	2	
3	User2	0	0	Config...	0	1	Off	12	3	
4	User1	0	3	Config...	3	8	Off	16	2	

Now the CCEs used by the two subsequent DCIs/PDCCHs are not overlapping and the two DCIs/PDCCHs are configured to be transmitted consecutive, i.e. there is no gap between them ("No. Dummy CCEs" = 0).

The figure below shows the resulting PDCCH after multiplexing for this example.



## 5.2 Subframes Handling in the R&S Signal Generator

In the following the subframes handling concept and implementation in the R&S Signal Generator is explained.

### 5.2.1 Copy/Paste Subframe

In order to simplify the configuration of the EUTRA/LTE signal the user has the possibility to copy and paste settings from one subframe to another. Note that beside the cyclic prefix length only the structure of PDCCH and PDSCH allocations for the downlink and the PUSCH and PUCCH allocations for the uplink are copied. P-SYNC/S-SYNC, PBCH and Sounding Reference Signals are not considered. This is due to the fact that the P-SYNC/S-SYNC are configured globally in the "General DL Settings" menu and can there-

fore not be overwritten in the "Frame Configuration - DL" menu; the PBCH can only be configured in subframe 0 and can therefore also not be overwritten. Respectively, the Sounding Reference Signal is set individually for each user equipment in the [User Equipment Configuration](#) dialog.

Copying allocations from a subframe without P-SYNC/S-SYNC/PBCH to one with P-SYNC/S-SYNC/PBCH and vice versa might lead to conflict situations. In this case the rules discussed in [chapter 5.1, "Conflict Handling in the R&S Signal Generator"](#), on page 41 become effective.

However, a configurations can occur where in different subframes allocations which are identical by means of scheduled resource blocks have a different amount of physical bits available, due to the out stamping of overlapping subcarriers.

## 5.2.2 Number of Configurable Subframes

Another possibility to simplify the configuration of the EUTRA/LTE signal for the user is to configure only a small number of subframes manually and then let the EUTRA/LTE fill the whole frame periodically with the configured subframes. Internally the [Copy/Paste Subframe](#) functionality is used, so again only the structure of the PDCCH/PDSCH in downlink and the PUCCH/PUSCH in uplink are copied, but no P-SYNC/S-SYNC/PBCH/PRACH or sounding reference signals.

## 5.2.3 Extension to Four Configurable Frames in Uplink and Downlink Direction

The R&S Signal Generator supports the configuration of up to four frames in uplink and downlink direction. However, there is a limitation for the maximum number of the real configurable subframes in this four frames depending on the transmission direction and several other parameters.

### 5.2.3.1 Uplink Direction

In uplink direction, maximum number of the real configurable subframes depends on the selected [Duplexing](#) mode (TDD or FDD), [UL/DL Configuration](#) and whether a [realtime feedback](#) is enabled or not.

The maximum number of configurable subframes changes as function of the parameters in the following way:

- For **Disabled** Realtime Feedback
  - In FDD duplexing mode, the maximum number of configurable subframes is a value between 1 and 40 subframes, where the maximum number of 40 subframes is available for four configurable frames
  - In a TDD frame only the uplink subframes are enabled for configuration. The number of the configurable subframes is determined by the selected "UL/DL Configuration" and the possible values are listed in the corresponding column in the cross-reference table below.

- For **Enabled** Realtime Feedback, the maximum number of configurable subframes is determined by the "Number of HARQ Processes", that itself also depends on the duplexing mode and the UL/DL configuration.  
For an overview of the possible values, see the corresponding column in the cross-reference [table 5-1](#).

The subframe to be configured is selected by means of the parameter "Subframe Selection". The maximum value for this parameter is then determined by the number of the last configurable subframe (see [table 5-1](#)).

**Table 5-1: Value range for the parameter Number of Configurable UL Subframes**

Duplexing mode	UL/DL Configuration	UL subframes in the first four frames  (see <a href="#">figure 3-6</a> )	Number of UL subframes per frame	Number of HARQ processes	Value range for the parameter Number of Configurable UL Subframes	
					disabled realtime feedback	enabled realtime feedback
TDD	0	2, 3, 4, 7, 8, 9, 12, 13, 14, 17, 18, 19, 22, 23, 24, 27, 28, 29, 32, 33, 34, 37, 38, 39	6	7	1 .. 24	1, 7
	1	2, 3, 7, 8, 12, 13, 17, 18, 22, 23, 27, 28, 32, 33, 37, 38	4	4	1 .. 16	1, 2, 4
	2	2, 7, 12, 17, 22, 27, 32, 37	2	2	1 .. 8	1, 2
	3	2, 3, 4, 12, 13, 14, 22, 23, 24, 32, 33, 34	3	3	1 .. 12	1, 3
	4	2, 3, 12, 13, 22, 23, 32, 33	2	2	1 .. 8	1, 2
	5	2, 12, 22, 32	1	1	1 .. 4	1
	6	2, 3, 4, 7, 8, 12, 13, 14, 17, 18, 22, 23, 24, 27, 28, 32, 33, 34, 37, 38	5	6	1 .. 20	1, 2, 3, 6
FDD	-	0 .. 39	10	8	1 .. 40	1, 2, 4, 8

**Example:**

- For selected FDD duplexing mode, disabled realtime feedback and **Number of Configurable Subframes** set to 13, the value range for the parameter Subframe Selection is 0 ..12.
- For selected TDD duplexing mode, "UL/DL Configuration" 6 and disabled realtime feedback the Number of Configurable Subframes is in the range 1 .. 20 (see [table 5-1](#)).
  - If for instance the "Number of Configurable Subframes" is set to 10, the value range for the parameter Subframe Selection is 0 .. 18,
  - For "Number of Configurable Subframes" is set to 4, the value range for the parameter Subframe Selection is 0 .. 7.
- For selected TDD duplexing mode, "UL/DL Configuration" 6 and enabled realtime feedback, up to 6 HARQ process can be configured and 1, 2, 3 or 6 Configurable Subframes are available.
  - If for instance the "Number of Configurable Subframes" is set to 6, the value range for the parameter Subframe Selection is 0 .. 12 (subframe number 12 is the sixth allowed subframe),
  - For "Number of Configurable Subframes" is set to 2, the value range for the parameter Subframe Selection is 0 .. 3.

**5.2.3.2 Downlink Direction**

In downlink direction, maximum number of the real configurable subframes depends on the selected [Duplexing](#) mode (TDD or FDD), [UL/DL Configuration](#), whereas in downlink direction the special subframes are also configurable.

Since the realtime feed functionality is an uplink feature, the maximal number of the configurable subframes in downlink direction is not additionally limited by the number of HARQ processes.

The subframe to be configured is selected by means of the parameter Subframe Selection. The maximum value for this parameter is then determined by the number of the last configurable subframe (see also [table 5-2](#)).

**Table 5-2: Value range for the parameter Number of Configurable DL Subframes**

Duplexing mode	UL/DL Configuration	DL and Special subframes in the first four frames (see <a href="#">figure 3-6</a> )	Number of DL and special subframes per frame	Value range for the parameter Number of Configurable DL Subframes
TDD	0	0, 1, 5, 6, 10, 11, 15, 16, 20, 21, 25, 26, 30, 31, 35, 36	4	1 .. 16
	1	0, 1, 4, 5, 6, 9 10, 11, 14, 15, 16, 19 20, 21, 24, 25, 26, 29, 30, 31, 34, 35, 36, 39	6	1 .. 24

Duplexing mode	UL/DL Configuration	DL and Special subframes in the first four frames (see figure 3-6)	Number of DL and special subframes per frame	Value range for the parameter Number of Configurable DL Subframes
	2	0, 1, 3, 4, 5, 6, 8, 9 10, 11, 13, 14, 15, 16, 18, 19 20, 21, 23, 24, 25, 26, 28, 29, 30, 31, 33, 34, 35, 36, 38, 39	8	1 .. 32
	3	0, 1, 5, 6, 7, 8, 9 10, 11, 15, 16, 17, 18, 19 20, 21, 25, 26, 27, 28, 29, 30, 31, 35, 36, 37, 38, 39	7	1 .. 28
	4	0, 1, 4, 5, 6, 7, 8, 9 10, 11, 14, 15, 16, 17, 18, 19 20, 21, 24, 25, 26, 27, 28, 29, 30, 31, 34, 35, 36, 37, 38, 39	8	1 .. 32
	5	0, 1, 3, 4, 5, 6, 7, 8, 9 10, 11, 13, 14, 15, 16, 17, 18, 19 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39	9	1 .. 36
	6	0, 1, 5, 6, 9 10, 11, 15, 16, 19, 20, 21, 25, 26, 29, 30, 31, 35, 36, 39	5	1 .. 20
FDD	-	0 .. 39	10	1 .. 40

## 5.3 Power Setting

The R&S Signal Generator equipped with option Digital Standard EUTRA/LTE (R&S SMx/AMU-K55/K255) provides several possibility to adjust the power level of the generated LTE signal as well as to adjust the relations between the power levels of the channels and signals in the LTE signal itself.

### 5.3.1 General Power Settings

The general power settings are as follow:

- Output level (Pout) of the instrument that can be adjusted in the Level display in the header of the instrument.
- [Power Offset relative to Level Display](#) is a parameter related to the level of the signal at the output of the baseband part of the instrument. The parameter sets the relative power offset of the selected baseband path compared to the power level displayed



in the header of the instrument. A value of 0 dB refers to the level set in the main "Level" settings; a negative value lowers the level of the selected baseband. Use this parameter to adjust the baseband output level compared to the baseband level of the other baseband if the performed test case requires the signals of UEs with different SNR and the same AWGN block is used. An example of such a test scenario are the Multi user PUCCH tests as defined in the 3GPP specification TS36.141.

### 5.3.2 Downlink Power Settings

In downlink direction, the value displayed in the "Level" display defines the RMS level of the output signal calculated upon several frames. In the FDD duplexing mode, the displayed RMS and the PEP values are valid for the whole frame, while in TDD duplexing mode, the calculation is based only on the downlink parts of the frame, i.e. the DL sub-frames and the DwPTS (see also parameter "[Level Reference](#)" on page 190).

Additionally to the general power settings, the following settings are influencing the power of the output signal in downlink direction:

- Reference Signal Power
- P-SYNC Power, S-SYNC Power
- PBCH Power and PDSCH Power
- PCFICH Power, PHICH Power, PDCCH Power
- PDSCH P\_B (PDSCH rho\_B/rho\_A) and PDCCH rho\_B/rho\_A

All DL power configurations are set relative to each other and the absolute power level of one resource element during one sub-frame depends on the configuration during the remaining sub-frames. If for instance the PDCCH power is set to 2 dB and a certain PDSCH has a power of -3 dB, this means that the power level of the PDCCH sub-carriers is with 5 dB higher than the power level of the PDSCH sub-carriers.

The basis for the calculation of the absolute power level of the channels and the signals in DL direction is the power of one reference signal resource element. The value is displayed in the [General DL Settings](#) dialog by means of the parameter [RS Power per RE relative to Level Display](#). Use this parameter to configure a specific absolute power of one Reference Signal's sub-carrier, like for example to set a required SNR defined for a 15kHz sub-band.

To calculate the absolute power value a single Reference Signal sub-carrier, consider the general power settings and the relative RS Power.

**Example:**

For the default setting of this firmware, the values of the related parameters are as follow:

"Level display" = - 30 dB

"RS Power per RE relative to Level Display" = - 27.78 dB

"Power Offset relative to Level Display" = 0 dB

The absolute power level of a single Reference Signal sub-carrier is the sum of these three values, i.e. -57.78 dBm.

If for instance the value of the PDSCH power is changed to - 3 dB, the absolute power level of a PDSCH sub-carrier calculated based on the absolute power level of a single Reference Signal is than -60.78 dBm.

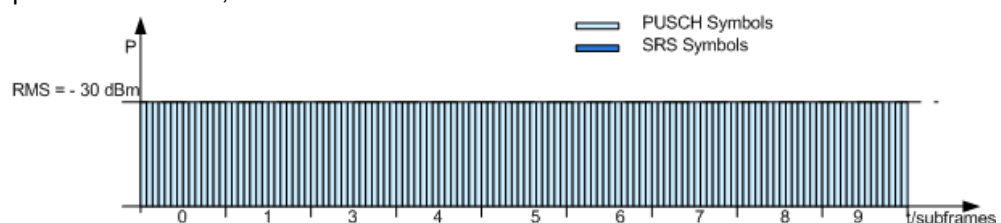
### 5.3.3 Uplink Power Settings

Additionally to the [General Power Settings](#), the following settings are influencing the power of the output signal in uplink direction:

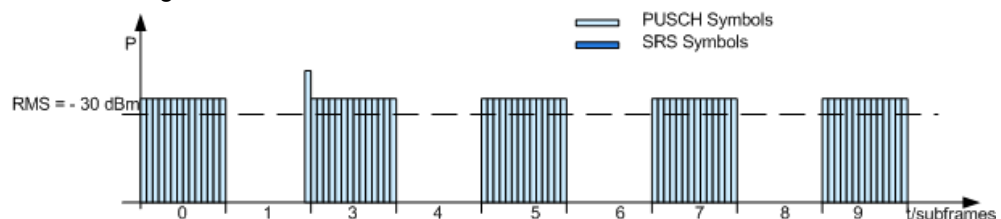
- Level Reference
- Power factors for PUSCH/PUCCH/PRACH/SRS
- DRMS Power Offset (available for PUSCH and PUCCH)
- UE Power

While generating an uplink signal, the power level displayed in the Level Display in the header of the instrument defines the actual RMS level at the output. The RMS and PEP values however are calculated based upon different parts of the signal depending on the selected [Level Reference](#) in the [Filter/Clipping/Power Settings](#) dialog.

- "Level Reference" set to "Frame RMS Power" (UL FDD) or "UL Part of Frame RMS Power" (UL TDD)  
In the FDD duplexing mode, the displayed RMS and the PEP values are valid for the whole frame, while in TDD duplexing mode, the calculation is based only on the uplink parts of the frame, i.e. the UL subframes and the UwPTS.

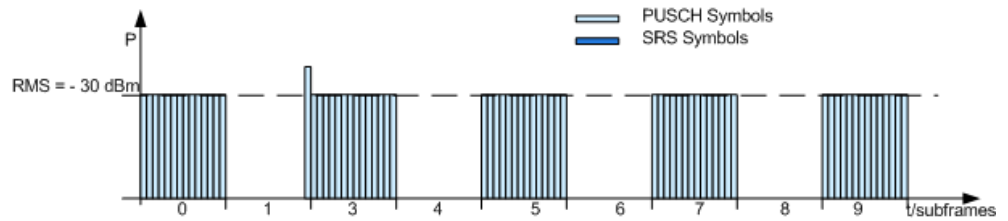


**Note:** The absolute power of a single subframe depends also on the signal within of the remaining subframes.



- "Level Reference" set to "UE Burst RMS Power" (UL FDD and UL TDD)

The RMS and PEP power levels displayed in the header of the instrument are measured only for a certain burst of a single UE. See the description of the parameter [Level Reference](#) for description of the decision algorithm and how the reference bursts are selected.



Use this mode to simplify the setting up of the SNR required for the test cases defined in the 3GPP specification TS36.141, in case the PUSCH is not transmitted in every subframe.

## 6 Realtime Feedback for Closed Loop BS Tests

The EUTRA/LTE uplink realtime feedback functionality requires the additional option R&S SMx/AMU-K69 Closed Loop BS Tests. This option extends the EUTRA/LTE option R&S SMx/AMU-K55 with the possibility to perform closed loop performance tests with feedback as defined in 3GPP TS 36.141, chapter 8.



The Realtime Feedback Configuration is enabled only for UE1 in instruments equipped with the option R&S SMx/AMU-K69.



Realtime Feedback Configuration is not available for the R&S Signal Generator SMBV and for the simulation software R&S WinIQSIM2.

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This feature allows the DUT to dynamically control the transmission of channel coded data packets. By means of the feedback sent from the DUT to the SMU/AMU, ACK/NACK signaling (HARQ feedback) and timing adjustment is possible, similar to the feedback sent from a base station to a user equipment by means of the air interface (PDCCH / PHICH channels).

By means of ACK/NACK commands, the DUT can control the channel coding configuration (i.e. the redundancy version) of the transmitted PUSCH packets in real time. The behavior of the SMU/AMU is similar to the behavior of the HARQ entity / the HARQ processes of a real user equipment (according to 3GPP TS 36.321).

By means of timing adjustment/timing advance commands, the DUT can request time shifts of the uplink signal generated by R&S SMU/AMU and thus causing a delay or advance of the uplink signal in real time (according to 3GPP TS 36.213).

### 6.1 Exemplary Testing Scenario

The tests are setup according to the testing specifications in TS 36.141, chapter 8. For example the test "Performance requirements for UL timing adjustment" (TS 36.141, section 8.2.2) can be setup according to the following figure. One single R&S SMU/AMU is sufficient.

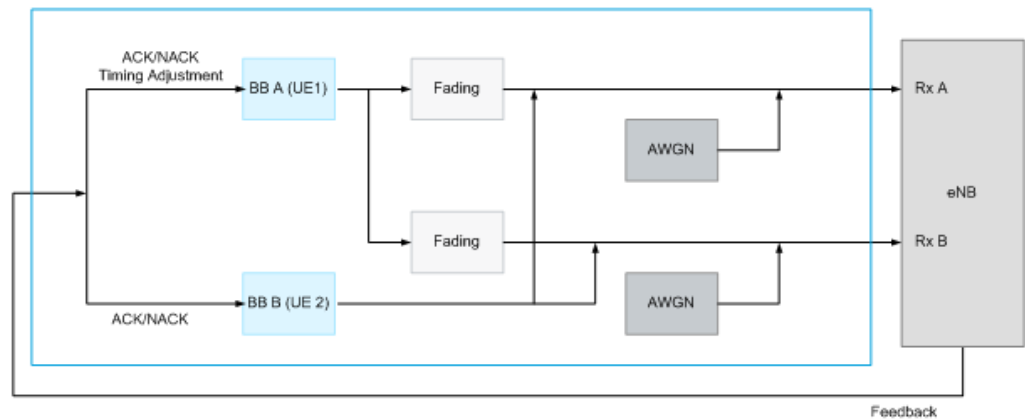
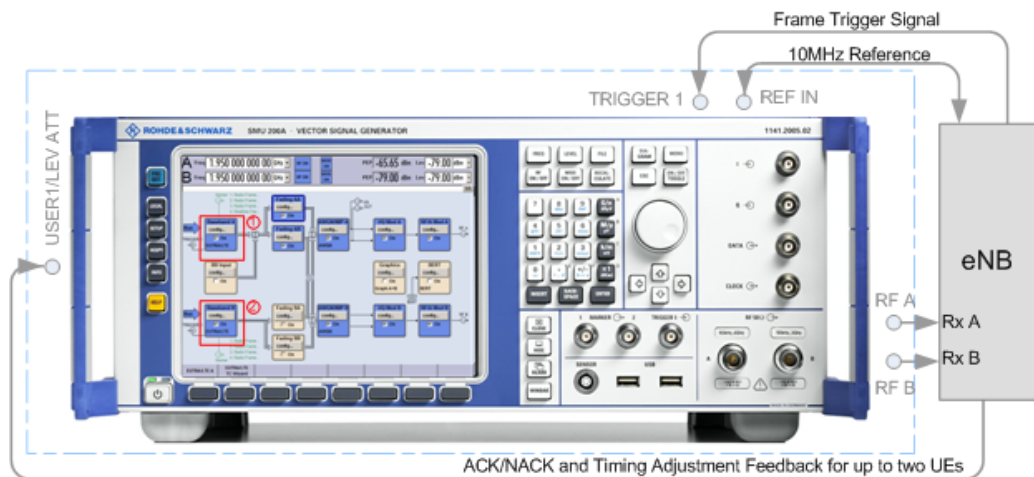


Fig. 6-1: Exemplary test scenario

As the R&S SMU/AMU has internal fading and AWGN generators, no more test equipment is needed to perform the performance requirement test measurements. The simulation of the propagation conditions according to the specified test scenarios is achieved by selecting the required fading profiles and an additive white Gaussian noise. For more detailed description about the available fading profiles and how to work with the fading generator, refer to the description "Fading Simulator".

The feedback is transmitted from the DUT to the R&S SMU/AMU by means of the serial protocol (serial mode). The 10 MHz external reference line has to be connected between the DUT and R&S SMU/AMU and the R&S SMU/AMU and the DUT have to be synchronized by a common trigger source (downlink timing).



- 1 = Baeband A generates the signal of the stationary UE
- 2 = Baeband B generates the signal of the moving UE

## 6.2 Feedback Modes

The test setups for performance verification require a feedback line from the DUT (base station) to the signal source. The R&S Signal Generator provides two interfaces for the necessary feedback line, a binary and a serial one, and two connectors, the LEVATT

connector and the USER1 connector. Both interfaces are suitable for HARQ feedback tests; for testing of an UL timing adjustment however, a connection over a serial feedback line has to be established.

The input impedance of the connectors and the low/high threshold voltage are configurable parameters. Use the "Global Trigger/Clock Settings" dialog and adjust the parameters "Threshold Trigger/Control Input" and "Impedance Trigger/Control Input" as required.

### 6.2.1 Binary Mode

A binary line carries the information in form of a high and low voltage level and is sufficient for the transmission of ACK and NACK commands. In the binary mode, the instrument detects the voltage level at the input connector and depending on the configuration (see parameter "[ACK Definition](#)" on page 161), the input level is interpreted as ACK or NACK.

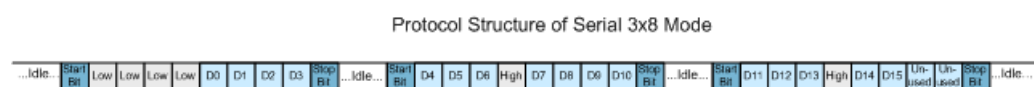
### 6.2.2 Serial Mode

The serial line carries the information in form of commands where a command consists of 16 data bits (D0..D15), 1 start bit (low level) and 1 stop bit (high level). No parity bit has to be transmitted. The least significant bit (D0) is transmitted first.

The feedback commands are transmitted with a "Serial Rate" of 115.2 kbps or 1.92 Mbps. Between two consecutive commands or before the very first command, the line has to be held on high level (idle).

### 6.2.3 Serial 3x8 Mode

In this mode, a command does not consist of one singular serial packet, but consists of three serial packets.



**Fig. 6-2: Structure of one feedback command in "Serial 3x8" mode**

Each of the three packets consists of one start bit (low level), eight serial bits and one stop bit (high level). No parity bits have to be transmitted. The sixteen data bits D0 ... D15 are distributed among the three times eight serial bits according to figure. The remaining serial bits must have specified low or high levels according to the figure for synchronization purposes.

The three serial packets of the feedback commands are transmitted with a "Serial Rate" of 115.2 kbps or 1.92 Mbps. Between two consecutive packets or between two consecutive commands or before the very first command, the line has to be held on high level (idle).

## 6.2.4 Structure of a serial and 3x8 serial feedback command

The [table 6-1](#) shows the structure and the meaning of the 16 data bits (D0..D15) in a feedback command, where D15 refers to the most significant bit.

**Table 6-1: Structure of one feedback command**

D15-D14	D13-D11	D10-D0
BB Selector	Message Type Selector	Message Bits

- The **BB Selector** (D15-D14) determines for which of the baseband blocks the feedback command is for.  
 R&S SMU/AMU can be equipped with up to two baseband blocks, where each baseband block can simulate one UE with closed loop feedback. The BB selector takes value in the range from 0 to 3 and can be arbitrarily assigned to each baseband block. Therefore, it is possible to send different feedback commands to different baseband blocks over one feedback line.  
 Alternatively, several baseband blocks that use the same BB selector can share the feedback commands, even if these baseband blocks are in different instruments (R&S SMU/AMU) connected to the same feedback line.
- The **Message Type Selector** (D13-D11) determines the message type and the command that is signaled (see [table 6-2](#)).

**Table 6-2: Message types**

Message Type Selector	Message Type	Description
0	HARQ Feedback Auto	Carries only ACK/NACK feedback. The redundancy version (RV) to be used in the next PUSCH transmission of the affected HARQ process is determined automatically
1	HARQ Feedback with RV request	Carries ACK/NACK feedback and a request for a specific redundancy version (RV). This RV is then applied in the next PUSCH transmission of the affected HARQ process. This command causes the instrument's HARQ process logic to "jump" to the first occurrence of the requested redundancy version in the configured redundancy version sequence (according to the HARQ process description in 3GPP TS 36.321).
2	Timing Advance Command (Absolute)	Requests an absolute timing advance of the uplink signal
3	Timing Adjustment Command (Relative)	Requests a relative timing adjustment of the uplink signal
4	Combined HARQ Feedback Auto and Relative Timing Adjustment Command	Combination of the both commands "HARQ Feedback Auto" and the "Timing Adjustment (Relative)". The instrument behaves exactly as if the HARQ feedback and the timing adjustment would be sent in two separate commands
5-7	reserved	-

- Message Bits** (D10-D0)

The figure 6-3 gives an overview of the structure of the different commands and the information they carry.

Message Type	Message Bits											
	D10	D9	D8	D7	D6	D5	D4		D3	D2	D1	D0
HARQ Feedback Auto	reserved					For FDD mode: reserved For TDD mode and UL/DL configurations 1..6: reserved For TDD mode and UL/DL configuration 0:				0: NACK 1: ACK	reserved	
HARQ Feedback with RV request						<ul style="list-style-type: none"> <li>- 1: adjust subframe "n+7"</li> <li>- 2: adjust subframe "n+k"</li> <li>- 0 or 3: adjust both subframes "n+k" and "n+7"</li> </ul>					Requested redundancy version (RV). D1 is MSB. D0 is LSB.	
Timing Advance Command (Absolute)	11-bit timing advance command $T_A$ according to TS 36.213, chapter 4.2.3. The D10 is MSB and D0 is the LSB.											
Timing Adjustment Command (Relative)	reserved					6-bit timing adjustment command $T_A$ according to TS 36.213, chapter 4.2.3. <ul style="list-style-type: none"> <li>- <math>T_A = 31</math> means no adjustment</li> <li>- <math>T_A &gt; 31</math> means an increasing advance of the uplink signal</li> <li>- <math>T_A &lt; 31</math> means the advance of the uplink signal is decreased by delaying the signal</li> </ul> The D5 is MSB, the D0 is LSB.						
Combined HARQ Feedback Auto and Relative Timing Adjustment Command	6-bit timing adjustment command $T_A$ according to TS 36.213, chapter 4.2.3. <ul style="list-style-type: none"> <li>- <math>T_A = 31</math> means no adjustment</li> <li>- <math>T_A &gt; 31</math> means an increasing advance of the uplink signal</li> <li>- <math>T_A &lt; 31</math> means the advance of the uplink signal is decreased by delaying the signal</li> </ul> The D10 is MSB, the D5 is LSB.					For FDD mode: reserved For TDD mode and UL/DL configurations 1..6: reserved For TDD mode and UL/DL configuration 0: <ul style="list-style-type: none"> <li>- 1: adjust subframe "n+7"</li> <li>- 2: adjust subframe "n+k"</li> <li>- 0 or 3: adjust both subframes "n+k" and "n+7"</li> </ul>				0: NACK 1: ACK	reserved	

Fig. 6-3: Message bits



**Example:**

The figure below depicts the example of a serial feedback command with the following settings:

- BB Selector = 01
- Message Type Selector = 000, i.e. HARQ Feedback Auto
- ACK/NACK bit = 1, i.e. ACK is transmitted
- Message Bits D3-D4 are reserved for FDD mode.

The least significant bit (LSB) is transmitted first.

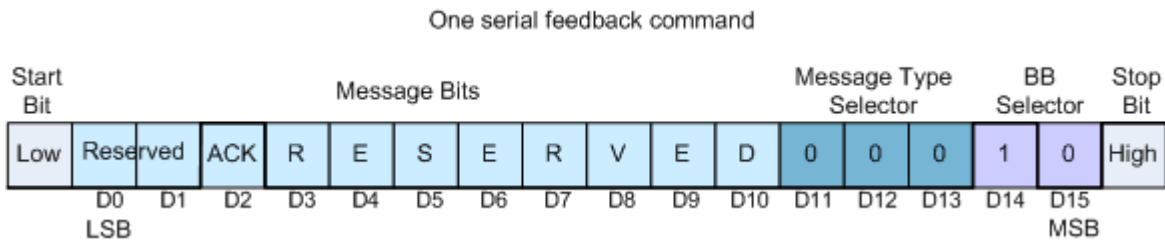


Fig. 6-4: Example of a serial feedback command (HARQ Feedback Auto)

## 6.3 Timing Aspects

The available number of messages per subframe in the downlink timing depends on the feedback line used. A binary feedback line allows only one feedback message per subframe in downlink timing, whereas zero, one or several feedback messages can be sent over the serial or the serial 3x8 one.

### 6.3.1 Parameterization of the feedback timing

The parameterization of the feedback timing depends on the "Feedback Mode" (binary, serial or serial 3x8) and the selected "Distance Mode" (3GPP or direct response).

#### 6.3.1.1 Timing for binary mode with 3GPP Distance Mode, serial or serial 3x8 mode

The figure below illustrates the parameterization of the feedback timing. The example shows timing of feedback commands carrying the information that would be sent in a PDCCH/PHICH channel in downlink subframe  $n$ , in comparison to the downlink signal of the air interface. It is a prerequisite that the base station and the instrument are synchronized by means of a common trigger source and a 10 MHz reference line.

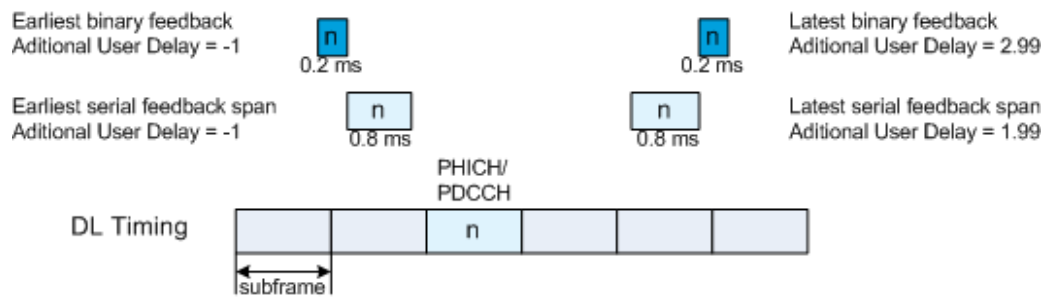


Fig. 6-5: Parameterization of the feedback timing

The exact timing of the feedback commands can be adjusted by the parameter [Additional User Delay](#).

- In **binary mode**, an "Additional User Delay" of 0 means, the instrument reads the binary feedback at the point in time that coincides with the beginning of the subframe (in downlink timing), in which the respective information would be sent in the PDCCH/PHICH channels over the air interface.  
Note that the feedback level has to be held constant from 0.1 ms before this point in time until 0.1 ms after this point in time.  
For binary mode, the additional user delay can vary between -1.00 and 2.99 subframes.
- In **serial** and **serial 3x8 mode**, an "Additional User Delay" of 0 means that all serial feedback commands that contain information which would be sent in the PDCCH/PHICH channels in one specific subframe, have to be sent inside a 0.8 ms time span starting 0.1 ms after the beginning of this PDCCH/PHICH subframe (downlink timing) and ending 0.1 ms before the end of this PDCCH/PHICH subframe.  
For serial and serial 3x8 mode, the additional user delay can vary between -1.00 and 1.99 subframes.

### 6.3.1.2 Maximum number of serial feedback commands

The serial feedback commands and the individual serial packets of the serial 3x8 feedback command can be transmitted asynchronously inside the serial feedback span. Technically, the instrument is able to process a maximum number of 40 serial commands in one serial feedback span, independently from the baseband selectors. For [Serial Rate](#) of 115.2 kbps, the number of commands is further limited due to their length and the low bit rate. A maximum number of 5 commands fit into the 0.8 ms serial feedback span. Up to three commands consisting each of three serial packets can be transmitted within the 0.8 ms while using the serial 3x8 feedback.

### 6.3.1.3 Timing for binary mode with Response Distance Mode

In **binary mode**, there is also another possibility to determining the uplink subframe, in which the signaled feedback has the desired effect. In this "Direct Response Distance Mode", the influenced uplink subframe is calculated from the position of the last sent uplink packet of a HARQ process (see the example on [figure 6-6](#)).

Supposing an initial timing advance of 0, an additional user delay of 0 would mean, that the binary feedback to a specific uplink HARQ packet is expected by the instrument at

the point in time that coincides with the beginning of this uplink subframe, which does not make sense. Therefore, for the "Direct Response Distance Mode", the allowed range of the parameter "Additional User Delay" starts with +1.00 subframes.

The uplink subframe in which the signaled HARQ feedback has the desired effect is the next uplink subframe corresponding to the HARQ process the feedback was for.

Note that the feedback level has to be held constant from 0.1 ms before until 0.1 ms after the point in time when the instrument expects the binary feedback.

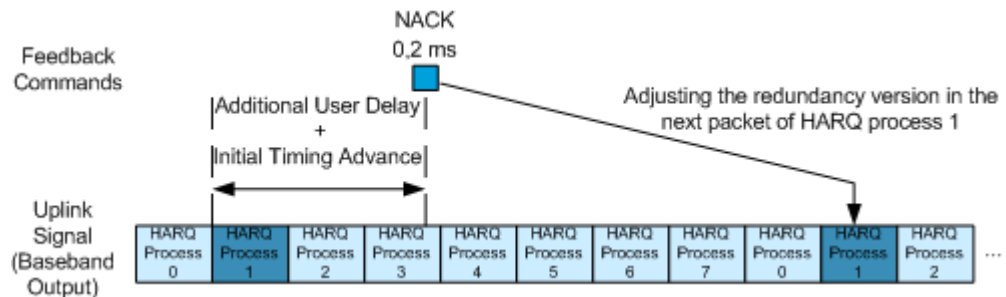


Fig. 6-6: Timing of feedback commands in Direct Response Distance Mode (Example for FDD).

### 6.3.2 Uplink Timing

The uplink subframe in which the signaled feedback has the desired effect is calculated from the downlink subframe number n, according to 3GPP TS 36.213, section 4.2.3 (timing adjustment/timing advance commands) and chapter 8 (HARQ feedback commands).

The figure below depicts the principle of the uplink timing by means of an example of a FDD mode with 8 active HARQ processes.

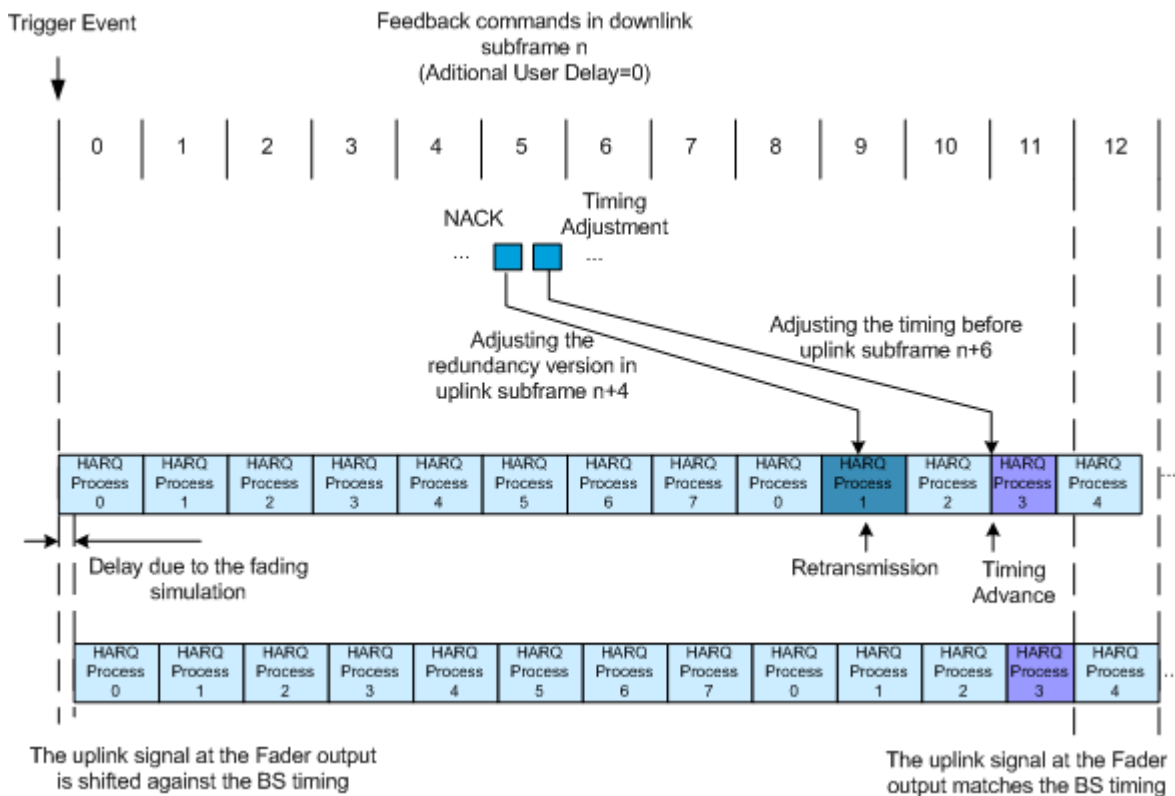


Fig. 6-7: Timing of feedback commands in Direct Response Distance Mode (Example for FDD).

In FDD, due to invariant DL and UL subframe configuration and continuous DL and UL transmission, the retransmission of data occurs in a predefined time after the initial transmission. In TDD however, such a fixed relation is not possible and the time varies depending on the active UL/DL configuration.

- A **timing adjustment command** corresponding to downlink subframe  $n$  causes a timing adjustment of the uplink signal at the beginning of uplink subframe  $n+6$ .
- A HARQ feedback command corresponding to downlink subframe  $n$  causes an adjustment of the redundancy version in:
  - uplink subframe  $n+4$ , if FDD is used without subframe bundling operation and if there is a PUSCH transmission scheduled in uplink subframe  $n+4$ .
  - uplink subframe  $n+k$ , with  $k$  given in table 8-2 of TS 36.213, if TDD is used with UL/DL configurations 1 to 6 without subframe bundling operation and if there is a PUSCH transmission scheduled in uplink subframe  $n+k$
  - uplink subframe determined by the bits D4-D3 of the HARQ feedback command, "HARQ Feedback Auto" or "HARQ Feedback with RV request" (see table 6-2), in case of TDD transmission with UL/DL configuration 0.
  - Note that for binary HARQ feedback, both the subframes  $n+k$  and  $n+7$  are modified.

### 6.3.2.1 General timing rules

The first HARQ feedback recognized by the instrument after triggering is the feedback responding to the first uplink PUSCH transmission. For example, if a PUSCH is scheduled

in uplink subframe 0 and if FDD without subframe bundling is used, the first HARQ feedback recognized by the instrument is the one affecting uplink subframe 8.

If no HARQ feedback command is received for a specific HARQ process in serial mode, the instrument behaves as if NACK was signaled in a "HARQ Feedback Auto" command. If there is a conflict between several HARQ feedback commands (because they would affect the same uplink PUSCH transmission), only the last received HARQ feedback command is considered.

The first timing advance or timing adjustment command that is recognized by the instrument after triggering is the one causing a timing adjustment at the beginning of uplink subframe 8.

If no timing advance or timing adjustment command is received, then no timing adjustment is applied, (i.e. the timing advance in subframe  $n+6$  will not be modified). If there is a conflict between several timing advance or timing adjustment commands (because they would affect the same uplink subframe), only the last received timing advance / adjustment command is considered.

If the serial or serial 3x8 mode is used, the serial line has to be held idle (high) during downlink subframe 0.

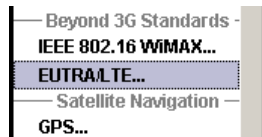
## 6.4 Limitation

Although an arbitrary data source can be selected, the used user data before the channel coding is the same in all subframes for all HARQ processes and for all transmissions.

If for instance a Transport Block Size of 47520 is configured and the Data Source is set to PN9, then the first 47520 bits of the PN9 sequence are used as an input for all HARQ processes (even after an ACK), regardless of the performed transmission. However, since different redundancy versions are applied during the channel coding, the bit stream at the output of the channel coder is different for the different retransmissions.

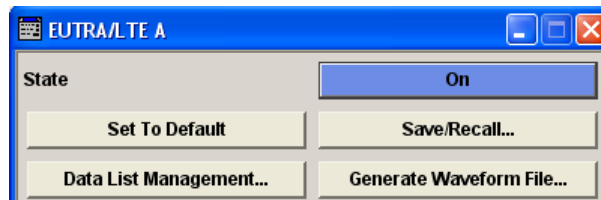
## 7 EUTRA/LTE User Interface

To access the dialog for setting the EUTRA/LTE digital standard, select "Baseband block > EUTRA/LTE" or use the menu tree under "Baseband".

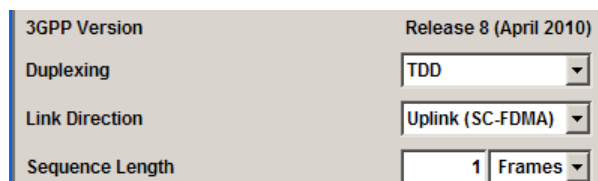


### 7.1 Main Menu for EUTRA/LTE Signals

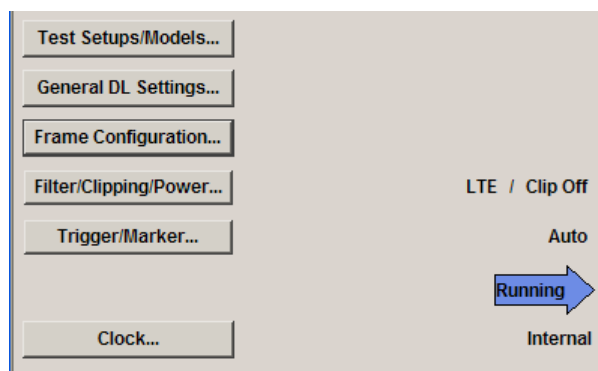
The menu is split into several sections for configuring the standard. The upper menu section is where the EUTRA/LTE digital standard is enabled and reset, the default settings are called, and where the generated waveform file can be selected.



The middle menu section is where EUTRA/LTE related settings such as the link direction and the sequence length can be selected.



The buttons in the lower menu section lead to submenus to configure the EUTRA/LTE signal and setting the filter, trigger, and clock parameters.



#### State

Activates or deactivates the EUTRA/LTE standard.

Activating this standard disables all the other digital standards and digital modulation modes.

In case of two-path instruments, this affects the same path.

**Note:** For two path instruments and configured antenna for path B, enabling the LTE signal simulation will disable all other digital standards and digital modulation modes even in the path B.

The EUTRA/LTE signal is generated according to the performed settings.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:STATe on page 289

### Set to Default

Calls the default settings.

Parameter	Values
Duplexing	FDD
Link Direction	Downlink (OFDMA)
Sequence Length	1 Frame
DL Channel Bandwidth	10 MHz
Physical Resource Block Bandwidth	12 * 15 kHz
Number Of Resource Blocks per Slot	50
Occupied Bandwidth /MHz	9.015
Sampling Rate /MHz	15.360
FFT Size	1024
Cell ID	0
Cyclic Prefix	Normal
PHICH Duration	Normal
Global MIMO Configuration	1 TxAntenna
Simulated Antenna	Antenna 1

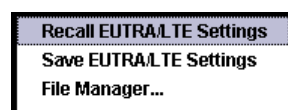
SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:PRESet on page 290

### Save/Recall...

Calls the "Save/Recall" menu.

From the "Save/Recall" menu, the "File Select" windows for saving and recalling EUTRA/LTE configurations and the "File Manager" is called.



EUTRA/LTE configurations are stored as files with the predefined file extension `*.eutra`. The file name and the directory they are stored in are user-definable.

The complete settings in the "EUTRA/LTE" dialog are saved and recalled.

"Recall EUTRA/Opens the "File Select" window for loading a saved EUTRA/LTE configuration"   
LTE Setting" uration.

The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.

"Save EUTRA/ Opens the "File Select" window for saving the current EUTRA/LTE signal   
LTE Setting" configuration.

The name of the file is specified in the "File name" entry 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:EUTRa:SETTing:CATalog` on page 290

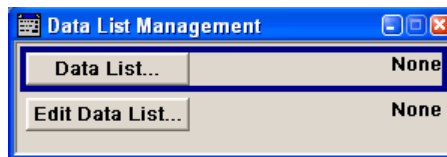
`[ :SOURce<hw> ] :BB:EUTRa:SETTing:LOAD` on page 291

`[ :SOURce<hw> ] :BB:EUTRa:SETTing:STORE` on page 291

`[ :SOURce<hw> ] :BB:EUTRa:SETTing:DEL` on page 291

### 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.

**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 "eutra"
SOUR:BB:DM:DLIS:DATA 1,1,0,1,0,1,0,1,1,1,1,0,0,0
SOUR:BB:DM:DLIS:DATA:APP 1,1,0,1,0,1,0,1,1,1,1,0,0
```

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :DATA on page 348

[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :DSElect on page 349

[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:DATA on page 402

[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:DSElect on page 402

**Generate Waveform File...**

Calls the "Generate Waveform" menu. This menu is used to store the current EUTRA/LTE 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.

**Note:** Even for enabled Realtime Feedback (see [chapter 7.13.3, "Realtime Feedback Configuration"](#), on page 159), the waveform file is generated as if this functionality is disabled.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:WAVEform:CREate on page 292

**Test Case Wizard**

Opens the Test Case Wizard dialog (see [chapter 8, "Test Case Wizard"](#), on page 204).

**3GPP Version**

Displays the current version of the 3GPP standard.

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

SCPI command:

[ :SOURce ] :BB:EUTRa:VERSion on page 292

**Duplexing**

Selects the duplexing mode. The duplexing mode determines how the uplink and downlink signals are separated.

"TDD" In TDD mode, the same frequency is used for both directions of transmission (uplink and downlink). With one baseband, either only downlink or only uplink can be generated.

"FDD" In FDD mode, different frequencies are used for downlink and uplink directions.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DUPLexing on page 289

### Link Direction

Selects the transmission direction.

"Downlink (OFDMA)" The transmission direction selected is base station to user equipment. The signal corresponds to that of a base station. For the downlink, the physical layer mode is always set to OFDMA.

"Uplink (SC-FDMA)" The transmission direction selected is user equipment to base station. The signal corresponds to that of a user equipment. For the uplink, the physical layer mode is always set to SC-FDMA.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:LINK on page 290

### Sequence Length

Sets the sequence length of the signal in number of frames. One frame corresponds to 10 ms. The signal is calculated in advance and output in the arbitrary waveform generator. The maximum number of frames is calculated as follows:

Max. No. of Frames = Arbitrary waveform memory size/(sampling rate x 10 ms).

If the Realtime Feedback functionality is enabled, the signal of UE1 does not depend on the sequence length, since this signal is not calculated in advance. The configuration of the sequence length is then only required, if also the signal of UE2, UE3 or UE4 is used.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:SLENgth on page 292

### Test Setups/Models

Calls dialog for selecting one of the test models defined in the 3GPP specification TS 36.141 and the self-defined test setups.

The dialog is described in [chapter 7.3, "Test Setups/Models"](#), on page 80.

SCPI command:

n.a.

### General DL Settings.../ General UL Settings.../ General Settings

The name of the button depends on the chosen link direction (uplink or downlink) and the selected duplexing mode (FDD or TDD).

Calls the "General DL Settings / General UL Settings / General TDD Settings" dialog for configuring the EUTRA/LTE system.

The dialogs are described respectively in [chapter 7.4, "General DL Settings / General TDD Settings"](#), on page 82 and [chapter 7.11, "General UL Settings"](#), on page 135.

SCPI command:

n.a.

**Frame Configuration...**

Calls the "Frame Configuration" dialog for configuring the allocation of the resource blocks to the different users, as well as the configuration of the users.

The dialog depends on the chosen link direction. The menu is described in [chapter 7.5, "DL Frame Configuration"](#), on page 93 and [chapter 7.12, "UL Frame Configuration"](#), on page 148 respectively.

SCPI command:

n.a.

**Filtering/Clipping/Power...**

Calls the menu for setting baseband filtering, clipping and the general power settings. The current filter and the clipping state are displayed next to the button.

The menu is described in [chapter 7.18, "Filter/Clipping/Power Settings"](#), on page 185.

SCPI command:

n.a.

**Trigger/Marker**

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

Calls the dialog for selecting the trigger mode and trigger source, for configuring the marker signals, and for setting the time delay of an external trigger signal. This dialog is described in [chapter 7.19, "Trigger/Marker/Clock Settings"](#), on page 192.

The currently selected trigger mode and trigger source are displayed next to the button.

SCPI command:

n.a.

**Execute Trigger**

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:EUTRa:TRIGger:EXECute](#) on page 309

**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:EUTRa:TRIGger:ARM:EXECute](#) on page 308

**Clock**

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

Calls the menu for selecting the clock source and for setting a delay.

This menu is described in [chapter 7.19.5, "Clock Settings"](#), on page 200.

SCPI command:

n.a.

## 7.2 LTE Logfile Generation



Logfile Generation requires an additional SW option and is enabled only for instruments equipped with R&S SMx/AMU-K81.

---

This functionality enables the generation of logfiles for exchanging intermediate results of different logging points in the signal processing chain. Analysing the content of the logfiles may help to verify the signal processing chain in both the DL and UL direction. The intermediate results provide a basis for enhanced debugging. To verify the FEC implementation of the DUT for instance, the coded bitstream from the R&S Signal Generator can be loaded into a Rx software module for offline analysis in a simulation environment, or it can be compared to the bitstreams from a Tx software module. Due to the full remote control of this functionality, optimization of the design flow with process automatization can be achieved, too.

### 7.2.1 Signal Processing Chains and Logging Points

Logfile generation can be enabled after a completed processing step of the selected channel, at the so called logging point. Logging points (PTxx) are available after each completed processing stage up to the "Precoding", as shown on the figures bellow.

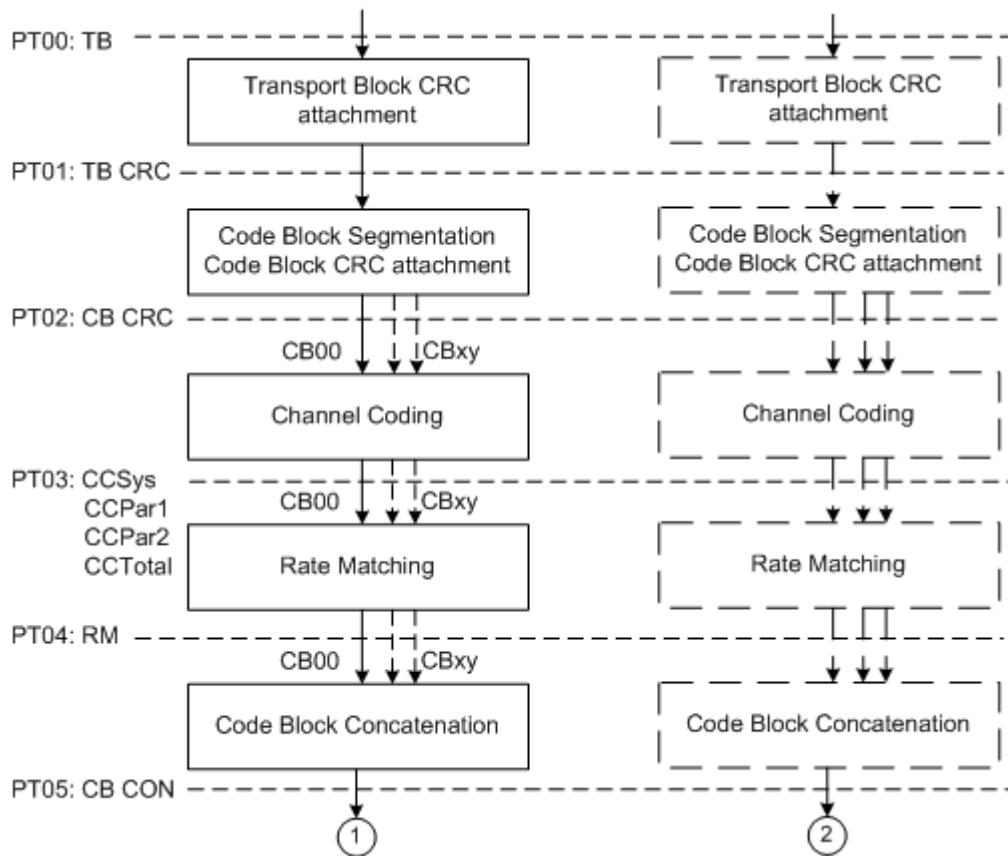
The results of the "Resource Element Mapping/OFDM Mapper" are not logged!



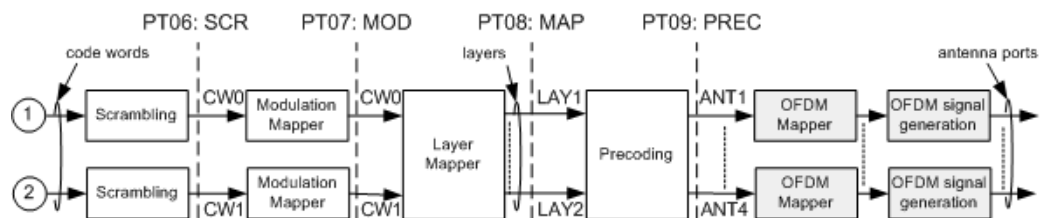
For detailed information about the signal processing of all channels, refer to the corresponding 3GPP specification.

---

**Signal Processing in Downlink**



**Fig. 7-1: Transport channel processing for DL-SCH (according to 3GPP TS 36.212)**



**Fig. 7-2: Overview of physical channel processing (according to 3GPP TS 36.211)**

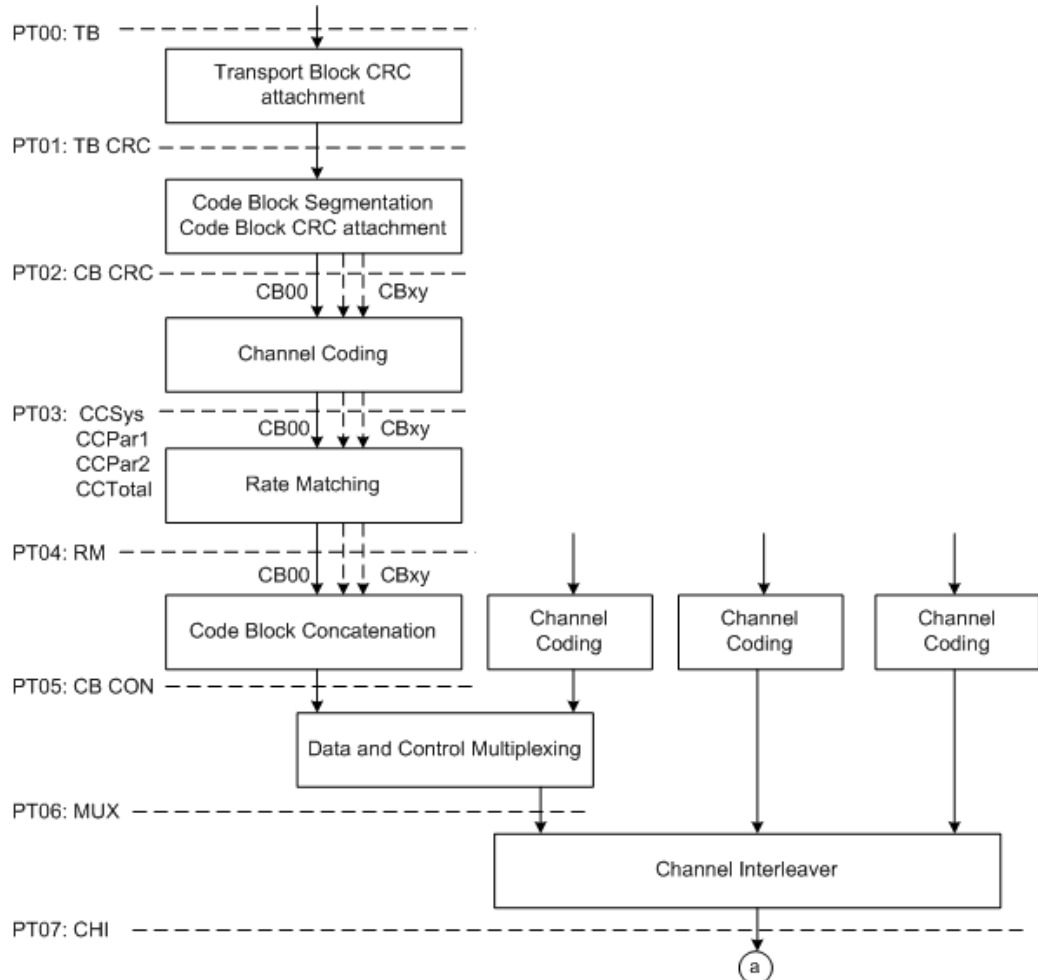
The [table 7-1](#) gives an overview of the logging point available for the DL channels.

**Table 7-1: Available logging points per DL channel**

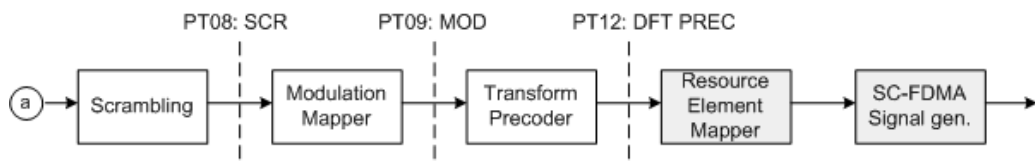
Point/ Channel	PT00 TB	PT01 TBCRC	PT02 CBCRC	PT03 CC	PT04 RM	PT05 CBCON	PT06 SCR	PT07 MOD	PT08 MAP	PT09 PREC
PDSCH	X	X	X	X	X	X	X	X	X	X
PBCH <sup>1)</sup>	X	X		X	X		X	X	X	X
PCFICH <sup>1)</sup>	X						X	X	X	X
PHICH <sup>1)</sup>	X							X <sup>2)</sup>	X <sup>2)</sup>	X <sup>2)</sup>
PDCCH <sup>1)</sup>	X <sup>3)</sup>	X <sup>3)</sup>		X <sup>3)</sup>	X <sup>3)</sup>	X	X	X	X	X

- 1) the channel has one codeword and one code block
- 2) an individual file is generated per PHICH group
- 3) an individual file is generated per DCI

**Signal Processing in Uplink**



**Fig. 7-3: Transport channel processing for UL-SCH (according to 3GPP TS 36.212)**



**Fig. 7-4: Overview of uplink physical channel processing (according to 3GPP TS 36.211)**

Refer to [table 7-2](#) for an overview of logging points available for the UL channels.

Table 7-2: Available logging points per UL channel

Point / Channel	PT00 TB	PT01 TBCRC	PT02 CBCRC	PT03 CC	PT04 RM	PT05 CBCON	PT06 MUX	PT07 CHI	PT08 SCR	PT09 MOD	PT10 MAP	PT11 PREC	PT12 DFT PREC
PUSCH	X	X	X	X	X	X	X	X	X	X	-	-	X



In the uplink direction, logging points PT10 and PT11 are reserved for future use.

## 7.2.2 Output Files

The output logfiles are stored in a user-defined network directory, selected with the parameter [Output Path](#). The logfiles are named according to the naming conventions described in [chapter 7.2.2.1, "File Names"](#), on page 71. Description of the available file formats is given below.

### File Formats

Generally, the logfiles are generated in two file formats:

- Bitstream  
The logfile contains a sequence of "1" and "0"; one value per line  
The logfile of the PHICH contains also the entry "-" that corresponds to DTX.
- IQ Samples  
The logfile contains pairs of I and Q samples; one I or Q sample per line

File format IQ Samples is used for the logfiles generated for the logging points "Modulation Mapping", "Layer Mapping" and "Precoding". The other logfiles are output in a Bitstream format.

An exception are the extended DCI/UCI logfiles (see ["Extended DCI Logfile"](#), on page 74 and ["Extended UCI Logfile"](#), on page 77).

### 7.2.2.1 File Names

The generated logging files are named according to the following naming structure:

```
[<Preamble>_]<Frame#>_<Subframe#>_<Channel>[_<User/Allocation#>|<DCI#>|<Group#>]_<Point#>[_<CW#>|<LAY#>|<ANT#>]_<Point Name>[_<CodeBlock#>].dat
```

An exception are the extended DCI/UCI logfiles. The file names of these two logfiles are as follow:

```
[<Preamble>_]ExtendedDciLog.txt and [<Preamble>_]ExtendedUciLog.txt
```

**Table 7-3: Description of the File Name Structure**

	Description	Value Range
<Preamble>	Optional user-defined preamble	-
<Frame#>	Frame Number	F000 .. F873
<Subframe#>	Subframe Number	SF0 .. SF9
<Channel>	Channel Name	DL: PBCH   PCFICH   PHICH   PDCCH   PDSCH
		UL: PUSCH
<User/Allocation#>	PDSCH allocation only	USER1 .. USER4 ALL000 .. ALL101
<DCI#>	PDCCH allocation only each PDCCH DCI is logged individually	DCI00 .. DCI19
<Group#>	PHICH Group an individual file is generated for each PHICH group	Group00   Group01
<Point#>	Logging Point Number	see <a href="#">table 7-4</a>
<CW#>	PDSCH allocation only Codeword	CW0   CW1
<LAY#>	Layer Number	LAY1   LAY2
<ANT#>	Antenna Number	ANT1 .. ANT4
<PointName>	Logging Point designation	see <a href="#">table 7-4</a>
<CodeBlock#>	PDSCH allocation only	CB00 .. CB20

There is a fixed cross-reference between the logging point number and the logging point designation (see [table 7-4](#)).

**Table 7-4: Logging Points Overview**

<Point#>	<PointName>	Description
PT00	TB	Bits of the Transport Block
PT01	TBCRC	Bits after Transport Block CRC
PT02	CBCRC	Bits after Code Block CRC One file per code block is generated
PT03	Bits after Channel Coding (one file per code block)	
	CCSys	Systematic Bits
	CCPar1	Parity 1 Bits
	CCPar2	Parity 2 Bits
	CCTotal	PDSCH and PUSCH allocation only Complete bit-stream after channel coding, incl. systematic, parity 1 and parity 2 bits



<Point#>	<PointName>	Description
PT04	RM	Bits after Rate Matcher (one file per code block)
PT05	CBCON	Bits after Code Block Concatenation
PT06	DL: SCR	Bits after Scrambling
	UL: MUX	Bits after Data and Control Multiplexing
PT07	DL: MOD	IQ-Samples after Modulation
	UL: CHI	Bits after channel interliever
PT08	DL: MAP	IQ-Samples after Layer Mapping (one file per layer)
	UL: SCR	Bits after Scrambling
PT09	DL: PREC	IQ-Samples after Precoding (one file per antenna)
	UL: MOD	IQ-Samples after Modulation
PT10	UL: MAP	Reserved for future use
PT11	UL: PREC	
PT12	UL: DFT_PREC	IQ-Samples after DFT

#### Example: List of the output logfiles for PDSCH

The following output files are generated for one PDSCH channel, configured on a allocation with index ALL002 in the third subframe (SF2) of the first frame (F000). The instrument is configured to generate a MIMO signal with two antennas (PREC\_ANT1 and PREC\_ANT2). Channel coding and scrambling are enabled (CCPar1, CCPar2, CCSys, CCTotal and SCR). Two codewords (CW0 and CW1) and two layers (LAY0 and LAY1) are used; three code blocks per code (CB00, CB01, CB02) are generated.

All logging points are enabled and a preamble (20100825Log) is selected.

```
<User/Allocation#>_<Point#>[_<CW#>|<LAY#>|<ANT#>]_<Point
Name>[_<CodeBlock#>].dat
```

```
20100825Log_F000_SF2_PDSCH_ALL002_PT00_CW0_TB.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT00_CW1_TB.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT01_CW0_TBCRC.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT01_CW1_TBCRC.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW0_CBCRC_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW1_CBCRC_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW0_CBCRC_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW1_CBCRC_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW0_CBCRC_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT02_CW1_CBCRC_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar1_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar1_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar1_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar1_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar1_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar1_CB02.dat
```

```

20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar2_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar2_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar2_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar2_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCPar2_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCPar2_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCSys_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCSys_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCSys_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCSys_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCSys_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCSys_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCTotal_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCTotal_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCTotal_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCTotal_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW0_CCTotal_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT03_CW1_CCTotal_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW0_RM_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW1_RM_CB00.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW0_RM_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW1_RM_CB01.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW0_RM_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT04_CW1_RM_CB02.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT05_CW0_CBCON.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT05_CW1_CBCON.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT06_CW0_SCR.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT06_CW1_SCR.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT07_CW0_MOD.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT07_CW1_MOD.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT08_LAY0_MAP.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT08_LAY1_MAP.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT09_ANT1_PREC.dat
20100825Log_F000_SF2_PDSCH_ALL002_PT09_ANT2_PREC.dat

```

### 7.2.2.2 Extended Logfiles Contents

The instrument generates only one logfile with extended information regarding the DCI/UCI mapping.

#### Extended DCI Logfile

An Extended DCI Logfile summarizes the information for the whole generated signal and may contains information for more than one frame. The information is grouped in rows with different syntax.

- PCFICH mapping, i.e the resource elements the PCFICH REGs are mapped to  
<Frame#>, <Subframe#>, PCFICH: REG-Idx=<REG#>: Subcarrier=<Subcarrier#>, Symbol=<OFDMSymbol#>

- PHICH mapping, i.e the resource elements the PHICH REGs of the individual PHICH groups are mapped to  
`<Frame#>, <Subframe#>, PHICH: Group=<Group#>: REG-Idx=<REG#>: Subcarrier=<Subcarrier#>, Symbol=<OFDMSymbol#>`
- PDCCH number of useful REGs  
`<Frame#>, <Subframe#>, PDCCH: Cols=<Cols#>, Rows=<Rows#>, Useful REGs:<REG#>`  
 The Number of Useful REGs corresponds to the value displayed with the parameter [Number of available REGs \(PDCCH\)Number of Available REGs](#).
- The start CCE-Index of the individual DCIs  
`<Frame#>, <Subframe#>, DCI: DCI Idx=<DCI#>, Start CCE-Idx=<CCE#>`  
 The DCI Idx corresponds to the row in the DCI Table and the Start CCE-Idx is the [CCE Index](#) for the corresponding DCI.
- PDCCH mapping, i.e the resource elements the PDCCH REGs of the individual PDCCHs are mapped to  
`<Frame#>, <Subframe#>, PDCCH: Idx=<Symbol#>: REG-Idx=<REG#>: Subcarrier=<Subcarrier#>, Symbol=<OFDMSymbol#> [--- DTX REG]`  
 The additional information DTX REG is assigned to all Dummy PDCCH REGs (see ["Number of Dummy REGs"](#) on page 116).



Sub-carrier with index 0 is the most left sub-carrier, i.e. the one belonging to the resource block 0.

### Example: Content of an Extended DCI Logfile

The instrument is configured to generate a DL LTE signal with 1.4MHz bandwidth (6 RBs), normal Cyclic Prefix, Extended PHICH Duration and Control Region for PDCCH of 3 OFDM symbols. Two Antennas are selected, path A generate the signal of Antenna 1 and Path B, the signal of Antenna 2.

A PDCCH Format Variable is selected and the PDCCH is configured as given on the figure bellow.

	User	UE_ID n_RNTI	DCI Format	Content	PDCCH Format	Number CCEs	Search Space	CCE Index	No.Dummy CCEs	Conflict
0	User1	0	0	Config...	1	2	On	0	0	
1 >	SI-RNTI	65535	1A	Config...	0	1	On	2	1	

Generation of Extended DCI Logfile is enabled and the file contains the following information (only the beginning of the file is listed):

```
F00,SF0,PCFICH: REG-Idx=0: Subcarrier=1, Symbol=0
F00,SF0,PCFICH: REG-Idx=0: Subcarrier=2, Symbol=0
F00,SF0,PCFICH: REG-Idx=0: Subcarrier=4, Symbol=0
F00,SF0,PCFICH: REG-Idx=0: Subcarrier=5, Symbol=0
F00,SF0,PCFICH: REG-Idx=1: Subcarrier=19, Symbol=0
F00,SF0,PCFICH: REG-Idx=1: Subcarrier=20, Symbol=0
```

```

F00,SF0,PCFICH: REG-Idx=1: Subcarrier=22, Symbol=0
F00,SF0,PCFICH: REG-Idx=1: Subcarrier=23, Symbol=0
F00,SF0,PCFICH: REG-Idx=2: Subcarrier=37, Symbol=0
F00,SF0,PCFICH: REG-Idx=2: Subcarrier=38, Symbol=0
F00,SF0,PCFICH: REG-Idx=2: Subcarrier=40, Symbol=0
F00,SF0,PCFICH: REG-Idx=2: Subcarrier=41, Symbol=0
F00,SF0,PCFICH: REG-Idx=3: Subcarrier=55, Symbol=0
F00,SF0,PCFICH: REG-Idx=3: Subcarrier=56, Symbol=0
F00,SF0,PCFICH: REG-Idx=3: Subcarrier=58, Symbol=0
F00,SF0,PCFICH: REG-Idx=3: Subcarrier=59, Symbol=0

F00,SF0,PHICH: Group=0: REG-Idx=0: Subcarrier=7, Symbol=0
F00,SF0,PHICH: Group=0: REG-Idx=0: Subcarrier=8, Symbol=0
F00,SF0,PHICH: Group=0: REG-Idx=0: Subcarrier=10, Symbol=0
F00,SF0,PHICH: Group=0: REG-Idx=0: Subcarrier=11, Symbol=0
F00,SF0,PHICH: Group=0: REG-Idx=1: Subcarrier=24, Symbol=1
F00,SF0,PHICH: Group=0: REG-Idx=1: Subcarrier=25, Symbol=1
F00,SF0,PHICH: Group=0: REG-Idx=1: Subcarrier=26, Symbol=1
F00,SF0,PHICH: Group=0: REG-Idx=1: Subcarrier=27, Symbol=1
F00,SF0,PHICH: Group=0: REG-Idx=2: Subcarrier=48, Symbol=2
F00,SF0,PHICH: Group=0: REG-Idx=2: Subcarrier=49, Symbol=2
F00,SF0,PHICH: Group=0: REG-Idx=2: Subcarrier=50, Symbol=2
F00,SF0,PHICH: Group=0: REG-Idx=2: Subcarrier=51, Symbol=2

F00,SF0,PDCCH: Columns:32, Rows:2, Useful REGs:41
F00,SF0,DCI: DCI Idx=0: Start CCE-Idx=0
F00,SF0,DCI: DCI Idx=1: Start CCE-Idx=2
F00,SF0,PDCCH: Idx=0: REG-Idx=10: Subcarrier=0, Symbol=1
F00,SF0,PDCCH: Idx=0: REG-Idx=10: Subcarrier=1, Symbol=1
F00,SF0,PDCCH: Idx=0: REG-Idx=10: Subcarrier=2, Symbol=1
F00,SF0,PDCCH: Idx=0: REG-Idx=10: Subcarrier=3, Symbol=1
F00,SF0,PDCCH: Idx=1: REG-Idx=26: Subcarrier=0, Symbol=2
F00,SF0,PDCCH: Idx=1: REG-Idx=26: Subcarrier=1, Symbol=2
F00,SF0,PDCCH: Idx=1: REG-Idx=26: Subcarrier=2, Symbol=2
F00,SF0,PDCCH: Idx=1: REG-Idx=26: Subcarrier=3, Symbol=2
.....
    
```

The figure 7-5 shows the resource allocation for this example. See also [chapter 3.2.4, "Downlink Control Information Transmission"](#), on page 20.

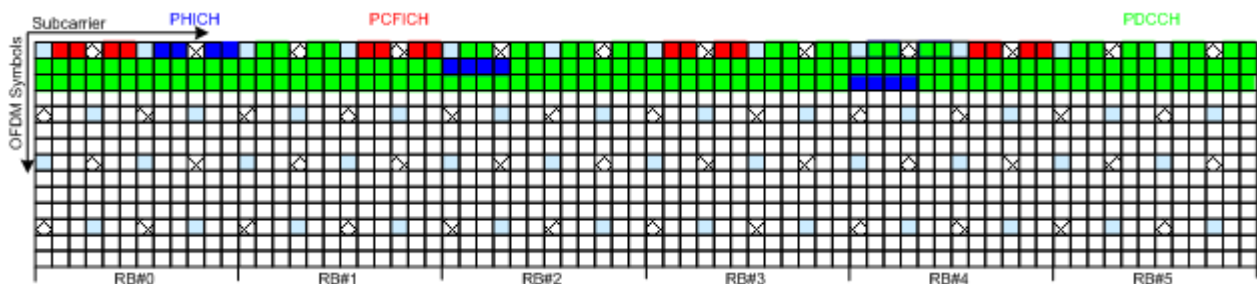


Fig. 7-5: Example of Downlink Control Information Mapping

### Extended UCI Logfile

The Extended UCI Logfile summarizes the information for the whole generated signal and may contains information for more than one frame. The information is grouped in rows with the following syntax:

```
<Frame#>, <Subframe#>, PUSCH <ChannelCodingMode> Number of Bits:
No.HARQ Bits=<HARQ#>,No.RI Bits=<RI#>,No.CQI
Bits=<CQI#>,No.coded HARQ Bits=<CodedHARQ#>,No.coded RI
Bits=<CodedRI#>,No.coded CQI Bits=<CodedCQI#>,No.coded UL-SCH
Bits=<UL-SCH#>
```

#### Example:

The PUSCH carries multiplexed control information and data (UCI+UL-SCH) and the channel is configured as shown on the figure below:

Channel Coding/Multiplexing	
HARQ ACK	
ACK/NACK Mode	Multiplexing
Number of A/N Bits	3
ACK/NACK Pattern	0...
Number of Coded A/N Bits	34
Rank Indication(RI)	
Number of RI Bits	2
RI Pattern	0...
Number of Coded RI Bits	12
Channel Quality Indication(CQI)	
Number of CQI Bits	1
CQI Pattern	0...
Number of Coded CQI Bits	4
UL-SCH	
Total Number Of Physical Bits	1 728
Number Of Coded UL-SCH Bits	1 712
Transport Block Size/Payload	600
Redundancy Version Index	0

The first line of the logfile is: F00, SF0, PUSCH UCI+UL-SCH Number of Bits: No.HARQ Bits=3, No.RI Bits=2, No.CQI Bits=1, No.coded HARQ Bits=34, No.coded RI Bits=12, No.coded CQI Bits=4, No.coded UL-SCH Bits=1712

### 7.2.3 Working with the Logfile Generation Functionality

The R&S Signal Generator generates logfiles only if the logging state is enabled. Adjusting the settings in the "Logfile Generation" dialog does not affect the content of the generated EUTRA/LTE signal and does not cause a recalculation of the signal. The generation of new logfiles is triggered by changing of a signal relevant EUTRA/LTE parameter or by enabling/disabling the generation of EUTRA/LTE signal.



Activation of logfile generation slows down the calculation speed of the instrument. Enable this function only if logfiles are explicitly requested.

### General Workflow

To enable the generation of logfiles proceed as follow:

1. In the "EUTRA/LTE > Logfile Generation > Output Path" dialog, select the network directory the logfiles are saved to, e.g. `<root>/logfiles` and select a "Logging File Preamble", e.g. `201008Log`.

**Note:** The network directory should be empty. Existing logfiles are overwritten. It is recommended to use different preambles to assure that previous logfiles are not lost.

2. If required, enable "Extended DCI/UCI Logging".
3. Select the processing chain points for that logfiles are to be generated, e.g. "Point 3: Channel Coding".

**Tip:** Not all of the available logging point are relevant for all channels. The processing of the PBCH for instance does not include the step "Code block segmentation / CRC", i.e. even if the Logging Point "Point 2: Code block segmentation / CRC" is enabled, no logfile is generated (see [table 7-1](#)).

No logfiles are generated also in case that the corresponding processing step is disabled in the EUTRA/LTE dialog. For example, if channel coding and/or scrambling are disabled for some channel, no logfiles for the Point 3 and/or Point 6/Point 8 are available for this channel as long as these processing steps are not enabled.

4. Set the "Logging State" to On to enable logfile generation.
5. Adjust the EUTRA/LTE Settings as required and enable signal generation.

## 7.2.4 Logfile Generation Settings

To access the dialog, select "EUTRA/LTE Main Dialog > Logfile Generation".

## Downlink Settings

## Uplink Settings

**Logging State**

Enables/disables logfile generation.

**Note:** Activation of logfile generation slows down the calculation speed of the instrument. Enable this function only if logfiles are explicitly requested.

See also [chapter 7.2.3, "Working with the Logfile Generation Functionality"](#), on page 77.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:STATE` on page 426

**Output Path**

Selects the network directory the logged files are stored in.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:OUTPut` on page 426

**Logging Files Preamble**

An optional preamble may be added to the file name. Refer to [chapter 7.2.2.1, "File Names"](#), on page 71 for a description of the file naming convention used.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:LFP` on page 426

**Extended DCI/UCI Logging**

Enables the generation of a logfile with extended information regarding the DCI/UCI mapping.

For description of the content of the generated file, see ["Extended DCI Logfile"](#), on page 74 and respectively ["Extended UCI Logfile"](#), on page 77.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:EDLogging` on page 427

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:EULogging` on page 427

**Physical Channels**

Selects the channel for that logfiles are generated.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:ENCC` on page 427

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:PBCH` on page 427

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:PDSCh` on page 427

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:PUSCh` on page 427

**Enable/Disable All**

Enables/disables all logging points.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:EALL` on page 427

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:DALL` on page 427

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:EALL` on page 427

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:DALL` on page 427

**Logging Point**

Enables/disables one particular logging point.

Refer to [chapter 7.2.1, "Signal Processing Chains and Logging Points"](#), on page 68 for description on the available logging points.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:LOGPoint<ch0>` on page 427

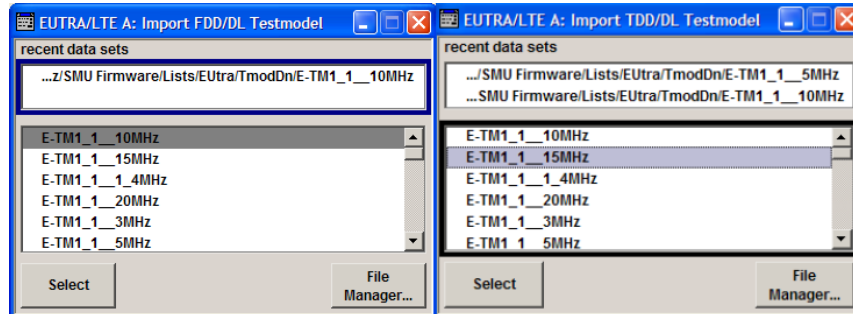
`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:LOGPoint<ch0>` on page 427

## 7.3 Test Setups/Models

To access the "Test Setups/Models" dialog, select "EUTRA/LTE Main Dialog > Test Setups/Models".



The dialog offers quick selection and settings adjustment according to one of the various EUTRA Test Models (E-TM) as defined in the 3GPP specification TS 36.141. The EUTRA Test Models are defined for FDD and TDD duplexing mode.



### EUTRA Test Models (E-TM) Downlink

Opens a window in which to select a EUTRA Test Model (E-TM) in accordance with the 3GPP standard TS 36.141.

The DL test models are predefined configurations of LTE settings. Three main groups of test models are defined, the E-TM1, E-TM2 and E-TM3. All test models use the following parameters:

- single antenna port, single code word, single layer and no precoding
- duration of one frame
- normal cyclic prefix
- localized virtual resource blocks, no intra-subframe hopping for PDSCH
- UE-specific reference signals are not used

The data content of the physical channels and signals are defined in the 3GPP specification. Each E-TM is defined for six different channel bandwidths, 1.4/3/5/10/15 and 20MHz. The test models are defined for specific test purpose (see [table 7-5](#)).

**Table 7-5: E-TM available for selection**

EUTRA Test Model	Defined for tests on
E-TM1.1	<ul style="list-style-type: none"> <li>• BS output power</li> <li>• Unwanted emissions</li> <li>• Transmitter intermodulation</li> <li>• RS absolute accuracy</li> </ul>
E-TM1.2	<ul style="list-style-type: none"> <li>• ACLR</li> <li>• Operating band unwanted emissions</li> </ul>
E-TM2	<ul style="list-style-type: none"> <li>• Total power dynamic range (lower OFDM symbol power limit at min power)</li> <li>• EVM of single 64QAM PRB allocation (at min power)</li> <li>• Frequency error (at min power)</li> </ul>
E-TM3.1	<ul style="list-style-type: none"> <li>• Output power dynamics</li> <li>• Transmitted signal quality (Frequency error and EVM for 64QAM modulation, at max power)</li> </ul>

EUTRA Test Model	Defined for tests on
E-TM3.2	Transmitted signal quality: <ul style="list-style-type: none"> <li>• Frequency error</li> <li>• EVM for 16QAM modulation</li> </ul>
E-TM3.3	Transmitted signal quality: <ul style="list-style-type: none"> <li>• Frequency error</li> <li>• EVM for QPSK modulation</li> </ul>

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:SETTing:TMOD:DL` on page 291

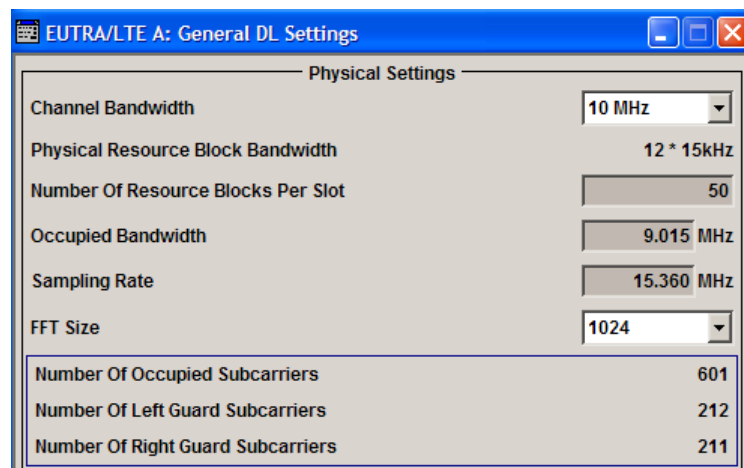
`[ :SOURce<hw> ] :BB:EUTRa:SETTing:TMOD:TDD` on page 291

## 7.4 General DL Settings / General TDD Settings

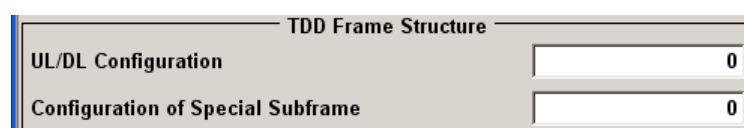
The "General DL Settings" menu allows configuring the EUTRA/LTE system for transmission direction downlink and consists of six sections, "Physical Settings", "Cell Specific Settings", "MIMO", "Downlink Reference Signal Structure", "Synchronization Signal Settings" and "Pseudo-Random Sequence Generation".

Since the EUTRA/LTE standard defines no differences between TDD and FDD signals on the physical layer if only one link direction is considered at once, the "General TDD Settings" menu comes with the same parameters as the "General DL Settings" menu and is only extended with the "TDD Frame Structure" section.

In the "Physical Settings" section, the channel bandwidth respectively the number of resource blocks per slot is selected. The other parameters are fixed and read-only.



The "TDD Frame Structure" section is available only, if the TDD is selected as a duplexing mode. In this section, the TDD frame is configured by means of adjustment of the UL/DL configuration and the special subframe configuration.



In the "Configuration Mode" section a selection is made, whether the PDSCH Scheduling is performed manual or according to the configuration made for the DCIs.

K55 Configuration	
PDSCH Scheduling	Manual

In the "MIMO" section the global MIMO configuration and the simulated antenna are selected.

MIMO	
Global MIMO Configuration	4 TxAntennas
Simulated Antenna Path A	Antenna 3
Simulated Antenna Path B	Antenna 2

In the "Cell Specific Settings" section, the physical layer cell identity settings and the DL power control settings are configured.

Cell Specific Settings	
Cell ID	0
Physical Cell ID Group	0
Physical Layer ID	0
Cyclic Prefix	User Defined
PDSCH P_B	0
PDSCH Ratio rho_B/rho_A	0.000 dB
PDCCH Ratio rho_B/rho_A	0.000 dB
PHICH Duration	Normal
PHICH N_g	1/2
RA_RNTI	1

In the "Downlink Reference Signal Structure" and the "Synchronization Signal Settings" sections, the power level of the reference signals and the P-/S-SYNC can be set and the P-/S-SYNC can be enabled or disabled.

Downlink Reference Signal Structure	
Reference Signal Power	2.000 dB
EPRE RS relative to Level Display	0.000 dB

Synchronization Signal Settings	
P-/S-SYNC Tx Antenna	All
P-SYNC Power	0.000 dB
S-SYNC Power	0.000 dB

## 7.4.1 Physical Settings

In the "Physical Settings" section, the channel bandwidth respectively the number of resource blocks per slot is selected. The other parameters are fixed and read-only.

### Channel Bandwidth

Sets the channel bandwidth of the EUTRA/LTE system.

Although the 3GPP specification bases on bandwidth agnostic layer 1 and channel bandwidth is determined by specifying the desired number of resource blocks, the current EUTRA standardization focuses on six bandwidths (1.4, 3, 5, 10, 15 and 20 MHz).

For backward compatibility with previous version of this software, this parameter allows the flexibility to choose, whether a user defined bandwidth or one of the pre-defined channel bandwidths is used.

If a pre-defined channel bandwidth is selected; the actual "Number of Resource Blocks Per Slot" is internally calculated for the selected "Channel Bandwidth" and "Physical Resource Block Bandwidth".

The sampling rate, occupied bandwidth and FFT size are therefore determined by the parameter "Number of Resource Blocks Per Slot". If required, the [FFT Size](#) can be adjusted.

See also [table 4-1](#) for an overview of this cross-reference between the parameters.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:BW on page 323

### Physical Resource Block Bandwidth

Displays the bandwidth of one physical resource block.

**Note:** In this release, this value is fixed to 12 x 15 kHz.

SCPI command:

n.a.

### Number of Resource Blocks Per Slot

This parameter determines the channel bandwidth.

If the parameter "Channel Bandwidth" is set to one of the pre-defined channel bandwidths (1.4, 3, 5, 10, 15 or 20 MHz), the value "Number of Resource Blocks Per Slot" is read only and is automatically set according to the selected channel bandwidth and "Physical Resource Block Bandwidth".

If a user defined channel bandwidth is selected, the parameters "Number of Resource Blocks Per Slot" and "Physical Resource Blocks Bandwidth" determine the actual channel bandwidth.

However, the sampling rate and the occupied bandwidth are determined by the parameter "Number of Resource Blocks Per Slot". If required, the [FFT Size](#) can be adjusted.

See also [table 4-1](#) for an overview of this cross-reference between the parameters.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:NORB on page 323

### FFT Size

Sets the FFT (Fast Fourier Transformation) size.

The FFT size can be freely selected for all bandwidth definitions under the following constraints:

- For a specific bandwidth, all FFT sizes are applicable as long as the size is greater than the number of occupied subcarriers.  
By default, the smallest available FFT size is selected.
- To decrease the number of unused guard subcarriers and the resulting sampling rate, for channel bandwidth of 15 MHz a DFT size of 1536 is provided along with the default FFT size of 2048.

See also [table 4-1](#) for an overview of the cross-reference between the parameter and the available FFT sizes.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:DL:FFT](#) on page 324

### Occupied Bandwidth

Displays the occupied bandwidth. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:DL:OCCBandwidth](#) on page 324

### Sampling Rate

Displays the sampling rate. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot."

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:DL:SRATe](#) on page 323

### Number Of Occupied Subcarriers

Displays the number of occupied subcarriers. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

See also [table 4-1](#) for an overview of this cross-reference between the parameters.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:DL:OCCSubcarriers](#) on page 324

### Number Of Left Guard Subcarriers

Displays the number of left guard subcarriers. This value is set automatically according to the parameter "Number of Resource Blocks Per Slot".

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:DL:LGS](#) on page 324

### Number Of Right Guard Subcarriers

Displays the number of right guard subcarriers. This value is set automatically according to the parameter "Number of Resource Blocks Per Slot".

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:DL:RGS](#) on page 325

## 7.4.2 TDD Frame Structure

The "TDD Frame Structure" section is available only, if the TDD is selected as a duplexing mode. In this section, the TDD frame is configured by means of adjustment of the UL/DL configuration and the special subframe configuration (see also [chapter 3.2.1, "OFDMA Parameterization"](#), on page 17).

### UL/DL Configuration

Sets the Uplink-Downlink Configuration number, i.e. defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TDD:UDConf on page 318

### Configuration of Special Subframes

Sets the Special Subframe Configuration number, i.e. together with the parameter [Cyclic Prefix](#) defines the lengths of the DwPTS, the Guard Period and the UpPTS.

The DwPTS length selected with this parameter determines the maximum number of the OFDM symbols available for PDSCH in the special subframe.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TDD:SPSConf on page 318

## 7.4.3 Configuration Mode

In the "Configuration Mode" section a selection is made, whether the PDSCH Scheduling is performed manual or according to the configuration made for the DCIs.

### PDSCH Scheduling

Determines whether the configuration and scheduling of the different PDSCH allocations inside of the DL allocation table is performed manual or according to the configuration made for the DCIs.

**Note:** Switching from "Auto/DCI" mode to "Manual" mode enables all parameters in the DL allocation table for configuration without to change their values. Switching from Manual to Auto/DCI mode, however, triggers a reset of the frame prior to reconfiguration of the PDSCH allocations according to the settings made for the PDCCH DCIs, i.e. the settings made in the DL allocation table are lost.

"Manual"            In this default mode, there is no cross-reference between the settings made for the PDCCH DCIs and the PDSCHs settings. The PDSCH allocations have to be configured manually in the DL allocation table.

"Auto/DCI"

Precoding for spatial multiplexing will be performed according to 3GPP TS 36.211 and the selected parameters. This mode assures a 3GPP compliant EUTRA/LTE signal and the PDSCH allocations are configured automatically according to the configuration of the PDCCH DCIs.

The generation of a compliant signal requires some limitations in the configuration flexibility, especially regarding the power setting:

- The value of the parameter [Reference Signal Power](#) is fixed to 0dB.
- The PDSCH [Power](#) of each allocation belonging to a user is set as configured with the parameter [P\\_A](#) for the corresponding user in the "Configure User" dialog.
- All four users are activated with enabled [Scrambling](#) and [Channel Coding](#).

Not all combinations of [DCI Format](#), [Users](#) and [UE\\_ID/n\\_RNTI](#) are allowed. The [table 7-6](#) shows this dependency.

**Table 7-6: DCI Formats dependencies**

User	UE ID/n_RNTI	DCI Format
User 1 .. 4	As defined for the corresponding user	0,1,1a,1b,1d,2,2a,3,3a
P-RNTI	65534	1a,1c
SI-RNTI	65535	
RA-RNTI	As defined with the parameter <a href="#">RA_RNTI</a> in the "General DL Setting" dialog	

#### 7.4.4 MIMO

In the MIMO section, the MIMO configuration and the simulated antennas are defined.

##### Global MIMO Configuration

Determines the number of transmit antennas of the simulated EUTRA/LTE system. Depending on this parameter, the [Downlink Reference Signal Structure](#) will be set accordingly (see also [figure 3-9](#)).

**Note:** One baseband simulates one antenna.

"1 TxAntenna" Enables single antenna port transmission.

"2 TxAntennas/ 4 TxAntennas" Enables a multiple antenna transmission. The transmission mode, transmit diversity or spatial multiplexing, is determined per allocation with the parameter [Precoding Scheme](#).

- "SISO + BF" Selects a Single Input Single Output (SISO) transmission with beamforming (BF). Beamforming is a method to increase the SNR of the signal received by the UE. In the R&S Signal Generator, beamforming is implemented as a single layer PDSCH which is mapped to the different antennas with individual phase offsets. To simplify the configuration and in order to fulfill the requirements as specified in 3GPP TS 36.101, Annex A the same precoding vector as in a MIMO case used.
- Note:** While generating signal in this mode, the antennas simulated by path A and Path B are **not** MIMO antennas. The signal at the output of both paths is the same SISO signal with the same **cell-specific reference signals**.
- To enable the instrument to generate a **transmission using antenna port 5** signal (transmission corresponding to the UE-specific reference signal) as defined in the 3GPP specification, set the parameter [Precoding Scheme](#) to "Tx Mode 7 (UE-spec.RS)".
- In this case, the generated signal carries a combination of common signal part (PBCH, PDCCH, cell-specific RS,...), which is identical on all antennas, and UE-specific PDSCH, which is different on the antennas due to the applied precoding.
- Note that, although the generation of a beamformed signal requires more than one antenna, for the UE it appears as a SISO signal.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:MIMO:CONFiguration](#) on page 320

#### Simulated Antenna

Determines the simulated antenna in case the [Global MIMO Configuration](#) is set to 1 TX Antenna. The configuration of the Downlink Reference Signal structure is set accordingly (see [figure 3-9](#)).

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:MIMO:ANTenna](#) on page 320

#### Simulated Antenna Path A

Determines the simulated antenna for path A. The configuration of the [Downlink Reference Signal Structure](#) is set accordingly (see also [figure 3-9](#)).

The possible values of this parameter depend on the setting of the parameter [Global MIMO Configuration](#).

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:MIMO:ANTA](#) on page 321

#### Simulated Antenna Path B

(Available for two-path instruments only)

Determines the simulated antenna for path B.

**Note:** For two path instruments, setting the parameter "Simulated Antenna Path B" to any values but None, enables LTE signal simulation for path B and will disable all other digital standards and digital modulation modes in this path.



Enabling path B to simulate an antenna automatically couples path A and path B, i.e. path B is controlled via path A. The signal generated by path B has identical parameters with the settings made for path A and the downlink reference signal's parameters "First Reference Signal Position", "Subcarrier Offset" and "Use Second Reference Signal" are set accordingly.

The configuration of the [Downlink Reference Signal Structure](#) is set accordingly (see also [figure 3-9](#)).

The possible values of this parameter depend on the setting of the parameter [Global MIMO Configuration](#).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MIMO:ANTB on page 321

### 7.4.5 Cell Specific Settings

In the "Cell Specific Settings" section, the physical layer cell identity settings and the DL power control settings are configured.

#### Cell ID

Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3\*[Physical Cell ID Group](#) + [Physical Layer ID](#)

There is a cross-reference between the values of this three parameters and changing of one of them results in adjustment in the values of the others.

The Cell ID determinates:

- the downlink reference signal pseudo-random sequence,
- the frequency shifts of the reference signal,
- the S-SYNC sequence,
- the cyclic shifts for PCFICH, PHICH and PDCCH mapping and
- the pseudo-random sequence used for scrambling.

Remote-control command: 301

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :PLCi ] :CID on page 325

#### Physical Cell ID Group

Sets the physical cell identity group.

To configure these identities within a cell ID group, set the parameter [Physical Layer ID](#).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :PLCi ] :CIDGroup on page 326

#### Physical Layer ID

Sets the identity of the physical layer within the selected physical cell identity group, set with parameter [Physical Cell ID Group](#).

The Physical Layer ID determinates the Zadoff-Chu orthogonal sequence carried by the P-SYNC and used for cell search.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL[:PLCi] :PLID on page 326

### Cyclic Prefix (General DL Settings)

Sets the cyclic prefix length for all subframes.

The number of the OFDM symbols is set automatically.

"Normal" Normal cyclic prefix, i.e. the DL slot contains 7 OFDM symbols.

"Extended" Extended cyclic prefix, i.e. the DL slot contains 6 OFDM symbols. The extended cyclic prefix is defined in order to cover large cell scenarios with higher delay spread and MBMS transmission.

"User Defined" The cyclic prefix length can vary over the subframes. The cyclic prefix length is set per subframe in the DL Frame Configuration menu with the parameter [Cyclic Prefix](#).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:CPC on page 326

### PDSCH P\_B

Sets the parameter PDSCH P\_B and defines the cell-specific ratio rho\_B/rho\_A according to 3GPP TS 36.213, Table 5.2-1.

The following table gives an overview of the resulting values of the parameter [PDSCH Ratio rho\\_B/rho\\_A](#) as function of the values for the parameter PDSCH P\_B and the number of configured antennas.

PDSCH P_B	1 Tx antenna	2 or 4 Tx antennas
0	0.000 dB	0.969 dB
1	-0.969 dB	0.000 dB
2	-2.218 dB	-1.249 dB
3	-3.979 dB	-3.010 dB

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:PDSCh:PB on page 327

### PDSCH Ratio rho\_B/rho\_A

Displays the transmit energy ratio among the resource elements allocated for PDSCH in the OFDM symbols containing reference signal (P\_B) and such not containing one (P\_A).

The value displayed is determined by the parameter [PDSCH P\\_B](#) and additionally depends on the number of configured antennas.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:PDSCh:RATBa on page 327

**PDCCH Ratio rho\_B/rho\_A**

Sets the transmit energy ratio among the resource elements allocated for PDCCH in the OFDM symbols containing reference signal (P\_B) and such not containing one (P\_A).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:PDCCh:RATBa on page 327

**PBCH Ratio rho\_B/rho\_A**

Sets the transmit energy ratio among the resource elements allocated for PBCH in the OFDM symbols containing reference signal (P\_B) and such not containing one (P\_A).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:PBCH:RATBa on page 328

**PHICH Duration**

Sets the PHICH duration, i.e. the allocation of the PHICH resource element groups over the OFDM symbols.

The value selected puts the lower limit of the size of the [Control Region for PDCCH](#) that is signaled by the PCFICH.

- |            |                                                                                                                                               |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| "Normal"   | All resources element groups of PHICH (see <a href="#">Number of PHICH Groups</a> ) are allocated on the first OFDM symbol (OFDM Symbol 0).   |
| "Extended" | The resources element groups of PHICH are distributed over three OFDM symbols for a normal subframe or over two symbols within a special one. |

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:PHICH:DURation on page 328

**PHICH N\_g**

Sets the parameter N\_g according to 3GPP TS 36.211, section 6.9.

"1/6, 1/2, 1, 2" The actual **Number of PHICH Groups** for the different subframes is calculated according to the following formula:

$$N_{PHICH}^{group} = \begin{cases} \lfloor N_g(N_{RB}^{DL}/8) \rfloor & \text{for normal cyclic prefix} \\ \lfloor 2 \cdot N_g(N_{RB}^{DL}/8) \rfloor & \text{for extended cyclic prefix} \end{cases}$$

In FDD mode, the calculated value corresponds directly to the parameter "Number of PHICH Groups".

In TDD mode however, the resulting value for the parameter Number of PHICH Groups is the value calculated according to the formula above, additionally multiplied with a coefficient selected from the following table.

UL/DL Configuration	Subframe number									
	0	1	2	3	4	5	6	7	8	9
0	2	1	-	-	-	2	1	-	-	-
1	0	1	-	-	1	0	1	-	-	1
2	0	0	-	1	0	0	0	-	1	0
3	1	0	-	-	-	0	0	0	1	1
4	0	0	-	-	0	0	0	0	1	1
5	0	0	-	0	0	0	0	0	1	0
6	1	1	-	-	-	1	1	-	-	1

The parameter "Number of PHICH Groups" is read-only.

"Custom" Enables the selection of user-defined value for the parameter "Number of PHICH Groups".

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:PHICH:NGParameter](#) on page 329

### RA\_RNTI

Sets the random-access response identity RA-RNTI.

The value selected here determined the value of the parameter [UE\\_ID/n\\_RNTI](#) in case a RA\_RNTI "User" is selected.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:CSEttings:RARnti](#) on page 326

## 7.4.6 Downlink Reference Signal Structure

In the "Downlink Reference Signal Structure" section, the power of the reference signals is set.

For an overview of the provided power settings and detailed information on how to adjust them, refer to [chapter 5.3, "Power Setting"](#), on page 48.

**Reference Signal Power**

Sets the power of the reference signal (PRS relative).

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:REFSig:POWer](#) on page 321

**RS Power per RE relative to Level Display**

Displays the power of the reference signal (RS) per resource element (RE) relative to the power value, displayed in the Level display in the header of the instrument.

**Note:** The displayed value is actualized only if the EUTRA/LTE signal generation is enabled ([State](#) = On).

If a MIMO configuration is enabled, the value of this parameter is equal for all antennas; this applies also for the antenna configured in the path B.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:REFSig:EPRE](#) on page 321

## 7.4.7 Synchronization Signal Settings

In the "Synchronization Signal Settings" section, the power of the P-SYNC/S-SYNC is set.

**P-/S-SYNC Tx Antenna**

Defines on which antenna port the P-/S-SYNC is transmitted.

The available values depend on the number of configured antennas.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:SYNC:TXANtenna](#) on page 322

**P-SYNC Power**

Sets the power of the P-SYNC allocations.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:SYNC:PPOWer](#) on page 322

**S-SYNC Power**

Sets the power of the S-SYNC allocations.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:SYNC:SPOWer](#) on page 322

## 7.5 DL Frame Configuration

The "DL Frame Configuration" menu for downlink allows configuring the subframes and the OFDMA resource allocations. The "DL Frame Configuration" menu consists of three sections, "General Frame Configuration", "Subframe Configuration" and the "Allocation Table".

	CW	Mod.	Enh. Sett.	VRB Gap	No. RB	No. Sym.	Offs RB	Offs Sym.	Auto	Phys. Bits	Data Source	DList Pattern	Rho A /dB	Content Type	State	Conf.
0	1/1	QPSK	Config...	-	6	4	22	7(1/0)	Off	480	PN9	-	0.000	PBCH	On	
1	1/1	QPSK		-	50	2	0	0(0/0)	Off	1920	PDCCH	-	0.000	PDCCH	On	
2	1/1	QPSK	Config...	2	4	12	0	2(0/2)	On	1056	PN9	-	0.000	PDSCH	On	
3.1	1/2	64-QAM	Config...	-	4	12	4	2(0/2)	On	3168	User1	-	-6.020	PDSCH	On	
3.2	2/2	16-QAM	Config...	-	4	12	4	2(0/2)	On	2112		-			On	
4	1/1	QPSK	Config...	1	4	12	8	2(0/2)	On	1056	User4	-	0.000	PDSCH	On	
5	1/1	QPSK	Config...	-	1	12	12	2(0/2)	On	-	PN9	-	0.000	PDSCH	Off	
6	1/1	QPSK	Config...	-	1	12	13	2(0/2)	On	-	PN9	-	0.000	PDSCH	Off	

## 7.5.1 General Frame Configuration

### No Of Configurable (DL) Subframes

Sets the number of configurable subframes. Only the downlink and the special subframes are enabled for configuration if TDD mode is selected.

All downlink/special subframes are filled periodically with the configured subframes with the exception of the P-SYNC/S-SYNC which are set globally in the "General DL Settings" menu and the PBCH which can only be configured in subframe 0.

For more detailed information about the maximum number of configurable subframes and for description of the dependencies between the parameters, see [chapter 5.2.3, "Extension to Four Configurable Frames in Uplink and Downlink Direction"](#), on page 45.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:CONSubframes on page 343

### Reset Subframe Configuration

Resets settings of all subframes including cyclic prefix and number of used allocations to the default values.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:RSTFrame on page 343

### Configure User

Calls the "Configure User" menu for configuring allocations for different users.

The menu is described in [chapter 7.8, "Configure User"](#), on page 130.

SCPI command:

n.a.

**Behavior In Unscheduled REs (OCNG)**

Selects either to fill unscheduled resource elements and subframes with dummy data or DTX.

This function can be used as an OFDMA Channel Noise Generator (OCNG) according to 3GPP TS 36.101.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:BUR](#) on page 342

**Dummy Data Configuration**

(Available for Dummy Data only)

Calls the "Dummy Data Configuration" menu for setting the modulation, power and data source for the dummy data.

The menu is described in [chapter 7.9, "Dummy Data Configuration"](#), on page 133.

SCPI command:

n.a.

## 7.5.2 Subframe Configuration

**Subframe Selection**

Sets the subframe to be configured in the frame configuration table.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:SFSelection](#) on page 343

**Cyclic Prefix**

Configuration of the cyclic prefix per subframe is only enabled, if the parameter [Cyclic Prefix](#) is set to User Defined.

The number of the OFDM symbols per subframe is set automatically.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL\[:SUBF<st0>\]:CYCPrefix](#) on page 343

**No. Of Used Allocations**

Sets the number of scheduled allocations in the selected subframe.

The number of available allocations depends on the allocation's content type for a subframe and the general channel bandwidth setting.

The default value depends on the existence of a PBCH channel in a subframe. In this case the default value is set to 2, otherwise to 1; the second respectively the first allocation is reserved for the PDCCH, regardless whether this allocation is enabled or not.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL\[:SUBF<st0>\]:ALCount](#) on page 344

**Copy Subframe Settings**

Copies the settings of the selected subframe. P-SYNC/S-SYNC/PBCH settings are not considered.

For more detailed information, see [chapter 5.2.1, "Copy/Paste Subframe"](#), on page 44.

SCPI command:

n.a.

#### **Paste Subframe Settings**

Pastes the subframe settings to the selected subframe. P-SYNC/S-SYNC/PBCH settings are not considered.

For more detailed information, see [chapter 5.2.1, "Copy/Paste Subframe"](#), on page 44.

SCPI command:

n.a.

#### **Show Time Plan**

Calls the time plan for the OFDMA resource allocation.

The menu is described in detail in [chapter 7.10, "OFDMA Timeplan"](#), on page 134.

SCPI command:

n.a.

#### **Configure PCFICH, PHICH, PDCCH**

Calls a dialog for configuring the PCFICH, PHICH and PDCCH.

The dialog is described in detail in [chapter 7.7, "Enhanced Channel Configuration"](#), on page 109.

SCPI command:

n.a.

### **7.5.3 Resource Allocation Table DL**

The resource allocation table is located in the lower part of the "DL Frame Configuration" menu. The resource allocation table is where the individual allocation parameters for a subframe are set.

#### **Allocation number**

Displays the consecutive number of the allocation.

SCPI command:

n.a.

#### **Code Word**

Determines whether one or two codewords use the same physical resource, and whether codeword #1 or #2 is configured with this allocation table entry

In case the data source for an allocation is set to User, changing this parameter will set also the parameter "Code Word" of all allocations, belonging to the same User in the corresponding subframe.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ALLoc<ch0>:CODWords`  
on page 344



**Mod.**

Selects the modulation scheme for the allocation.

In case the data source for an allocation is set to User, changing this parameter will set also the parameter "Modulation" of all allocations, belonging to the same User in the corresponding subframe.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :  
MODulation on page 345
```

**Enhanced Settings DL**

Calls the "Enhanced Settings" dialog for configuration of precoding and channel coding (see [chapter 7.6, "Enhanced Settings"](#), on page 103).

SCPI command:

n.a.

**VRB Gap**

Enables the utilization of Virtual Resource Blocks (VBR) of distributed type and determines whether the first or the second gap is applied, i.e. determines the distribution and the mapping of the VRB pairs to the Physical Resource Blocks (PRB) pairs.

The VRB-to-PRB mapping and the calculation of the VRB gap values are performed according to 3GPP TS 36.211. The specification defines two types of VRBs, a localized distribution with a direct mapping and distributed VRBs for better frequency diversity. The distribution of the VRBs is performed in such a way, that consecutive VRBs are not mapped to frequency-consecutive PRBs, i.e. the VRBs are spread over the frequencies. Each single VRB pair is split into two parts and a frequency gap between these two VRB parts is introduced, i.e. a frequency hopping on a slot basis is applied. For wider channel bandwidths (more than 50 RBs), a second VRB gap with smaller size may be applied.

**Tip:** Use the "DL Time Plan" to visualize the PDSCH mapping.

The information whether localized or distributed VBRs are applied is carried by the PDCCH. The DCI Formats [1A/1B/1D](#) provide the special 1-bit flag "Localized/Distributed VBR Assignment" for this purpose. The selection whether the first or the second gap is applied, is determined by the additional bit "Gap Value".

**Note:** In case a [Auto DCI](#) mode is used, the "VRB Gap" value is read-only and is set according to the configuration of the corresponding DCI format.

**Example:**

"DL Channel Bandwidth" = 10 MHz (50 RBs)

Three subframes are configured:

- Subframe#0  
 PDSCH allocaton#2 (User2): "VRB Gap" = 0  
 PDSCH allocaton#3 (User4): "VRB Gap" = 0

	CW	Mod.	Enh. Sett.	VRB Gap	No. RB	No. Sym.	Offs RB	Offs Sym.	Auto	Phys. Bits	Data Source	DList Pattern	Rho A /dB	Content Type	State	Conf.
0	1/1	QPSK	Config...	-	6	4	22	7(1/0)	Off	480	MIB	-	0.000	PBCH	On	
1	1/1	QPSK		-	50	2	0	0(0/0)	Off	1920	PDCCH	-	0.000	PDCCH	On	
2	1/1	QPSK	Config...	-	2	12	0	2(0/2)	On	552	User2	-	0.000	PDSCH	On	
3	1/1	QPSK	Config...	-	2	12	2	2(0/2)	On	552	User4	-	0.000	PDSCH	On	

- Subframe#1  
 PDSCH allocaton#2 (User2): "VRB Gap" = 1  
 PDSCH allocaton#3 (User4): "VRB Gap" = 1  
 Both allocations use distributed VRBs; the first VRB gap is applied.  
 According to TS 36.211, the 1st VRB gap for 10 MHz channel bandwidth is **27 RBs**

	CW	Mod.	Enh. Sett.	VRB Gap	No. RB	No. Sym.	Offs RB	Offs Sym.	Auto	Phys. Bits	Data Source	DList Pattern	Rho A /dB	Content Type	State	Conf.
0	1/1	QPSK		-	50	2	0	0(0/0)	Off	1920	PDCCH	-	0.000	PDCCH	On	
1	1/1	QPSK	Config...	1	2	12	0	2(0/2)	On	552	User2	-	0.000	PDSCH	On	
2	1/1	QPSK	Config...	1	2	12	2	2(0/2)	On	552	User4	-	0.000	PDSCH	On	
3	1/1	QPSK	Config...	-	1	12	4	2(0/2)	On	-	PN9	-	0.000	PDSCH	Off	

- Subframe#2  
 PDSCH allocaton#2 (User2): "VRB Gap" = 1  
 PDSCH allocaton#3 (User4): "VRB Gap" = 2  
 Both allocations use distributed VRBs; the first VRB gap is applied for PDSCH allocation#2 (User2) and the second VRB gap for the allocation#3 (User4) .  
 According to TS 36.211, the 2nd VRB gap for 10 MHz channel bandwidth is **9 RBs**

	CW	Mod.	Enh. Sett.	VRB Gap	No. RB	No. Sym.	Offs RB	Offs Sym.	Auto	Phys. Bits	Data Source	DList Pattern	Rho A /dB	Content Type	State	Conf.
0	1/1	QPSK		-	50	2	0	0(0/0)	Off	1920	PDCCH	-	0.000	PDCCH	On	
1	1/1	QPSK	Config...	1	2	12	0	2(0/2)	On	552	User2	-	0.000	PDSCH	On	
2	1/1	QPSK	Config...	2	2	12	2	2(0/2)	On	552	User4	-	0.000	PDSCH	On	
3	1/1	QPSK	Config...	-	1	12	4	2(0/2)	On	-	PN9	-	0.000	PDSCH	Off	

Use the "DL Time Plan" to visualize the PDSCH mapping.

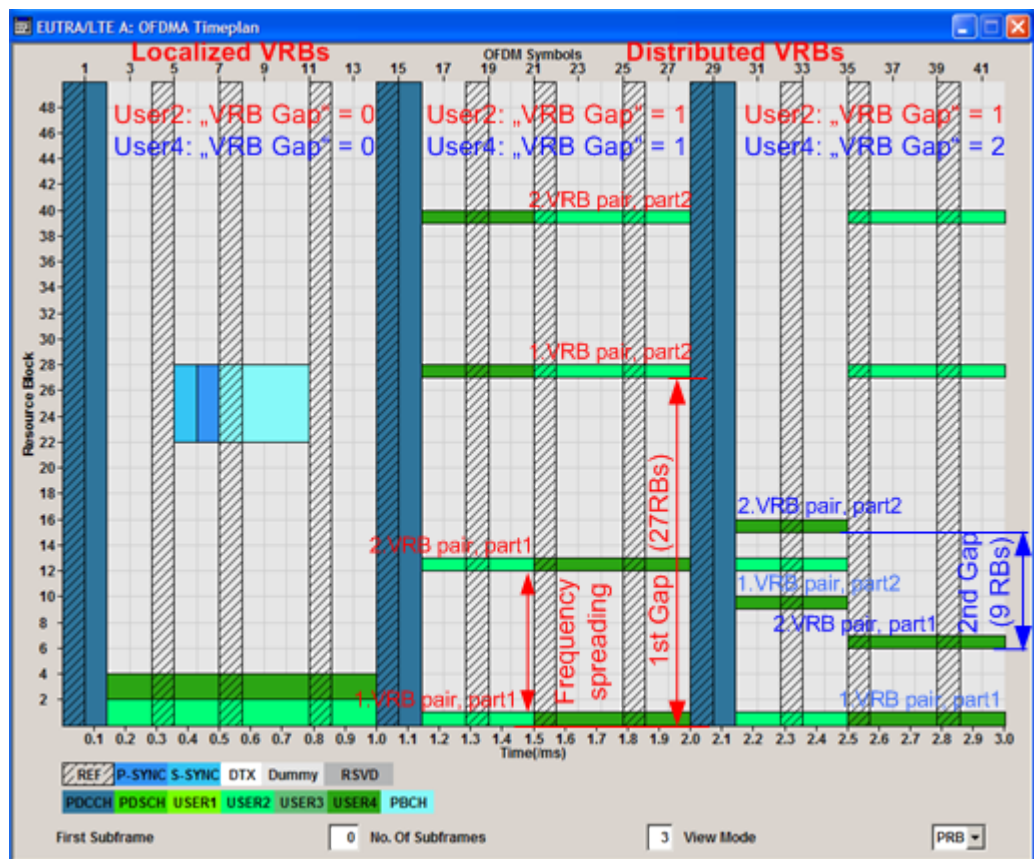


Fig. 7-6: DL Time Plan

Subframe#0 = Localized VRB, direct mapping VRB-to-PRB

Subframe#1 = Distributed VRB: 1st Gap=27 RBs applied for User2 and User4

Subframe#2 = Distributed VRB: 1st Gap=27 RBs applied for User2, 2nd Gap=9RBs applied for User4

- "0" A **localized distribution** is applied, i.e. the PDSCH mapping is performed on a direct VRB-to-PRB mapping.
- "1" Enables a **distributed** resource block allocation. The first VRB gap is used.
- "2" Enabled for "Channel Bandwidths" greater than 50 RBs. The mapping is based on the second (smaller) VRB gap.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :GAP`  
 on page 345

**No. RB (Resource Blocks)**

Defines bandwidth of selected allocation in terms of resource blocks per slot.

In case two codewords are configured, the defined bandwidth of the allocation with the second codeword is determinate by the selected bandwidth of the first one.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :RBCount`  
 on page 346

**No. Sym.**

Sets the size of the selected allocation in OFDM symbols.

For FDD mode and content type PDSCH, this value is set automatically in a way that the allocation always fills the complete subframe with consideration of the symbol offset.

**Example:**

For Cyclic Prefix with normal length (14 OFDMA Symbols) and Symbol Offset = 2 the resulting No. Of Symbols is 12.

In case two codewords are configured, the size of the allocation with the second codeword is determinate by the size of the first one.

While configuring a special subframe for TDD mode, the maximum size of the PDSCH allocation is determined by the selected [Configuration of Special Subframes](#) and depends on the selected [Cyclic Prefix](#).

The table below shows the cross-reference between the special subframe configuration and the maximum number of OFDM symbols available for PUSCH (DwPTS) in a special subframe for normal and extended CP respectively.

Configuration of Special Sub-frame	DwPTS (Normal CP)	DwPTS (Extended CP)
0	3	3
1	9	8
2	10	9
3	11	10
4	12	3
5	3	8
6	9	9
7	10	-
8	11	-

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
SYMCount on page 346
```

**Offs RB**

Sets the start resource block of the selected allocation.

**Note:** If the "Auto Offset Calculation" mode is activated, this value is read only.

In case two codewords are configured, the start resource block of the allocation with the second codeword is determinate by the selected start resource block of the first one.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
RBOffset on page 347
```

**Offs Sym.**

Sets the start OFDM symbol of the selected allocation.

**Note:** If the "Auto Offset Calculation" mode is activated, this value is read only.

For extended cyclic prefix, the maximum symbol offset is 13.

**Note:** According to 3GPP TS 36.211, up to first three OFDM symbols of a subframe are reserved for control information (PDCCH). Therefore, for PDSCH allocations the maximum value is 3, regardless of the cyclic prefix length.

In case two codewords are configured, the start OFDM symbol of the allocation with the second codeword is determinate by the selected start OFDM symbol of the first one.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
SYMoffset on page 347
```

**Auto**

Sets whether automatic offset calculation is used or not.

**Note:** If the "Auto Offset Calculation" mode is activated, the resource block offset and the start symbol offset are set automatically and cannot be changed.

By setting new allocations or changing the number of RBs of an existing allocation, the Auto mode tries to distribute the allocations with activated Auto mode in an optimal manner to the available resource blocks by adjusting the parameters "Offset RB". The resulting "No. of Bits" of a certain allocation can vary, due to overlapping control channels.

If it is not possible to distribute the changed configuration to the available resources blocks, a conflict is displayed.

**Note:** "Auto Offset Calculation" mode is only available for PDSCH. For PDCCH this parameter is always off.

In case two codewords are configured, the state of the "Auto Offset Calculation" mode of the second codeword is set to the state of the first one.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :AOC
on page 348
```

**Phys. Bits**

Displays the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority (see [chapter 5.1, "Conflict Handling in the R&S Signal Generator"](#), on page 41 ).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PHYSbits on page 348
```

**Data Source**

Selects the data source for the selected allocation.

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

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

Data sources for "User 1 .. 4" can be configured in the [Configure User](#) dialog.

For PBCH allocation with enabled parameter [MIB \(including SFN\)](#), the "Data Source" is automatically set to "MIB".

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :DATA
on page 348
```

### **DLlist/Pattern**

Displays the bit pattern or selected DLISt data, depending on the selected data source.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
DSElect on page 349
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PATtern on page 349
```

### **Power**

Sets the power  $P_{\text{PDSCH}}$  respectively  $P_{\text{PBCH}}$  for the selected allocation.

The power of the PDCCH allocation  $P_{\text{PDCCH}}$  is read-only. The value is set in the "Enhanced Channel Configuration" dialog of the corresponding subframe.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
POWer on page 350
```

### **Content Type (DL)**

Selects the type of the selected allocation.

**Note:** There can be only one PBCH in subframe 0.

The reserved channel (RSVD) can be used for simulating possible upcoming channel types.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
CONType on page 350
```

### **State (allocation)**

Sets the allocation to active or inactive state.

In case two codewords are configured, the state of the allocation with the second codeword is determinate by the state of the first one.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
STATe on page 351
```

### **Conflict**

Indicates a conflict between allocations.

For more information, see [chapter 5.1, "Conflict Handling in the R&S Signal Generator"](#), on page 41.

SCPI command:

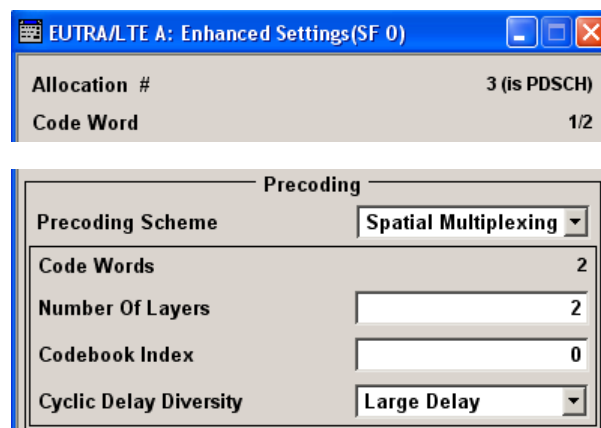
```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
```

CONFLict on page 351

## 7.6 Enhanced Settings

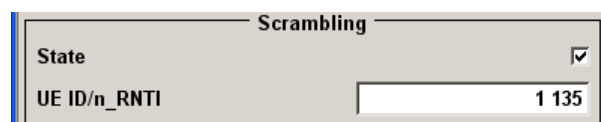
The "Enhanced Settings" menu allows you to define and configure the precoding and the channel coding settings for the DL channels PBCH and PDSCH. The settings are configurable on a subframe basis.

The parameters available for configuration in section "Precoding" depend on the global MIMO configuration, the content of the allocation and the selected codeword. Since the same precoding settings are used for both codewords, the "Precoding" section is not displayed in the "Enhanced Settings" menu of the second codeword.



The values of parameters "Scrambling State", "UE ID" and "Channel Coding State" are read-only for all allocations, where a User 1..4 is selected as "Data Source". These parameters are set in the [Configure User](#) dialog for the corresponding user.

For all allocations belonging to the same user, the "Enhanced Settings" menu can be called from any allocation related to this user.



Channel Coding	
State	<input checked="" type="checkbox"/>
Type	TC 1/3
Number Of Physical Bits	316
Transport Block Size/Payload	<input type="text" value="1 500"/>
Redundancy Version Index	<input type="text" value="0"/>
IR Soft Buffer Size	<input type="text" value="304 000"/>

Channel Coding	
State	<input checked="" type="checkbox"/>
Type	CONV 1/3
Number Of Physical Bits	1920/4 Frames,480/1 Frame
MIB(including SFN)	<input type="checkbox"/>
Transport Block Size/Payload	<input type="text" value="24"/>

## 7.6.1 Allocation Settings

### Allocation #

Displays the number of the allocation and the channel type the enhanced settings are configured for.

SCPI command:

n.a.

### Code Word

Displays the number of the codeword and the total number of codewords used for the selected allocation.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ALLoc<ch0>:CODWords`  
on page 344

## 7.6.2 Precoding Settings

The parameters available for configuration in section "Precoding" depend on the global MIMO configuration, the content of the allocation and the selected codeword. Since the same precoding settings are used for both codewords, the "Precoding" section is not displayed in the "Enhanced Settings" menu of the second codeword.

### Precoding Scheme

Selects the precoding scheme.

This parameter is available for the first codeword only.

**Note:** The available selections depend on the selected [Content Type](#) and the [MIMO Configuration](#).

"None" Disables precoding.

"Spatial Multi-plexing" Precoding for spatial multiplexing will be performed according to 3GPP TS 36.211 and the selected parameters.

"Tx Diversity" Precoding for transmit diversity will be performed according to 3GPP TS 36.211 and the selected parameters.



"Tx Mode 7 (UE-spec.RS)" Sets the PDSCH to transmission mode 7, as described in 3GPP TS 36.213, i.e. UE-specific RS will be added to the PDSCH. This special mode is defined for transmission using antenna port 5. In the R&S Signal Generator, antenna port 5 is simulated by all enabled antennas, depending on the selected [Global MIMO Configuration](#). Note that for "SISO + BF" configuration mode, antenna port 5 is simulated by maximum two antennas.

**Note:** To enable the instrument to generate a **transmission using antenna port 5** signal (transmission corresponding to the UE-specific reference signal) as defined in the 3GPP TS 36.101, chapter 8.3, set the parameter "Global MIMO Configuration" to "SISO + BF".

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PRECoding:SCHEME on page 355
```

### Code Words

Displays the number of the codewords used for the selected allocation.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> :CODWords
on page 344
```

### Number of Layers

Displays the number of layers for the selected allocation. The number of available layers depends on the selected Content Type and the precoding scheme.

The combination of number of code words and number of layers determines the layer mapping for the selected precoding scheme.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PRECoding:NOLayers on page 355
```

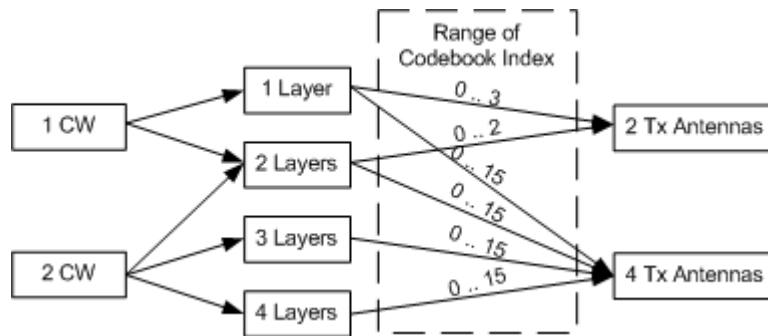
### Codebook Index

(Enabled for [Precoding Scheme](#) set to Tx Diversity or Spatial Multiplexing and codeword 1 only)

Sets the codebook index for the selected allocation, i.e. selects the predefined pre-coder matrix.

The number of available codebook indices depends on the [Global MIMO Configuration](#), i.e. the number of used antennas.

The figure below shows the range of the Codebook Index for Spatial Multiplexing.



The combination of codebook index and the selected [Number of Layers](#) determines the pre-coding matrix used for precoding.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PRECoding:CBINDEX on page 354
```

### Cyclic Delay Diversity

(Enabled for [Precoding Scheme](#) set to Tx Diversity or Spatial Multiplexing and codeword 1 only)

Sets the CDD for the selected allocation.

The combination of cyclic delay diversity and the selected [Number of Layers](#) determines the precoding parameters for spatial multiplexing.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PRECoding:CDD on page 355
```

## 7.6.3 Scrambling Settings

### State Scrambling (DL)

Enables/disables the bit-level scrambling.

If a "User 1..4" is selected for the [Data Source](#) in the allocation table for the corresponding allocation, the "State Scrambling" is read only and the value is displayed as set in the [Configure User](#) dialog for the corresponding user.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
SCRambling:STATe on page 356
```

### UE ID/n\_RNTI (PDSCH)

Sets the user equipment identifier (n\_RNTI) of the user to which the PDSCH transmission is intended. The UE ID is used to calculate the scrambling sequence.

If a "User 1..4" is selected for the [Data Source](#) in the allocation table for the corresponding allocation, the "UE ID" is read only and the value is displayed as set in the [Configure User](#) dialog for the corresponding user.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
SCRambling:UEID on page 357
```

## 7.6.4 Channel Coding Settings

### State Channel Coding (DL)

Enables/disables channel coding for the selected allocation and code word.

If a User "1..4" is selected for the [Data Source](#) in the allocation table for the corresponding allocation, the "Channel Coding State" is read only and the value is displayed as set in the [Configure User](#) dialog for the corresponding user.

A PBCH can be generated in one of the following modes:

- Without channel coding, i.e. this parameter is disabled.  
Dummy data or user-defined data list are used.
- Channel coding with arbitrary transport block content  
Channel coding is activated and parameter [MIB \(including SFN\)](#) is disabled.
- Channel coding with real data (MIB) including SFN  
Channel coding and MIB are activated.

For the PBCH allocation with activated channel coding, one block of data (Transport Block Size of 24) is coded jointly and then spread over four frames. Hence, the ARB sequence length has to be set accordingly to be a multiple of four.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
CCODing:STATE on page 353
```

### Type Channel Coding (DL)

Displays the used channel coding scheme and channel coding rate.

PBCH uses always tail biting convolution coding with code rate 1/3; PDSCH uses always turbo code with code rate 1/3.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
CCODing:TYPE on page 354
```

### Number of Physical Bits (DL)

Displays the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority (see [chapter 5.1, "Conflict Handling in the R&S Signal Generator"](#), on page 41).

If a User 1..4 is selected for the [Data Source](#) in the allocation table for the corresponding allocation, the value of the parameter "Number of Physical Bits" is the sum of the [Configure User](#) of all single allocations that belong to the same user in the selected subframe.

The size of the PBCH allocation is fixed to 1920/4 Frames, 480/1 Frame.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PHYSbits on page 348
```

### MIB (including SFN)

(for PBCH only)

Enables/disables transmission of real MIB (master information block) data, calculated according to the values of the following "General DI Settings" parameters:

- [Channel Bandwidth](#)
- [PHICH Duration](#)
- [PHICH N\\_g](#)

The SFN (System Frame Number) is included as well.

If this parameter is enabled, the "[Transport Block Size](#)" is fixed to 24 and the [Data Source](#) for the PBCH allocation is set to "MIB".

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL:PBCH:MIB on page 352
```

### Transport Block Size/Payload (DL)

Defines the size of the transport block/payload in bits.

- Since only one transport block is generated and spread over all allocations, for allocations with "Data Source" set to User 1..4, the channel coding parameters "Transport Block Size", "Redundancy Version Index" and "IR Soft Buffer Size" are related to all allocations that belong to the same user in the corresponding subframe.
- In case a spatial multiplexing with two code words is configured, individual transport blocks for the two code blocks are generated.
- For PBCH allocations with enabled parameter [MIB \(including SFN\)](#), the transport block size is fixed to 24.

Set the transport block size to 24 if a generation compliant to the 3GPP specifications is required.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
CCODing:TBSize on page 353
```

### Redundancy Version Index (PDSCH)

Sets the redundancy version index.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
CCODing:RVIndex on page 353
```

### IR Soft Buffer Size (PDSCH)

Sets the size of the IR soft buffer for the selected transport block (N\_IR from TS 36.212).

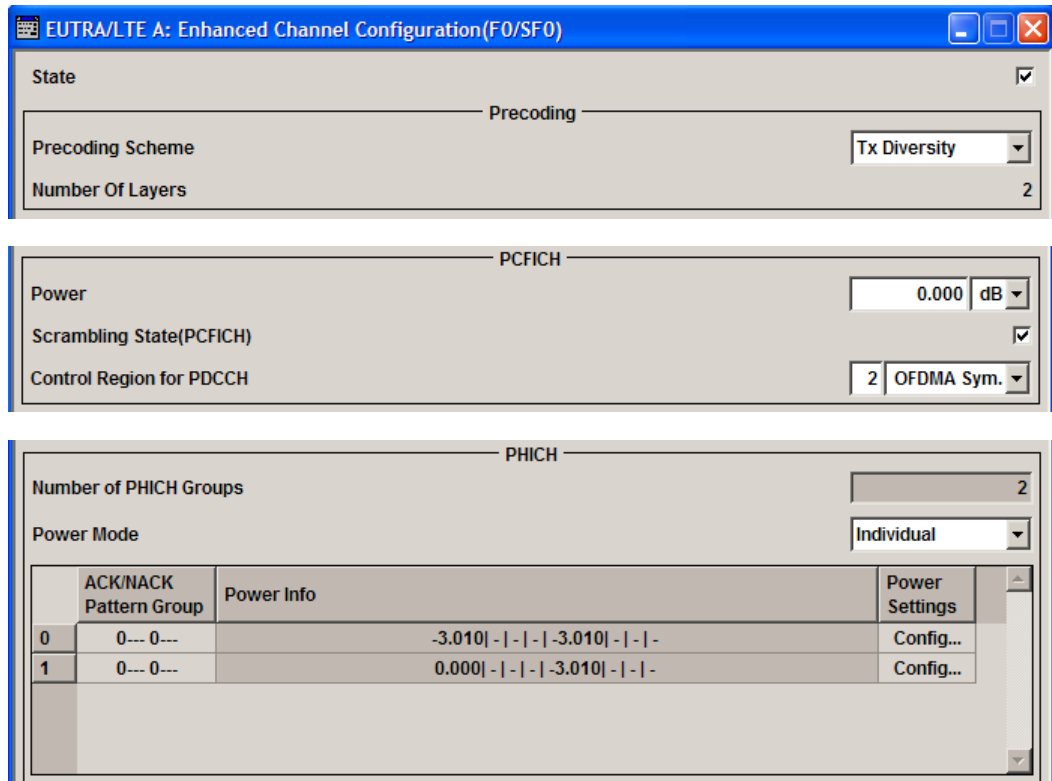
SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
CCODing:ISBSize on page 352
```

## 7.7 Enhanced Channel Configuration

The "Enhanced Channel Configuration" menu allows you to define and configure the PCFICH, PHICH and PDCCH settings per subframe. The subframe for which the PCFICH, PHICH and PDCCH settings are currently configured is indicated in the window name.

The parameters available for configuration in section "Precoding" depend on the [Global MIMO Configuration](#).



PDCCH

Power 0.000 dB

Scrambling State(PDCCH)

Number of Bits 1 872

Number of available REGs 234

Number of available CCEs 26

PDCCH Format Variable

Dummy CCE REGs Data

Dummy CCE Data Source PN9

	User	UE_ID n_RNTI	DCI Format	Content	PDCCH Format	Number CCEs	Search Space	CCE Index	No.Dummy CCEs	Conflict
0	User1	6	3	Config...	1	2	On	4	2	
1 >	RA_RNTI	1	1A	Config...	3	8	On	8	10	

### 7.7.1 Precoding Settings

#### State (Enhanced Channels)

Enables/disables the PDCCH, PCFICH and PHICH allocation.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:STATE` on page 359

#### Precoding Scheme (Enhanced Channels)

Selects the precoding scheme for PDCCH, PCFICH and PHICH.

"None" Disables precoding.

"Tx Diversity" Precoding for transmit diversity will be performed according to 3GPP TS 36.211 and the selected parameters.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PRECoding:SCHEME`

on page 360

#### Number of Layers (Enhanced Channels)

(Enabled for [Precoding Scheme](#) set to Tx Diversity)

Displays the number of layers for PDCCH, PCFICH and PHICH. This value is fixed to 1 for PDCCH, PCFICH and PHICH.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PRECoding:NOLayers`

on page 360

## 7.7.2 PCFICH Settings

### Power (PCFICH)

Sets the power of the PCFICH ( $P_{PCFICH}$ ).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PCFich:POWer
```

on page 360

### Scrambling State (PCFICH)

Enables/disables the scrambling of the PCFICH.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PCFich:SCRambling:
```

STATE on page 361

### Control Region for PDCCH

Sets the size of the control region, i.e. the number of OFDM Symbols that he region spans.

Whether 1, 2, 3 or 4 OFDM Symbols can be reserved for PDCCH depends on the parameters given in the following table.

Channel Bandwidth	PHICH Duration	Duplex. Mode	OFDM Symbols in	the control region
			Normal Subframe	Special Subframe
No RB > 10	Normal	FDD	1,2,3	-
	Normal	TDD	1,2,3	1,2
	Extended	FDD	3	-
	Extended	TDD	3	2
No RB <=10	Normal	FDD	2,3,4	-
	Normal	TDD	2,3,4	2
	Extended	FDD	3,4	-
	Extended	TDD	3,4	2

The size of the control region can vary per subframe.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL:BW on page 323
```

```
[ :SOURCE<hw> ] :BB:EUTRa:DL:PHICh:DURation on page 328
```

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PCFich:CREGion
```

on page 361

### 7.7.3 PHICH Settings

#### Number of PHICH Groups

Displays the number of available PHICH groups, depending on the value of the parameter [PHICH N\\_g](#).

This parameter is enabled for configuration only if the parameter "PHICH N\_g" is set to "Custom".

- For normal CP, one PHICH group consists of 8 ACK/NACK messages from several users.
- For extended CP, 4 ACK/NACK messages from several users are carried by on PHICH group.

Each PHICH group uses 3 resource element groups (REGs); hence the total number of REGs used for PHICH is 3 times the number of PHICH groups.

The number of the available OFDM symbols for the allocation of this total number of REGs depends on the selection made for the parameter [PHICH Duration](#) (normal or extended).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PHICH:NOGRoups
```

on page 363

#### Power Mode

Determines whether all PHICH in a PHICH group are send with the same power or enables the adjustment of each  $P_{PHICH}$  individually.

The parameter [Power Info](#) displays the power values of the configured PHICHs.

"Constant"      The power of a PHICH ( $P_{PHICH}$ ) in a PHICH group is set with the parameter [Power](#).

"Individual"     The power of the individual PHICHs is set in the [PHICH Power Config](#) dialog.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PHICH:PMODE on page 361
```

#### Power (PHICH)

Sets the power of one PHICH ( $P_{PHICH}$ ) in a PHICH group, i.e. the total power of one PHICH group is the sum of the power of the transmitted PHICHs within this group.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PHICH:POWer on page 362
```

#### ACK/NACK Pattern Group 0 .. 9

Sets the ACK/NACK pattern for the corresponding PHICH group.

A "1" indicates an ACK, a "0" - a NACK, a "-" indicates DTX.

DTX means that the corresponding PHICH is not transmitted, i.e. the orthogonal sequence is not used.



Since the number of ACK/NACK messages carried by a PHICH group depends on the [Cyclic Prefix](#), a pattern group consists of 8 or 4 values for normal and extended CP respectively.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PHICH:ANPattern<ch0>`  
on page 363

### Power Info

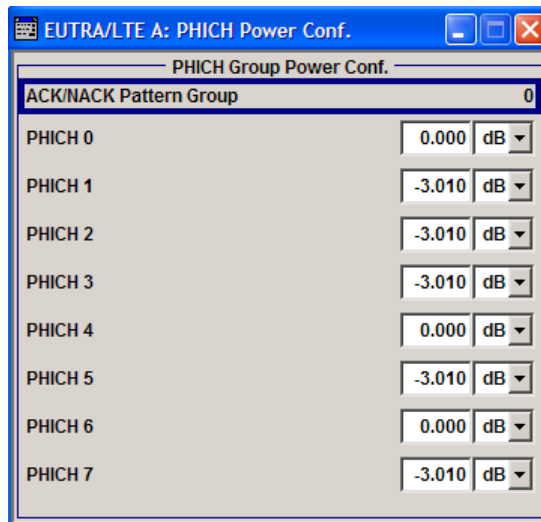
Displays the power values of the configured PHICHs.

SCPI command:

n.a.

### Power Settings Config.

Opens the "PHICH Power Config". dialog to configure the power of the PHICHs individually.



"ACK/NACK Pattern Group" Displays the ACK/NACK pattern group the values are adjusted for.

"PHICH 0..7" Sets the power of the individual PHICHs

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PHICH:GROup<ch0> :ITEM<user0>:POW` on page 362

## 7.7.4 PDCCH Settings

### Power

Sets the power of the PDCCH (PPDCCH).

The value set with this parameter is also displayed in the allocation table for the corresponding allocation.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:POWer` on page 363

#### Scrambling State (PDCCH)

Enables/disables the scrambling of the PDCCH.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:SCRambling:STATE` on page 364

#### Number of Bits (PDCCH)

Displays the number of bits allocated for PDCCH.

The number of bits available for PDCCH allocation depends on the selected [Channel Bandwidth](#), the [Global MIMO Configuration](#), the [Number of PHICH Groups](#), the [PHICH Duration](#) and the [Control Region for PDCCH](#).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:BITS` on page 364

#### Number of available REGs (PDCCH)

Displays the number of the REGs that are available for the PDCCH allocation.

The number of REGs available for PDCCH allocation depends on the [Number of Bits available for PDCCH](#) ( $\#Bits_{PDCCH}$ ) and is calculated as follow:

$$\#REGs\ available_{PDCCH} = \#Bits_{PDCCH} / 8$$

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:AVRegs` on page 364

#### Number of available CCEs (PDCCH)

Displays the number of the control channel elements (CCEs) that are available for the PDCCH allocation.

The PDCCH is mapped to the REGs not used for PHICH and PCFICH and transmitted on one or several CCEs, where a CCE corresponds to 9 REGs, i.e. the number of the available CCEs is calculated as follow:

$$\#CCEs\ available_{PDCCH} = \#REGs\ available\ PDCCH / 9$$

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:AVCCes` on page 365

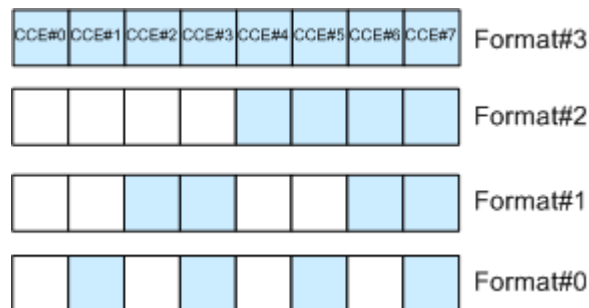
#### PDCCH Format

Sets the PDCCH format.

The PDCCH format determines how many CCEs (control channel elements) will be used for the transmission of the PDCCH, i.e. determines how many PDCCHs ( $\#PDCCH$ ) can be transmitted.

The table below gives an overview of the supported PDCCH Formats, as defined in the 3GPP specification.

The figure below shows the distribution of the PDCCH over the CCEs for the different formats.



"Variable" Select this mode to enable full flexibility by the configuration of the down-link control information (DCI) format and content (see [chapter 7.7.5, "PDCCH Format Variable"](#), on page 116).

"-1" R&S Signal Generator's proprietary format for legacy support.  
This format corresponds to the transmission of one PDCCH on all available REGs, i.e.

- $\text{REGs available PDCCH} = \text{\#REGs allocated PDCCH}$ ,
- $\text{\#PDCCH} = 1$ ,
- $\text{\#DummyREGs} = 0$ .

"0" One PDCCH is transmitted on one CCE, i.e.  $\text{\#REG}=1$ .

"1" One PDCCH is transmitted on two CCEs, i.e.  $\text{\#REG}=18$ .

"2" One PDCCH is transmitted on four CCEs, i.e.  $\text{\#REG}=36$ .

"3" One PDCCH is transmitted on eight CCEs, i.e.  $\text{\#REG}=72$ .

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:FORMAT
```

on page 365

#### Number of PDCCHs

(for "PDCCH Format" different than "Variable")

Sets the number of PDCCHs to be transmitted.

The maximum number PDCCH that can be transmitted on the available REGs for PDCCH depends on the number of REGs ( $\text{\#REG}$ ) reserved for the transmission of one PDCCH, i.e. depends on the selected [PDCCH Format](#) and is calculated as follow:

$$\text{\#PDCCH} = \text{REGs available PDCCH} / \text{\#REG}.$$

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:NOPDcchs
```

on page 366

#### Number of REGs allocated to PDCCH

(for "PDCCH Format" different than "Variable")

Displays the number of REGs that are actually allocated for PDCCH transmission (#REGs allocated<sub>PDCCH</sub>) and is calculated as follow:

$$\#REGs \text{ allocated}_{PDCCH} = \#PDCCH * \#REG$$

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:ALRegs  
on page 367

#### Number of Dummy REGs

(for "PDCCH Format" different than "Variable")

Displays the number of REGs that are available for the PDCCH allocation but are not allocated and is calculated as follow:

$$\#DummyREGs = REGs \text{ available } PDCCH - \#REGs \text{ allocated } PDCCH.$$

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:DREGs on page 367

#### Data Source (PDCCH)

(for "PDCCH Format" different than "Variable")

Selects the data source for PDCCH.

Data lists can be generated internally in the data editor or externally and have to have a file extension \*.dm\_iqd.

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:DATA on page 368

#### DList/Pattern (PDCCH)

(for "PDCCH Format" different than "Variable")

Displays the bit pattern or selected DLISt data, depending on the selected data source.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:PATtern  
on page 368

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:PATtern  
on page 368

### 7.7.5 PDCCH Format Variable

The parameters described in this section are only available for "PDCCH Format" set to "Variable".

Use these parameters and the DCI table to configure the multiple scheduling messages (DCIs) with the corresponding PDCCHs.

	User	UE_ID n_RNTI	DCI Format	Content	PDCCH Format	Number CCEs	Search Space	CCE Index	No.Dummy CCEs	C.
0	RA_RNTI	23	1C	Config...	1	2	Off	0	1	
1	User1	6	2A	Config...	2	4	Off	3	0	
2 >	None	0	3	Config...	3	8	Off	7	28	

### Dummy CCE REGs

Sets the behavior of the dummy REGs, i.e. determines whether dummy data or DTX is transmitted.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:DCRegs:TRSource
on page 369
```

### Dummy CCE Data Source

Selects the data source for the dummy CCE.

"Data lists" can be generated internally in the data editor or externally and have to have a file extension \*.dm\_iqd.

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:DCRegs:DATA
on page 369
```

### DList/Pattern (Dummy CCE)

Displays the bit pattern or selected DLIST data, depending on the selected data source.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:DCRegs:PATtern
on page 370
```

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:DCRegs:DSElect
on page 369
```

### Append

Adds a new row at the end of the table.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:APPend
on page 371
```

**Insert**

Insert a new row before the current one.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:SITem
```

on page 370

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:INSert
```

on page 371

**Delete**

Deletes the selected row.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:SITem
```

on page 370

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:DELete
```

on page 371

**Down/Up**

Moves the selected row down or up.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:SITem
```

on page 370

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:DOWN
```

on page 371

**Reset**

Resets the table.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:RESet
```

on page 372

**User (PDCCH Format Variable)**

Selects the User the DCI is dedicated to.

The available "DCI Formats" depend on the value of this parameter.

"User 1 .. 4" Selects one of the four users configured in the [Configure User](#) dialog.

"P-RNTI/S-RNTI/RA-RNTI" A group of users is selected.

"None" Allows free definition of all settings

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:
```

USER on page 374

**UE\_ID/n\_RNTI**

Displays the UE\_ID or the n\_RNTI for the selected PDCCH.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:
```

UEID on page 372

**DCI Format**

Sets the DCI format for the selected PDCCH.

The downlink control information (DCI) is a message used to control the physical layer resource allocation in both the UL and DL direction and carries scheduling information as well as uplink power control commands. The DCI is mapped on the PDCCH and depending on the DCI message size and usage are categorized into four different formats that are further sub-divided (see [table 7-7](#)).

**Table 7-7: Overview DCI Formats**

DCI Format	Purpose
<a href="#">DCI Format 0</a>	PUSCH allocation information
<a href="#">DCI Format 1</a> <a href="#">DCI Format 1A</a> <a href="#">DCI Format 1B</a> <a href="#">DCI Format 1C</a> <a href="#">DCI Format 1D</a>	PDSCH information with one code word
<a href="#">DCI Format 2/2A</a>	PDSCH information for MIMO configuration (two code words)
<a href="#">DCI Format 3/3A</a>	Uplink power control information

The fields of each DCI format are configurable parameters that can be adjusted in the corresponding dialog box. Select [Content Config](#) to access this dialog box for the selected "DCI Format".

Not all DCI Formats are always enabled for selection. The table below gives an overview of the cross-reference between the available DCI Formats and the selected [User](#).

User	DCI Format
P-RNTI/SI-RNTI/RA-RNTI	1A, 1C
User 1..4	1, 1A, 1B, 1D, 2, 2A
None	All formats

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :DCIFmt on page 372
```

**Content Config**

Opens a dialog box to configure the DCI fields of the selected [DCI Format](#).

SCPI command:

n.a.

**PDCCH Format (Variable)**

Sets the PDCCH format.

The PDCCH format determines how many [CCEs](#) (control channel elements) will be used for the transmission of the PDCCH.

The table below gives an overview of the supported PDCCH Formats, as defined in the 3GPP specification.

PDCCH format	Number of CCEs	Number of REGs	Number of PDCCH bits
0	1	9	72
1	2	18	144
2	4	36	288
3	8	72	576

- "0" One PDCCH is transmitted on one CCE, i.e. #REG=1.  
 "1" One PDCCH is transmitted on two CCEs, i.e. #REG=18.  
 "2" One PDCCH is transmitted on four CCEs, i.e. #REG=36.  
 "3" One PDCCH is transmitted on eight CCEs, i.e. #REG=72.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
PFMT on page 373
```

### Number CCEs

Displays the number of control channel elements used for the transmission of the PDCCH.

The value is determined by the selected [PDCCH Format \(Variable\)](#).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
NCCes on page 373
```

### Search Space

While enabled, this parameter configures the PDCCH DCI to be transmitted within the common or UE-specific search space.

The search space determines the set of CCEs a UE monitors. The UE can decode only the control information on a PDCCH that is transmitted over CCEs within the search space this UE monitors.

Each UE has multiple UE-specific search space, determined as a function of the UE\_ID and the subframe. A UE-specific search space applies for the [User](#) set to User 1..4 and None cases.

A common search space is used when all or a group of UEs are addressed and applies for the "User" set to P-ENTI, SI-RNTI and PA-RNTI cases.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
SESPace on page 375
```



**CCE Index**

Sets the CCE start index.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
CINDEX on page 373
```

**Number of Dummy CCEs**

Displays the number of dummy CCEs that are appended to the corresponding PDCCH.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
NDCCes on page 374
```

**Conflict (DCI)**

Indicates a conflict between two DCI formats.

For more information on how to solve DCI conflicts, see [chapter 5.1.3, "DCI Conflict Handling"](#), on page 43.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
CONFLICT on page 374
```

**Bit Data**

Displays the resulting bit data as selected with the DCI format parameters.

The mapping DCI format fields to the information bits is according to the 3GPP specification TS 36.212.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
DCIConf:BITData on page 375
```

**DCI Format 0**

The DCI format 0 is used for scheduling uplink transmission on PUSCH and transmits the information listed in the table below.

DCI Format 0	
PUSCH Frequency Hopping	<input checked="" type="checkbox"/>
Res. Block Assignment and Hop. Res. Allocation	26
Modulation and Cod. Scheme and Red. Version	23
New Data Indicator	<input type="checkbox"/>
TPC Command for PUSCH	3
Cyclic Shift for DMRS	2
CQI Request	<input type="checkbox"/>
Data	
Bit Data	010 0000 0110 1010 1110 1101 0000

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting [Bit Data](#) is displayed.

Control Information Field	SCPI command	Dependencies
"PUSCH Frequency Hopping"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:PFHopping on page 380	
"Resource Block Assignment and Hopping Resource Allocation"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RAHR on page 382	
"Modulation and Coding Scheme and Redundancy Version"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 379	
"New Data Indicator"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 380	
"TPC Command for PUSCH"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 385	
"Cyclic Shift for DMRS"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:CSDMrs on page 377	
"UL Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:ULIndex on page 386	Enabled for TDD mode and <a href="#">UL/DL Configuration 0</a>
"Downlink Assignment Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 378	Enabled for TDD mode and <a href="#">UL/DL Configuration 1 - 6</a>
"CQI Request"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:CQIRequest on page 377	

### DCI Format 1

The DCI format 1 carries information for scheduling transmission of one code word on PDSCH. The different fields of this format are summarized in the table below.

DCI Format 1

Resource Allocation Header

Resource Block Assignment

Modulation and Coding Scheme

HARQ Process Number

New Data Indicator

Redundancy Version

TPC Command for PUCCH

Downlink Assignment Index

Data

Bit Data 10 0000 0000 0000 0010 0001 1010 0111 1100

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting **Bit Data** is displayed.

Control Information Field	SCPI command	Dependencies
"Resource Allocation Header"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RAH on page 381	Enabled for Channel Bandwidth > 10RBs
"Resource Block Assignment"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 382	
"Modulation and Coding Scheme"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 379	
"HARQ Process Number"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 379	
"New Data Indicator"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 380	
"Redundancy Version"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 382	
"TPC Command for PUCCH"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 385	
"Downlink Assignment Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 378	Enabled for "TDD" mode

### DCI Format 1A

DCI format 1A is used for the compact scheduling of one PDSCH code word and random access procedure initiated by a PDCCH order.

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting **Bit Data** is displayed.

The contents of DCI Format 1A are listed in the table below; the available fields depend whether a PDSCH or PRACH is transmitted.

Control Information Field	SCPI command	Dependencies
"Localized/Distributed VRB Assignment"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA on page 387	
"GAP Value"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP on page 378	Enabled for Channel Bandwidth >= 50RBs, Distributed VBR Assignment and User = User 1..4
"Resource Block Assignment"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 382	
"Modulation and Coding Scheme"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 379	PDSCH Mode
"HARQ Process Number"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 379	PDSCH Mode
"New Data Indicator"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 380	PDSCH Mode
"Redundancy Version"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 382	PDSCH Mode
"TPC Command"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 385	PDSCH Mode
"Downlink Assignment Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 378	PDSCH Mode Enabled for "TDD" mode

Control Information Field	SCPI command	Dependencies
"Preamble Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :DCIConf:PRACH:PRINdex on page 376	PRACH Mode
"PRACH Mask Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :DCIConf:PRACH:MINdex on page 376	PRACH Mode

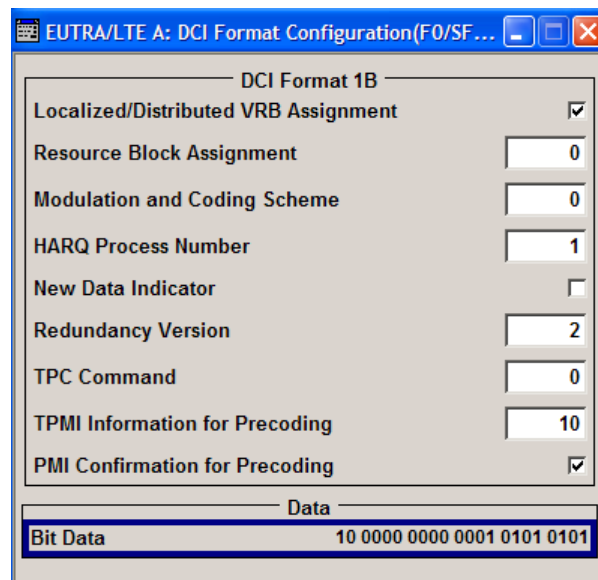
SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :DCIConf:F1AMode on page 375

### DCI Format 1B

DCI format 1B is used for the compact scheduling of one PDSCH code word with precoding information, i.e. when MIMO operation is involved.

The precoding information consists of 2 or 4 bits for 2 and 4 antennas respectively.



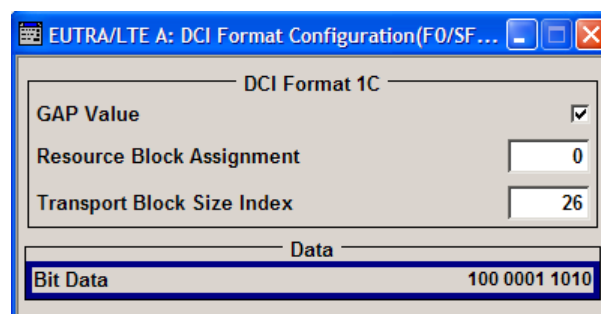
The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting [Bit Data](#) is displayed.

The DCI Format 1B transmits the information listed in the table below.

Control Information Field	SCPI command	Dependencies
"Localized/Distributed VRB Assignment"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA on page 387	
"GAP Value"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP on page 378	Enabled for Channel Bandwidth >= 50RBs, Distributed VBR Assignment and User = User 1..4
"Resource Block Assignment"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 382	
"Modulation and Coding Scheme"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 379	
"HARQ Process Number"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 379	
"New Data Indicator"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 380	
"Redundancy Version"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 382	
"TPC Command"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 385	
"Downlink Assignment Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 378	Enabled for TDD mode
"TPMI Information for Precoding"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI on page 386	
"PMI Confirmation for Precoding"	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:PMI on page 380	

### DCI Format 1C

DCI format 1C is used for very compact scheduling of one PDSCH code word.



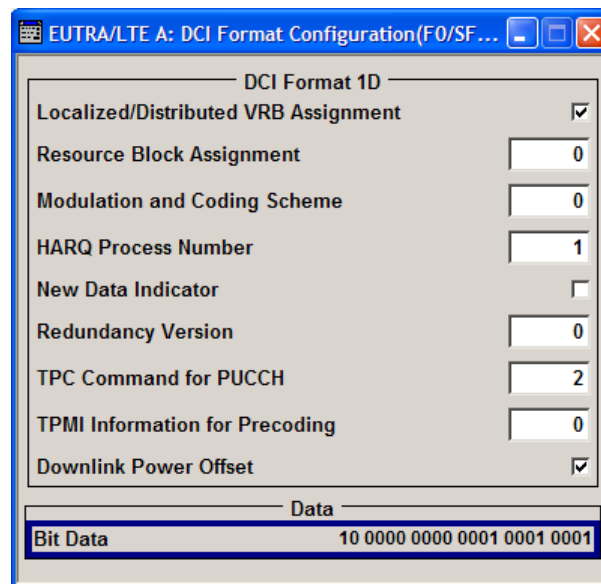
The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting **Bit Data** is displayed.

The DCI Format 1C transmits the information listed in the table below.

Control Information Field	SCPI command	Dependencies
GAP Value	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP on page 378	Enabled for Channel Bandwidth >= 50RBs
Resource Block Assignment	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 382	
Transport Block Size Index	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TBSI on page 385	

### DCI Format 1D

DCI format 1D is used for the compact scheduling of one PDSCH code word with precoding and power offset information.



The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting **Bit Data** is displayed.

The DCI Format 1D transmits the information listed in the table below.

Control Information Field	SCPI command	Dependencies
Localized/Distrib	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA on page 387	
Resource Block Assignment	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 382	
GAP Value	[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP on page 378	Enabled for Channel Bandwidth >= 50RBs, Distributed VBR Assignment and User = User 1..4

Control Information Field	SCPI command	Dependencies
Modulation and Coding Scheme	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:MCSR on page 379	
HARQ Process Number	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:HPN on page 379	
New Data Indicator	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:NDI on page 380	
Redundancy Version	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:RV on page 382	
TPC Command for PUCCH	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:TPCC on page 385	
Downlink Assignment Index	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:DLAindex on page 378	Enabled for TDD mode
TPMI Information for Precoding	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:TPMI on page 386	
Downlink Power Offset	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:DPOffset on page 378	

### DCI Format 2/2A

The DCI Format 2 is used for scheduling PDSCH when spatial multiplexing is configured. The DCI Format 2A is also used for the scheduling in a spatial multiplexing configuration, but without PMI feedback.

Since MIMO operation requires two codewords, the modulation and coding scheme, new data indicator and the redundancy version are signaled separately for each of the codewords. The spatial multiplexing also requires a transmission of precoding information.

The transport block to codeword mapping is performed according to the 3GPP specification, i.e. transport block 1 (TB1) is mapped to codeword 1 (CW1) and TB2 to CW2 respectively. The "Transport Block to Codeword Swap Flag" determines the mapping in case both transport blocks are enabled. If this swap flag is enabled, the TB1 is mapped to CW2 and vice versa.



**EUTRA/LTE A: DCI Format Configuration(F0/SF0/2)**

DCI Format 2

Resource Allocation Header

Resource Block Assignment

TPC Command

HARQ Process Number

Transport Block to Codeword Swap Flag

Transport Block 1

Modulation and Coding Scheme

New Data Indicator

Redundancy Version

Transport Block 2

Modulation and Coding Scheme

New Data Indicator

Redundancy Version

Precoding Information

Data

Bit Data 00 0000 0000 0000 0011 1001 1100 0110 0000 0011 0000 0001

The fields defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting **Bit Data** is displayed.

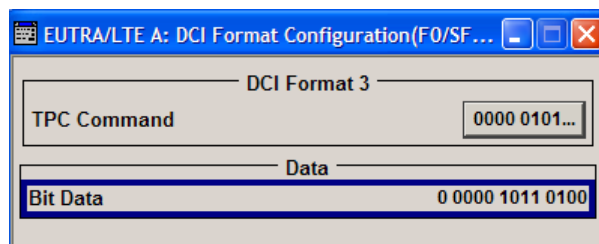
The DCI Format 2/2A transmits the information listed in the table below.

Control Information Field	SCPI command	Dependencies
Resource Allocation Header	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:RAH on page 381	Enabled for Channel Bandwidth > 10RBs
Resource Block Assignment	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:RBA on page 382	
TPC Command for PUCCH	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:TPCC on page 385	
Downlink Assignment Index	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:DLAindex on page 378	Enabled for TDD mode
HARQ Process Number	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:HPN on page 379	
Transport Block to Codeword Swap Flag	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:SWAPflag on page 383	
Precoding Information	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:PRECinfo on page 381	
"Transport Block 1"		

Control Information Field	SCPI command	Dependencies
Modulation and Coding Scheme	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL [ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:TB1:MCS on page 383</code>	
New Data Indicator	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL [ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:TB2:NDI on page 384</code>	
Redundancy Version	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL [ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:TB1:RV on page 384</code>	
"Transport Block 2"		
Modulation and Coding Scheme	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL [ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:TB2:MCS on page 383</code>	
New Data Indicator	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL [ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:TB2:NDI on page 384</code>	
Redundancy Version	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL [ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:TB2:RV on page 384</code>	

### DCI Format 3/3A

The DCI Format 3/3A is used for the transmission of TPC Commands for PUCCH and PUSCH with 2-bit and a single bit power adjustment respectively.



The "TPC Command" is set as a bit pattern.

The field defined in the DCI format are mapped to the information bits according to the 3GPP specification and the resulting **Bit Data** is displayed.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :DCIConf:TPCinstr on page 385
```

## 7.8 Configure User

The "Configure User" menu allows you to define and configure up to four scheduled user equipments that can be freely distributed over the whole frame by setting the data source of a certain allocation to "User 1 .. 4". Using this feature ensures that a common data source is used for allocations of one user equipment also in case that these allocations are non-adjacent.

Following settings are identical for all allocations belonging to the same user in one sub-frame:

- **Modulation** - changing the modulation of one of the allocations belonging to a user changes the modulation of all other allocations of the same user in the subframe. Different modulations may be selected for the two code words of an allocation.

	Code Word	Mod.	Enhanced Settings	No. RB	No. Sym.	Offs RB	Offs Sym.	Auto	Phys. Bits	Data Source	DList Pattern	Power /dB	Content Type	State	Confl.
0	1/1	QPSK	Config...	6	4	22	7(1/0)	Off	480	PN9	-	0.00	PBCH	On	
1	1/1	QPSK		50	2	0	0(0/0)	Off	-	PN9	-	0.00	PDCCH	Off	
2	1/1	QPSK	Config...	1	12	0	2(0/2)	On	264	PN9	-	0.00	PDSCH	On	
3	1/1	QPSK	Config...	1	12	1	2(0/2)	On	264	PN9	-	0.00	PDSCH	On	
4.1	1/2	16-QAM	Config...	1	12	2	2(0/2)	On	528	User3	-	0.00	PDSCH	On	
4.2	2/2	QPSK	Config...	1	12	2	2(0/2)	On	264		-			On	
5.1	1/2	16-QAM	Config...	1	12	3	2(0/2)	On	528	User3	-	0.00	PDSCH	On	
5.2	2/2	QPSK	Config...	1	12	3	2(0/2)	On	264		-			On	

- Complete **Precoding Settings** - changing the precoding settings of one of the allocations belonging to a user changes the precoding settings of all other allocations of the same user in the subframe.

The image shows two side-by-side screenshots of the 'Enhanced Settings(SF 0)' dialog box. The left window is for Allocation # 4 (is PDSCH) with Code Word 1/2. The right window is for Allocation # 5 (is PDSCH) with Code Word 1/2. Both windows show the same three sections: Precoding, Scrambling, and Channel Coding. In the Precoding section, 'Precoding Scheme' is 'Spatial Multiplexing', 'Code Words' is 2, 'Number Of Layers' is 2, 'Codebook Index' is 2, and 'Cyclic Delay Diversity' is 'No CDD'. In the Scrambling section, 'State' is checked and 'UE ID/n\_RNTI' is 5. In the Channel Coding section, 'State' is checked, 'Type' is 'TC 1/3', 'Number of Physical Bits' is 1056, 'Transport Block Size' is 1500, 'Redundancy Version Index' is 0, and 'IR Soft Buffer Size' is 19200.

- **Scrambling Settings** (**Scrambling State** and **UE ID/n\_RNTI**) and **Channel Coding State** - changing the scrambling settings and the channel coding state for one user changes the scrambling settings and the channel coding state of all allocations of the same user in the frame. The **Scrambling State**, **UE ID/n\_RNTI** and **Channel Coding State** are also displayed in the "Enhanced Settings" dialog of each allocation.

	Scram.	CC	UE ID/n_RNTI	Data Source	DList/Pattern	P_A
User1	On	Off	2	PN9	-	0 dB
User2	On	Off	1	PN9	-	-3.01 dB
User3	Off	On	5	PN9	-	0 dB
User4	Off	Off	0	PN9	-	2.04 dB

For more details, see [chapter 4.8, "Data Allocations"](#), on page 36.

**User (Configure User)**

Displays the consecutive number of the users.

SCPI command:

n.a.

**State Scrambling (User)**

Enables/disables scrambling for all allocations belonging to the selected user.

The "Scrambling State" ("Enhanced Settings" menu) of all allocations for which "User 1..4" is selected as [Data Source](#), is set to the value set with this parameter.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL:USER<ch>:SCRambling:STATe` on page 401

**State Channel Coding (User)**

Enables/disables channel coding for all allocations belonging to the selected user.

The "Channel Coding State" ("Enhanced Settings" menu) of all allocations for which "User 1..4" is selected as [Data Source](#), is set to the value set with this parameter.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL:USER<ch>:CCODing:STATe` on page 401

**UE ID/n\_RNTI (User)**

Sets the user equipment ID. This UE ID will be used for the generation of the scrambling sequence for the allocation, for which an "User 1..4" is selected as [Data Source](#) in the allocation table of [DL Frame Configuration](#) dialog.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL:USER<ch>:UEID` on page 401

**Data Source (User)**

Selects the data source for the selected user.

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

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL:USER<ch>:DATA` on page 402

**DList Pattern (User)**

Displays the bit pattern or selected DLISt data, depending on the selected data source.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL:USER<ch>:DSElect` on page 402

`[ :SOURCE<hw> ] :BB:EUTRa:DL:USER<ch>:PATTern` on page 403

**P\_A**

Sets PDSCH power factor according to 3GPP TS 36.213, chapter 5.2.

This power value is applied to all allocations that belong to the corresponding user. The power of an allocation is additionally determined by the parameter "PDSCH Scheduling Mode". In a normal operation, the power values in the allocation table are configurable parameters. In the Auto/DCI mode however, the power value is fixed and cannot be adjusted.

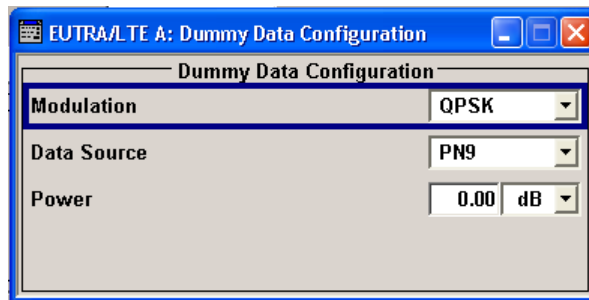
For the DCI format 1D, an additional level offset has to be considered.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:PA on page 402

## 7.9 Dummy Data Configuration

The "Dummy Data Configuration" menu is called in the "Frame Configuration" menu with the button "Dummy Data Configuration". Here the dummy data for filling the unscheduled resource blocks and subframes are configured, if this feature has been enabled in the "Frame Configuration" menu.



### Modulation (Dummy Data)

Selects the modulation of the dummy data.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:DUMD:MODulation on page 403

### Data Source (Dummy Data)

Selects the data source for the dummy data configuration.

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

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:DUMD:DATA on page 404

### Pattern (Dummy Data)

(Available for data source Pattern only)

Opens the editor for configuring a bit pattern. The length is limited to 64 bits.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:DUMD:PATtern](#) on page 404

#### **Select Data List (Dummy Data)**

(Available for data source Data List only)

Opens the "Load Data" List window for loading a saved dummy data list. The data list of the selected (highlighted) file is loaded by pressing the "Select" button.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:DUMD:DSElect](#) on page 404

#### **Power (Dummy Data)**

Sets the power of the subcarriers allocated with dummy data.

SCPI command:

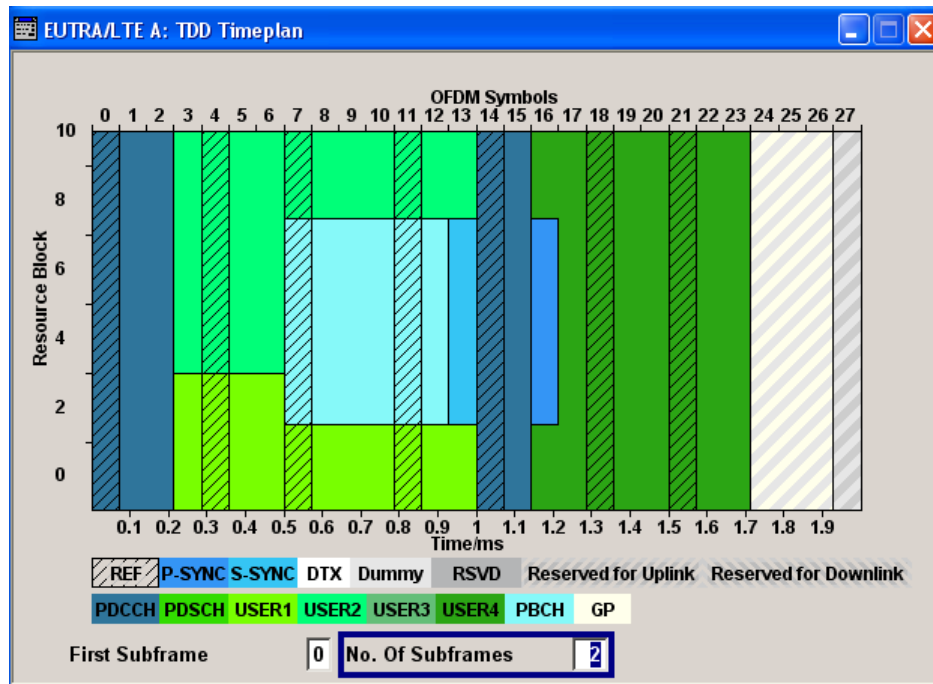
[\[:SOURCE<hw>\]:BB:EUTRa:DL:DUMD:POWer](#) on page 403

## 7.10 OFDMA Timeplan

The "OFDMA Timeplan" menu is called in the "Frame Configuration" menu with the button "Show Time Plan".

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation to a UE can span 1 to up to "No. of Resource Blocks" in the frequency domain.

P-SYNC/S-SYNC is automatically calculated according to the settings in [General DL Settings](#) dialog.



**First Subframe**

Selects the first subframe to be displayed.

SCPI command:

n.a.

**No. of Subframes**

Selects the number of subframes to be displayed.

SCPI command:

n.a.

**View Mode**

Determines whether the time plan shows the allocated Virtual Resource Blocks (VRBs) or the Physical Resource Blocks (PRBs).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:VIEW:MODE on page 342

## 7.11 General UL Settings

The General UL Settings menu allows configuring the EUTRA/LTE system for transmission direction uplink.

In the "Physical Settings" section, the channel bandwidth respectively the number of resource blocks per slot is selected.

Physical Settings	
Channel Bandwidth	3 MHz
Physical Resource Block Bandwidth	12 * 15kHz
Number Of Resource Blocks Per Slot	15
Occupied Bandwidth /MHz	2.700 0
Sampling Rate /MHz	3.840
FFT Size	256
Number Of Occupied Subcarriers	180
Number Of Left Guard Subcarriers	38
Number Of Right Guard Subcarriers	38

In the "Cell Specific Settings" section, the physical layer cell identity settings and the structure of the PUSCH, PUCCH, PRACH, SRS and the uplink reference signals are set.

The other parameters are fixed and read-only.

Cell Specific Settings	
Cell ID	100
Physical Cell ID Group	33
Physical Layer ID	1
Cyclic Prefix	Extended
Fast Forward(N_c)	1 600

UL Reference Signals	
Group Hopping	<input checked="" type="checkbox"/>
Sequence Hopping	<input checked="" type="checkbox"/>
Delta Sequence Shift for PUSCH	11
n(1)_DMRS	2
Enable n_PRS	<input checked="" type="checkbox"/>

PRACH	
PRACH Frequency Offset	0
PRACH Configuration	3
Restricted Set (High Speed Mode)	<input checked="" type="checkbox"/>

PUSCH Structure	
Frequency Hopping Mode	Intra-subframe
Number of Sub-bands	3



PUCCH Structure	
Number of RBs used for PUCCH	4
Delta Shift	2
Delta Offset	0
N(1)_cs	6
Range n(1)_PUCCH (Normal CP)	0...44
Range n(1)_PUCCH (Extended CP)	0...29
Range n(2)_PUCCH	0...15

SRS Structure	
SRS Subframe Configuration	0
Configuration Period T_SFC	1
Transmission Offset Delta_SFC	{0}
SRS Bandwidth Configuration C_SRS	0

### 7.11.1 Physical Settings

#### Channel Bandwidth (UL)

Sets the channel bandwidth of the EUTRA/LTE system.

Although the 3GPP specification bases on bandwidth agnostic layer 1 and channel bandwidth is determined by specifying the desired number of resource blocks, the current EUTRA standardization focuses on seven bandwidths (1.4, 3, 3.2, 5, 10, 15 and 20 MHz).

For backward compatibility with previous version of the implementation, this parameter allows the flexibility to choose, whether a user defined bandwidth or one of the pre-defined channel bandwidths is used.

If a pre-defined channel bandwidth is selected; the actual "Number of Resource Blocks Per Slot" is internally calculated for the selected "Channel Bandwidth" and "Physical Resource Block Bandwidth".

The sampling rate, occupied bandwidth and FFT size are therefore determined by the parameter "Number of Resource Blocks Per Slot". If required, the [FFT Size](#) can be adjusted.

See also [table 4-1](#) for an overview of this cross-reference between the parameters.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:BW on page 330

#### Physical Resource Block Bandwidth (UL)

Displays the bandwidth of one physical resource block.

**Note:** In this release, this value is fixed to 12 x 15 kHz.

SCPI command:

n.a.

**Number of Resource Blocks Per Slot (UL)**

This parameter determines the channel bandwidth.

If the parameter "Channel Bandwidth" is set to one of the pre-defined channel bandwidths (1.4, 3, 5, 10, 15 or 20 MHz), the value "Number of Resource Blocks Per Slot" is read only and is automatically set according to the selected channel bandwidth and "Physical Resource Block Bandwidth".

If a user defined channel bandwidth is selected, the parameters "Number of Resource Blocks Per Slot" and "Physical Resource Blocks Bandwidth" determine the actual channel bandwidth.

The sampling rate and the occupied bandwidth are determined by the parameter "Number of Resource Blocks Per Slot". If required, the [FFT Size](#) can be adjusted.

See also [table 4-1](#) for an overview of this cross-reference between the parameters.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:NORB](#) on page 330

**Occupied Bandwidth (UL)**

Displays the occupied bandwidth. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:OCCBandwidth](#) on page 331

**Sampling Rate (UL)**

Displays the sampling rate. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:SRATE](#) on page 330

**FFT Size (UL)**

Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected "Number of Resource Blocks Per Slot".

See also [table 4-1](#) for an overview of this cross-reference between the parameters.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:FFT](#) on page 331

**Number Of Occupied Subcarriers (UL)**

Displays the number of occupied subcarriers. The value is automatically set according to the parameter "Number of Resource Blocks Per Slot".

See also [table 4-1](#) for an overview of this cross-reference between the parameters.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:OCCSubcarriers](#) on page 331

**Number Of Left Guard Subcarriers (UL)**

Displays the number of left guard subcarriers. This value is set automatically according to the parameter "Number of Resource Blocks Per Slot".

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:LGS](#) on page 332

**Number Of Right Guard Subcarriers (UL)**

Displays the number of right guard subcarriers. This value is set automatically according to the parameter "Number of Resource Blocks Per Slot".

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:UL:RGS on page 332

**7.11.2 TDD Frame Structure**

The "TDD Frame Structure" section is available only, if the TDD is selected as a duplexing mode. In this section, the TDD frame is configured by means of adjustment of the UL/DL configuration and the special subframe configuration (see also [chapter 3.2.1, "OFDMA Parameterization"](#), on page 17).

**UL/DL Configuration**

Sets the Uplink-Downlink Configuration number, i.e. defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TDD:UDConf on page 318

**Configuration of Special Subframes**

Sets the Special Subframe Configuration number, i.e. together with the parameter [Cyclic Prefix](#) defines the lengths of the DwPTS, the Guard Period and the UpPTS.

The DwPTS length selected with this parameter determines the maximum number of the OFDM symbols available for PDSCH in the special subframe.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TDD:SPSConf on page 318

**7.11.3 Cell Specific Settings**

In the "Cell Specific Settings" section, the physical layer cell ID settings, the UL Reference Signal settings, the PUSCH, PUCCH and PRACH structures are selected.

**Cell ID (UL)**

Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3\*[Physical Cell ID Group](#) + [Physical Layer ID](#)

There is a cross-reference between the values of this three parameters and changing of one of them results in adjustment in the values of the others.

The Cell ID determinates:

- the reference signal grouping hopping pattern,
- the reference signal sequence hopping,
- the PUSCH demodulation reference signal pseudo-random sequence,

- the cyclic shifts for PUCCH formats 1/1a/1b and sequences for PUCCH formats 2/2a/2b and
- the pseudo-random sequence used for scrambling
- the pseudo-random sequence used for type 2 PUSCH frequency hopping.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :PLCi ] :CID` on page 332

#### Physical Cell ID Group (UL)

Sets the ID of the physical cell identity group.

To configure these identities, set the parameter [Physical Layer ID](#).

The physical layer cell identities determine the sequence shift pattern used for PUCCH.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :PLCi ] :CIDGroup` on page 333

#### Physical Layer ID (UL)

Sets the identity of the physical layer within the selected physical cell identity group, set with parameter [Physical Cell ID Group](#).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :PLCi ] :PLID` on page 333

#### Cyclic Prefix (General UL Settings)

Sets the cyclic prefix length for all subframes.

The number of the SC-FDMA symbols is set automatically.

"Normal" Normal cyclic prefix, i.e. the UL slot contains 7 SC-FDMA symbols.

"Extended" Extended cyclic prefix, i.e. the UL slot contains 6 SC-FDMA symbols. The extended cyclic prefix is defined in order to cover large cell scenarios with higher delay spread and MBMS transmission.

"User Defined" The cyclic prefix length can vary over the subframes. The cyclic prefix length is set per subframe in the "UL Frame Configuration" dialog with the parameter [Cyclic Prefix](#).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL :CPC` on page 333

### 7.11.4 UL Reference Signals

#### Group Hopping

Enables/disables group hopping for the uplink reference signals demodulation reference signal (DMRS) and sounding reference signal (SRS).

17 different hopping patterns and 30 different sequence shift patterns are used for group hopping.

PUSCH and PUCCH use the same group hopping pattern that is calculated if the "Group Hopping" is enabled. The group hopping pattern is generated by a pseudo-random sequence generator.

The sequence shift pattern of PUCCH is derived from the physical layer cell ID set as a combination of the parameters [Physical Cell ID Group](#) and [Physical Layer ID](#).

The PUSCH sequence shift pattern is determinate by the parameter [Delta Sequence Shift for PUSCH](#).

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:REFSig:GRPHopping](#) on page 334

### Sequence Hopping

Enables/disables sequence hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

Sequence Hopping and [Group Hopping](#) can be activated simultaneously, but only group hopping will be applied in this case, as defined in 3GPP TS 36.211.

The sequence hopping is generated by a pseudo-random sequence generator.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:REFSig:SEQHopping](#) on page 334

### Delta Sequence Shift for PUSCH

Sets the delta sequence shift for PUSCH needed for the calculation of the group hopping pattern.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:REFSig:DSSHift](#) on page 334

### n(1)\_DMRS

Sets the part of the demodulation reference signal (DMRS) index which is broadcasted and therefore valid for the whole cell. This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:REFSig:DMRS](#) on page 335

### Enable n\_PRs

Enables the use of the pseudo-random sequence n\_PRs in the calculation of the demodulation reference signal (DMRS) index as defined in 3GPP TS 36.211, chapter 5.5.2.1.1.

If n\_PRs is disabled, it is possible to set the cyclic shift to 0 for all subframes.

This parameter has to be enabled in order to generate a 3GPP compliant uplink signal.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:REFSig:ENPRs](#) on page 335

## 7.11.5 PRACH Settings

The cell specific parameters in this section determine the PRACH configuration according to the 3GPP TS 36.211.

The UE-specific parameters, necessary for the complete definition of the PRACH, are configurable in the [User Equipment Configuration](#) dialog of the corresponding UE.

**PRACH Frequency Offset**

For preamble formats 0-3, sets the prach-FrequencyOffset  $n_{PRBoffset}^{RA}$  as defined in the 3GPP TS 36.211, i.e. determines the first physical resource block available for PRACH expressed as a physical resource block number that fulfills the equation:

$$0 \leq n_{PRBoffset}^{RA} \leq \text{Number of UL Resource Blocks} - 6$$

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:UL:PRACH:FOFFset on page 337

**PRACH Configuration**

Sets the PRACH configuration index as defined in the 3GPP TS 36.211, i.e. defines the subframes in which random access preamble transmission is allowed.

The PRACH allocation occupies a bandwidth of 6 RBs.

However, the PRACH distribution (subframe, length, offset) depends on several other parameters:

- selected "Cyclic Prefix"
- selected [PRACH Frequency Offset](#)
- selected frame format, i.e. on the selected [Duplexing](#) mode
- selected [Frequency Resource Index](#) (for TDD mode).

Not all combinations of channel bandwidth, PRACH configuration and PRACH frequency offset are allowed.

The table below gives an overview on the dependency of the value range of the parameter "PRACH Configuration" and other parameters.

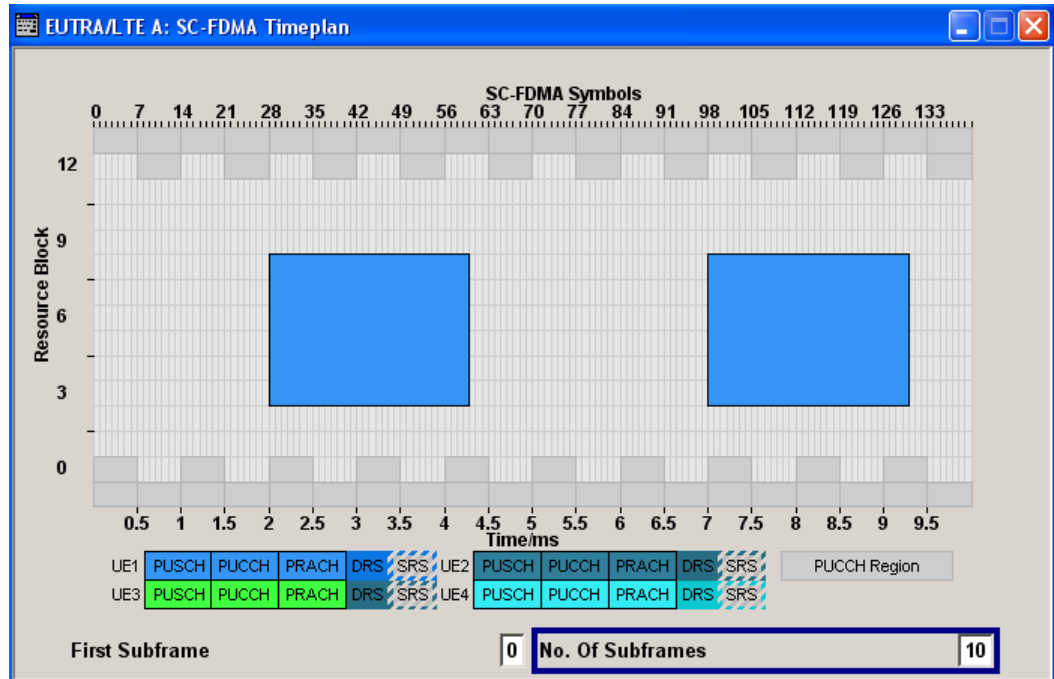
Duplexing Mode	<a href="#">Configuration of Special Subframes</a>	<a href="#">(Global) Cyclic Prefix</a>	PRACH Configuration
FDD	-	Normal/Extended	0 .. 63
TDD	0 .. 3	Normal/Extended	0 .. 47
	4	Normal	0 .. 47
	4	Extended	0 .. 57
	5 .. 8	Normal/Extended	0 .. 57

The [Preamble Format](#) is automatically derived from the "PRACH Configuration".

Use the SC-FDMA Time plan to display the PRACH distribution.

**Example:**

The timeplan below illustrates the PRACH distribution of a PRACH Configuration#55 (Preamble Format#3) for FDD duplexing mode and normal Cyclic Prefix with adjusted PRACH frequency Offset.



SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:PRACH:CONFiguration](#) on page 337

**Restricted Set (High Speed Mode)**

Selects whether a restricted preamble set (high speed mode) or the unrestricted preamble set (normal mode) will be used.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:PRACH:RSET](#) on page 338

**7.11.6 PUSCH Structure****Uplink Frequency Hopping Mode**

Sets the frequency hopping mode for PUSCH.

Frequency hopping is applied according to 3GPP TS 36.213.

"Inter-sub-frame" The PUSCH position in terms of used resource blocks is changed each subframe.

"Intra-sub-frame" Both intra- and inter-subframe hopping are performed. The PUSCH position in terms of used resource blocks is changed each slot and each subframe.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:PUSCh:FHMode on page 338

#### **PUSCH Hopping Offset**

Sets the PUSCH Hopping Offset  $N_{RB}^{HO}$ .

The PUSCH Hopping Offset determines the first physical resource block and the maximum number of physical resource blocks available for PUSCH transmission if PUSCH frequency hopping is used.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:PUSCh:FHOFFset on page 338

#### **Number of Sub-bands**

Sets the number of sub-bands ( $N_{sb}$ ) into that the total range of physical resource blocks available for PUSCH transmission is divided. The frequency hopping is performed at sub-band level.

The size of one sub-band is determined by the number of resource blocks available for PUSCH transmission, the "Number of Sub-bands" and the PUSCH hopping parameters.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:PUSCh:NOSM on page 339

### **7.11.7 PUCCH Structure**

#### **Number of RBs used for PUCCH**

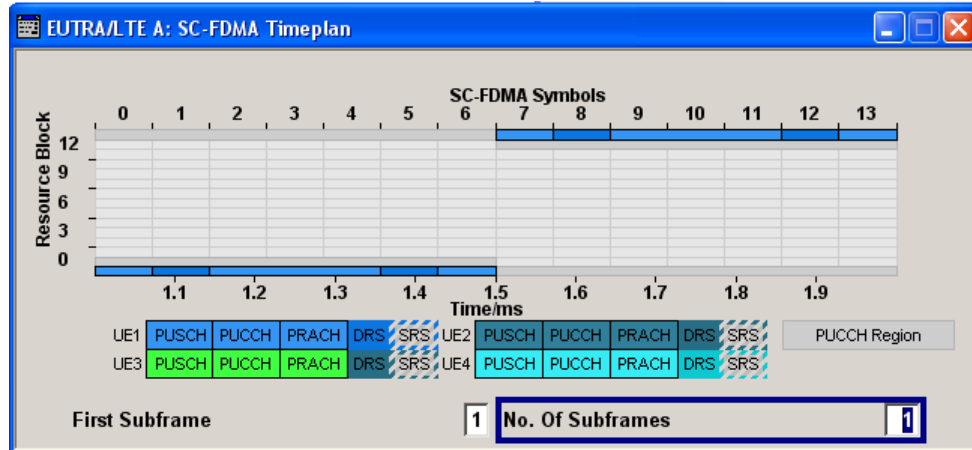
Sets the PUCCH region in terms of reserved resource blocks, located at the edges of the channel bandwidth (see [figure 3-13](#)).

The PUCCH region is displayed on the SC-FDMA Timeplan.



**Example:**

The figure below shows an example of a subframe with PUCCH region with three reserved resource blocks and PUCCH Format 2a.



SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:PUCCh:NORB` on page 339

**Delta Shift**

Sets the delta shift parameter, i.e. the cyclic shift difference between two adjacent PUCCH resource indices with the same orthogonal cover sequence (OC).

The delta shift determines the number of available sequences in a resource block that can be used for PUCCH formats 1/1a/1b (see also [chapter 3.3.3, "Uplink Control Information Transmission"](#), on page 27).

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:PUCCh:DESHift` on page 339

**Delta Offset**

Sets the PUCCH delta offset parameter, i.e. the cyclic shift offset. The value range depends on the selected [Delta Shift](#).

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:PUCCh:DEOffset` on page 339

**N(1)\_cs**

Sets the number of cyclic shifts used for PUCCH format 1/1a/1b in a resource block used for a combination of the formats 1/1a/1b and 2/2a/2b.

Only one resource block per slot can support a combination of the PUCCH formats 1/1a/1b and 2/2a/2b.

The number of cyclic shifts available for PUCCH format 2/2a/2b N(2)\_cs in a block with combination of PUCCH formats is calculated as follow:

$$N(2)_{cs} = 12 - N(1)_{cs} - 2$$

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:PUCCh:N1CS` on page 340

**N(2)\_RB**

Sets bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

Since there can be only one resource block per slot that supports a combination of the PUCCH formats 1/1a/1b and 2/2a/2b, the number of resource block(s) per slot available for PUCCH format 1/1a/1b is determinate by "N(2)\_RB".

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:PUCCh:N2RB on page 340

**Range n(1)\_PUCCH (Normal CP)**

Displays the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of normal CP.

Insufficient ranges are displayed as '-'.

This parameter determines the value range of index `n_PUCCH` for PUCCH format 1/1a/1b in case of normal cyclic prefix.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:PUCCh:N1NMax on page 340

**Range n(1)\_PUCCH (Extended CP)**

Displays the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of Extended CP.

Insufficient ranges are displayed as '-'.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:PUCCh:N1EMax on page 341

**Range n(2)\_PUCCH**

Displays the range of possible number of PUCCH format 2/2a/2b transmissions from different users in one subframe.

Insufficient ranges are displayed as '-'.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:PUCCh:N2Max on page 341

## 7.11.8 SRS Structure

The cell specific parameters in this section determine the structure of the sounding reference signal (SRS) according to the 3GPP TS 36.211.

The UE-specific parameters, necessary for the complete definition of the SRS structure and SRS mapping, are configurable in the [User Equipment Configuration](#) dialog of the corresponding UE.

**SRS Subframe Configuration**

Sets the cell specific parameter SRS subframe configuration.

The UEs will send shortened PUSCH/PUCCH in these cell-specific subframes, regardless whether the UEs are configured to send a SRS in the according subframe or not.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:REFSig:SRS:SUConfiguration` on page 336

### Configuration Period T\_SFC

Displays the value for the cell specific parameter configuration period  $T_{SFC}$  in subframes, depending on the selected "SRS Subframe Configuration" and the "Duplexing" mode.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:REFSig:SRS:TSFC` on page 337

### Transmission Offset Delta\_SFC

Displays the value for the cell specific parameter transmission offset  $\Delta_{SFC}$  in subframes, depending on the selected "SRS Subframe Configuration" and the "Duplexing" mode.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:REFSig:SRS:DSFC` on page 336

### SRS Bandwidth Configuration C\_SRS

Sets the cell specific parameter SRS Bandwidth Configuration ( $C_{SRS}$ ).

The SRS Bandwidth Configuration  $C_{SRS}$ , the [SRS Bandwidth B\\_SRS](#) and the [Channel Bandwidth \(UL\)](#) determine the length of the sounding reference signal sequence, calculated according to 3GPP TS 36.211.

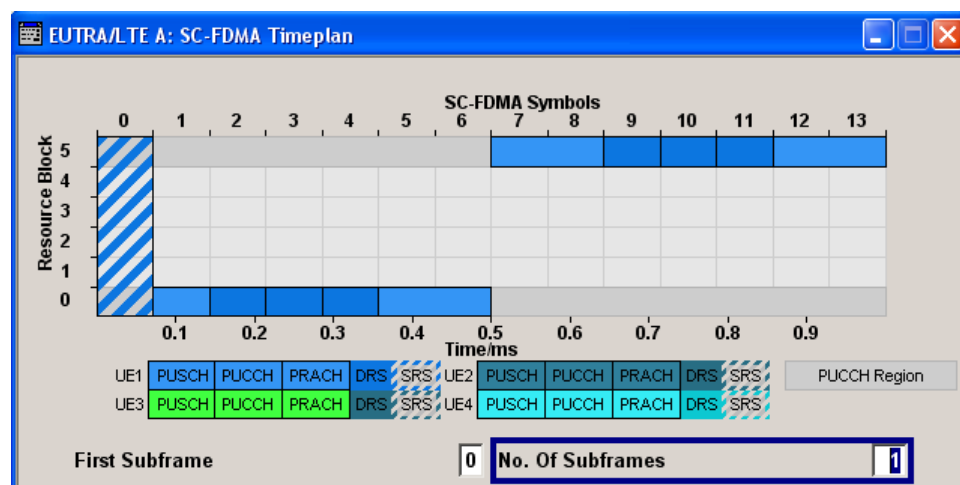
SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:REFSig:SRS:CSRS` on page 336

### A/N + SRS simultaneous Tx

Enables/disables simultaneous transmission of SRS (sounding reference signal) and ACK/NACK messages, i.e. simultaneous transmission of SRS and PUCCH.

Simultaneous transmission of SRS and PUCCH is allowed only for PUCCH formats 1, 1a and 1b, since CQI reports are never simultaneously transmitted with SRS.



If this parameter is disabled, the SRS is not transmitted in the corresponding subframe.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:REFSig:SRS:ANSTx](#) on page 335

### SRS MaxUpPTS

Enables/disables the cell specific parameter srsMaxUpPts.

If enabled, a SRS transmission in the UpPTS field (TDD) is made only in the frequency area that does not overlap with the frequency resources reserved for a possible PRACH preamble format 4 transmission.

This is done by reconfiguring the number of SRS resource blocks in the special subframes, which would otherwise be determined by C\_SRS and B\_SRS.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:REFSig:SRS:MUPTs](#) on page 335

## 7.12 UL Frame Configuration

The "UL Frame Configuration" menu for uplink allows configuring the subframes and the SC-FDMA resource allocations. The "UL Frame Configuration" menu consists of three sections, "General Frame Configuration", "Subframe Configuration" and the "Allocation Table".

Section "General Frame Configuration" includes the configuration of the different user equipment.

The screenshot shows the 'EUTRA/LTE A: UL Frame Configuration' window. It is divided into three main sections:

- General Frame Configuration:** Includes a 'Select User Equipment' section with four buttons for UE1, UE2, UE3, and UE4, each with a checked 'On' checkbox. To the right, there is a 'No. Of Configurable Subframes' field set to '6' and a 'Reset Subframe Configuration' button.
- Subframe Configuration:** Includes a 'Subframe Selection' field set to '0', 'Copy Subframe', and 'Paste Subframe' buttons. Below it is a 'Cyclic Prefix' dropdown menu set to 'Normal' and a 'Show Time Plan...' button.
- Allocation Table:** A table with columns: Content Type, UE, Enhanced Settings, Modulation /Format, No.RB, Offset VRB, Offs. PRB Slot n, Offs. PRB Slot n+1, Phys.Bits, Power/dB, State, and Conflict. The table contains four rows of data.

	Content Type	UE	Enhanced Settings	Modulation /Format	No.RB	Offset VRB	Offs. PRB Slot n	Offs. PRB Slot n+1	Phys.Bits	Power/dB	State	Conflict
0	PUSCH	UE1	Config...	QPSK	10	2	2	2	-	0.000	Off	
1	PUSCH	UE2	Config...	16-QAM	10	13	1	13	5760	0.000	On	
2	PUCCH	UE3	Config...	F1	1	-	49	0	-	0.000	On	
3	PUCCH	UE4	Config...	F2a	1	-	0	49	21	0.000	On	

## 7.12.1 General Frame Configuration

### Select User Equipment (UE1...UE4)

Calls the User Equipment menu for configuring Reference Signals for different users.

The menu is described in section [chapter 7.13, "User Equipment Configuration"](#), on page 153.

The check box activates or deactivates selected UE.

**Note:** Disabling the UE deactivates the corresponding allocations. Neither reference signal, nor PUSCH/PUCCH allocations will be transmitted if an UE is deactivated.

SCPI command:

n.a.

### No Of Configurable (UL) Subframes

Sets the number of configurable subframes in the up to four configurable frames.

All uplink subframes are filled periodically with the configured subframes with the exception of the Sounding Reference Signal which are set individually for each UE in the "User Equipment" menu.

The maximum number of configurable subframes depends on the selected [Duplexing mode](#) (TDD or FDD), [UL/DL Configuration](#) and whether a [realtime feedback](#) is enabled or not.

For more detailed information about the maximum number of configurable subframes and for description of the dependencies between the parameters, see [chapter 5.2.3, "Extension to Four Configurable Frames in Uplink and Downlink Direction"](#), on page 45.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:CONSubframes](#) on page 388

### Reset Subframe Configuration

Resets settings of all subframes including cyclic prefix to the default values.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:RSTFrame](#) on page 388

## 7.12.2 Subframe Configuration

### Subframe Selection

Sets the subframe to be configured in the frame configuration table.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:SFSelection](#) on page 388

### Cyclic Prefix (UL)

Configuration of the cyclic prefix per subframe is only enabled, if the parameter [Cyclic Prefix \(General UL Settings\)](#) is set to User Defined.

The number of the SC-FDMA symbols per subframe is set automatically

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :CYCPrefix` on page 389

#### **Copy Subframe Settings**

Copies the settings of the selected subframe. Sounding Reference signals are not considered.

For more detailed information, see [chapter 5.2.1, "Copy/Paste Subframe"](#), on page 44.

SCPI command:

n.a.

#### **Paste Subframe Settings**

Pastes the subframe settings to the selected subframe. Sounding Reference signals are not considered.

For more detailed information, see [chapter 5.2.1, "Copy/Paste Subframe"](#), on page 44.

SCPI command:

n.a.

#### **Show Time Plan**

Calls the time plan for the SC-FDMA resource allocation.

The menu is described in detail in section [chapter 7.16, "SC-FDMA Timeplan"](#), on page 183.

SCPI command:

n.a.

### **7.12.3 Allocation Table UL**

The resource allocation table is located in the lower part of the "UL Frame Configuration" menu. The resource allocation table is where the individual allocation parameters for a subframe are set.

#### **Allocation number (UL)**

Displays the consecutive number of the allocation.

SCPI command:

n.a.

#### **Content Type (UL)**

Selects the content type of the selected allocation.

Data source settings for PUSCH is configurable in dialog [chapter 7.13, "User Equipment Configuration"](#), on page 153.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:CONType`  
on page 391

**User Equipment**

Selects the UE the selected allocation belongs to.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:UEType
```

on page 392

**Enhanced Settings UL**

Calls dialog for configuration of PUSCH/PUCCH depending on the selected allocation (see [chapter 7.14, "Enhanced PUSCH Settings"](#), on page 175 and [chapter 7.15, "Enhanced PUCCH Settings"](#), on page 180).

SCPI command:

n.a.

**Modulation/Format**

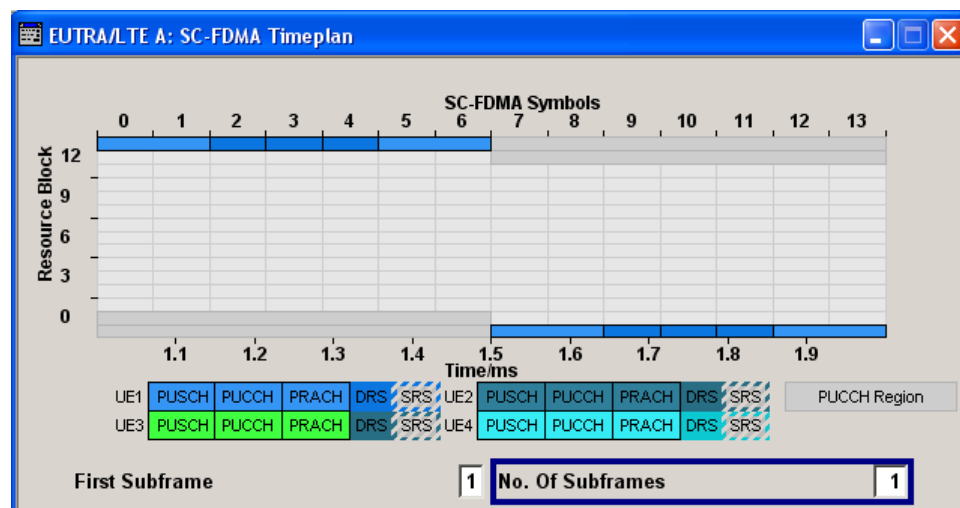
For PUSCH allocation, this parameter sets the modulation scheme (QPSK, 16QAM or 64QAM) for the allocation.

This parameter is read-only, if a predefined [FRC](#) is selected.

For PUCCH allocation, this parameter sets the PUCCH Format (1/1a/1b/2/2a/2b). See [chapter 3.3.3, "Uplink Control Information Transmission"](#), on page 27 for an overview of the allowed PUCCH formats. Use the SC-FDMA Time plan to visualize the position and structure of the configured PUCCH allocation.

**Example:**

The figure below shows an example of a subframe with PUCCH region with three reserved resource blocks and ["PUCCH Format"](#) on page 181 1/1a/1b.



SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:MODulation
```

on page 389

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:FORMat
```

on page 389

**No. RB (Resource Blocks)**

Sets the size of the selected allocation in resource blocks.

This parameter is read-only, if a predefined **FRC** is selected.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:RBCount
```

on page 389

**Offset VRB**

Sets the virtual resource block offset of the selected subframe.

This parameter is read-only, if a predefined **FRC** is selected.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:VRBoffset
```

on page 390

**Offs PRB Slot n**

Displays the start resource block of the selected allocation in slot n of the subframe.

The start physical resource block in slot n is set automatically and can deviate from the **Offset VRB** if frequency hopping is used.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :SLOT<user0>:ALLoc<ch0>:
```

RBOffset on page 390

**Offs PRB Slot n+1**

Displays the start resource block of the selected allocation in slot n+1 of the subframe.

The start physical resource block in slot n+1 is set automatically and can deviate from the **Offset VRB** if frequency hopping is used.

In case an intra-subframe hopping for hopping type 2 is applied, the start resource block in slot 1 is determinate by the selected **Number of Sub-bands**.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :SLOT<user0>:ALLoc<ch0>:
```

RBOffset on page 390

**Phys. Bits / Total Number of Physical Bits**

Displays the size of the selected allocation in bits. The value is set automatically according to the current allocation's settings.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PHYSbits
```

on page 391

**Power (UL)**

Sets the power for the selected allocation, i.e. PUSCH or PUCCH power level.

The PUSCH power level ( $P_{\text{PUSCH}}$ ) and the PUCCH power level ( $P_{\text{PUCCH}}$ ) can vary per subframe.

For global adjustment of the transmit power of the corresponding UE, use the parameter **UE Power** ( $P_{\text{UE}}$ ).



An additional boost of the reference signals DRS and SRS per UE can be applied with the parameters **DRS Power Offset** ( $P_{\text{DRS\_offset}}$ ) and **SRS Power Offset** ( $P_{\text{SRS\_offset}}$ ) respectively.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :POWer` on page 391

#### State (UL)

Sets the allocation to active or inactive state.

**Note:** Disabling an allocation deactivate the PUSCH/PUCCH and the corresponding demodulation reference signal, but does not affect other allocations of the UE or the sounding reference signal.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :STATe` on page 392

#### Conflict (UL)

Indicates a conflict between UEs and in case an allocation exceeds the available number of resource blocks.

For more information, see [chapter 5.1, "Conflict Handling in the R&S Signal Generator"](#), on page 41.

SCPI command:

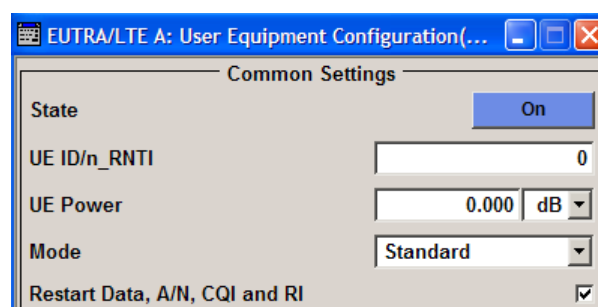
`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :CONFLict` on page 392

## 7.13 User Equipment Configuration

The "User Equipment 1 - 4" menus for users 1 to 4 allows to define and configure up to four scheduled user equipments that can be freely distributed over the whole frame. For each user equipment, the structure of the demodulation reference signal and the sounding reference signal can be configured individually.

The "User Equipment 1 – 4" menu consists of four main sections "Common Settings", "FRC Configuration", "Physical Uplink Shared Channel (PUSCH)" and "Reference Signal Structure". Section "Realtime Feedback Configuration" is enabled only for instrument equipped with the option R&S SMx/AMU-K69.

In section "Common Settings", the state of the user equipment, UE ID and the operational mode can be set.



Section "FRC Configuration" enables a quick access to the parameters according to pre-defined fixed reference channels.

FRC Configuration	
FRC State	On
FRC	A4_3
Allocated Resource Blocks	6
Modulation	16-QAM
Payload Size	2600
Physical Bits Per Subframe(Unshortened PUSCH)	3456
Offset VRB	4
n(2)_DMRS	3

Section "Realtime Feedback Configuration" provides an access to the parameters required for generating signals in accordance to the HARQ feedback or UL timing adjustments test cases.



The "Realtime Feedback Configuration" is enabled only for UE1 in instruments equipped with the option R&S SMx/AMU-K69.

"Realtime Feedback Configuration" is not available for the R&S Signal Generator SMBV and for the simulation software R&S WinIQSIM2.

Realtime Feedback Configuration		Realtime Feedback Configuration	
Realtime Feedback Mode	Serial	Realtime Feedback Mode	Binary ACK/NACK
Redundancy Version Sequence	0,2,3,1	Redundancy Version Sequence	0,2,3,1
Max. Number Of Transmissions	4	Max. Number Of Transmissions	4
Initial Timing Advance	0 16 T_S	Initial Timing Advance	0 16 T_S
Connector	User 1	ACK Definition	High
Additional User Delay	0.00 Subframes	Connector	User 1
Baseband Selector	0	Additional User Delay	0.00 Subframes
Serial Rate	115.2 kbps		

In section "Physical Uplink Shared Channel (PUSCH)", the data source for the PUSCH can be selected and channel coding can be configured. Use the [Enhanced PUSCH Settings](#) dialog to adjust the additional settings for channel coding of the control information and the multiplexing of the data and control information.

Physical Uplink Shared Channel(PUSCH)

Data Source

Scrambling

State

Channel Coding and Multiplexing

State

Mode

I\_HARQ\_offset

I\_RI\_offset

I\_CQI\_offset

Channel Coding Configuration

Channel Interleaver

Section Reference Signal Structure is where reference signal structure can be configured individually for demodulation and sounding purposes.

Reference Signal Structure

DRS Power Offset  dB

SRS State

A/N + SRS simultaneous Tx

SRS Power Offset  dB

SRS Cyclic Shift

<<< Hide Signal Structure Configuration Details

SRS Structure

Configuration Index I\_SRS

Periodicity T\_SRS  ms

Subframe Offset T\_offset

SRS Bandwidth B\_SRS

Transmission Comb k TC

Hopping Bandwidth b\_hop

Freq. Domain Position n\_RRC

The "PRACH Power Ramping" and "PRACH Configuration" settings are available when the user equipment "Mode" is set to PRACH.

PRACH Power Ramping

State

Transition Time  us

PRACH Configuration							
Preamble Format (Burst Format)							0
Number of Configurable Frames							1
SF	RB Offset	Ncs Conf.	Logical Root Sequence Index	Sequence Index (v)	Delta t/us	Power /dB	State
0	0	0	0	0	0	0	Off
1	19	4	4	4	0.03	0.004	On
2	0	0	0	0	0	0	Off
3	0	0	0	0	0	0	Off
4	19	1	3	0	0	0	On
5	0	0	0	0	0	0	Off
6	0	0	0	0	0	0	Off
7	19	15	0	0	0	0	On
8	0	0	0	0	0	0	Off
9	0	0	0	0	0	0	Off

### 7.13.1 Common Settings

In section "Common Settings", the state of the user equipment, UE ID and the operational mode can be set.

#### State (User Equipment)

Activates or deactivates the user equipment.

**Note:** Disabling the UE deactivates the corresponding allocations. Neither reference signal, nor PUSCH/PUCCH allocations will be transmitted if an UE is deactivated.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:STATE` on page 406

#### UE ID/n\_RNTI (User Equipment)

Sets the radio network temporary identifier (RNTI) of the UE.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:ID` on page 406

#### UE Power

Sets the power level of the selected UE (PUE).

The UE power level determines the power levels of the reference signals (DRS and SRS) and the power level of the allocations (PUSCH ( $P_{\text{PUSCH}}$ ) and PUCCH ( $P_{\text{PUCCH}}$ )).

The UE power level can be used for global adjustment of the transmit power of the corresponding UE.

The PUSCH and PUCCH Power level can vary per subframe.

An additional boost of the reference signals DRS and SRS per UE can be applied with the parameters **DRS Power Offset** ( $P_{\text{DRS\_offset}}$ ) and **SRS Power Offset** ( $P_{\text{SRS\_offset}}$ ) respectively.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:POWER` on page 407

**Mode (User Equipment)**

Selects whether the user equipment is in standard or in PRACH mode.

"Standard" Sets the operational mode of the user equipment to standard.

"PRACH" Sets the operational mode of the user equipment to PRACH (see [chapter 7.13.8, "PRACH Configuration"](#), on page 173).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:MODE` on page 406

**Restart Data, A/N, CQI and RI every subframe**

If activated, the data source, the ACK/NACK pattern, the CQI pattern and RI are restarted every subframe.

This parameter is always enabled, if realtime feedback is active.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:DACRestart` on page 406

**7.13.2 FRC Configuration**

This section enables a quick configuration of the predefined fixed reference channels (FRC) according to 3GPP TS 36.141, Annex A "Reference Measurement channels".

When "FRC Configuration" is enabled, several parameters are predefined and their values are displayed as read-only. The table below gives an overview of the parameters that are affected by the FRC configuration.

Dialog	Parameter	Value
"UE Configuration"	Scrambling	On
	Channel Coding State	On
	Interleaver	On
	SRS State	Off (the SRS can be activated manually if FRC state is ON)
"UL Allocation Table"	Modulation	According to the selected FRC
PUSCH allocations of the corresponding UE in all subframes	No. RB	According to the selected FRC

Dialog	Parameter	Value
"Enhanced PUSCH Settings"	Frequency Hopping	Off
For the corresponding UE in all subframes	HARQ ACK Type	None
	Number of CQI Bits	0
	Number of coded CQI Bits	0
	Transport Block Size/Payload	According to the selected FRC

### FRC State

Enables/disables FRC configuration.

Enabling FRC configuration sets some parameters to their predefined values, i.e. several parameters are displayed as read-only. Reconfiguration of the values of these parameters is possible only after disabling the FRC configuration. An exception is the SRS state that can be changed even while a FRC configuration is enabled.

The FRC State is disabled and cannot be enabled, if a "User Defined" [Cyclic Prefix](#) is selected.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:STATE](#) on page 409

### FRC

Selects a predefined fixed reference channel according to 3GPP TS 36.141, Annex A.

Since the predefined FRCs require minimum channel bandwidth and predefined cyclic prefix, the currently available FRCs are limited by the selected [Number of RBs per Slot](#) and [Cyclic Prefix](#). The [FRC State](#) is disabled and there are no FRCs available for selection, if a "User Defined" cyclic prefix is selected.

**Table 7-8: Supported FRCs**

FRC	Description
A1_1 .. A1_5	Fixed Reference Channels for reference sensitivity and in-channel selectivity (QPSK, R=1/3).
A2_1 .. A2_3	Fixed Reference Channels for dynamic range (16QAM, R=2/3).
A3_1 .. A3_7	Fixed Reference Channels for performance requirements (QPSK 1/3).
A4_1 .. A4_8	Fixed Reference Channels for performance requirements (16QAM 3/4).
A5_1 .. A5_7	Fixed Reference Channels for performance requirements (64QAM 5/6).
A7_1 .. A7_6	Fixed Reference Channels for UL timing adjustment (Scenario 1).
A8_1 .. A8_6	Fixed Reference Channels for UL timing adjustment (Scenario 2).

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:TYPE](#) on page 409

**Allocated Resource Blocks**

Displays the number of the allocated resource blocks for the selected FRC.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:ALRB](#) on page 407

**Modulation (FRC)**

Displays the modulation for the selected FRC.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:ALRB](#) on page 407

**Payload Size (FRC)**

Displays the payload size for the selected FRC.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:PASize](#) on page 408

**Physical Bits Per Subframe (Unshortened PUSCH)**

Displays the total number of physical bits available for the PUSCH allocation per subframe, in that unshortened PUSCH is transmitted. Shortened PUSCH transmissions occurs in a cell specific SRS subframe or in subframes where SRS is transmitted.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:TNOBits](#) on page 409

**Offset VRB (FRC)**

Sets the virtual resource block (VRB) offset for all PUSCH allocation of the selected UE in all subframes.

The [VRB Offset](#) set for the individual subframes in the "UL Allocation Table" are overwritten.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:VRBoffset](#) on page 410

**n(2)\_DMRS (FRC)**

Sets the UE specific part of the demodulation reference signal (DMRS) index for all PUSCH allocation of the selected UE in all subframes.

The [n\(2\)\\_DMRS](#) set for the individual subframes in the "Enhanced PUSCH Settings" dialog for the corresponding UE is overwritten.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:N2DMrs](#) on page 408

### 7.13.3 Realtime Feedback Configuration

The EUTRA/LTE uplink realtime feedback functionality requires the additional option R&S SMx/AMU-K69 Closed Loop BS Tests. This option extends the EUTRA/LTE option R&S SMx/AMU-K55 with the possibility to perform closed loop performance tests with feedback as defined in 3GPP TS 36.141, chapter 8.



The Realtime Feedback Configuration is enabled only for UE1 in instruments equipped with the option R&S SMx/AMU-K69.



Realtime Feedback Configuration is not available for the R&S Signal Generator SMBV and for the simulation software R&S WinIQSIM2.

The feedback functionality can be enabled once per baseband block. The user interface and the parameters available for configuration depend on the selected [Realtime Feedback Mode](#). For detailed description of the Realtime Feedback functionality, see [chapter 6, "Realtime Feedback for Closed Loop BS Tests"](#), on page 52.

Realtime Feedback Configuration		Realtime Feedback Configuration	
Realtime Feedback Mode	Serial	Realtime Feedback Mode	Binary ACK/NACK
Redundancy Version Sequence	0,2,3,1	Redundancy Version Sequence	0,2,3,1
Max. Number Of Transmissions	4	Max. Number Of Transmissions	4
Initial Timing Advance	0   16 T_S	Initial Timing Advance	0   16 T_S
Connector	User 1	ACK Definition	High
Additional User Delay	0.00   Subframes	Connector	User 1
Baseband Selector	0	Additional User Delay	0.00   Subframes
Serial Rate	115.2 kbps		

### Realtime Feedback Mode

Enables realtime feedback and determines the mode (binary or serial).

- "Off" Realtime feedback is disabled.
- "Binary ACK/NACK" The ACK/NACK feedback is implemented as low/high voltage level on the feedback line connector.  
Use the parameter [ACK Definition](#) to determine whether a high or a low voltage level represents an ACK.  
Timing Adjustments Feedback is not supported in this mode.
- "Serial" ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial protocol (see [chapter 6.2.2, "Serial Mode"](#), on page 54).
- "Serial 3x8" ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial commands, consisting of three serial packets (see [chapter 6.2.3, "Serial 3x8 Mode"](#), on page 54).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:UL:RTFB:ITADvance on page 424

### Redundancy Version Sequence

Determines the sequence of redundancy versions for the individual HARQ processes.

Unless otherwise requested by serial feedback commands, the first value in the sequence of redundancy versions is used each time an ACK is received or for the very first transmission of a process.

The sequence of redundancy versions is read out cyclically, i.e. whenever a NACK is received and a retransmission is requested, the next redundancy version in the sequence is used.



The first value in the sequence is used again even in case a NACK is received, if the [Max. Number of Transmissions](#) in a process was reached.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:RVSequence` on page 425

### Max. Number of Transmissions

After this maximum number of transmissions (incl. first transmission), the first redundancy version of the redundancy version sequence is used even in case of NACK.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:MAXTrans` on page 424

### Initial Timing Advance

The initial timing advance of the uplink signal (at the output of the instrument's baseband unit) in units of 16 TS.

An initial timing advance greater than zero means that the beginning of the very first subframe of the uplink signal is omitted.

For binary feedback, the timing advance of the uplink signal stays constant (and equal to the initial timing advance) throughout the whole signal output.

The additional timing offset  $N_{TA\_offset}$  for TDD, as defined in TS 36.211, is set by the parameter [Signal Advance N\\_TA\\_offset](#) in the "Trigger/Marker" dialog.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:ITADvance` on page 424

### ACK Definition

("Binary ACK/NACK" mode only)

Determines whether a high or a low binary level on the feedback line connector represents an ACK.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:ACKDefinition` on page 422

### Connector

Determines the feedback line connector (LEVATT or USER1).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:CONNector` on page 423

### Distance Mode

(Binary ACK/NACK mode only)

Determines how the number of the uplink subframe is calculated, in which the signaled feedback has the desired effect.

See also [chapter 6.3.1, "Parameterization of the feedback timing"](#), on page 57.

"3GPP"      The uplink subframe in which the signaled feedback has the desired effect is calculated from the downlink subframe number  $n$ , in which the feedback was received, according to 3GPP TS 36.213.

"Direct Response" The uplink subframe in which the signaled feedback has the desired effect is calculated from the last sent uplink packet of the HARQ processes.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:DMODE` on page 424

#### **Additional User Delay**

Determines the point in time when the feedback can be sent to the instrument.

For more information see [chapter 6.3, "Timing Aspects"](#), on page 57.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:ADUDelay` on page 422

#### **Baseband Selector**

("Serial" and "Serial 3x8" mode only)

This parameter is required for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:BBSelector` on page 422

#### **Serial Rate**

(Serial and Serial 3x8 mode only)

Determines the bit rate of the serial transmission. Possible rates are 115.2 kbps, 1.6 Mbps and 1.92 Mbps.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:SERate` on page 425

#### **Block Error Insertion**

Enables/disables the statistical insertion of block errors into PUSCH packets.

The block error insertion can be enabled for a single HARQ process or for all processes.

In the single HARQ process case, the used process is always the one that corresponds to the first activated PUSCH.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:BEINsertion` on page 423

#### **Block Error Rate**

Block error rate for the statistical insertion of block errors.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:BERate` on page 423

### **7.13.4 Physical Uplink Shared Channel (PUSCH)**

In section "Physical Uplink Shared Channel (PUSCH)", the data source for the PUSCH can be selected and the channel coding can be configured. Use the [Enhanced PUSCH](#)

**Settings** dialog to adjust the additional settings for channel coding of the control information and the multiplexing of the data and control information.

### Data Source (PUSCH)

Selects the data source for the Physical Uplink Shared Channel (PUSCH) allocation of UE.

New data is retrieved from the data source for every subframe where PUSCH is configured, unless the parameter [Restart Data, A/N, CQI and RI every subframe](#) is enabled.

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

Data lists are selected in the "File Select" window, which is called by means of the "Data List Management" button.

If the "Pattern" data type is used, the bit pattern is defined in the "Pattern" input box. The length is limited to 64 bits.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PUSCh:DATA` on page 414

### Data Pattern (PUSCH)

(Available for data source Pattern only)

Displays the bit pattern.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PUSCh:PATtern` on page 414

### Data List (PUSCH)

(Available for data source Data List only)

Opens the "Load PUSCH Data List (UE)" window for loading a saved PUSCH data list. The data list of the selected (highlighted) file is loaded by pressing the "Select" button.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PUSCh:DSElect` on page 414

### State Scrambling (PUSCH)

Enables/disables scrambling for all PUSCH allocations of the corresponding UE.

This parameter is always enabled, if a predefined [FRC](#) is selected.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:PUSCh:SCRambling:STATe](#)  
on page 415

### State Channel Coding and Multiplexing (PUSCH)

Enables/disables channel coding and multiplexing of data and control information for all PUSCH allocations of the corresponding UE.

If this parameter is disabled, the content retrieved from the [Data Source](#) is forwarded to the scrambler without any coding processing.

Additional parameters for the encoding of control information can be set in [Enhanced PUSCH Settings](#) dialog.

This parameter is always enabled, if a predefined [FRC](#) is selected.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:STATe](#) on page 415

### Mode Channel Coding

Defines the information transmitted on the PUSCH.

"UCI+UL-SCH" Control information and data is multiplexed into the PUSCH.

"UL-SCH" Only data is transmitted on PUSCH.

"UCI only" Only uplink control information is transmitted on PUSCH.  
This mode will be supported in a future firmware version.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:MODE](#) on page 415

### I\_HARQ\_offset

Sets the HARQ-ACK offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IHARqoffset](#)  
on page 416

### I\_RI\_offset

Sets the RI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IRIoffset](#)  
on page 417

### I\_CQI\_offset

Sets the CQI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:ICQioffset](#)  
on page 416

**Channel Interleaver (PUSCH)**

Enables/disables channel interleaving.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:PUSCh:CCODing:INTerleaver`

on page 416

**7.13.5 Reference Signal Structure**

Section "Reference Signal Structure" is where reference signal structure can be configured individually for demodulation and sounding purposes.

In the "SRS Structure" section, the UE specific sounding reference signal parameters according to 3GPP TS 36.213 and 3GPP TS 36.211 are enabled for configuration.

The cell specific parameters, necessary for the complete definition of the SRS structure and SRS mapping, are configurable in the [General UL Settings](#) dialog.

To visualize the SRS transmission, use the SC-FDMA time plan.

**DRS Power Offset**

Sets the power offset of the Demodulation Reference Signal (DRS) relative to the power level of the PUSCH or PUCCH allocation of the corresponding subframe.

The selected DRS power offset ( $P_{\text{DRS\_Offset}}$ ) applies for all subframes.

Depending on the allocation of the subframe, the effective power level of the DRS is calculated as following:

- for PUSCH allocation  
 $P_{\text{DRS}} = P_{\text{UE}} + P_{\text{PUSCH}} + P_{\text{DRS\_Offset}}$
- for PUCCH allocation  
 $P_{\text{DRS}} = P_{\text{UE}} + P_{\text{PUCCH}} + P_{\text{DRS\_Offset}}$

The PUSCH and PUCCH **Power** levels ( $P_{\text{PUSCH}}$  and  $P_{\text{PUCCH}}$ ) can vary per subframe.

For global adjustment of the transmit power of the corresponding UE, use the parameter **UE Power** ( $P_{\text{UE}}$ ).

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:DRS:POWoffset` on page 417

### **SRS State**

Enables/disables sending of SRS for the corresponding UE.

In the symbols reserved for SRS transmission, PUSCH is not transmitted.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:STATe` on page 417

### **SRS Power Offset**

Sets the power offset of the Sounding Reference Signal (SRS) relative to the power of the corresponding UE.

The selected SRS power offset applies for all subframes.

The effective power level of the SRS is calculated as follow:

$$P_{\text{SRS}} = P_{\text{UE}} + P_{\text{SRS\_Offset}}$$

For global adjustment of the transmit power of the corresponding UE, use the parameter **UE Power** ( $P_{\text{UE}}$ ).

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:POWoffset` on page 418

### **SRS Cyclic Shift n\_CS**

Sets the cyclic shift  $n_{\text{CS}}$  used for the generation of the sounding reference signal CAZAC sequence.

Since the different shifts of the same Zadoff-Chu sequence are orthogonal to each other, applying different SRS cyclic shifts can be used to schedule different users to transmit simultaneously their sounding reference signal.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:CYCShift` on page 418

### **Show Signal Structure Configuration Details>>>**

Opens the menu for configuring the sounding reference signal structure.

SCPI command:

n.a.

## **7.13.6 SRS Structure**

In the "SRS Structure" section, the UE specific sounding reference signal parameters according to 3GPP TS 36.213 and 3GPP TS 36.211 are enabled for configuration.

The cell specific parameters, necessary for the complete definition of the SRS structure and SRS mapping, are configurable in the **General UL Settings** dialog.

To visualize the SRS transmission, use the SC-FDMA time plan.

SRS Structure	
Configuration Index $I_{\text{SRS}}$	0
Periodicity $T_{\text{SRS}}$	2 ms
Subframe Offset $T_{\text{offset}}$	0,1
SRS Bandwidth $B_{\text{SRS}}$	0
Transmission Comb $k_{\text{TC}}$	0
Hopping Bandwidth $b_{\text{hop}}$	0
Freq. Domain Position $n_{\text{RRC}}$	0

### Configuration Index $I_{\text{SRS}}$

Sets the UE specific parameter SRS configuration index  $I_{\text{SRS}}$ . Depending on the selected "Duplexing Mode", this parameter determines the parameters [SRS Periodicity  \$T\_{\text{SRS}}\$](#)  and [SRS Subframe Offset  \$T\_{\text{offset}}\$](#)  as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

SCPI command:

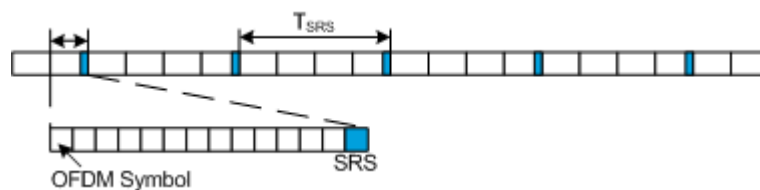
`[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS` on page 419

### Periodicity $T_{\text{SRS}}$

Displays the UE specific parameter SRS periodicity  $T_{\text{SRS}}$ , i.e. displays the interval of milliseconds after which the SRS is transmitted. The displayed value depends on the selected SRS [Configuration Index  \$I\_{\text{SRS}}\$](#)  and "Duplexing Mode" as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

Adjust the SRS configuration index to enable more frequent SRS transmission like each 2 ms or an infrequently SRS transmission like each 320 ms for instance.

For TDD duplexing mode, a  $T_{\text{SRS}}$  of 2 ms means that SRS is transmitted two times in 5 ms.



**Example:**

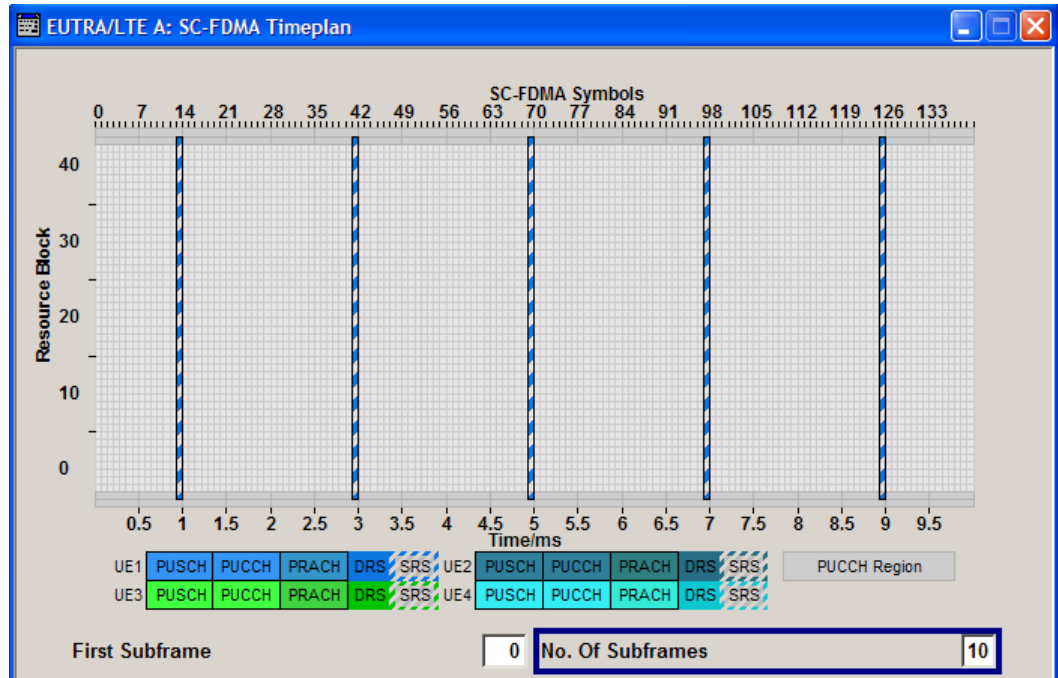
"Configuration Index" = 0, i.e. "Periodicity  $T_{SRS}$ " = 2 ms and "Subframe Offset  $T_{offset}$ " = 0

"SRS State" = On

"Duplexing" = FDD

The default values of all other SRS parameters are left unchanged.

The SRS is transmitted every 2 ms and occupies the entire channel bandwidth, i.e. frequency hopping is not enabled.



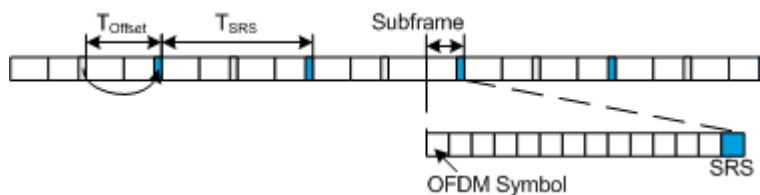
SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:TSRS on page 419

**Subframe Offset  $T_{offset}$**

Displays the UE specific parameter SRS subframe offset  $T_{offset}$ , depending on the selected SRS Configuration Index  $I_{SRS}$  and "Duplexing Mode" as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

A SRS subframe offset shifts the SRS pattern, i.e. while SRS periodicity  $T_{SRS}$  remains constant, the SRS transmission is delayed with period of time equal to the SRS subframe offset  $T_{offset}$ .





**Example:**

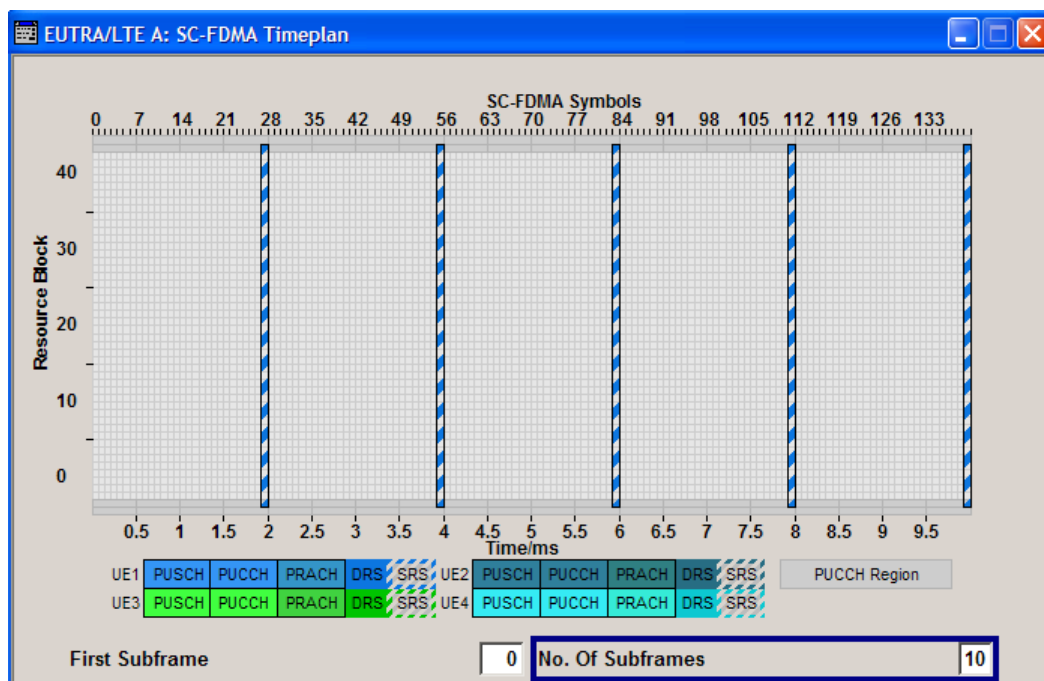
"Configuration Index" = 1, i.e. "Periodicity T\_SRS" = 2 ms and "Subframe Offset T\_offset" = 1

"SRS State" = On

"Duplexing" = FDD

The default values of all other SRS parameters are left unchanged.

The SRS is transmitted every 2 ms and occupies the entire channel bandwidth, i.e. frequency hopping is not enabled. Compared to the SRS transmission with T\_offset = 0, the SRS transmission is delayed with 1 ms.



For TDD duplexing mode, a T\_offset of 0 or 5 means that SRS is transmitted in the second last symbol of the special subframe (in the UpPTS part). For this cases, adjust the parameter [Configuration of Special Subframes](#) so that an UpPTS field length of two symbols is assured.

For TDD duplexing mode with T\_SRS value of 2 ms, two T\_offset values are displayed, corresponding to the two SRS transmissions per 5 ms. For example, the values 0,1 mean that two SRS transmissions occur, both in the special subframe. One of them is in the second last symbol and the other one, in the last symbol of the subframe.

SCPI command:

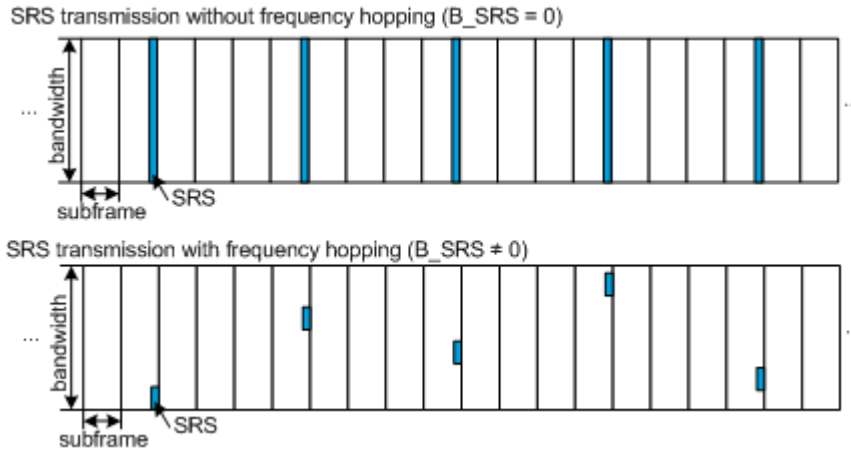
```
[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:TOffset on page 420
```

**SRS Bandwidth B\_SRS**

Sets the UE specific parameter SRS Bandwidth B\_SRS, as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

The SRS can span the entire frequency bandwidth or can employ frequency hopping where several narrowband SRSs cover the same total bandwidth.

There are up to four SRS bandwidths defined in the standard. The most narrow SRS bandwidth ( $B_{SRS} = 3$ ) spans four resource blocks and is available for all channel bandwidths; the other three values of the parameter  $B_{SRS}$  define more wideband SRS bandwidths, available depending on the channel bandwidth.



There are up to four SRS bandwidths defined in the standard. The most narrow SRS bandwidth (" $B_{SRS}$ " = 3) spans four resource blocks and is available for all channel bandwidths; the other three values of the parameter  $B_{SRS}$  define more wideband SRS bandwidths, available depending on the channel bandwidth.

The SRS transmission bandwidth is determined additionally by the "SRS Bandwidth Configuration  $C_{SRS}$ ".

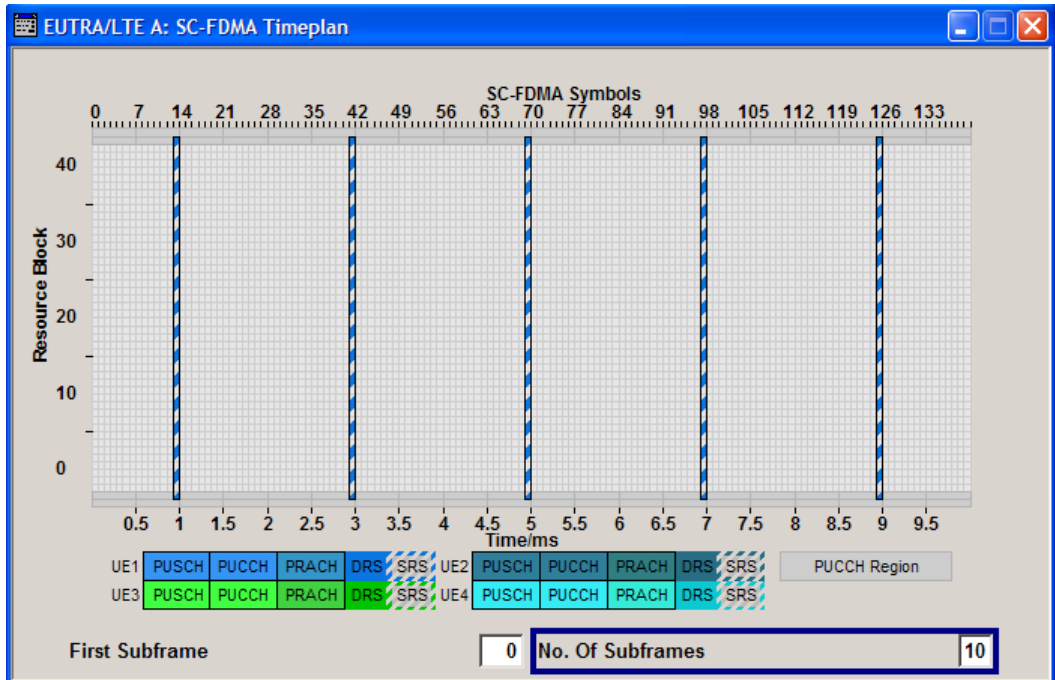
**Example:**

"SRS State" = *On*

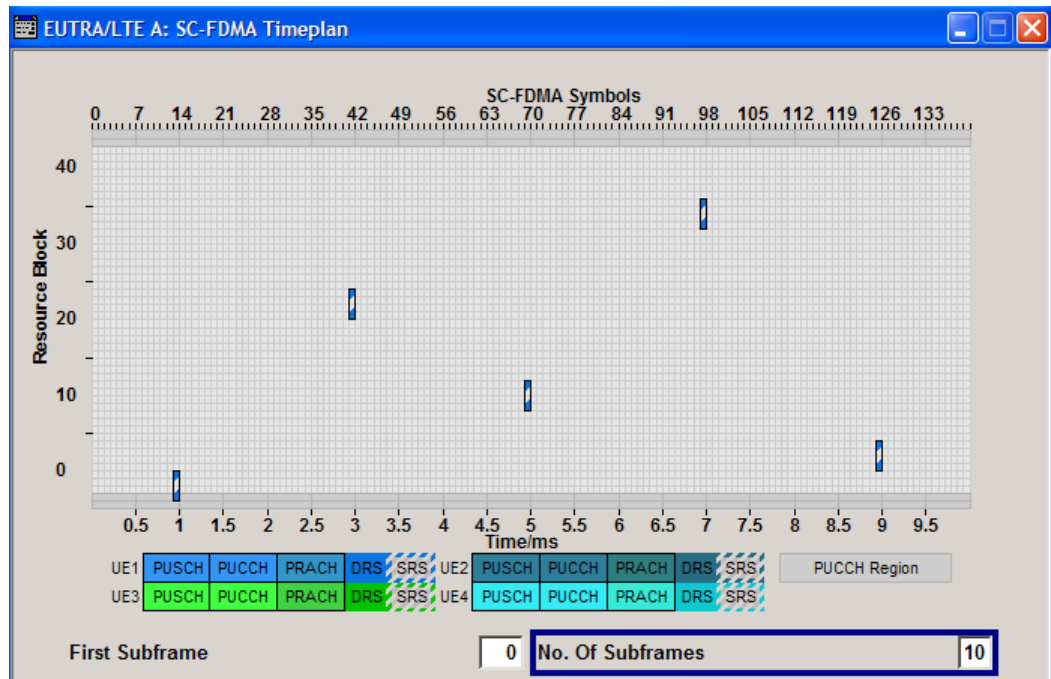
"Duplexing" = *FDD*

The default values of all other SRS parameters are left unchanged.

For B\_SRS = 0 the SC-FDMA time plan shows a wideband SRS without frequency hopping.



Changing the SRS bandwidth to "B\_SRS" = 3 results in the most narrowband SRS transmission with SRS bandwidth of 4 RBs and enabled frequency hopping.



SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:BSRS` on page 418

#### Transmission Comb k TC

Sets the UE specific parameter transmission comb  $k_{TC}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:TRComb` on page 421

#### Hopping Bandwidth b\_hop

Sets the UE specific parameter frequency hopping bandwidth  $b_{hop}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

SRS frequency hopping is enabled, if  $b_{HOP} < B_{SRS}$ .

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:BHOP` on page 418

#### Freq. Domain Position n\_RRC

Sets the UE specific parameter  $freqDomainPosition_{n_{RRC}}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

This parameter determines the starting physical resource block of the SRS transmission.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:NRRc` on page 421

### 7.13.7 PRACH Power Ramping

The "PRACH" settings are available when the user equipment "Mode" is set to PRACH.

#### State PRACH Power Ramping

Activates Power Ramping for the PRACH preamble. The start and the end of the preamble is cyclically extended and multiplied with a ramping function ( $\sin^2$ ).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:PRStAte on page 410

#### Transition Time

Defines the transition time from beginning of the extended preamble to the start of the preamble itself.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:PRTT on page 410

### 7.13.8 PRACH Configuration

The "PRACH" settings are available when the user equipment "Mode" is set to PRACH.

In the "PRACH Configuration" section, the UE specific parameters according to 3GPP TS 36.211 are enabled for configuration.

The cell specific parameters, necessary for the complete definition of the PRACH, are configurable in the [General UL Settings](#) dialog.

#### Preamble Format (Burst Format)

Displays the preamble format.

The "Preamble Format" is automatically derived from the [PRACH Configuration](#).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:PRFormat on page 411

#### Number of Configurable Frames

Shows how many frames can be configured.

A maximum number of 20 frames are available for configuration; the currently available number of frames depends on the selected ARB [Sequence Length](#).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:CFRames on page 411

#### SF

Displays the consecutive number of the subframe.

The subframes available for configuration depend on the selected "Duplexing" mode and "PRACH Configuration".

SCPI command:

n.a.

**RB Offset**

Displays the starting RB, as set with the parameter [PRACH Frequency Offset](#).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RBOffset
```

on page 411

**Frequency Resource Index**

This parameter is enabled in TDD duplexing mode only.

Sets the frequency resource index  $f_{RA}$  for the selected subframe.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:FRIndex
```

on page 412

**Ncs Configuration**

Selects the Ncs configuration of the selected subframe, i.e. determines the Ncs value for the selected preamble set according to TS 36.211, table 5.7.2.-2 and 5.7.2-3.

The value range of this parameter depends on the selected Duplexing mode, PRACH configuration and whether a restricted preamble set is enabled or not.

Parameter	Value Range Ncs Configuration
Disabled <a href="#">Restricted Set (High Speed Mode)</a>	0 .. 15
Enabled "Restricted Preamble Set"	0 .. 14
TDD + <a href="#">PRACH Configuration</a> > 47	0 .. 6

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:NCSConf
```

on page 412

**Logical Root Sequence Index**

Selects the logical root sequence index for the selected subframe.

The value range of this parameter depends on the combination of selected Duplexing mode and PRACH configuration.

Parameter	Value Range Logical Root Sequence Index
TDD + <a href="#">PRACH Configuration</a> > 47 i.e. Preamble Format 4	0 .. 137
All other cases	0 .. 837

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RSEquence
```

on page 413

**Sequence Index (v)**

Selects the sequence index **v** for the selected subframe, i.e. selects which one of the 64 preambles available in a cell will be used.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:SINDEX`  
on page 413

**Delta t/us**

Sets the parameter Delta\_t in us.

A value of delta t different than 0 causes a time shift of the configured preamble.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:DT` on page 413

**Power (PRACH)**

Sets the PRACH power relative to the UE power. The PRACH power can be adjusted independently for every configured preamble.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:POWER` on page 412

**State (PRACH)**

Enables/disables the PRACH for the selected subframe.

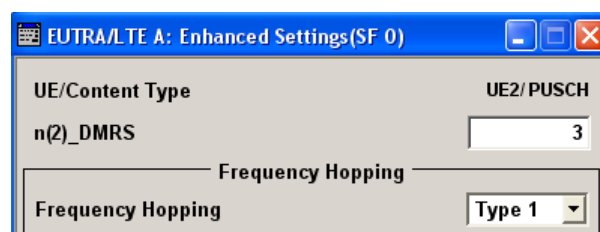
The subframes available for configuration depend on the selected PRACH configuration.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:STATE` on page 413

## 7.14 Enhanced PUSCH Settings

The "Enhanced Settings" menu for PUSCH allows you to define and configure additional PUSCH parameters, such as the settings of the uplink shared channel (UL-SCH), HARQ control information and the Channel Quality Control Information (CQI). This dialog provides the possibility to adjust the parameters for channel coding of the control information (HARQ and CQI) and to configure the multiplexing of this control information with the data transmission over the UL-SCH.



Channel Coding/Multiplexing	
HARQ ACK	
ACK/NACK Mode	Multiplexing
Number of A/N Bits	4
ACK/NACK Pattern	0001 0110...
Number of Coded A/N Bits	16
Rank Indication(RI)	
Number of RI Bits	2
RI Pattern	0001 1...
Number of Coded RI Bits	6
Channel Quality Indication(CQI)	
Number of CQI Bits	5
CQI Pattern	1100 1110...
Number of Coded CQI Bits	8
UL-SCH	
Total Number Of Physical Bits	2 880
Number Of Coded UL-SCH Bits	2 866
Transport Block Size/Payload	1 500
Redundancy Version Index	3

### 7.14.1 Frequency Hopping

#### UE/Content Type

Displays the UE number and the content type of the selected allocation.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:CONType  
on page 391
```

#### n(2)\_DMRS

Sets the part of the demodulation reference signal (DMRS) index which is part of the uplink scheduling assignment and therefore only valid for the according UE in the according subframe.

This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:NDMRs  
on page 393
```

#### Frequency Hopping

Enables/disabled frequency hopping for PUSCH.

Frequency hopping is applied according to 3GPP TS 36.213.



Based on the hopping information, a UE performing PUSCH frequency hopping applies one of the two possible [Hopping Type](#).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:FHOP:
STATE on page 394
```

#### Information in Hopping Bits

Sets the information in hopping bits according to the PDCCH DCI format 0 hopping bit definition. This information determines whether type 1 or type 2 hopping is used in the subframe, and - in case of type 1 - additionally determines the exact hopping function to use.

Frequency hopping is applied according to 3GPP TS 36.213.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:FHOP:
IIHBits on page 394
```

#### Hopping Type

Displays the frequency hopping type used, as defined in 3GPP TS 36.213.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:FHOP:TYPE
on page 394
```

## 7.14.2 Channel Coding / Multiplexing



All parameters in this section are enabled for configuration only if the [Channel Coding](#) for the corresponding user equipment is activated and the [Mode Channel Coding](#) is set to "UCI+UL-SCH" or "UCI Only".

#### ACK/NACK Mode

Sets the ACK/NACK mode to Multiplexing or Bundling according to 3GPP TS 36.212, chapter 5.2.2.6.

ACK/NACK Mode Bundling is defined for TDD duplexing mode only and is the only one available mode for [UL/DL Configuration 5](#).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:HARQ:MODE
on page 395
```

#### N\_bundled

For "ACK/NACK Mode Bundling", sets the parameter N\_bundled according to 3GPP TS36.212, section 5.2.2.6.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:HARQ:
NBUNdled on page 395
```

**Number of A/N Bits**

Sets the number of ACK/NACK bits.

Set this parameter to 0 to deactivate the ACK/NACK transmission for the corresponding subframe.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:HARQ:BITS`  
on page 395

**ACK/NACK Pattern**

Sets the ACK/NACK bits in form of a 64 bits long pattern.

A "1" indicates an ACK, a "0" - a NACK.

The pattern is read out cyclically and if the pattern is longer than the selected "Number of ACK/NACK Bits", different bits will be transmitted in different subframes using this configuration.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:HARQ: PATTern`  
on page 396

**Number of Coded A/N Bits**

Displays the number of coded ACK/NACK bits.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:HARQ: CBITs`  
on page 395

**Number of RI Bits**

Sets the number of rank indication (RI) bits.

Set this parameter to 0 to deactivate the RI for the corresponding subframe.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:RI:BITS`  
on page 397

**RI Pattern**

Sets the RI bits in form of a 64 bits long pattern.

The pattern is read out cyclically and if the pattern is longer than the selected "Number of RI Bits", different bits will be transmitted in different subframes using this configuration.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:RI: PATTern`  
on page 398

**Number of Coded RI Bits**

Displays the number of coded RI bits.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the [Number of Physical Bits for UL-SCH](#) is determined by the number of coded bits used for CQI and RI transmission.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:RI:CBITs
```

on page 397

#### Number of CQI Bits

Sets the number of CQI bits before channel coding.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the [Number of Physical Bits for UL-SCH](#) is determined by the number of coded bits used for CQI and RI transmission.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:CQI:BITS
```

on page 396

#### CQI Pattern

Sets the CQI pattern for the PUSCH.

The pattern is read out cyclically and if the pattern is longer than the selected "Number of CQI Bits", different bits will be transmitted in different subframes using this configuration.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:CQI:
```

PATtern on page 397

#### Number of Coded CQI Bits

Displays the number of coded CQI bits.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:CQI:CBITs
```

on page 396

#### Phys. Bits / Total Number of Physical Bits

Displays the size of the selected allocation in bits. The value is set automatically according to the current allocation's settings.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PHYSbits
```

on page 391

#### Number of Coded UL-SCH Bits

Displays the number of physical bits used for UL-SCH transmission.

If a "Channel Coding Mode UCI + UL-SCH" is selected, the value is calculated as follows:

"Number of Coded UL-SCH Bits" = [Total Number of Physical Bits](#) - [Number of Coded CQI Bits](#) - [Number of Coded RI Bits](#)

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:ULSch:
```

BITs on page 398

**Transport Block Size/Payload (PUSCH)**

Sets the size of the transport block.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUSCh:CCODing: TBSize` on page 398

**Redundancy Version Index (PUSCH)**

Sets the redundancy version index.

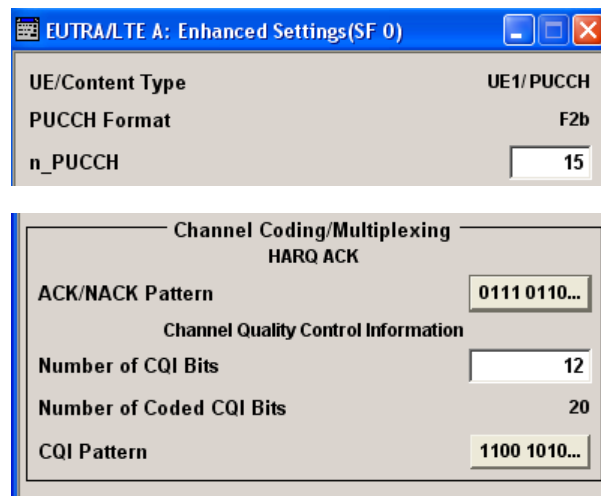
SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUSCh:CCODing: RVIndex` on page 399

## 7.15 Enhanced PUCCH Settings

The "Enhanced Settings" menu displays the PUCCH relevant settings and allows you to define and configure the PUCCH resource index.

The "Channel Coding / Multiplexing" section and the parameters available for configuration depend on the selected **PUCCH Format** for the corresponding user equipment.



PUCCH Format 1 carries no control information, i.e. the entire "Channel Coding/Multiplexing" section is not displayed. CQI control information is carried only by PUCCH formats 2/2a/2b and the CQI parameters are enabled only if one of these formats is selected.

**UE/Content Type**

Displays the UE number and the content type of the selected allocation.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :CONType` on page 391

**PUCCH Format**

Displays the selected PUCCH Format.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:FORMat
```

on page 389

**n\_PUCCH**

Sets the resource index for PUCCH format 1/1a/1b respectively 2/2a/2b.

For configuration of multi user PUCCH tests according to 3GPP TS 36.141, annex A9, set the n\_PUCCH parameter to the value defined in table A.9-1, column "RS orthogonal cover / ACK/NACK orthogonal cover". The R&S Signal Generator calculates and configures automatically the values defined in the columns "Cyclic shift index" and "Orthogonal cover index".

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:NPAR
```

on page 399

**ACK/NACK Pattern (PUCCH)**

(enabled for PUCCH formats 1a/1b and 2a/2b only)

Sets the ACK/NACK pattern for the PUCCH for the selected subframe.

A "1" indicates an ACK, a "0" - a NACK; the symbol "-" is used for DTX indication, i.e. incorrect detection of PDCCH CRC.

In case of [PUCCH Format](#) 1b or 2b, the only allowed combinations are "00", "01", "10", "11" and "-". A combination of ACK/NACK and DTX is not permitted.

**Note:** DTX will be supported in a later version.

To enable the generation of signal with ACK/NACK information that vary not only per subframe but also differs over the frames, set an ACK/NACK pattern with more than 1 bit for the PUCCH formats 1a/2a and respectively 2 bits for formats 1b/2b. The ACK/NACK pattern has a maximal length of 32 bits and is read out cyclically.

**Example:**

"Duplexing Mode" = FDD

"Sequence Length" = 4 Frames (BB:EUTR:SLEN 4)

"Number of Configurable Subframes" = 8 (BB:EUTR:UL:CONS 8)

"PUCCH Format" = 1a or 2a (BB:EUTR:UL:SUBF0:ALL1:FORM F1A|F2A)

"ACK/NACK Pattern" = 01001 (BB:EUTR:UL:SUBF0:ALL1:PUCCH: HARQ: PATT #B01001, 5)

The generated signal will carry ACK/NACK information as shown on the figure bellow.

Example: PUCCH Format 1a/2a, ACK/NACK Pattern '01001'

Subframe	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9
Frame#1	ACK/ NACK=0								ACK/ NACK=1	
Frame#2							ACK/ NACK=0			
Frame#3				ACK/ NACK=0						
Frame#4			ACK/ NACK=1							

By changing only the PUCCH Format to 1b or 2b (BB:EUTR:UL:SUBF0:ALL1:FORM F1B|F2B), the ACK/NACK information per subframe will change as shown on the figure bellow.

Example: PUCCH Format 1b/2b, ACK/NACK Pattern '01001'

Subframe	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9
Frame#1	ACK/ NACK=01								ACK/ NACK=00	
Frame#2							ACK/ NACK=10			
Frame#3				ACK/ NACK=10						
Frame#4			ACK/ NACK=01							

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:HARQ: PATTern on page 399

**Number of CQI Bits (PUCCH)**

(enabled for PUCCH formats 2/2a/2b only)

Sets the number of CQI bits before channel coding.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:CQI:BITS on page 400

**Number of Coded CQI Bits (PUCCH)**

Displays the number of coded CQI bits.

The number of coded CQI bits for PUCCH is always 20.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:CQI:CBITs on page 399

**CQI Pattern (PUCCH)**

Sets the CQI pattern for the PUCCH.

The length of the pattern is determined by the value of the parameter [Number of CQI Bits](#).

SCPI command:

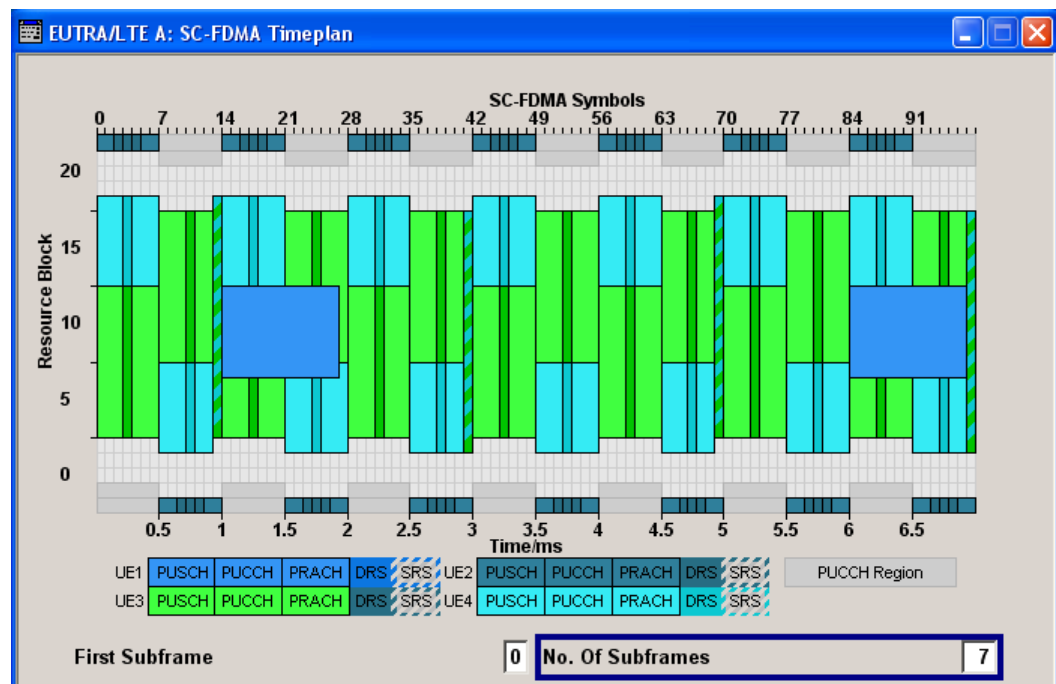
```
[ :SOURCE<hw> ] :BB:EUTRA:UL [ :SUBF<st0> ] :ALLOC<ch0> :PUCCh:CQI:
PATtern on page 400
```

## 7.16 SC-FDMA Timeplan

The "SC-FDMA Timeplan" menu is called in the "UL Frame Configuration" menu with the button "Show Time Plan".

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation of a UE can span 1 to up to "No. of Resource Blocks" in the frequency domain.

Sounding Reference Signals are automatically calculated according to the settings for signal structure in "User Equipment".

**First Subframe**

Selects the first subframe to be displayed.

SCPI command:

n.a.

**No. of Subframes**

Selects the number of subframes to be displayed.

SCPI command:

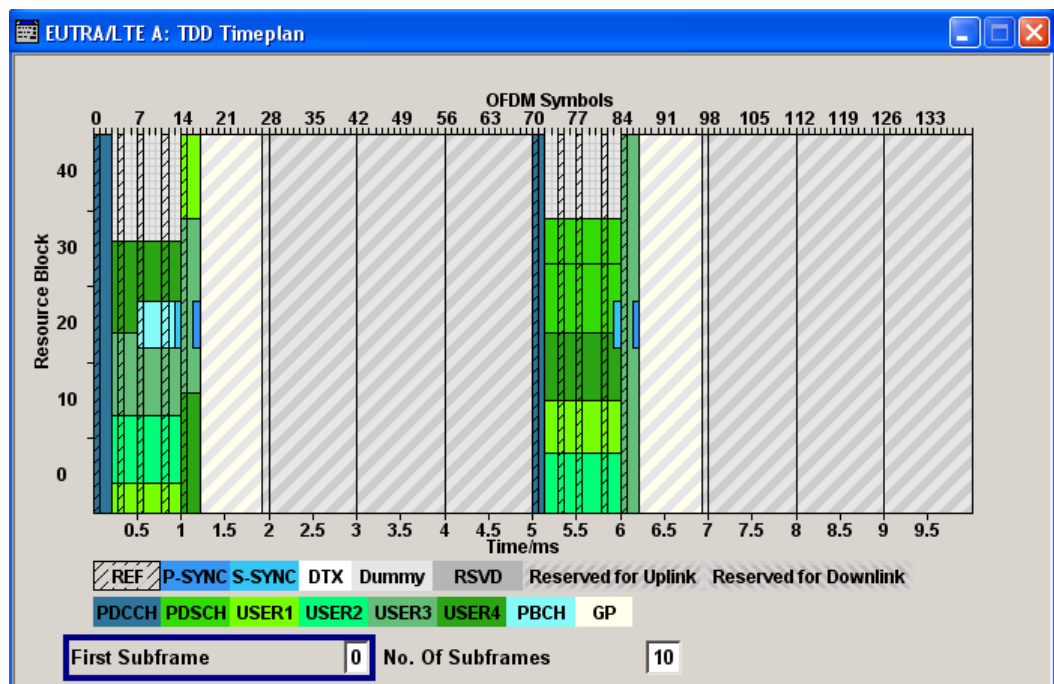
n.a.

## 7.17 TDD Timeplan

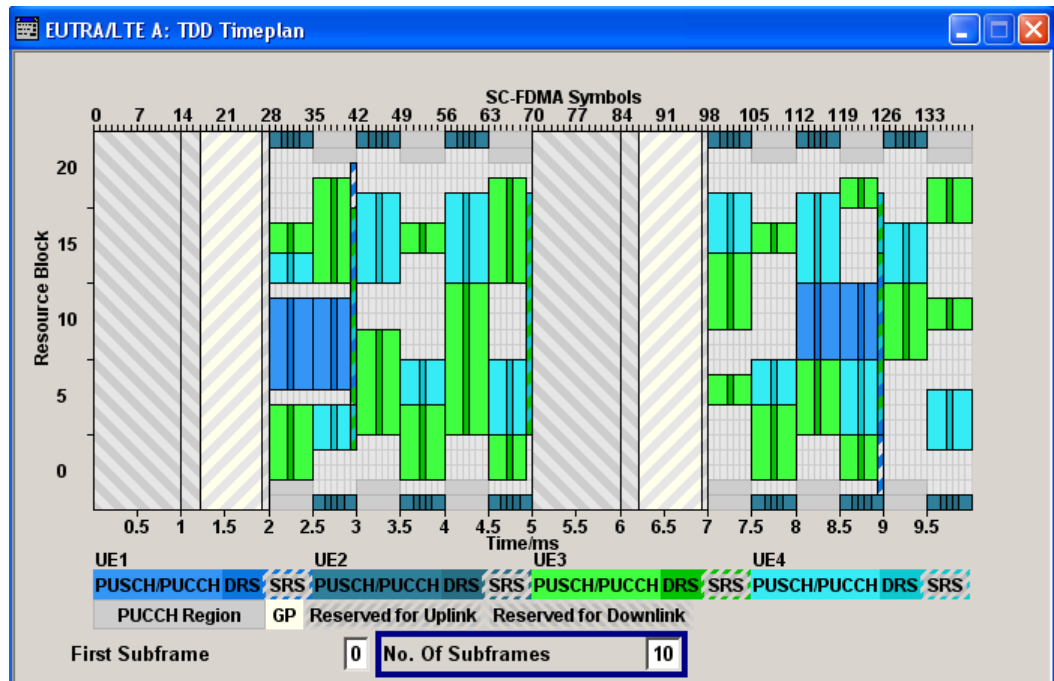
The "TDD Timeplan" menu is called in the "DL" or "UL Frame Configuration" menu with the button "Show Time Plan" whenever TDD is selected as "Duplexing" mode.

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain.

The frame structure of depends on the selected "DL/UL Configuration" and the "Configuration of Special Subframe".





**First Subframe**

Selects the first subframe to be displayed.

SCPI command:

n.a.

**No. of Subframes**

Selects the number of subframes to be displayed.

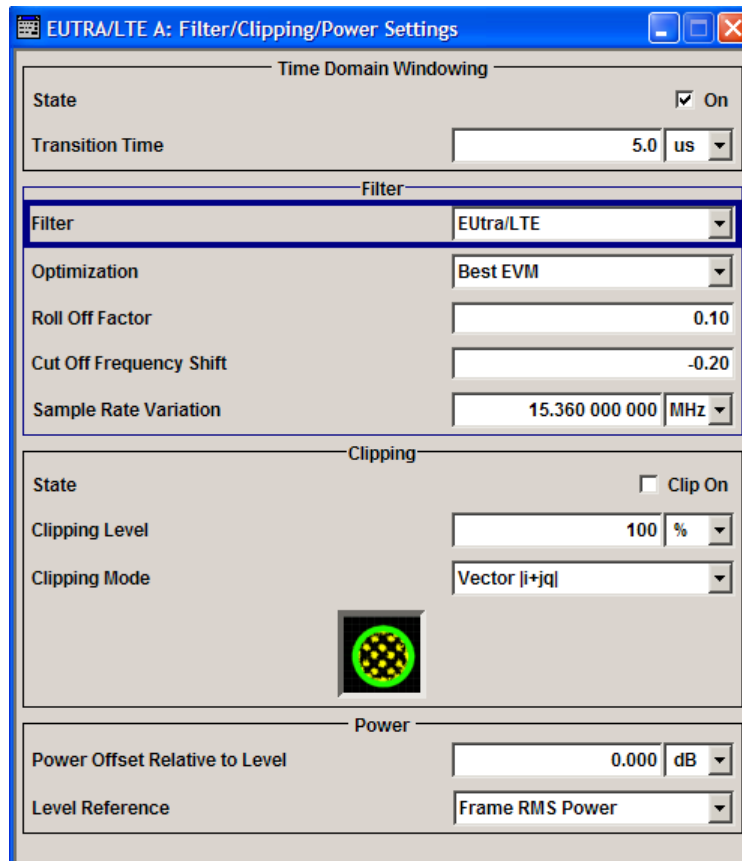
SCPI command:

n.a.

## 7.18 Filter/Clipping/Power Settings

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

The baseband filter, sample rate variation and clipping are defined in this menu.



## 7.18.1 Time Domain Windowing

### State (Time Domain Windowing)

Activates/deactivates the time domain windowing.

Time domain windowing is a method to influence the spectral characteristics (i.e. it removes the spikes caused by the OFDM) of the signal, which is not stipulated by the standard.

However, it does not replace oversampling and subsequent signal filtering.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TDW:STATe` on page 301

### Transition Time

Sets the transition time when time domain windowing is active.

The transition time defines the overlap range of two OFDM symbols. At a setting of 1 ms and if sample rate = 15.36 MHz, 15 samples overlap.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TDW:TRTime` on page 301

## 7.18.2 Filter Settings

### Filter

Sets the baseband filter.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:TYPE` on page 293

### Optimization

(available for Filter Type EUTRA/LTE only)

Defines whether the used EUTRA/LTE filter is optimized for ACP or EVM performance. If "Balanced EVM and ACP" is selected, a trade-off between ACP and EVM is selected.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:LTE:OPTimization`  
on page 297

### Load User Filter

(available for Filter Type user only)

Calls the menu "Select List File User Filter" for selecting a user-defined filter file with extension `*.vaf`.

For more information, refer to the description "Introduction to "filtwiz" Filter Editor" on the Rohde&Schwarz Internet page.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:USER` on page 299

### Roll Off Factor or BxT

Sets the filter parameter.

For the default cosine filter, a roll off factor of 0.10 is used.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:COSSine` on page 295

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:RCOSSine` on page 298

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:PGAuss` on page 298

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:GAUSSs` on page 296

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:SPHase` on page 298

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:APCO25` on page 295

`[ :SOURce<hw> ] :BB:EUTRa:FILTer:PARAmeter:LTE:ROFactor` on page 297

### Cut Off Frequency Shift

(available for filter parameter Cosine and EUTRA/LTE with EVM Optimization only)

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

The value range is -1.0 to 1.0.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:FILTer:PARAmeter:COsine:COFS](#) on page 296

[\[:SOURce<hw>\]:BB:EUTRa:FILTer:PARAmeter:LTE:OPTimization](#)  
on page 297

[\[:SOURce<hw>\]:BB:EUTRa:FILTer:PARAmeter:LTE:COFS](#) on page 297

### Cut Off Frequency Factor

(available for filter parameter Lowpass and EUTRA/LTE with ACP Optimization 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:EUTRa:FILTer:PARAmeter:LPASs](#) on page 296

[\[:SOURce<hw>\]:BB:EUTRa:FILTer:PARAmeter:LTE:OPTimization](#)  
on page 297

[\[:SOURce<hw>\]:BB:EUTRa:FILTer:PARAmeter:LTE:COFFactor](#) on page 297

[\[:SOURce<hw>\]:BB:EUTRa:FILTer:PARAmeter:LPASSEVM](#) on page 296

### Filter Mode

Selects an offline or realtime filter mode.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:FILTer:MODE](#) on page 294

### Sample Rate Variation

Sets the sample rate of the signal. A variation of this parameter only affects the ARB clock rate; all other signal parameters remain unchanged.

A variation of this parameter only affects the ARB clock rate; all other signal parameters remain unchanged. If the sampling rate in the "General Settings" menu is changed, this parameter is reset to the chosen sampling rate.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:SRATe:VARiation](#) on page 299

### 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:EUTRa:FILTer:ILENgtH:AUTO](#) on page 294

[\[:SOURce<hw>\]:BB:EUTRa:FILTer:ILENgtH](#) on page 294

### 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:EUTRa:FILTER:OSAMpling:AUTO](#) on page 295

[\[:SOURCE<hw>\]:BB:EUTRa:FILTER:OSAMpling](#) on page 294

### 7.18.3 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 EUTRA/LTE signal.

With baseband clipping, the signal level is 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.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:CLIPping:STATE](#) on page 300

#### 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:EUTRa:CLIPping:LEVel](#) on page 299

#### 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 (see also "Clipping State" on page 189).



"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:EUTRa:CLIPping:MODE](#) on page 300

## 7.18.4 Power Settings

The "Power" sections provides an access to the settings necessary to adjust the global power level of the generated LTE signal.

For an overview of the provided power settings and a detailed information on how to adjust them, refer to [chapter 5.3, "Power Setting"](#), on page 48.

Power	
Power Offset relative to Level Display	-3.01 dB
Level Reference	UE Burst RMS Power
Reference UE	UE1
Reference Subframe	3
Reference Channel	PUSCH w/o DRS

### Power Offset relative to Level Display

Sets the power offset of the according baseband relative to the RMS level displayed in the instrument's global Level display in the header of the instrument.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:POWC:ORTLevel](#) on page 302

### Level Reference

Defines the reference the instrument's global level display is referring to. XE

"Frame RMS Power" The displayed RMS and PEP are measured during the whole frame. Note that all frames are taken into account, not only the first one.

"DL Part of Frame RMS Power" The displayed RMS and PEP are measured during the DL part of the frame (all DL subframes and the DwPTS). Note that all frames are taken into account, not only the first one.

"UL Part of Frame RMS Power" The displayed RMS and PEP are measured during the UL part of the frame (all UL subframes and the UpPTS). Note that all frames are taken into account, not only the first one.

"UE Burst RMS Power" The displayed RMS and PEP are measured during a single subframe of a certain UE. One of the following channels is used:

- PUSCH (without DRS)
- PUCCH (without DRS)
- PRACH or
- SRS.

The subframe, channel and reference used are displayed by means of the parameters [Reference Subframe](#), [Reference Channel](#) and [Reference UE](#).

The suitable reference is selected automatically according the following algorithm:

- The first active UE is used
- The data part of the first PUSCH/PUCCH is used
- In PRACH mode, the first PRACH preamble is used
- If there is no active subframe, the SRS is used.

This power mode is required for setting the AWGN correctly (e.g. according to TS 36.141), in case not every possible subframe is used by the simulated UE. The actual part of the signal used for determining RMS and PEP are displayed in the graphical interface.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:POWC:LEVReference` on page 301

#### Reference UE

(enabled for [Level Reference](#) set to "UL Burst RMS Power")

Displays the UE the measured RMS and PEP is referring to.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:POWC:RUE` on page 303

#### Reference Subframe

(enabled for [Level Reference](#) set to "UL Burst RMS Power")

Displays the subframe the measured RMS and PEP is referring to.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:POWC:REFSubframe` on page 303

#### Reference Channel

(enabled for [Level Reference](#) set to "UL Burst RMS Power")

Displays the channel type the measured RMS and PEP is referring to.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:POWC:REFChannel` on page 302

## 7.19 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.

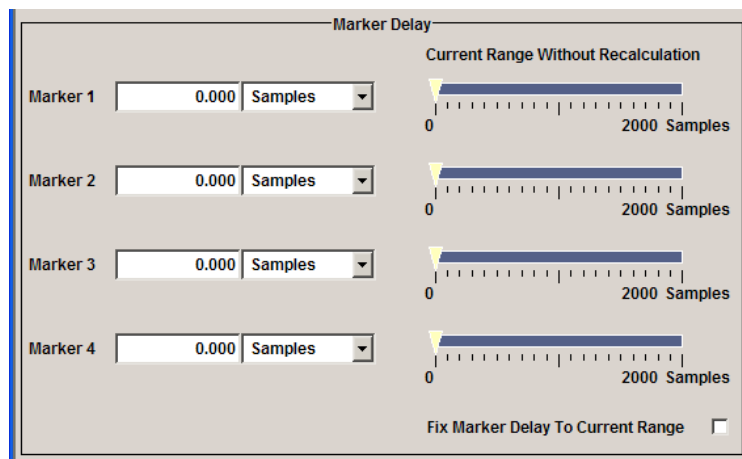
The screenshot shows the "Trigger In" dialog box. It contains a "Mode" dropdown menu currently set to "Retrigger", an "Execute Trigger" button, a "Source" dropdown menu currently set to "Internal", and a "Stopped" status indicator.

The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.

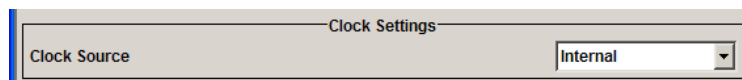
The screenshot shows the "Marker Mode" dialog box. It contains four marker configurations, labeled Marker 1 through Marker 4. Each marker configuration includes a dropdown menu for the signal type (all set to "Radio Frame Start"), a "Rise Offset" field (all set to "0"), and a "Fall Offset" field (all set to "0"). Each field has a "Samples" dropdown menu.

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.



### 7.19.1 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 external) 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 (internal with "Execute Trigger" or external) causes a restart.
- "Armed\_Retrigger" The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.  
Button "Arm" stops signal generation. A subsequent trigger event (internal 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 external) causes a restart.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa\[:TRIGger\]:SEQuence](#) on page 307

### Signal Duration Unit

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

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TRIGger:SLUNit](#) on page 312

### Signal Duration

Defines the length of the signal sequence to be output in the "Single" trigger mode. The unit of the entry is defined under "Signal Duration Unit". It is then 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:EUTRa:TRIGger:SLENgth](#) on page 311

### 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 externally) 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:EUTRa:TRIGger:RMODe](#) on page 311

### 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:EUTRa:TRIGger:ARM:EXECute on page 308

### Execute Trigger

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:EUTRa:TRIGger:EXECute on page 309

### 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 /

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:EUTRa:TRIGger:SOURce on page 313

### 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.

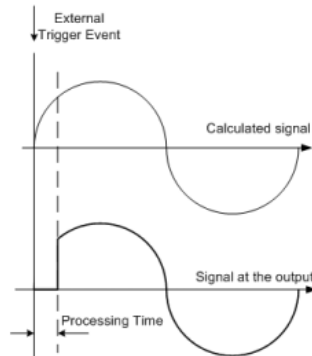
**Table 7-9: Typical Applications**

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"

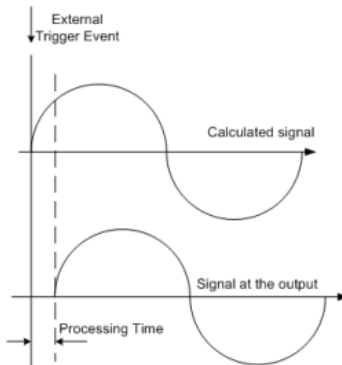
Corresponds to the default state of this parameter.

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:EUTRa:TRIGger:EXTErnal:SYNChronize:OUTPut`  
on page 309

**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:EUTRa:TRIGger [ :EXTErnal<ch> ] :DELay` on page 313

`[ :SOURce<hw> ] :BB:EUTRa:TRIGger:OBASeband:DELay` on page 310

**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:EUTRa:TRIGger [ :EXTeRnal<ch> ] :INHibit` on page 313

`[ :SOURce<hw> ] :BB:EUTRa:TRIGger:OBASeband:INHibit` on page 310

## 7.19.2 Timing Configuration

**Signal Advance  $N_{TA\_offset}$** 

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

Sets the parameter  $N_{TA\_offset}$  as defined in the 3GPP TS 36.211.

The parameter is available in "Uplink" direction, enabled "TDD" mode and "Trigger Mode" different than Auto.

The 3GPP TS 36.211 defines the signal advance parameter depending on the duplexing mode and specifies the following values:

- for FDD mode:  $N_{TA\_offset} = 0$
- for TDD mode:  $N_{TA\_offset} = 624$ .

In the R&S Signal Generator, however, the signal advance for the TDD mode can also be set to 0.

According to the 3GPP specification, the value of 624 means, that that the uplink signal is shifted against the downlink one. This instrument does not generate the uplink and downlink signal simultaneously and uses the marker signals to represent the downlink timing, i.e. setting the  $N_{TA\_offset}$  to 624 is used like a "negative trigger delay" and shifts the uplink signal against the trigger and the markers.

To achieve the shifting, the R&S Signal Generator processes the signal different, depending whether the "Realtime Feedback" mode is activated or not (see [figure 7-7](#)).

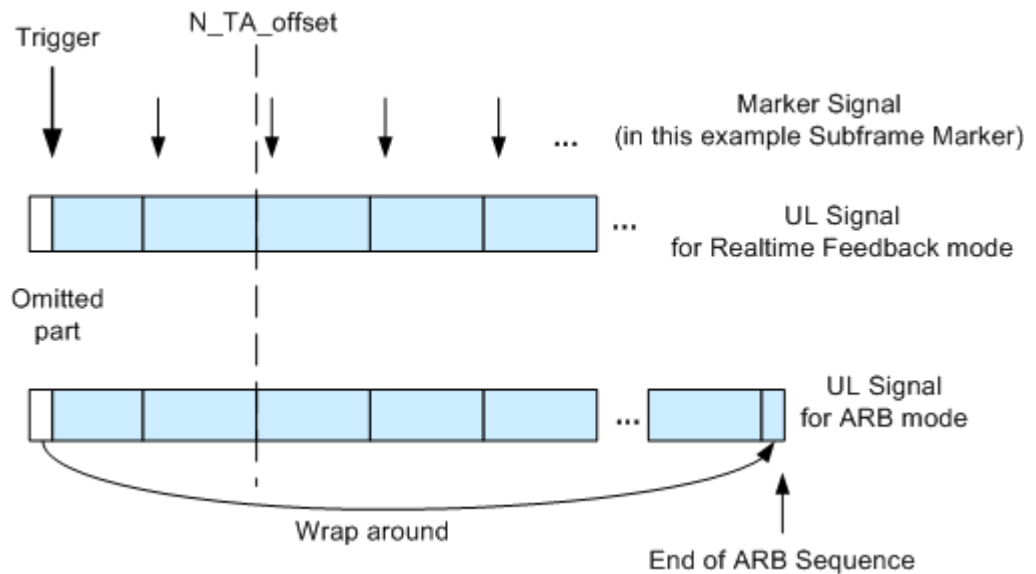


Fig. 7-7: Signal Processing

- In Realtime Feedback mode, the shifting is achieved by omitting the beginning of the signal, where the omitted part is exactly  $624 \times T_s$  long.
- When the Realtime Feedback mode is disabled and the instrument is working in the normal ARB mode, the samples of the ARB sequence are shifted with "wrap around", i.e. the omitted samples are added to the end of the ARB sequence. The total length of the sequence remains unchanged and is equal to sequence length in case of  $N_{TA\_offset} = 0$ .

**Note:** The time shift due to the  $N_{TA\_offset}$  is independent from the time shifts caused by the realtime feedback parameter [Initial Timing Advance](#) or by timing advance/adjustment commands. According to 3GPP TS 36.211, the resulting time shift is the sum of the selected time shifts.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TIMC:NTAoffset` on page 306

### 7.19.3 Marker Mode

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



The R&S SMBV Vector Signal generator supports only two markers.

#### Marker Mode

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

"Restart (ARB)" A marker signal is generated at the start of each ARB sequence.

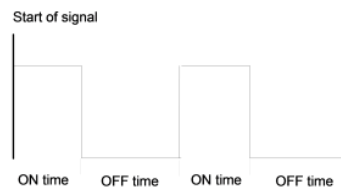
"Radio Frame Start" A marker signal is generated at the start of each radio frame.

- "Frame Active Part" The marker signal is high whenever a burst is active and low during inactive signal parts (such as the gaps between bursts in uplink mode or the uplink subframe in downlink TDD mode). This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.
- "Subframe" A marker signal is generated at the start of each subframe.
- "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:EUTRa:TRIGger:OUTPut<ch>:PERiod](#) on page 317

- "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:EUTRa:TRIGger:OUTPut<ch>:OFFTime](#) on page 317

[\[:SOURCE<hw>\]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime](#) on page 317

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE](#) on page 316

### Rise/Fall Offset

(Available for marker mode Subframe, Radio Frame Start, and Restart (ARB) only)

Sets the value for the rise/fall offset. The rising ramp of the marker is shifted by the set value in samples. Positive values shift the rising ramp to later positions; negative values shift it to earlier positions.

The value range is -640000 to 640000.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset](#) on page 317

[\[:SOURCE<hw>\]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset](#) on page 317

## 7.19.4 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.

**Note:** The R&S SMBV Vector Signal Generator supports only two markers.

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:EUTRa:TRIGger:OUTPut<ch>:DELay` on page 315

#### 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:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum`

on page 315

`[ :SOURce<hw> ] :BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum`

on page 315

#### 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:EUTRa:TRIGger:OUTPut:DELay:FIXed` on page 314

## 7.19.5 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.

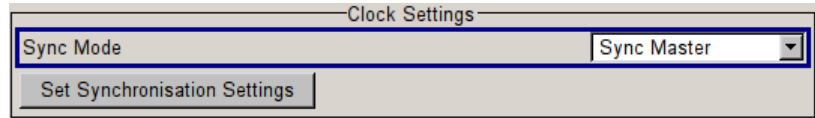
This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

**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:EUTRa:CLOCK:SYNChronization:MODE` on page 306

### Set Synchronization Settings

(for R&S SMBV only)

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

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:CLOCK:SYNChronization:MODE` on page 306

### 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:EUTRa:CLOCK:SOURce` on page 305

### Clock Mode

Enters the type of externally supplied clock.

- "Sample" A sample clock is supplied via the CLOCK connector.
- "Multiple Sample" A multiple of the sample clock is supplied via the CLOCK connector; the sample clock is derived internally from this.

"Custom" (not for R&S SMBV)  
 An external custom clock is supplied via the CLOCK connector.  
 The exact frequency of the provided clock has to be defined with parameter "Custom External Clock".

**Note:** Custom External Clock source in baseband B is only supported if baseband A is configured with EUTRA/LTE too. Furthermore the same settings for clock source and clock mode have to be set in baseband A and B. The user needs to take care of the correct settings.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:CLOCK:MODE` on page 304

### **Clock Multiplier**

Enters the multiplication factor for clock type "Multiple".

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:CLOCK:MULTIplier` on page 305

### **Custom External Clock**

Specifies the parameter for clock type "Custom" in case of external clock source.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:CLOCK:CUSTom` on page 304

### **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?`

## **7.19.6 Global Settings**

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

This settings are available for R&S SMx and R&S AMU instruments only.

### **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.

## 8 Test Case Wizard



The "Test Case Wizard" is supported by R&S SMU, R&S SMATE, R&S SMJ and R&S SMBV.

The "Test Case Wizard" supports tests on base stations in conformance with the 3GPP specification for Base Station conformance testing. It offers a selection of predefined settings according to Test Cases in TS 36.141. For an overview of the test cases covered by the test case wizard, refer to [chapter 8.3, "Supported Test Cases"](#), on page 206.

With the "Test Case Wizard", it is possible to create highly complex test scenarios with just a few keystrokes.

The "Test Case Wizard" has effect on frequency and level settings, link direction, filter, trigger, baseband clock source, marker settings and base station or user equipment configuration. Besides the EUTRA/LTE required settings also interfering signals (AWGN, CW interferer, co-located modulation signals) or fading profiles are set.



The test setups and the hardcopies in this description assume a fully equipped R&S SMU.

### 8.1 Introduction to Conformance Testing

The main purpose of the conformance testing is to ensure that the base station (BS) and the user equipment (UE) are fulfilling a defined level of minimum performance.

The 3GPP organization defines three groups of conformance testing for the UE: Radio Frequency (RF), Radio Resource Management (RRM) and Signaling. There is only one group conformance testing for the BS, the RF conformance tests.

This chapter is intended to give an overview of the 3GPP test specifications dealing with the conformance tests. Only a brief description is provided.

#### 8.1.1 UE Conformance Testing



The UE conformance tests are not in the scope of this description.

##### UE RF FDD/TDD Conformance Test Specifications

The UE RF conformance tests are based on the core specification TS 36.101 and are defined in the TS 36.521. The following list gives an overview of the related specifications:

- TS 36.124 "ElectroMagnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment"

- TS 36.521-1 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing"  
Overview of the test cases:
  - Subclause 6: UE RF transmitter test cases  
Transmit power, Output power dynamics, Transmit signal quality, Output RF spectrum emissions and Transmit intermodulation
  - Subclause 7: UE RF receiver test cases  
Diversity characteristics, Reference sensitivity power level, Maximum input level, Adjacent Channel Selectivity (ACS), In-band blocking, Out-of-band blocking, Narrow band blocking, Spurious response, Intermodulation characteristics, Spurious emissions
  - Subclause 8: UE RF FDD/TDD performance test cases  
Demodulation of PDSCH (Cell-Specific Reference Symbols), Demodulation of PDSCH (User-Specific Reference Symbols), Demodulation of PDCCH/PCFICH, Demodulation of PHICH, Demodulation of PBCH
- TS 36.521-2 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Implementation Conformance Statement (ICS)"
- TS 36.521-3 "User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Radio Resource Management (RRM) conformance testing"

#### UE RRM Conformance Test Specifications

The following specifications deal with UE RRM conformance testing:

- TS 36.133 "Requirements for support of radio resource management"
- TS 36.521-3 "User Equipment (UE) conformance specification; Part 3: Test suites"

#### UE Signaling Conformance Test Specifications

The UE signaling conformance tests are defined in the TS 36.523.

- TS 36.523-1 "User Equipment (UE) conformance specification; Part 1: Protocol conformance specification"
- TS 36.523-2 "User Equipment (UE) conformance specification; Part 2: Implementation Conformance Statement (ICS) proforma specification"
- TS 36.523-3 "User Equipment (UE) conformance specification; Part 3: Test suites"

## 8.1.2 BS Conformance Testing

#### BS RF FDD/TDD Conformance Test Specifications

The BS RF conformance tests are based on the core specification TS 36.101 and are defined in the TS 36.141.

- TS 36.113 "Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)"
- TS 36.141 "Base Station (BS) conformance testing"  
The BS RF Conformance Tests are described in [chapter 8.3, "Supported Test Cases"](#), on page 206.

### 8.1.3 Repeater Conformance Testing

The repeater conformance tests are based on the core specification TS 36.106 and defined in the TS 36.143 "FDD repeater conformance testing".

## 8.2 Basic Configuration

The basic equipment layout for performing test with the aid of "Test Case Wizard" is the same as for the EUTRA/LTE signal generation. It includes the options:

- Baseband Main Module (R&S SMU/SMJ/SMATE-B13)
- Baseband Generator (R&S SMx-B10)
- Digital Standard EUTRA/LTE (R&S SMx-K55)
- Frequency option (R&S SMx-B10x: RF 100kHz - x GHz)

However, some of the tests require further options. The additionally required hardware and/or software options are listed as a prerequisite in the description of the corresponding test case.



Test cases where the signal generator hardware and/or software equipment is not sufficient are shown in grey color but are not selectable.

RF power and frequency limitations of the hardware equipment restrict the setting ranges.

## 8.3 Supported Test Cases

The BS RF conformance tests defined in the TS 36.141 are divided into three main parts, the RF transmitter characteristics, the RF receiver characteristics and the RF performance requirements.

The "Test Case Wizard" supports the test cases listed in the tables below.



Only the test case that require a signal generator are implemented in the "Test Case Wizard".

**Table 8-1: Transmitter Tests**

Chapter in TS 36.141	Test Case	Section in this document with further information
6.2	Base station output power	this test case does not require a signal generator
<b>Output power dynamics</b>		
6.3.1	RE Power control dynamic range	
6.3.2	Total power dynamic range	
6.4	Transmit ON/OFF power	

Chapter in TS 36.141	Test Case	Section in this document with further information	
<b>Transmitted signal quality</b>			
6.5.1	Frequency error		
6.5.2	Error Vector Magnitude		
6.5.3	Time alignment between transmitter branches		
6.5.4	DL RS power		
<b>Unwanted emissions</b>			
6.6.1	Occupied bandwidth		
6.6.2	Adjacent Channel Leakage power Ratio (ACLR)		
6.6.3	Operating band unwanted emissions		
6.6.4	Transmitter spurious emissions		
6.7	Transmitter intermodulation		<a href="#">chap. 8.7.3, on page 223</a>

**Table 8-2: Receiver Characteristics**

Chapter in TS 36.141	Test Case	Section in this document with further information
7.2	Reference sensitivity level	<a href="#">chap. 8.8.4, on page 234</a>
7.3	Dynamic range	<a href="#">chap. 8.8.5, on page 236</a>
7.4	In-channel selectivity	<a href="#">chap. 8.8.6, on page 239</a>
7.5	Adjacent Channel Selectivity (ACS)	<a href="#">chap. 8.8.7, on page 242</a>
	Narrow-band blocking	<a href="#">chap. 8.8.8, on page 244</a>
7.6	Blocking	<a href="#">chap. 8.8.9, on page 247</a>
7.7	Receiver spurious emissions	this test case does not require a signal generator
7.8	Receiver intermodulation	<a href="#">chap. 8.8.10, on page 251</a>

**Table 8-3: Performance Requirement**

Chapter in TS 36.141	Test Case	Section in this document with further information
<b>Performance requirements for PUSCH</b>		
8.2.1	Performance requirements of PUSCH in multipath fading propagation conditions	<a href="#">chap. 8.9.3, on page 259</a>
8.2.2	Performance requirements for UL timing adjustment	<a href="#">chap. 8.9.4, on page 262</a>
8.2.3	Performance requirements for HARQ-ACK multiplexed on PUSCH	<a href="#">chap. 8.9.5, on page 267</a>
8.2.4	Performance requirements for High Speed Train conditions	<a href="#">chap. 8.9.6, on page 269</a>

Chapter in TS 36.141	Test Case	Section in this document with further information
<b>Performance requirements for PUCCH</b>		
8.3.1	ACK missed detection for single user PUCCH format 1a	<a href="#">chap. 8.9.7, on page 273</a>
8.3.2	CQI missed detection for PUCCH format 2	<a href="#">chap. 8.9.8, on page 275</a>
8.3.3	ACK missed detection for multi user PUCCH format 1a	<a href="#">chap. 8.9.9, on page 278</a>
<b>Performance requirements for PRACH</b>		
8.4.1	PRACH false alarm probability and missed detection	<a href="#">chap. 8.9.10, on page 283</a>

### 8.3.1 Generic Structure of the Description of the Implemented Test Cases

The description of the test cases in this document follows a common structure.

- Test Case Number and Test Case Name
- Short Description and Test Purpose  
Some of the definitions are directly taken from the 3GPP test specification.
- Prerequisites, required hardware and software options
- Test setup
- Description of test case specific parameters

## 8.4 Standard Test Setups

The tests can be performed using the standard test setup according to TS 36.141. Test setups beside the three standard test setups described below are specified at the individual description of the corresponding test case.

### 8.4.1 Standard Test Setup - One Path

In case of two-path instruments signal routing to path A is assumed for the graph below. RF port A outputs the wanted signal (with or without fading and/or interference) and is connected to the Rx port of the base station. The signal generator will start signal generation at the first eNB frame trigger sent to input TRIGGER 1.



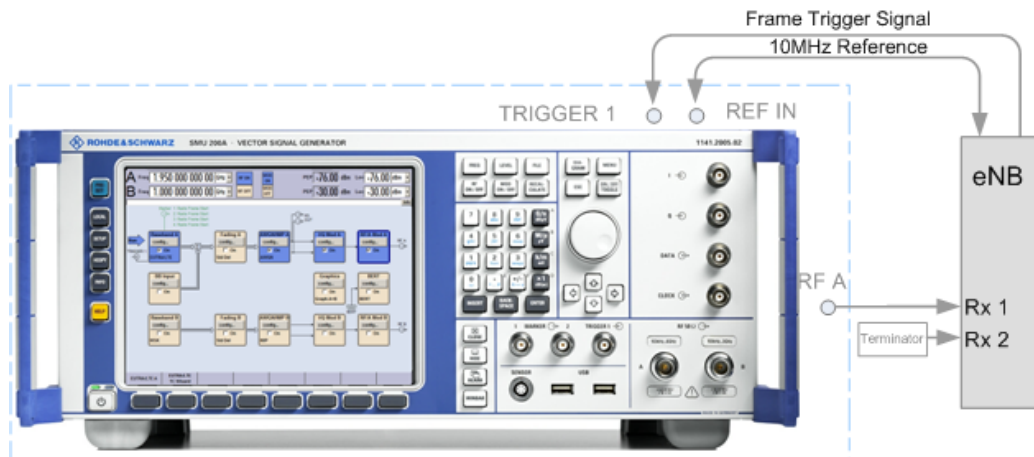


Fig. 8-1: One Path Standard Test Setup (Example of R&S SMU simulating the test case 7.3 "Dynamic Range")

For two-path instruments it is also possible to route baseband signal A to RF output B and connect RF output B to the Rx port of the base station.

### 8.4.2 Standard Test Setup - Two Paths

For two-paths measurements, the test cases always require option Second RF path (R&S SMx-B20x), a second option Baseband Main Module (R&S SMx-B13) and at least one option to generate the interfering signal in addition to the basic configuration. The signal routing is fixed.

The signal generator outputs the reference measurement channel signal, i.e. the wanted signal at output RF A and the interfering signal(s) at output RF B. After combining the two (three) signals the sum signal is fed into the base station Rx port. The signal generator will start signal generation at the first eNB frame trigger sent to input TRIGGER 1.

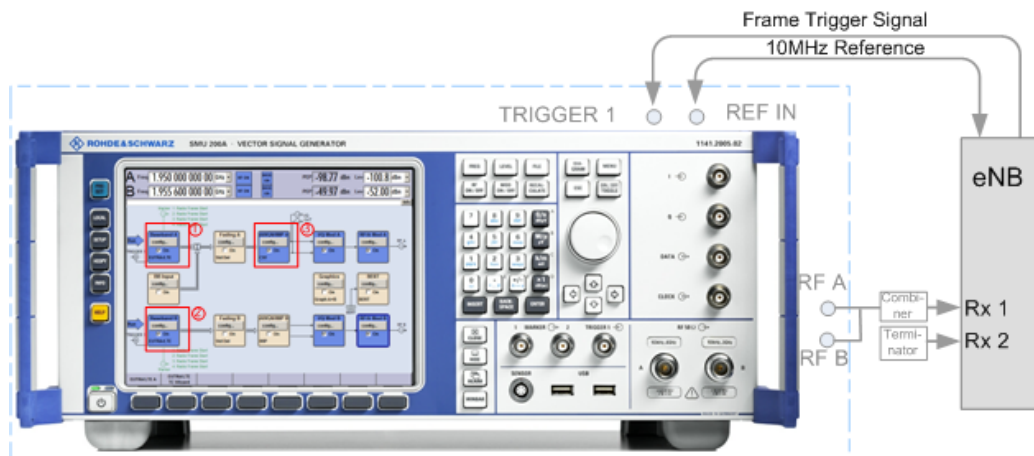


Fig. 8-2: Two Paths Standard Test Setup (Example of R&S SMU simulating test case 7.8 "Receiver Intermodulation")

- 1 = Baseband A generates the wanted signal
- 2 = Baseband B generates the EUTRA/LTE interfering signal
- 3 = AWGN A generates the CW interfering signal

### 8.4.3 Test Setup - Diversity Measurements

For diversity measurements, the test cases always require at least option Second RF path (R&S SMx-B20x) and a second option Baseband Main Module (R&S SMx-B13) in addition to the basic configuration. The signal routing is fixed.

RF output A and RF output B transmit the corrupted reference measurement channel signal (wanted signal) and are connected to the Rx ports of the base station for diversity reception. The signal generator will start signal generation at the first eNB frame trigger sent to input "Trigger 1".

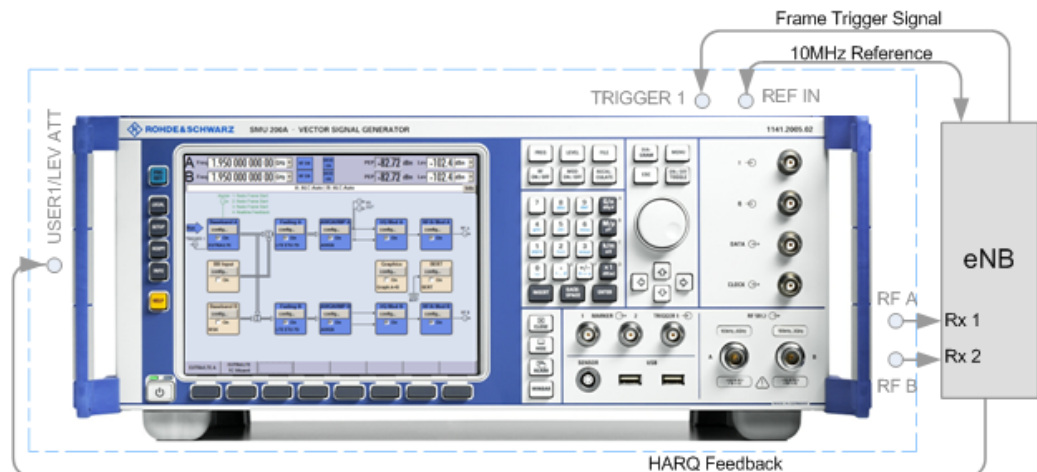


Fig. 8-3: Test Setup for Diversity Measurements (Example of R&S SMU simulating test case 8.2.1 "PUSCH in Multipath Fading Propagation Conditions")



As signal routing takes place at the output of the baseband block, the interference settings of the two paths are identical for diversity measurements.

### 8.4.4 Test Setup - Four Rx Antennas

Test setup with four Rx antennas require a second signal generator, equipped with the paths (e.g. two R&S SMU). The required options of both signal generators are identical. The signal routing is fixed.

RF output A and RF output B transmit the corrupted reference measurement channel signal (wanted signal) and are connected to the Rx ports of the base station for diversity reception. The signal generator will start signal generation at the first eNB frame trigger sent to input "Trigger 1".

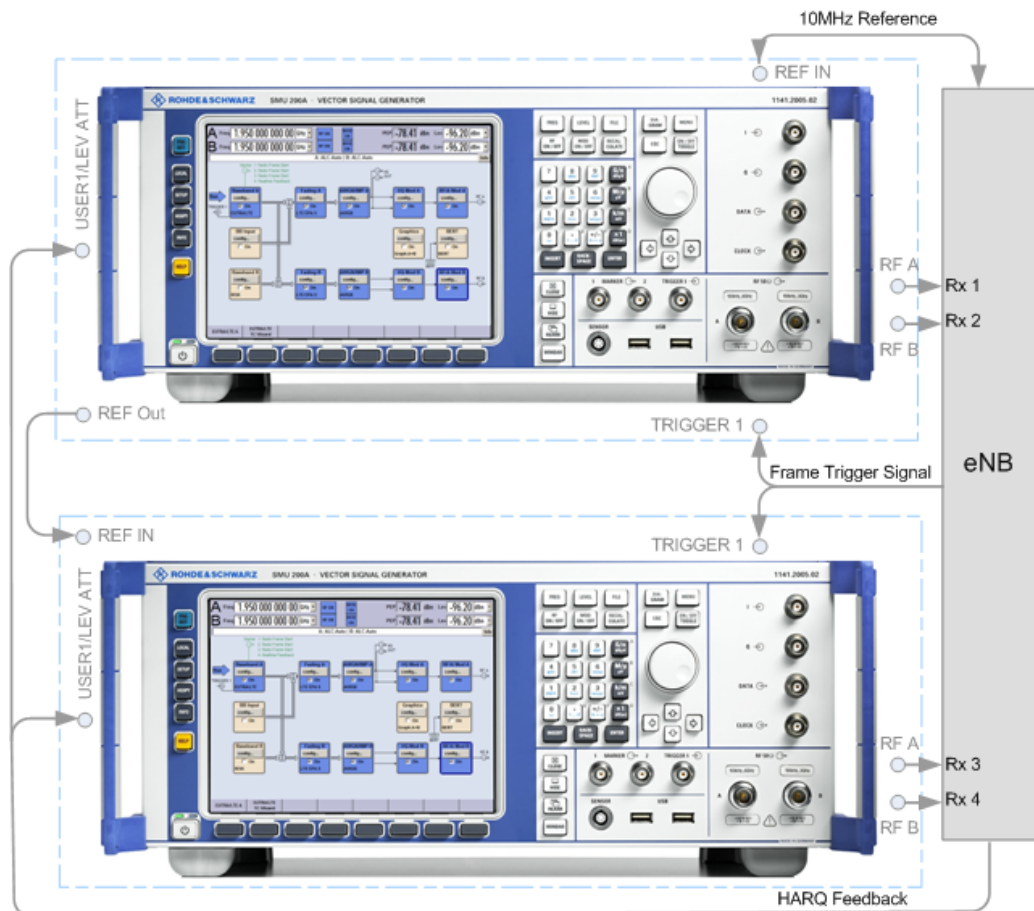


Fig. 8-4: Test Setup for tests with for Rx antennas (Example of 2xR&S SMU simulating test case 8.2.1 "PUSCH in Multipath Fading Propagation Conditions")



As signal routing takes place at the output of the baseband block, the interference settings of the two paths are identical for diversity measurements.

## 8.5 General Considerations

This section lists some common topics for all BS RF conformance tests. Considerations, that are specific to one conformance test part, are described at the corresponding section.

### Test Frequencies

EUTRA/LTE is designed to operate in the operating bands defined in table 8-4. The table shows start and stop frequencies of both uplink and downlink frequency bands according to 3GPP TS 36.141.

Table 8-4: EUTRA/LTE operating bands

EUTRA Operating Band	Uplink (UL) band BS receive UE transmit $F_{UL\_low}$ to $F_{UL\_high}$	Downlink (DL) operating band BS transmit UE receive $F_{DL\_low}$ to $F_{DL\_high}$	Duplex Mode
1	1920 MHz to 1980 MHz	2110 MHz to 2170 MHz	FDD
2	1850 MHz to 1910 MHz	1930 MHz to 1990 MHz	FDD
3	1710 MHz to 1785 MHz	1805 MHz to 1880 MHz	FDD
4	1710 MHz to 1755 MHz	2110 MHz to 2155 MHz	FDD
5	824 MHz to 849 MHz	869 MHz to 894MHz	FDD
6 <sup>1)</sup>	830 MHz to 840 MHz	875 MHz to 885 MHz	FDD
7	2500 MHz to 2570 MHz	2620 MHz to 2690 MHz	FDD
8	880 MHz to 915 MHz	925 MHz to 960 MHz	FDD
9	1749.9 MHz to 1784.9 MHz	1844.9 MHz to 1879.9 MHz	FDD
10	1710 MHz to 1770 MHz	2110 MHz to 2170 MHz	FDD
11	1427.9 MHz to 1447.9 MHz	1475.9 MHz to 1495.9 MHz	FDD
12	698 MHz to 716 MHz	728 MHz to 746 MHz	FDD
13	777 MHz to 787 MHz	746 MHz to 756 MHz	FDD
14	788 MHz to 798 MHz	758 MHz to 768 MHz	FDD
15	Reserved	Reserved	FDD
16	Reserved	Reserved	FDD
17	704 MHz to 716 MHz	734 MHz to 746 MHz	FDD
18	815 MHz to 830 MHz	860 MHz to 875 MHz	FDD
19	830 MHz to 845 MHz	875 MHz to 890 MHz	FDD
20	832 MHz to 862 MHz	791 MHz to 821 MHz	FDD
21	1447.9 MHz to 1462.9 MHz	1495.9 MHz to 1510.9 MHz	FDD
...			
33	1900 MHz to 1920 MHz	1900 MHz to 1920 MHz	TDD
34	2010 MHz to 2025 MHz	2010 MHz to 2025 MHz	TDD
35	1850 MHz to 1910 MHz	1850 MHz to 1910 MHz	TDD
36	1930 MHz to 1990 MHz	1930 MHz to 1990 MHz	TDD
37	1910 MHz to 1930 MHz	1910 MHz to 1930 MHz	TDD
38	2570 MHz to 2620 MHz	2570 MHz to 2620 MHz	TDD
39	1880 MHz to 1920 MHz	1880 MHz to 1920 MHz	TDD
40	2300 MHz to 2400 MHz	2300 MHz to 2400 MHz	TDD
1)	Band 6 is not applicable.		

The measurements that have to be performed according to 3GPP TS 36.141 in order to verify proper operation of systems apply to appropriate frequencies in the bottom, middle and top of the operating frequency band of the base station (BS). These frequencies are denoted as RF channels B (bottom), M (middle) and T (top).

### Reference Frequency

When building up the measurement setups according to TS 36.141 it might be useful that all the instruments share a common reference clock. In order to feed in the clock of an external clock the RF module configuration should be switched to external reference frequency.

External Reference Frequency	
Source	External
External Reference Frequency	10 MHz
Synchronisation Bandwidth	Standard

In the external reference mode an external signal with selectable frequency and defined level must be input at the REF IN connector. This signal is output at the REF OUT connector. The reference frequency setting is effective for both paths. For very good reference sources of high spectral purity a wideband setting is provided.

### Baseband Clock

The clock source is automatically switched to internal when the test case settings are activated.

### Improvement of signal quality

Improvement of signal quality is possible via several settings:

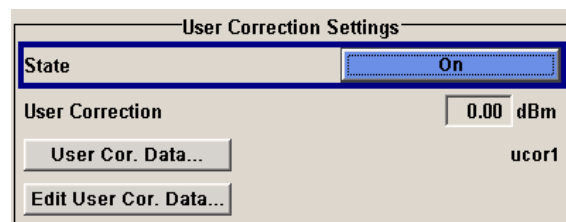
- In the "I/Q Settings" menu the internal baseband gain can be set to improved ACLR performance (3dB or 6 dB)

Internal Baseband	
Baseband Gain	Auto
	-3 dB (Best For Low Distortion)
	0 dB (Standard)
	3 dB (Best For High 3GPP ACLR)
	6 dB (Best For Low Noise)
	Auto

- In the "Automatic Level Control Settings" menu the RF output level can be recalibrated with "Search Once" in "Sample&Hold" mode. This is recommended if in CW mode the signal/intermodulation ratio is to be improved for multi-transmitter measurements. With setting "Auto", the level control is automatically adapted to the operating conditions, it may cause increased intermodulation, however.

Automatic Level Control Settings	
State	Off (Sample & Hold)
Search Once	

- In the "User Correction" menu a list of correction values can be created and subsequently activated. Thus, the frequency response of the test setup can be taken into account.



- In order to compensate cable loss and additionally inserted attenuators, the RF level can directly be adjusted in the "Level" input field.



- Additional settings in the impairments section of the AWGN block



### Virtual Resource Block (VRB) Offset

In the R&S Signal Generator the RBs are allocated by default at the left edge of the spectrum. However, some test cases do not require allocation of the entire bandwidth or RB allocation at a specific part of the bandwidth. Adjust the additional parameter "Offset VRB" to define the position of the RBs.

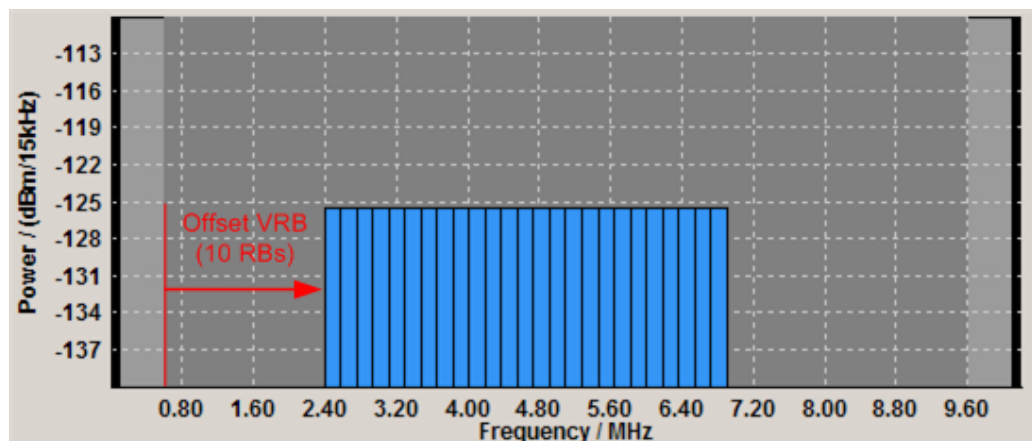
#### Example: Offset VRB

"Channel Bandwidth" = 10 MHz, i.e. 50 RBs

"Allocated Resource Blocks" = 25

"Offset VRB" = 10

The RBs are offset by 10 RBs and allocated RBs start at position 11.



Use also the [SC-FDMA Timeplan](#) to visualize the RB allocation for the wanted signal (path A) and the interfering signal (path B).

## 8.6 User Interface

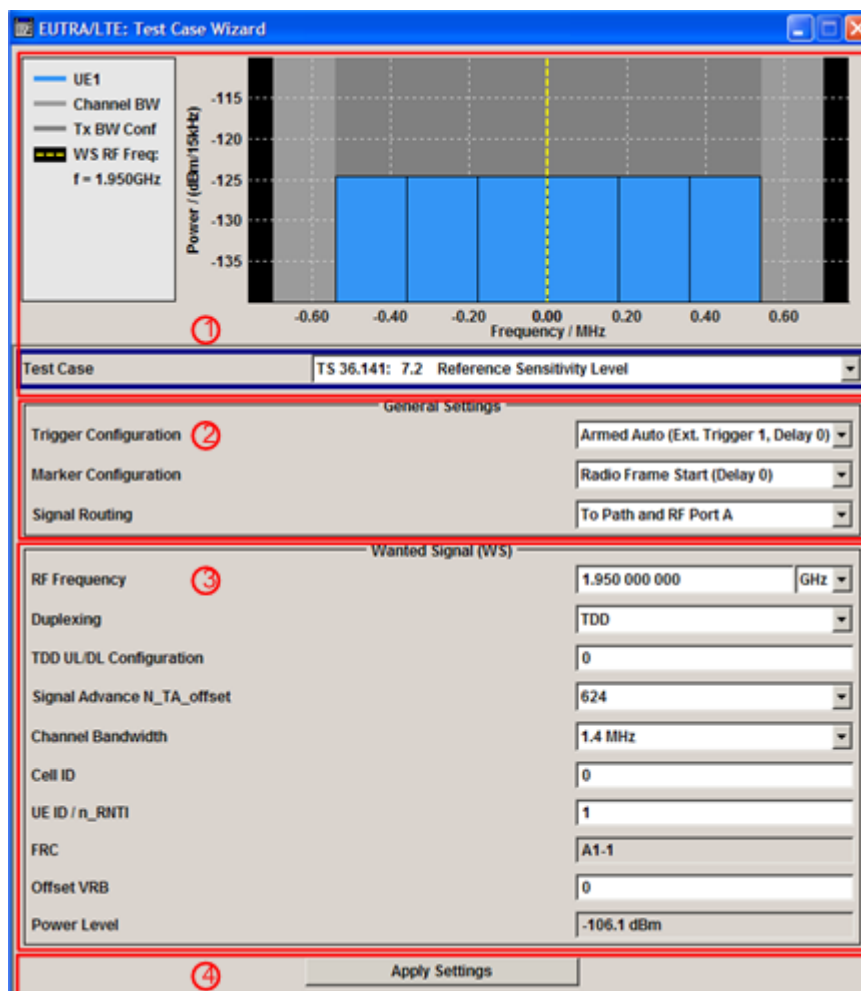
To access the "Test Case Wizard" dialog, select "Baseband Block > EUTRA/LTE > Test Case Wizard".



There is only one "Test Case Wizard" in the instrument, i.e. the same dialog can be accessed via each of the baseband blocks.

The "Test Case Wizard" dialog comprises three main parts, the "General Settings" area for selecting the test case and the settings regarding routing, trigger and marker configuration, an area with additional parameters like the configuration of the wanted and interfering signals, AWGN and fading settings and the "Apply Settings" button.

The graph symbolizes the interference scenario defined by power level and frequency offset.



- 1 = Graph
- 2 = General Settings
- 3 = Additional parameters
- 4 = Apply Settings

## 8.6.1 General Settings

The upper part of the dialog comprises the settings for selecting the test case and configuring the general signal generators parameters.

### Test Case

Selects the test case.

**Note:** Not all test case are available for all instruments. The enabled test cases depend on the instrument's hardware (e.g. instrument equipped with one or two paths, etc) and/or the installed SW options (e.g. Fading Simulator, etc.).

See [chapter 8.3, "Supported Test Cases"](#), on page 206 for an overview of the available test cases.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:TC` on page 437

### Trigger Configuration

Selects the trigger configuration. The trigger is used to synchronize the signal generator to the other equipment.

"Armed Auto Delay 0" The trigger settings are customized for the selected test case. The trigger (Ext. Trigger 1, setting "Armed Auto" with external trigger source "External Trigger 1" is used; the trigger delay is set equal to zero. Thus, the base station frame timing is able to synchronize the signal generator by a periodic trigger.

"Unchanged" The current trigger settings of the signal generator are retained unchanged.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:GS:TRIGgerconfig` on page 432

### Marker Configuration

Selects the marker configuration. The marker can be used to synchronize the measuring equipment to the signal generator.

"Radio Frame Start (Delay 0)" The marker settings are customized for the selected test case. "Radio Start (Delay 0)" Frame Start" markers are output; the marker delays are set equal to zero.

"Unchanged" The current marker settings of the signal generator are retained unchanged.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:GS:MARKerconfig` on page 431

### Instrument Setup

(two-path instruments only)

Determines whether one or both paths are used.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:GS:INSTsetup` on page 431

### Signal Routing

Selects the signal routing for baseband A signal which in most test cases represents the wanted signal.







**Signal Advance N\_TA\_offset**

Sets the parameter  $N_{TAOffset}$  (see also "[Signal Advance N\\_TA\\_offset](#)" on page 197).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:NTAOffset on page 439

**Channel Bandwidth**

Selects the channel bandwidth (see also "[Channel Bandwidth \(UL\)](#)" on page 137).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:CHBW on page 438

**Cell ID**

Sets the Cell ID (see also "[Cell ID \(UL\)](#)" on page 139).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:CLID on page 438

**Cyclic Prefix**

Selects normal or extended cyclic prefix.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:CYCPrefix on page 438

**UE ID/n\_RNTI**

Sets the UE ID/n\_RNTI.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:UEID on page 442

**FRC**

Displays the fixed reference channel used. An overview of the FRCs and the cross-reference between the selected [Channel Bandwidth](#) and the FRC is given in the individual description of the test cases.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:FRC on page 439

**Offset VRB**

Sets the number of RB the allocated RB(s) are shifted with (see also [example "Offset VRB"](#) on page 214).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:OVRB on page 440

**Power Level**

Displays the Power Level, depending on the selected test case.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:PLevel on page 440

### 8.6.3 Apply

Button "Apply Settings" triggers a selective preset of the signal generator prior to pre-setting the setting according to the selected test case. Further modification of the generator settings is still possible. Signal generation starts with the first trigger event.

#### Apply Settings

Activates the current settings of the test case wizard.

**Note:** The settings of the selected test case becomes active only after selecting "Apply Settings".

Initialization of the signal generator with the test case settings is performed by a partial selective reset that includes only the baseband, fading and AWGN module and the RF frequency and RF level settings. Other settings of the signal generator are not altered.

Before triggering the signal generator the user still can change these other settings. This is particularly useful when compensating for cable loss and additionally inserted attenuators by adjusting the RF power level offset is required.

Signal generation is started at the first trigger received by the generator. The RF output is not activated /deactivated by the test case wizard, so care has to be taken that "RF State" is On at the beginning of the measurement.

**Note:** For safety reasons the RF is not active unless the button "RF ON" has been selected.

**Note:** The settings in the dialogs "EUTRA/LTE > Trigger/Marker/Clock", in the "Global Trigger/Clock Settings" and in the "User Marker / AUX I/O Settings" are not affected by the selective preset, if the parameter "Trigger/Marker Configuration" is set to "Unchanged".

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:APPLYsettings` on page 430

## 8.7 Transmitter Characteristics (TS 36.141, Chapter 6)

The transmitter characteristics comprises the maximum output power, output power dynamics, transmitted signal quality, unwanted emissions and transmitter intermodulations. The "Test Case Wizard" supports the generation of signals in accordance with the transmitter intermodulations test case. A brief description about the unwanted emission tests is also provided (see [chapter 8.7.2, "Introduction to the Unwanted Emissions Tests"](#), on page 221).

### 8.7.1 Prior Considerations

#### Test Models

For the transmitter characteristic tests EUTRA test models (E-TM) are specified. For an overview of the test models, see ["EUTRA Test Models \(E-TM\) Downlink"](#) on page 81.

### Channels

According to the TS 36.141, the channels to test are located in the bottom (B), middle (M) and the top (T) of the supported frequency range of the base station. See [table 8-4](#) for an overview of the supported frequency operating bands.

### Filter Settings

The 3GPP EUTRA/LTE specifications do not define a standardized transmit filter neither for the UE nor for the base station. Therefore, when a test case is activated, a filter type EUTRA/LTE with "Best ACP Optimization" is automatically selected.

### Test Setup

Transmitter tests require a separate measuring equipment, e.g. the Vector Signal Analyzer R&S FSV.

## 8.7.2 Introduction to the Unwanted Emissions Tests

The unwanted emissions from the transmitter are divided into two main groups, the out-of-band (OOB) emissions and the spurious emissions. The out-of-band emissions are emissions on frequencies close to the frequency of the wanted signal. Spurious emissions are emissions caused by unwanted transmitter effects, like harmonics, parasitic emissions, intermodulation products and frequency conversion products.

- ACLR

The Adjacent Channel Leakage power Ratio (ACLR) is defined as the ratio between the power transmitted in the channel bandwidth of the wanted signal to the power of the unwanted emissions transmitted on the adjacent channel.

The corresponding receiver requirement is the Adjacent Channel Selectivity (ACS), described in [chapter 8.8.7, "Test Case 7.5A: Adjacent Channel Selectivity \(ACS\)"](#), on page 242.

The test specifications defines ACLR requirements for LTE and UTRA receivers. Different settings applies for paired and unpaired spectrum (see [table 8-5](#) and [table 8-6](#)).

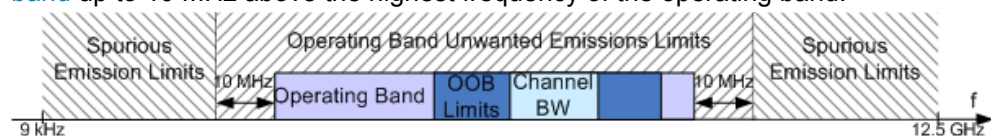
**Table 8-5: Base Station ACLR in paired spectrum**

EUTRA transmitted signal channel bandwidth $BW_{\text{Channel}}$ , MHz	BS adjacent channel center frequency offset below the first or above the last carrier center frequency transmitted	Assumed adjacent channel carrier (informative)	Filter on the adjacent channel frequency and corresponding filter bandwidth	ACLR limit
1.4 / 3 / 5 / 10 / 15 / 20	$BW_{\text{Channel}}$	EUTRA of same BW	Square ( $BW_{\text{Config}}$ )	44.2 dB
	$2 \times BW_{\text{Channel}}$	EUTRA of same BW	Square ( $BW_{\text{Config}}$ )	
	$BW_{\text{Channel}}/2 + 2.5$ MHz	3.84 Mcps UTRA	RRC (3.84 Mcps)	
	$BW_{\text{Channel}}/2 + 7.5$ MHz	3.84 Mcps UTRA	RRC (3.84 Mcps)	

**Table 8-6: Base Station ACLR in unpaired spectrum with synchronized operation**

EUTRA transmitted signal channel bandwidth $BW_{Channel}$ , MHz	BS adjacent channel center frequency offset below the first or above the last carrier center frequency transmitted	Assumed adjacent channel carrier (informative)	Filter on the adjacent channel frequency and corresponding filter bandwidth	ACLR limit
1.4 / 3	$BW_{Channel}$	EUTRA of same BW	Square ( $BW_{Config}$ )	44.2 dB
	$2x BW_{Channel}$	EUTRA of same BW	Square ( $BW_{Config}$ )	
	$BW_{Channel}/2 + 0.8$ MHz	1.28 Mcps UTRA	RRC (1.28 Mcps)	
	$BW_{Channel}/2 + 2.4$ MHz	1.28 Mcps UTRA	RRC (1.28 Mcps)	
5 / 10 / 15 / 20	$BW_{Channel}$	EUTRA of same BW	Square ( $BW_{Config}$ )	
	$2x BW_{Channel}$	EUTRA of same BW	Square ( $BW_{Config}$ )	
	$BW_{Channel}/2 + 0.8$ MHz	1.28 Mcps UTRA	RRC (1.28 Mcps)	
	$BW_{Channel}/2 + 2.4$ MHz	1.28 Mcps UTRA	RRC (1.28 Mcps)	
	$BW_{Channel}/2 + 2.5$ MHz	3.84 Mcps UTRA	RRC (3.84 Mcps)	
	$BW_{Channel}/2 + 7.5$ MHz	3.84 Mcps UTRA	RRC (3.84 Mcps)	
	$BW_{Channel}/2 + 5$ MHz	7.68 Mcps UTRA	RRC (7.68 Mcps)	
	$BW_{Channel}/2 + 15$ MHz	7.68 Mcps UTRA	RRC (7.68 Mcps)	

- **Operating Band Unwanted Emissions**  
The 3GPP specification introduces the term operating band unwanted emissions instead of the spectrum mask. The operating band unwanted emissions requirements are defined from 10 MHz below the lowest frequency of the downlink **operating band** up to 10 MHz above the highest frequency of the operating band.



**Fig. 8-5: Transmitter tests frequency limits**

The operating band unwanted emissions require a 100 kHz measurement bandwidth.

- **Spurious Emissions**  
The transmitter spurious emissions limits apply from 9 kHz to 12.5 GHz, excluding the frequency range defined for the operating band unwanted emissions (see [figure 8-5](#)). Refer to [table 8-7](#) for an overview of the general settings for the measurements. Additional requirements may apply for co-existence with other systems and/or co-location with other base stations. For detailed requirements, refer to the 3GPP TS 36.141.

**Table 8-7: Spurious emissions**

Frequency range	Maximum level Category A	Maximum level Category B	Measurement Band- width
9kHz - 150kHz	-13 dBm	-36 dBm	1 kHz
150kHz - 30MHz			10 kHz
30MHz - 1GHz			100 kHz
1GHz - 12.75 GHz		-30 dBm	1 MHz

### 8.7.3 Test Case 6.7: Transmitter Intermodulation

#### Test Purpose

The test purpose is to verify the ability of the BS transmitter to restrict the generation of intermodulation products in its non linear elements caused by presence of the own wanted signal and an interfering signal reaching the transmitter via the antenna [6].

#### Required Options

See [chapter 8.2, "Basic Configuration"](#), on page 206.

#### Test Setup

The RF OUT of the signal generator is connected to the analyzer via a circulator and external attenuator. The Tx signal of the base station is connected to the RF input of the analyzer via a circulator. The [figure 8-6](#) shows the basic test setup.

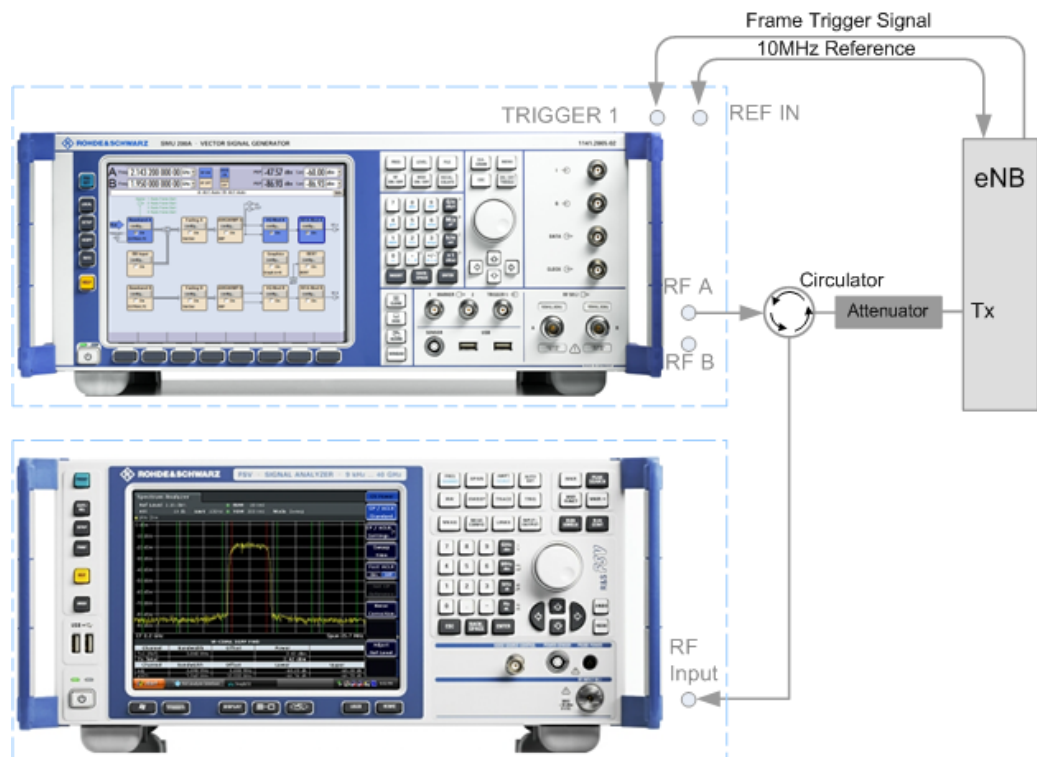


Fig. 8-6: Test setup for Test case 6.7: Transmitter Intermodulation

### Short Description

The transmitter intermodulation test is intended to verify the ability of the BS transmitter to restrict the generation of intermodulation products in its non linear elements caused by presence of wanted signal and an interfering signal reaching the transmitter via the antenna.

The BS transmits signals in accordance with E-TM1.1 at maximum power and with channel bandwidth  $BW_{\text{Channel}}$  corresponding to the maximum bandwidth supported by the base station. The interfering signal is an E-TM1.1 signal with 5 MHz channel bandwidth. The interfering signal power shall be 30 dB lower than the power of the wanted signal at the frequency offsets of  $\pm 2.5$  MHz,  $\pm 7.5$  MHz and  $\pm 12.5$  MHz.

The transmit intermodulation level shall not exceed the out-of-band emission requirements and transmitter spurious emissions requirements for all third and fifth order intermodulation products which appear in the frequency ranges defined in [table 8-5](#), [table 8-6](#) and [table 8-7](#). For detailed information about the operating band unwanted emissions, refer to section 6.6.3.5 in 3GPP TS 36.141 [6].

The test shall be done on three channels (B, M and T).



## General Workflow for Carrying Out a Test Case 6.7 Measurement

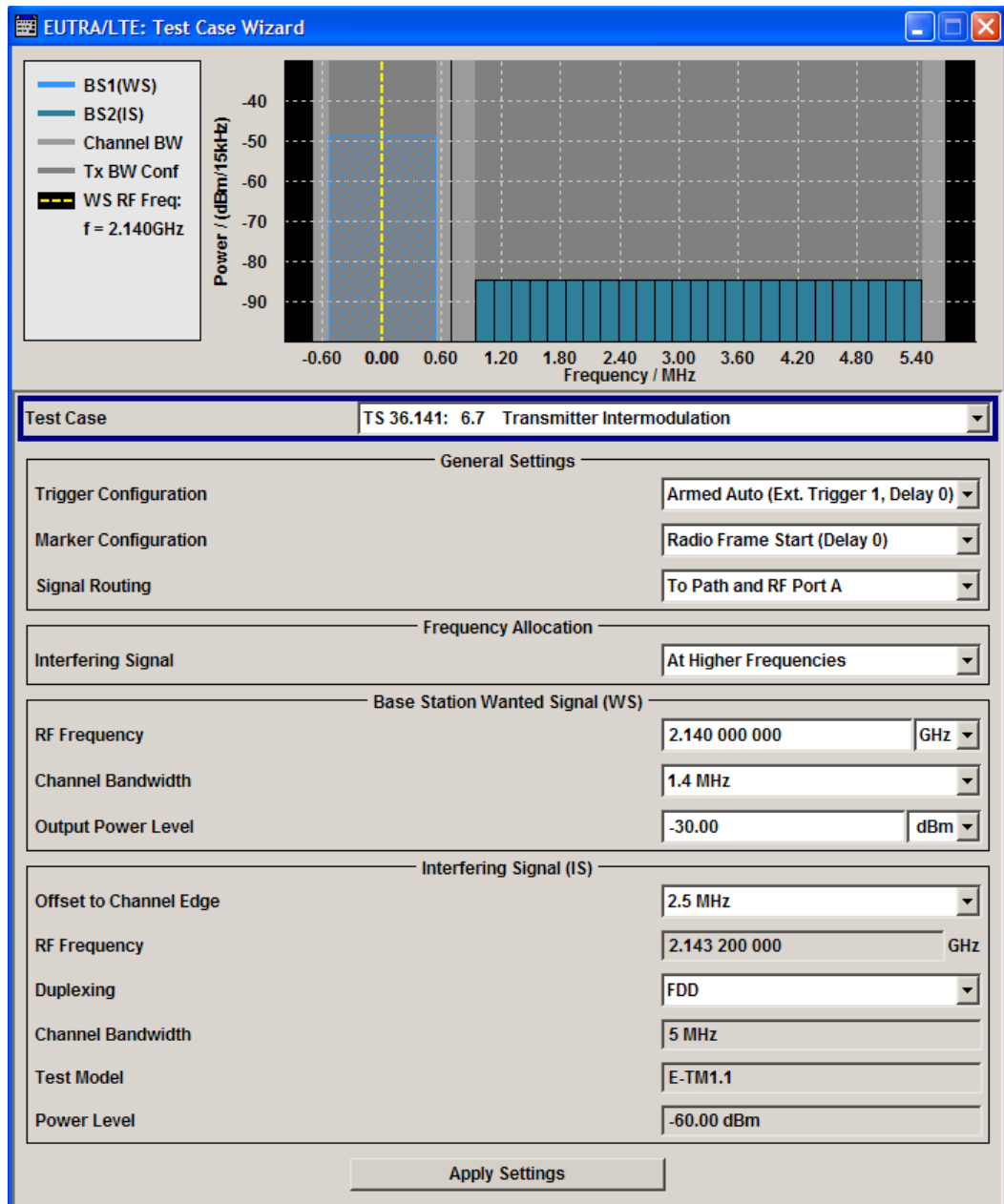


The following describes the general workflow, only the basic steps are listed.

For detailed description about working with the analyzer and the base station, refer to the corresponding description.

1. Set the base station to the basic state and configure it for the selected test case.
  - a) Initialize the base station,
  - b) Set the base station to test model E-TM1.1,
  - c) Set maximum transmit power,
  - d) Set the frequency.
2. Set the signal generator to the basic state
  - a) Preset the signal generator unless some settings (e.g. in terms of I/Q and RF blocks) have to be kept.
3. Set the analyzer to the basic state
4. Set the test case wizard
  - a) Select "Baseband Block > EUTRA/LTE > Test Case Wizard"
  - b) Select "Test Case 6.7: Transmitter Intermodulation".  
The parameters are preset according to TS 36.141
  - c) Adjust the settings of the wanted signal (RF level and Channel Bandwidth).
  - d) Enter the test frequency (e.g. M). It must be the same as the base station has been set to.
  - e) Enter the Interfering Signal parameters.
  - f) Activate the settings with the "Apply Settings" button.  
The signal generator is now ready to start signal generation
5. Set the analyzer to the measurement frequency and perform further necessary settings.  
Refer to the description of the analyzer for further information.
6. In the signal generator, switch on the RF output.
7. Start the measurement
  - a) Send a start trigger impulse from the base station to the signal generator and to the analyzer.  
  
The signal generator outputs the test model interfering signal; Measurement procedures are started.
8. Calculate the result  
The analyzer calculates the out-of-band emission and the spurious emission.

## User Interface

**Base Station Wanted Signal**

The common settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

**Output Power Level ← Base Station Wanted Signal**

Sets the output power level of the wanted signal. The power level of the interfering signal is always 30 dB lower than this level.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:OUPLevel on page 440

**Interfering Signal**

Comprises the settings of the interfering signal.

The interfering signal is an E-TM1.1 signal with 5 MHz channel bandwidth and center frequency relative to the carrier frequency of the wanted signal.

**Offset to Channel Edge ← Interfering Signal**

Defines the offset of the interfering signal center frequency relative to edge of the wanted channel bandwidth. This parameter determine the carrier frequency of the interfering signal (see [FR Frequency](#)).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:OCEdge on page 433

**FR Frequency ← Interfering Signal**

Displays the RF Frequency of the interfering signal, determined by the RF Frequency of the wanted signal and the selected [Offset to Channel Edge](#).

The RF Frequency<sub>interfering signal</sub> is calculated as follow:

- For "Frequency Allocation" set to "Interfering Signal at Higher Frequencies"  
"RF Frequency<sub>interfering signal</sub>" = "RF Frequency<sub>wanted signal</sub>" + Delta
- For "Frequency Allocation" set to "Interfering Signal at Lower Frequencies"  
"RF Frequency<sub>interfering signal</sub>" = "RF Frequency<sub>wanted signal</sub>" - Delta

Where for both cases **Delta** is calculated as follow:

$$\text{Delta} = \text{BW}_{\text{wanted signal}} / 2 + \text{Offset}_{\text{interfering signal}}$$

**Example:**

"BW<sub>wanted signal</sub>" = 1.4 MHz

"RF Frequency<sub>wanted signal</sub>" = 1 950 MHz

Offset<sub>interfering signal</sub> = 7.5 MHz

Delta =  $1.4/2 + 7.5 = 8.2$  MHz

For "Frequency Allocation" = "Interfering Signal at Higher Frequencies" the "RF Frequency<sub>interfering signal</sub>" =  $1\ 950 + 8.2 = 1\ 958.2$  GHz

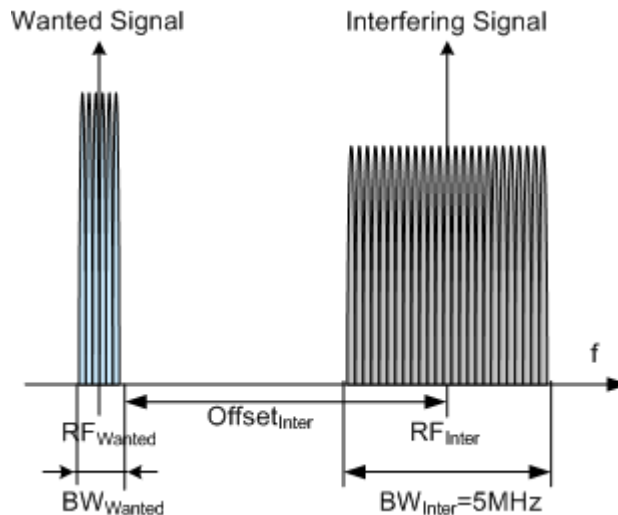


Fig. 8-7: Example: Offset to Channel Edge (Channel Bandwidth = 1.4 MHz)

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS:RFFrequency](#) on page 434

**Duplexing ← Interfering Signal**

Selects whether TDD or FDD duplexing mode is used.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS:DUPLex](#) on page 432

**Channel Bandwidth ← Interfering Signal**

Displays the channel bandwidth of the interfering signal. The value is fixed to 5 MHz.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS:CHBW](#) on page 432

**Test Model ← Interfering Signal**

Displays the test model. The interfering signal is generated according to E-TM1.1 test model.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS:TMODe1](#) on page 435

**Power Level ← Interfering Signal**

Displays the power level of the interfering signal. The power level is always 30 dB below the [Output Power Level](#) of the wanted signal.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:PLevel on page 434

## 8.8 Receiver Characteristics (TS 36.141, Chapter 7)

Most of the receiver tests can be performed with the signal generator only, i.e. without additional measurement equipment.

The receiver requirements are divided into the following main categories, intended to

- Prove the receiver's ability to receive the wanted signal:
  - [chapter 8.8.4, "Test Case 7.2: Reference Sensitivity Level"](#), on page 234
  - [chapter 8.8.5, "Test Case 7.3: Dynamic range"](#), on page 236
- Prove how susceptible the receiver is to different types of interfering signals:
  - [chapter 8.8.6, "Test Case 7.4: In-channel selectivity \(ICS\)"](#), on page 239
  - [chapter 8.8.7, "Test Case 7.5A: Adjacent Channel Selectivity \(ACS\)"](#), on page 242
  - [chapter 8.8.8, "Test Case 7.5B: Narrow-band blocking"](#), on page 244
  - [chapter 8.8.9, "Test Case 7.6: Blocking"](#), on page 247
  - [chapter 8.8.10, "Test Case 7.8: Receiver intermodulation"](#), on page 251

The several test cases shell cover a wide range of scenarios with different types of impairments on the wanted signal, that occur depending on the frequency offset between the wanted and the interfering signal.

### 8.8.1 Prior Considerations

**Fixed Reference Channels (FRC)**

The receiver tests use fixed reference channels (FRC) as defined in 3GPP TS 36.141, Annex A "Reference Measurement channels".

The following FRCs are defined for the receiver tests:

- FRC A1: A1-1 .. A1-5 (QPSK)
- FRC A2: A2-1 .. A2-3 (16QAM)



Refer to [table 7-8](#) for an overview of all supported FRC.

---

### Channels

According to the TS 36.141, the channels to test are located in the bottom (B), middle (M) and the top (T) of the supported frequency range of the base station. See [table 8-4](#) for an overview of the supported frequency operating bands.

### Channel Bandwidth of the LTE Interfering Signal

For all test cases using an interfering LTE signal, the bandwidth of the interfering signal shall be the same as the wanted signal, but at the most 5 MHz.

### Reference Sensitivity Power Level $P_{\text{REFSENS}}$

$P_{\text{REFSENS}}$  depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1. The [table 8-8](#) gives an overview of the resulting power levels for the wanted signal per test case.

*Table 8-8: BS reference sensitivity levels*

Channel Bandwidth, MHz	Reference sensitivity power level, $P_{\text{REFSENS}}$ , dBm	ACS Test Case Wanted signal mean power, dBm	Narrow-band Blocking/Blocking/Receiver Intermodulation Test Case Wanted signal mean power, dBm
1.4	-106.8	-95.9	-100.8
3	-103.0	-95.0	-97.0
5 /10 /15 /20	-101.5	-95.5	-95.5

### Power Settings

The "Level Reference" parameter in the "Filter/Clipping/Power Settings" dialog is automatically set to "Frame RMS Power" for FDD Duplexing Mode and to "UL Part of Frame RMS Power" for TDD Duplexing Mode.

### Filter Settings

The 3GPP EUTRA/LTE specifications do not define a standardized transmit filter neither for the UE nor for the base station. Therefore, when a test case is activated, a filter type EUTRA/LTE with "Best EVM Optimization" is automatically selected. An exception are the [Test Case 7.5A: Adjacent Channel Selectivity \(ACS\)](#) and the [Test Case 7.5B: Narrow-band blocking](#) where a "Best ACP Optimization" filter is applied for shaping the interfering signal.

## 8.8.2 General Workflow for Carrying Out a Receiver Test

The following instructions lists the general steps for performing a BS conformance test with the help of "Test Case Wizard". Specific requirements are described together with the individual test case.



For detailed description about the configuration of the base station, refer to the corresponding description.

1. Connect the R&S Signal Generator and the DUT according to the corresponding test case setup.  
See also [chapter 8.4, "Standard Test Setups"](#), on page 208.
2. Set the base station to the basic state
  - a) Initialize the base station
  - b) Set the frequency
  - c) Set the base station to receive the Fixed Reference Channel (for most receiver test cases)
3. Preset the signal generator to ensure a defined instrument state.
4. Configure the test case wizard
  - a) Select "Baseband Block > EUTRA/LTE > Test Case Wizard".
  - b) Choose the desired test case, e.g. "TS 36.141: 7.3 Dynamic Range".
  - c) Enter additional required parameters.
  - d) Enter the test frequency (e.g. M). It must be the same as the base station has been set to.
  - e) Activate the settings with the "Apply Settings" button.

The signal generator is now ready to start signal generation
5. Switch on RF output
6. If required, make additional settings (e.g. in the "I/Q Mod" or "RF" block) or change test case settings.
7. Start the measurement
  - a) Send a start trigger impulse from the base station to the signal generator.  
The signal generator will start signal generation.
8. Calculate the result  
The base station internally calculates the BER, BLER or Pd depending on the test case. This value is compared to the required value.

### 8.8.3 Interfering Signal Settings

The following settings are available for almost all receiver tests, requiring an interfering signal. Specific parameters are listed together with the description of the corresponding test case.

#### **Interferer Type**

(enabled for Blocking and Receiver Intermodulation tests)

Selects the type of the interfering signal:

- For **Blocking** tests, the interfering signal can be an in-band EUTRA/LTE signal or out-of-band CW signal.
- For **Receiver Intermodulation** tests, the first interfering signal can be an EUTRA/LTE signal or narrow-band EUTRA signal.  
The second interfering signal is always a CW signal.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:IFTYpe on page 433

### RF Frequency

Display the center frequency of the interfering signal.

The center frequency is calculated as follow:

- For "Frequency Allocation" set to "Wanted Signal at Lower Frequencies"  
"RF Frequency<sub>interfering signal</sub>" = "RF Frequency<sub>wanted signal</sub>" + Delta
- For "Frequency Allocation" set to "Wanted Signal at Higher Frequencies"  
"RF Frequency<sub>interfering signal</sub>" = "RF Frequency<sub>wanted signal</sub>" - Delta

Where for both cases Delta is calculated as follow:

$$\text{Delta} = \text{"Channel Bandwidth}_{\text{wanted signal}} / 2 + \text{Offset}_{\text{interfering signal}}$$

### Example:

$$\text{"Channel Bandwidth}_{\text{wanted signal}} = 5 \text{ MHz}$$

$$\text{"RF Frequency}_{\text{wanted signal}} = 1 \text{ 950 MHz}$$

$$\text{Offset}_{\text{interfering signal}} = 2.5025 \text{ MHz (see table 8-12)}$$

$$\text{Delta} = 5/2 + 2.5025 = 5.0025 \text{ MHz}$$

For "Frequency Allocation" = "Wanted Signal at Lower Frequencies" the "RF Frequency<sub>interfering signal</sub>" = 1 950 + 5.0025 = 1 955.0025 MHz

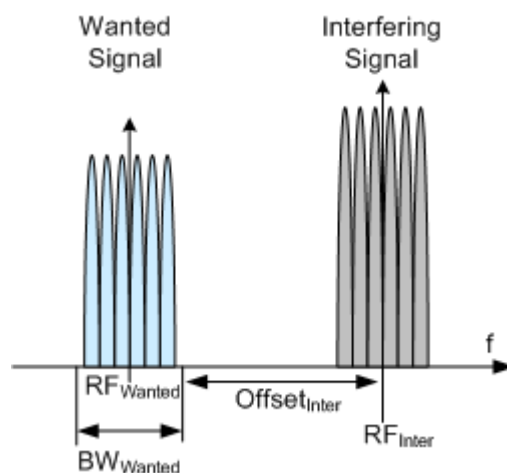


Fig. 8-8: Example: Adjacent Channel Selectivity (ACS), Channel BW = 1.4 MHz

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:RFFrequency on page 434



**Duplexing**

Selects whether TDD or FDD duplexing mode is used.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:IS:DUPLex on page 432

**TDD UL/DL Configuration**

For TDD mode, selects the UL/DL Configuration number.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:IS:TDDConfig on page 434

**Signal Advance N\_TA\_offset**

Sets the parameter  $N_{TAoffset}$  (see also "Signal Advance N\_TA\_offset" on page 197).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:IS:NTAOffset on page 433

**Channel Bandwidth**

Displays the channel bandwidth of the interfering signal. The interfering signal has the same bandwidth as the wanted signal, but at the most 5 MHz.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:IS:CHBW on page 432

**Cell ID**

Sets the Cell ID for the interfering signal.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:IS:CLID on page 432

**UE ID/n\_RNTI**

Sets the UE ID/n\_RNTI for the interfering signal.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:IS:UEID on page 435

**Number of Resource Blocks**

The number of RBs used by the LTE interfering signal is set automatically:

- For **ACS and In-channel Selectivity measurements**, the number of RBs depends on the selected channel bandwidth for the wanted signal. The bandwidth of the interfering signal is equal to the bandwidth allocated for the wanted signal, but at the most 5 MHz.
- For **Narrow-band Blocking** tests, the interfering signal is a single resource block LTE signal.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:IS:NRBlock on page 433

**Offset VRB**

(Test Case 7.4 and 7.5 only)

The position of the RBs allocated by the LTE interfering signal is determined automatically, depending on the selected "Channel Bandwidth" and the RBs allocation of the wanted signal.

- For **in-channel testing**, the parameter "Offset VRB" is used to allocate the wanted and the interfering signal around the center frequency (see also [figure 8-9](#)).
- For **ACS testing**, the "Offset VRB" is fixed to 0.
- For **narrow band blocking testing**, the "Offset VRB" is set in the way, that depending on the "Frequency Allocation" of the interfering signal, the narrow-band LTE interfering signal is allocated at the most left or the most right subcarrier in the allocated channel bandwidth

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:OVRB on page 434

### Frequency Shift m

(Test Case 7.5 only)

By default, the narrow-band LTE interfering signal is allocated at the most left (interfering signal at higher frequencies)/ most right (interfering signal at lower frequencies) subcarrier in the allocated channel bandwidth. However, the position of the interfering signal can be set by means of the parameter "Frequency Shift m", i.e. the allocated RB can be offset to a different center frequency (see [figure 8-10](#)).

The parameter [Interfering RB Center Frequency](#) displays the center frequency of the resource block the interfering signal is currently allocated on.

The value range of the parameter depends on the selected "Channel Bandwidth", as defined in [table 8-13](#).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:FRSHift on page 432

### Interfering RB Center Frequency

(for Narrow-band Block tests only)

Displays the center frequency of the single resource block interfering signal (see also [figure 8-10](#)).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:RBCFrequency on page 434

### Power Level

The power level of the interfering LTE signal is set automatically depending on the selected channel bandwidth.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:PLevel on page 434

## 8.8.4 Test Case 7.2: Reference Sensitivity Level

### Test Purpose

To verify that at the BS Reference sensitivity level the throughput requirement shall be met for a specified reference measurement channel [6].

**Required Options**

See [chapter 8.2, "Basic Configuration"](#), on page 206.

**Test Setup**

See [chapter 8.4.1, "Standard Test Setup - One Path"](#), on page 208

**Short Description**

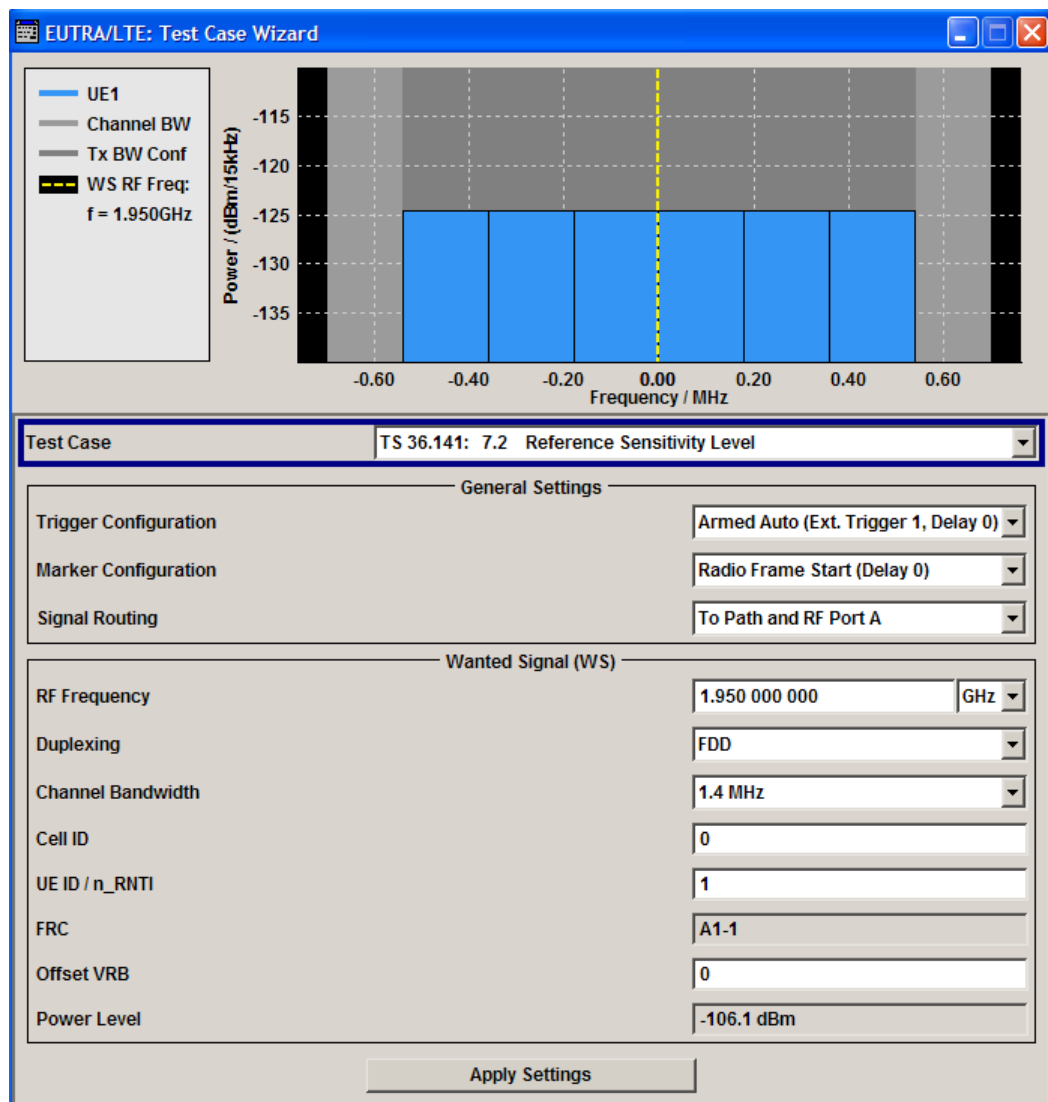
The reference sensitivity level measurement is a test case that aims to verify the Noise Figure of the receivers. The test case uses FRCs with QPSK modulation.

The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated; the position of the allocated RBs within the selected channel bandwidth can be adjusted by means of the parameter "Offset VRB".

For the parameter in the [table 8-9](#) the throughput measured shall be equal or greater than 95%.

**Table 8-9: Reference sensitivity levels**

Channel Bandwidth, MHz	Reference Measurements Channel	Reference sensitivity power level $P_{\text{REFSENS}}$ , dBm
1.4	FRC A1-1	-106.1
3	FRC A1-2	-102.3
5 / 10 / 15 / 20	FRC A1-3	-100.8



The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

### 8.8.5 Test Case 7.3: Dynamic range

#### Test Purpose

To verify that at the BS receiver dynamic range, the relative throughput shall fulfil the specified limit [6].

#### Required Options

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Option Additive White Gaussian Noise AWGN (R&S SMx-K62)

### Test Setup

See [chapter 8.4.1, "Standard Test Setup - One Path"](#), on page 208

### Short Description

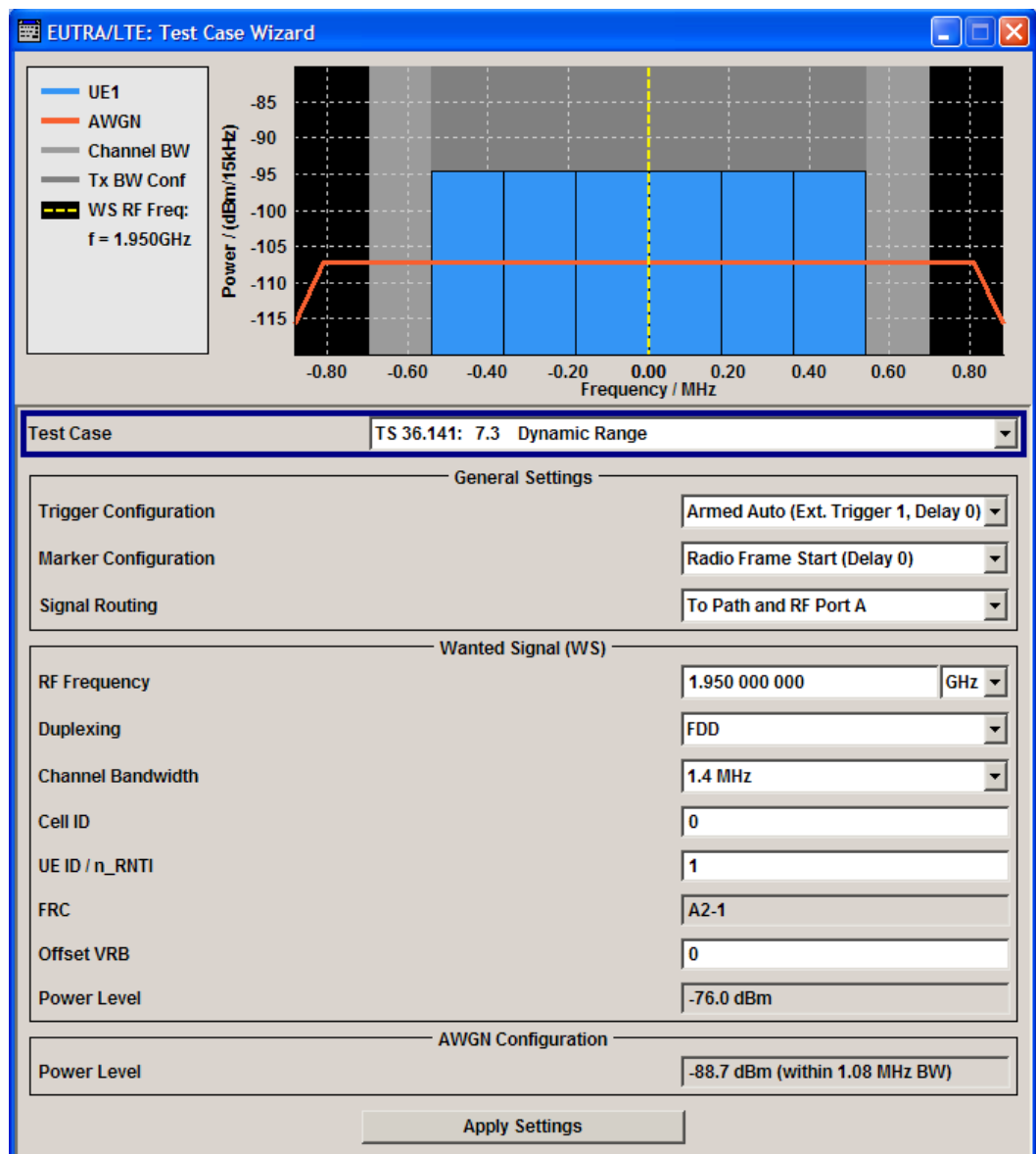
The dynamic range test case aims to stress the receiver and measure its capability to demodulate the useful signal even in the presence of a heavy interfering signal inside the received channel bandwidth. The test case uses FRCs with 16QAM modulation. The throughput measurements are performed for different level of the wanted and the interfering AWGN signals.

The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated; the position of the allocated RBs within the selected channel bandwidth can be adjusted by means of the parameter "Offset VRB".

For the parameter in the [table 8-9](#) the throughput shall be equal or greater than 95%.

**Table 8-10: Dynamic range**

Channel Bandwidth, MHz	Reference Measurements Channel	Wanted signal mean power, dBm	Interfering signal mean power, dBm / $BW_{Config}$	Type of interfering signal
1.4	FRC A2-1	-76.0	-88.7	AWGN
3	FRC A2-2	-72.1	-84.7	AWGN
5	FRC A2-3	-69.9	-82.5	AWGN
10	FRC A2-3	-69.9	-79.5	AWGN
15	FRC A2-3	-69.9	-77.7	AWGN
20	FRC A2-3	-69.9	-76.4	AWGN



The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

### AWGN Configuration

Comprises the settings of the interfering signal.

### Power Level ← AWGN Configuration

Displays the power level of the AWGN signal. The value is set automatically according to [table 8-10](#) and depending on the selected [Channel Bandwidth](#).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:AWGN:PLLevel on page 430

## 8.8.6 Test Case 7.4: In-channel selectivity (ICS)

### Test Purpose

The purpose of this test is to verify the BS receiver ability to suppress the IQ leakage [6].

### Required Options

The required options depend on whether the test will be performed with an instrument equipped with one or two paths.

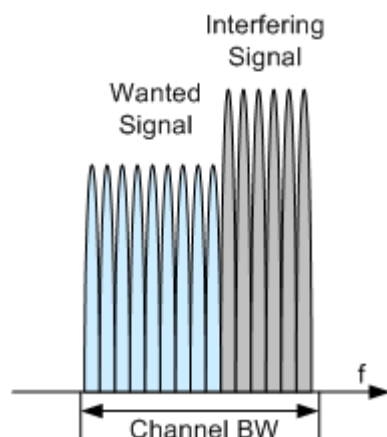
- Instrument equipped with one path, e.g. R&S SMU/SMJ/SMATE/SMBV:  
See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Instrument equipped with two paths, e.g. R&S SMU/SMATE:
  - See [chapter 8.2, "Basic Configuration"](#), on page 206.
  - Option Second RF path (R&S SMx-B20x)
  - Second Option Baseband Generator (R&S SMx-B10)
  - Second Option Baseband Main Module (R&S SMx-B13)
  - Second Option Digital Standard EUTRA/LTE (R&S SMx-K55)

### Test Setup

See [chapter 8.4.1, "Standard Test Setup - One Path"](#), on page 208 or [chapter 8.4.2, "Standard Test Setup - Two Paths"](#), on page 209

### Short Description

In-channel selectivity (ICS) is a measure of the receiver ability to receive a "weak" wanted signal at its assigned Resource Block locations in the presence of a "strong" interfering signal. The interfering signal shall be an EUTRA/LTE signal with the same bandwidth as the wanted signal, but at the most 5 MHz. The wanted and the interfering signal are allocated around the center frequency (see [figure 8-9](#)); to swap the position of the wanted and interfering signal, use the parameter "Frequency Allocation".



**Fig. 8-9: Example: In-channel selectivity (ICS), Channel BW = 3 MHz, Frequency Allocation = Lower Frequency**

The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated.

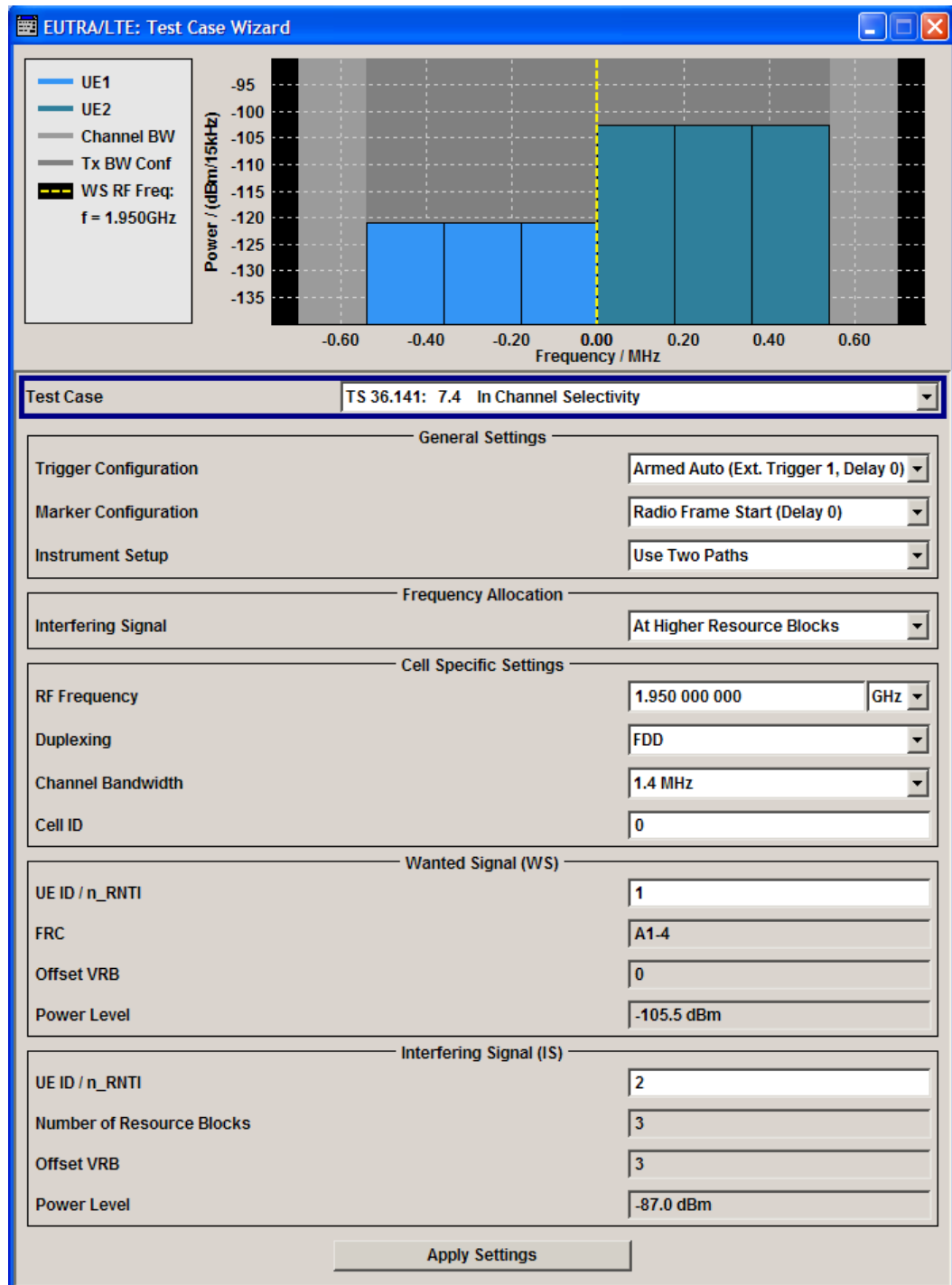
For the parameter in the [table 8-11](#) the throughput shall be equal or greater than 95%.

**Table 8-11: In-channel selectivity**

Channel Bandwidth, MHz	Reference Measurements Channel	Wanted signal mean power, dBm	Interfering signal mean power, dBm / $BW_{Config}$	Type of interfering signal
1.4	FRC A1-4	-105.5	-87	1.4 MHz EUTRA signal, 3 RBs
3	FRC A1-5	-100.7	-84	3 MHz EUTRA signal, 6 RBs
5	FRC A1-2	-98.6	-81	5 MHz EUTRA signal, 10 RBs
10	FRC A1-3	-97.1	-77	10 MHz EUTRA signal, 25 RBs
15	FRC A1-3	-97.1	-77	15 MHz EUTRA signal, 25 RBs <sup>*</sup>
20	FRC A1-3	-97.1	-77	20 MHz EUTRA signal, 25 RBs <sup>*</sup>

<sup>\*</sup>) Wanted and interfering signal are placed adjacently around the carrier frequency





The cell specific settings and the settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

Refer to [chapter 8.8.3, "Interfering Signal Settings"](#), on page 231 for description of the corresponding settings.

## 8.8.7 Test Case 7.5A: Adjacent Channel Selectivity (ACS)

### Test Purpose

To verify the ability of the BS receiver filter to suppress interfering signals in the channels adjacent to the wanted channel [6].

### Required Options

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Option Second RF path (R&S SMx-B20x)
- Second Option Baseband Generator (R&S SMx-B10)
- Second Option Baseband Main Module (R&S SMx-B13)
- Second Option Digital Standard EUTRA/LTE (R&S SMx-K55)

### Test Setup

See [chapter 8.4.2, "Standard Test Setup - Two Paths"](#), on page 209

### Short Description

The Adjacent Channel Selectivity (ACS) is a test case intended to verify that a BS receiver is able to demodulate a "weak" useful signal being superimposed by a "strong" interfering signal in the adjacent channel.

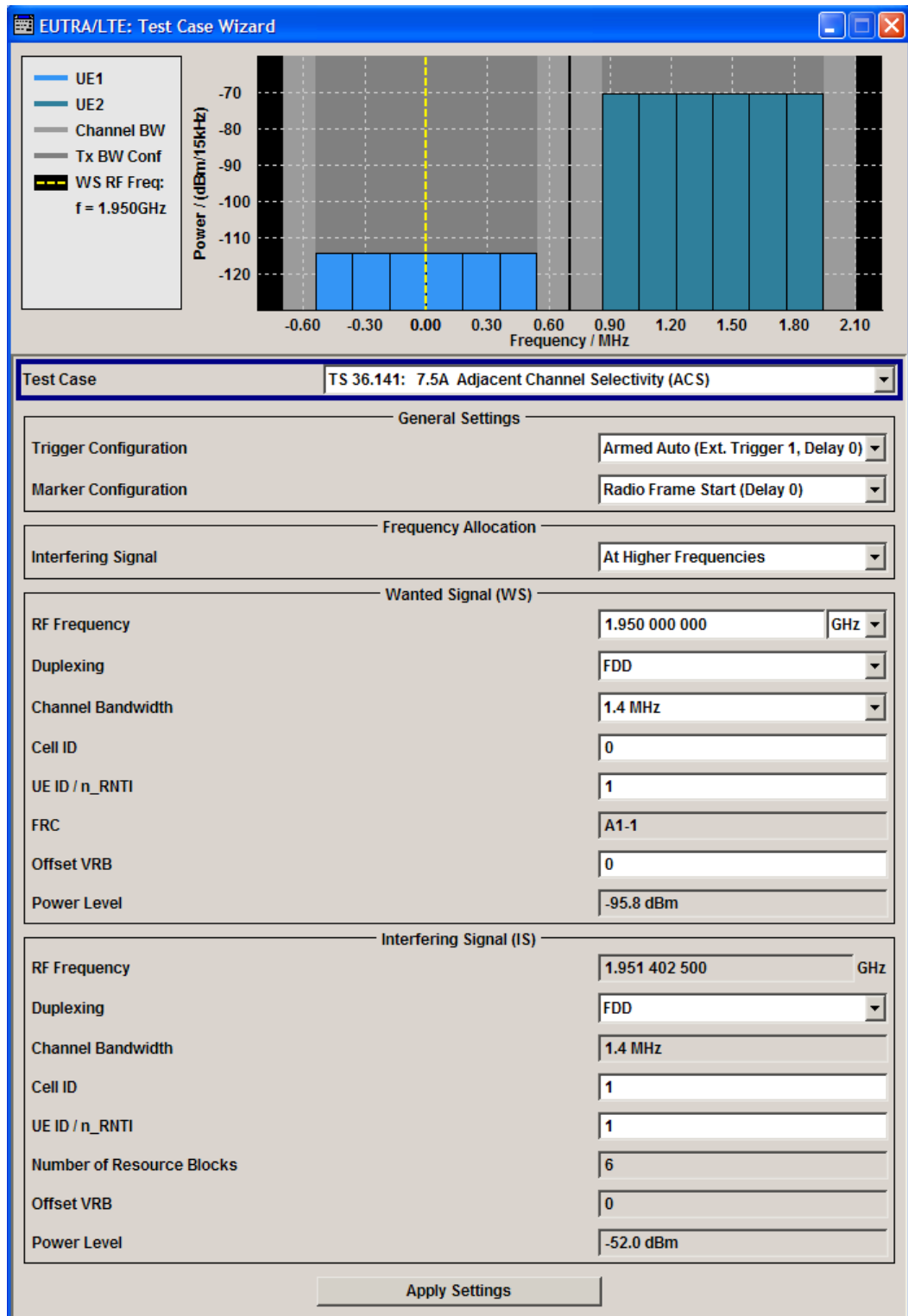
The wanted signal is a reference measurement channel FRC A1. The interfering signal shall be an EUTRA/LTE signal with the same bandwidth as the wanted signal, but at the most 5 MHz and a specified center frequency offset (see [figure 8-8](#)). The test shall be done on three channels (B, M and T).

For the parameter in the [table 8-12](#) the throughput shall be equal or greater than 95%.

**Table 8-12: Adjacent channel selectivity**

Channel Bandwidth, MHz	Wanted signal mean power, dBm	Interfering signal mean power, dBm	Interfering signal center frequency offset from the channel edge of the wanted signal, MHz	Type of interfering signal
1.4	$P_{\text{REFSENS}} + 11\text{dB}$	-52	0.7025	1.4 MHz EUTRA signal, 3 RBs
3	$P_{\text{REFSENS}} + 8\text{dB}$	-52	1.5075	3 MHz EUTRA signal, 6 RBs
5	$P_{\text{REFSENS}} + 6\text{dB}$	-52	2.5025	5 MHz EUTRA signal, 10 RBs
10	$P_{\text{REFSENS}} + 6\text{dB}$	-52	2.5075	10 MHz EUTRA signal, 25 RBs
15	$P_{\text{REFSENS}} + 6\text{dB}$	-52	2.5125	15 MHz EUTRA signal, 25 RBs
20	$P_{\text{REFSENS}} + 6\text{dB}$	-52	2.5025	20 MHz EUTRA signal, 25 RBs

$P_{REFSENS}$  depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1 (see table 8-8).



The settings of the wanted signal are described in chapter 8.6.2, "Wanted Signal and Cell Specific Settings", on page 218.

Refer to [chapter 8.8.3, "Interfering Signal Settings"](#), on page 231 for description of the corresponding settings.

### 8.8.8 Test Case 7.5B: Narrow-band blocking

#### Test Purpose

To verify the ability of the BS receiver filter to suppress interfering signals in the channels adjacent to the wanted channel [6].

#### Required Options

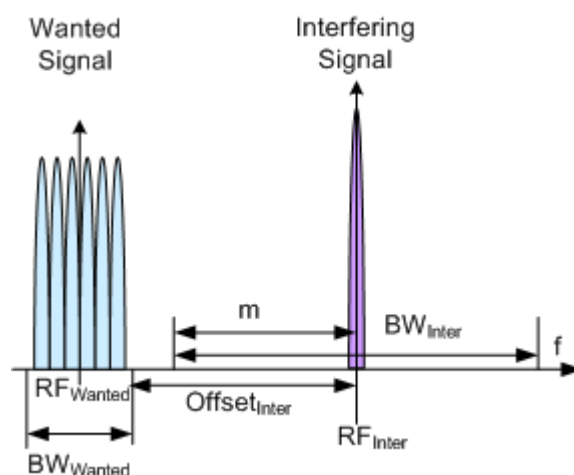
- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Option Second RF path (R&S SMx-B20x)
- Second Option Baseband Generator (R&S SMx-B10)
- Second Option Baseband Main Module (R&S SMx-B13)
- Second Option Digital Standard EUTRA/LTE (R&S SMx-K55)

#### Test Setup

See [chapter 8.4.2, "Standard Test Setup - Two Paths"](#), on page 209

#### Short Description

The Narrow-band Blocking is a test case intended to verify that a BS receiver is able to demodulate a "weak" useful signal being superimposed by a "strong" narrow-band interfering signal in the adjacent channel. The wanted signal is a reference measurement channel FRC A1. The interfering signal is a single resource block EUTRA/LTE signal in a channel with the same bandwidth as the wanted signal, but at the most 5 MHz. The interfering signal is located at a specified center frequency offset and adjacently to the channel edge of the wanted signal (see [figure 8-10](#)).



**Fig. 8-10: Example: Narrow-band Blocking**

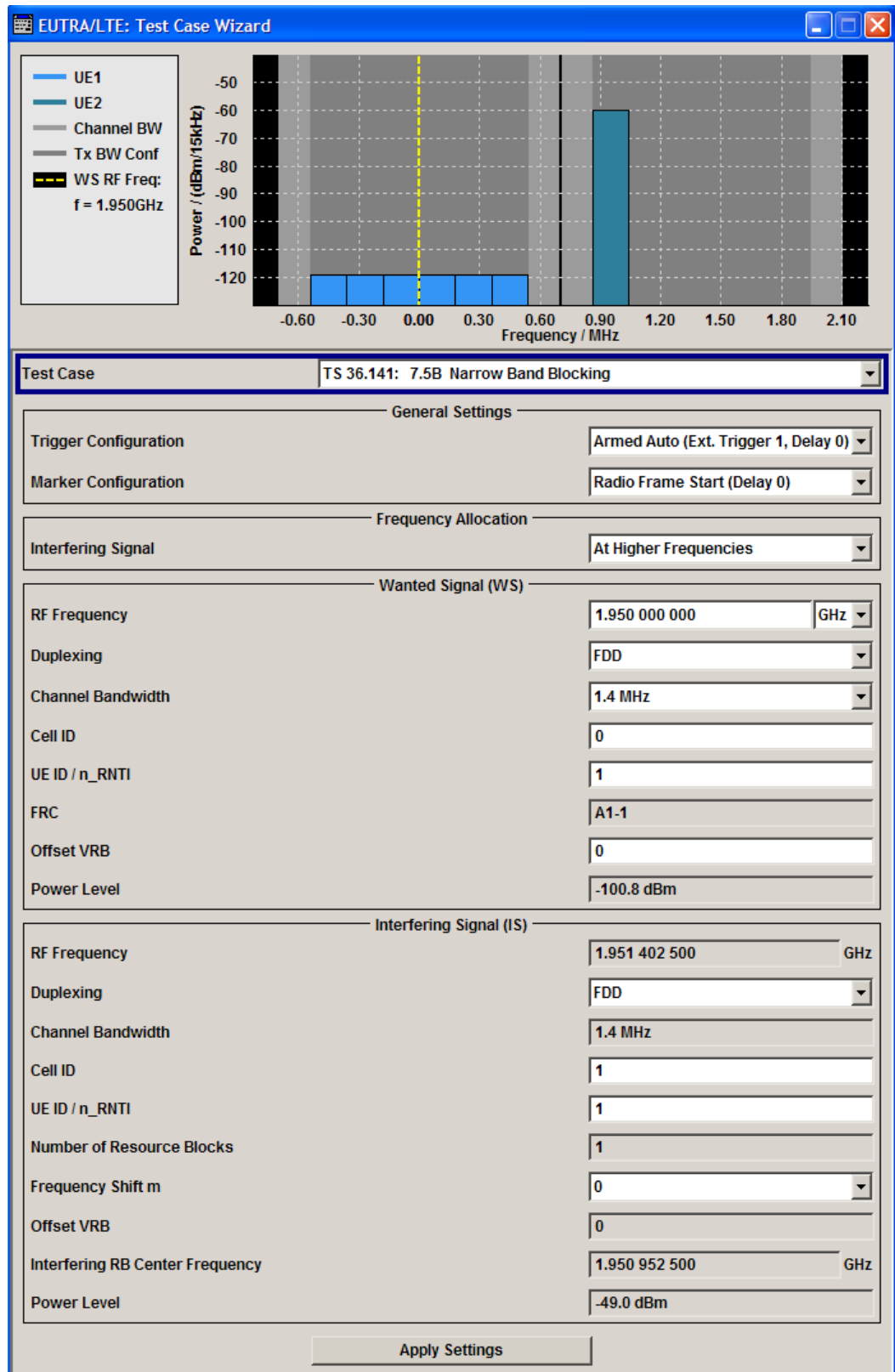
The test shall be done on three channels (B, M and T).

For the parameter in the [table 8-13](#) the throughput shall be equal or greater than 95%.

**Table 8-13: Interfering signal for Narrowband blocking requirement**

Channel Bandwidth, MHz	Wanted signal mean power, dBm	Interfering signal mean power, dBm	Interfering RB center frequency offset to the channel edge of the wanted signal, kHz	Type of interfering signal
1.4	$P_{\text{REFSENS}} + 6\text{dB}$	-49	252.5+m*180, m=0, 1, 2, 3, 4, 5	1.4 MHz EUTRA signal, 1 RB
3			247.5+m*180, m=0, 1, 2, 3, 4, 7, 10, 13	3 MHz EUTRA signal, 1 RB
5 / 10 / 15 / 20			342.5+m*180, m=0, 1, 2, 3, 4, 9, 14, 19, 24	5 MHz EUTRA signal, 1 RB

$P_{\text{REFSENS}}$  depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1 (see [table 8-8](#)).



The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

Refer to [chapter 8.8.3, "Interfering Signal Settings"](#), on page 231 for description of the corresponding settings.

## 8.8.9 Test Case 7.6: Blocking

### Test Purpose

The test stresses the ability of the BS receiver to withstand high-level interference from unwanted signals at specified frequency offsets without undue degradation of its sensitivity [6].

### Required Options

The following options are sufficient for tests with **CW interfering signal**:

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Option Second RF path (R&S SMx-B20x)

Additionally, the following options are necessary for tests with **LTE interfering signal**:

- Second Option Baseband Generator (R&S SMx-B10)
- Second Option Baseband Main Module (R&S SMx-B13)
- Second Option Digital Standard EUTRA/LTE (R&S SMx-K55)

### Test Setup

The blocking test using a EUTRA/LTE interfering signal can be performed with one instrument, see [chapter 8.4.2, "Standard Test Setup - Two Paths"](#), on page 209. This setup can also be used for the CW interfering signal case but only for the CW signals with up to 3 GHz or 6 GHz carrier, depending on the installed option. For tests with CW with frequency greater than 6 GHz a second signal generator is necessary, like R&S SMF for instance.

### Short Description

The blocking characteristics is a test case that verifies the ability of the receiver to demodulate a wanted signal in the presence of a strong interfering signal. The test is split into two scenarios:

- Test of in-band blocking, performed with an LTE interfering signal inside the operating band (see [table 8-4](#)), but not adjacent to the wanted signal.
- Test of out-of-band blocking, performed with a CW interfering signal with 1 MHz up to 12.750 GHz.

There is an additional (optional) blocking requirements for co-location with other base station.

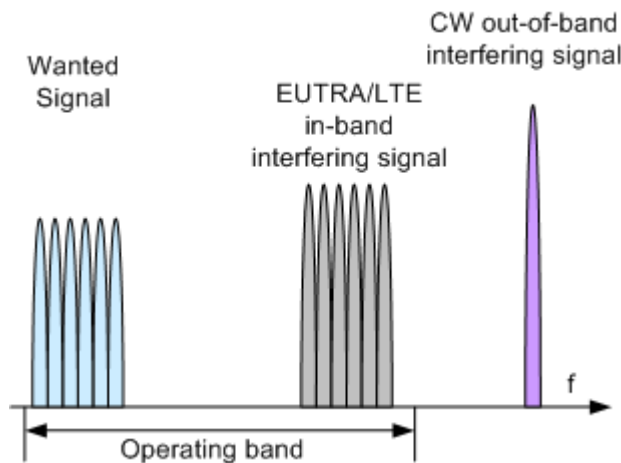


Fig. 8-11: Example: Blocking

The test shall be done on one channel (M).

For the parameter in the [table 8-14](#) the throughput shall be equal or greater than 95%.

Table 8-14: Blocking performance requirement

Operating Band	Center Frequency of Interfering Signal, MHz	Interfering Signal mean power, dBm	Wanted Signal mean power, dBm	Type of Interfering Signal
1-7, 9-11, 13-14, 33-40	$(F_{UL\_low} - 20)$ to $(F_{UL\_high} + 20)$	-43	$P_{REFSENS} + 6dB$	EUTRA/LTE*
	1 to $(F_{UL\_low} - 20)$ $(F_{UL\_high} + 20)$ to 12750	-15	$P_{REFSENS} + 6dB$	CW
8	$(F_{UL\_low} - 20)$ to $(F_{UL\_high} + 10)$	-43	$P_{REFSENS} + 6dB$	EUTRA/LTE*
	1 to $(F_{UL\_low} - 20)$ $(F_{UL\_high} + 10)$ to 12750	-15	$P_{REFSENS} + 6dB$	CW
12	$(F_{UL\_low} - 20)$ to $(F_{UL\_high} + 12)$	-43	$P_{REFSENS} + 6dB$	EUTRA/LTE*
	1 to $(F_{UL\_low} - 20)$ $(F_{UL\_high} + 12)$ to 12750	-15	$P_{REFSENS} + 6dB$	CW
17	$(F_{UL\_low} - 20)$ to $(F_{UL\_high} + 18)$	-43	$P_{REFSENS} + 6dB$	EUTRA/LTE*
	1 to $(F_{UL\_low} - 20)$ $(F_{UL\_high} + 18)$ to 12750	-15	$P_{REFSENS} + 6dB$	CW
	*) see <a href="#">table 8-15</a>			



**Table 8-15: EUTRA/LTE interfering signals for Blocking performance requirement**

Channel Bandwidth, MHz	Interfering signal center frequency minimum offset to the channel edge of the wanted signal, MHz	Type of interfering signal
1.4	2.1	1.4 MHz EUTRA signal
3	4.5	3 MHz EUTRA signal
5 / 10 / 15 / 20	7.5	5 MHz EUTRA signal

$P_{\text{REFSENS}}$  depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1 (see [table 8-8](#)).

EUTRA/LTE: Test Case Wizard

- UE1
- UE2
- Channel BW
- Tx BW Conf
- WS RF Freq:  
f = 1.950GHz

Test Case
TS 36.141: 7.6 Blocking

General Settings

Trigger Configuration

Armed Auto (Ext. Trigger 1, Delay 0)

Marker Configuration

Radio Frame Start (Delay 0)

Wanted Signal (WS)

RF Frequency	1.950 000 000	GHz
Duplexing	FDD	
Channel Bandwidth	1.4 MHz	
Cell ID	0	
UE ID / n_RNTI	1	
FRC	A1-1	
Offset VRB	0	
Power Level	-100.8 dBm	

Interfering Signal (IS)

Interferer Type	Eutra	
RF Frequency	1.952 000 000	GHz
Duplexing	FDD	
Channel Bandwidth	1.4 MHz	
Cell ID	1	
UE ID / n_RNTI	1	
Number of Resource Blocks	6	
Power Level	-43.0 dBm	

Interfering Signal (IS)	
Interferer Type	CW
Test Requirement	Blocking Performance
RF Frequency	1.952 000 000 GHz
Power Level	-15.0 dBm

The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

### Interfering Signal

The common settings of the interfering signal are described in [chapter 8.8.3, "Interfering Signal Settings"](#), on page 231.

### Test Requirement

For CW interfering signal, selects whether the standard out-of-band blocking requirements test is performed or the optional blocking scenario, when the BS is co-located with another BS in a different operating band.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:TREquire` on page 435

## 8.8.10 Test Case 7.8: Receiver intermodulation

### Test Purpose

The test purpose is to verify the ability of the BS receiver to inhibit the generation of intermodulation products in its non-linear elements caused by the presence of two high-level interfering signals at frequencies with a specific relationship to the frequency of the wanted signal [6].

### Required Options

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Option Additive White Gaussian Noise AWGN (R&S SMx-K62)
- Option Second RF path (R&S SMx-B20x)
- Second Option Baseband Generator (R&S SMx-B10)
- Second Option Baseband Main Module (R&S SMx-B13)
- Second Option Digital Standard EUTRA/LTE (R&S SMx-K55)

### Test Setup

See [chapter 8.4.2, "Standard Test Setup - Two Paths"](#), on page 209.

### Short Description

The receiver intermodulation test is a test scenario with two interfering signals, one CW and one EUTRA/LTE signal. The center frequency of the interfering signals is selected so that the third and higher order mixing products falls inside of the band of the wanted

signal. There is also a second narrow-band intermodulation scenarios defined, where the EUTRA/LTE interfering signal is a narrow-band signal with single resource block allocation and the CW interfering signal is placed very close to the wanted one.

The test shall be done on three channels (B, M and T).

For the parameter in the [table 8-16](#) and [table 8-17](#) the throughput shall be equal or grater than 95%.

**Table 8-16: Intermodulation performance requirement**

Channel Band-width, MHz	Wanted signal mean power, dBm	Interfering signal mean power, dBm	Interfering signal center frequency offset from the channel edge of the wanted signal, MHz	Type of interfering signal
1.4	$P_{\text{REFSENS}} + 6\text{dB}$	-52	2.1	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	4.9	1.4 MHz EUTRA signal
3	$P_{\text{REFSENS}} + 6\text{dB}$	-52	4.5	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	10.5	3 MHz EUTRA signal
5	$P_{\text{REFSENS}} + 6\text{dB}$	-52	7.5	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	17.5	5 MHz EUTRA signal
10	$P_{\text{REFSENS}} + 6\text{dB}$	-52	7.5	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	17.7	5 MHz EUTRA signal
15	$P_{\text{REFSENS}} + 6\text{dB}$	-52	7.5	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	18	5 MHz EUTRA signal
20	$P_{\text{REFSENS}} + 6\text{dB}$	-52	7.5	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	18.2	5 MHz EUTRA signal

**Table 8-17: Narrow-band intermodulation performance requirement**

Channel Band-width, MHz	Wanted signal mean power, dBm	Interfering signal mean power, dBm	Interfering signal center frequency offset from the channel edge of the wanted signal, kHz	Type of interfering signal
1.4	$P_{\text{REFSENS}} + 6\text{dB}$	-52	270	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	790	1.4 MHz EUTRA signal, 1 RB
3	$P_{\text{REFSENS}} + 6\text{dB}$	-52	275	CW

Channel Bandwidth, MHz	Wanted signal mean power, dBm	Interfering signal mean power, dBm	Interfering signal center frequency offset from the channel edge of the wanted signal, kHz	Type of interfering signal
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	790	3 MHz EUTRA signal, 1 RB
5	$P_{\text{REFSENS}} + 6\text{dB}$	-52	360	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	1060	5 MHz EUTRA signal, 1 RB
10	$P_{\text{REFSENS}} + 6\text{dB}$	-52	415	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	1420	5 MHz EUTRA signal, 1 RB
15	$P_{\text{REFSENS}} + 6\text{dB}$	-52	380	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	1600	5 MHz EUTRA signal, 1 RB
20	$P_{\text{REFSENS}} + 6\text{dB}$	-52	345	CW
	$P_{\text{REFSENS}} + 6\text{dB}$	-52	1780	5 MHz EUTRA signal, 1 RB

$P_{\text{REFSENS}}$  depends on the channel bandwidth as specified in TS 36.104 [9], subclause 7.2.1 (see [table 8-8](#)).

EUTRA/LTE: Test Case Wizard

<ul style="list-style-type: none"> <li><span style="color: blue;">—</span> UE1</li> <li><span style="color: teal;">—</span> UE2</li> <li><span style="color: orange;">—</span> CW Interferer</li> <li><span style="color: gray;">—</span> Channel BW</li> <li><span style="color: gray;">—</span> Tx BW Conf</li> <li><span style="color: yellow; border-bottom: 1px dashed yellow;">—</span> WS RF Freq: f = 1.950GHz</li> </ul>	
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--

Test Case TS 36.141: 7.8 Receiver Intermodulation

General Settings

Trigger Configuration	Armed Auto (Ext. Trigger 1, Delay 0)
Marker Configuration	Radio Frame Start (Delay 0)

Frequency Allocation

Interfering Signals	At Higher Frequencies
---------------------	-----------------------

Wanted Signal (WS)

RF Frequency	1.950 000 000 GHz
Duplexing	FDD
Channel Bandwidth	1.4 MHz
Cell ID	0
UE ID / n_RNTI	1
FRC	A1-1
Offset VRB	0
Power Level	-100.8 dBm

Interfering Signal 1

Interferer Type	Eutra
RF Frequency	1.955 600 000 GHz
Duplexing	FDD
Channel Bandwidth	1.4 MHz
Cell ID	1
UE ID / n_RNTI	1
Number of Resource Blocks	6
Power Level	-52.0 dBm

Interfering Signal 2

Interferer Type	CW
RF Frequency	1.952 800 000 GHz
Power Level	-52.0 dBm

The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

Refer to [chapter 8.8.3, "Interfering Signal Settings"](#), on page 231 for description of the corresponding settings.

## 8.9 Performance Requirements (TS 36.141, Chapter 8)

The BS RF performance requirements are divided into three main groups:

- Performance requirements for PUSCH, see
  - [chapter 8.9.3, "Test Case 8.2.1: PUSCH in multipath fading propagation conditions"](#), on page 259
  - [chapter 8.9.4, "Test Case 8.2.2: UL timing adjustment"](#), on page 262
  - [chapter 8.9.5, "Test Case 8.2.3: HARQ-ACK multiplexed on PUSCH"](#), on page 267
  - [chapter 8.9.6, "Test Case 8.2.4: High Speed Train conditions"](#), on page 269
- Performance requirements for PUCCH
  - [chapter 8.9.7, "Test Case 8.3.1: ACK missed detection for single user PUCCH format 1a"](#), on page 273
  - [chapter 8.9.8, "Test Case 8.3.2: CQI missed detection for PUCCH format 2"](#), on page 275
  - [chapter 8.9.9, "Test Case 8.3.3: ACK missed detection for multi user PUCCH format 1a"](#), on page 278
- Performance requirements for PRACH
  - [chapter 8.9.10, "Test Case 8.4.1: PRACH false alarm probability and missed detection"](#), on page 283

### 8.9.1 Prior Considerations

#### Fixed Reference Channels (FRC)

The receiver tests use fixed reference channels (FRC) as defined in 3GPP TS 36.141, Annex A "Reference Measurement channels".

The following FRCs are defined for the performance tests:

- FRC A3: A3-1 .. A3-7 (QPSK)
- FRC A4: A4-1 .. A4-8 (16QAM)
- FRC A5: A5-1 .. A5-7 (64QAM)
- FRC A7: A7-1 .. A7-6 (16QAM for UL timing adjustment)
- FRC A8: A8-1 .. A8-6 (QPSK for UL timing adjustment)



Refer to [table 7-8](#) for an overview of all supported FRC.

### Channels

According to the TS 36.141, the channels to test are located in the bottom (B), middle (M) and the top (T) of the supported frequency range of the base station. See [table 8-4](#) for an overview of the supported frequency operating bands.

### Power Settings

The "Level Reference" parameter in the "Filter/Clipping/Power Settings" dialog is automatically set to "UL Part of Frame RMS Power".

### Filter Settings

The 3GPP EUTRA/LTE specifications do not define a standardized transmit filter neither for the UE nor for the base station. Therefore, when a test case is activated, a filter type EUTRA/LTE with "Best EVM Optimization" is automatically selected.

### AWGN Power Level

The performance requirements tests are performed for a given SNR where the AWGN power level is determined per channel bandwidth and test case according to [table 8-18](#).

**Table 8-18: AWGN power level**

Channel bandwidth, MHz	AWGN power level PUSCH tests	AWGN power level PUCCH and PRACH tests
1.4	-92.7 dBm / 1.08 MHz	-98.7 dBm / 1.08 MHz
3	-88.7 dBm / 2.7 MHz	-85.7 dBm / 2.7 MHz
5	-86.5 dBm / 4.5 MHz	-83.5 dBm / 4.5 MHz
10	-83.5 dBm / 9 MHz	-80.5 dBm / 9 MHz
15	-81.7 dBm / 13.5 MHz	-78.7 dBm / 13.5 MHz
20	-80.4 dBm / 18 MHz	-77.4 dBm / 18 MHz

### SNR Correction Factor

The SNR correction factor is applied for **FRCs with not fully allocated RBs** and is calculated as follow:

$$SNR_{\text{CorrectionFactor}} = 10 \cdot \log_{10}(\# \text{Allocated RBs} / \# \text{Possible RBs}), \text{ dB}$$

**Table 8-19: SNR Correction Factor**

Channel Bandwidth, MHz	#Possible RBs	SNR <sub>CorrectionFactor</sub> , dB for FRC A3-1, A4-1, A4-2 and A5-1 with 1 allocated RB	SNR <sub>CorrectionFactor</sub> , dB PRACH Burst Format 0..3	SNR <sub>CorrectionFactor</sub> , dB PRACH Burst Format 4
1.4	6	-7.78	-0.13	-0.15
3	15	-11.76	-4.11	-4.13
5	25	-13.98	-6.33	-6.35
10	50	-16.99	-9.34	-9.36



Channel Bandwidth, MHz	#Possible RBs	SNR <sub>CorrectionFactor</sub> , dB for FRC A3-1, A4-1, A4-2 and A5-1 with 1 allocated RB	SNR <sub>CorrectionFactor</sub> , dB PRACH Burst Format 0.. 3	SNR <sub>CorrectionFactor</sub> , dB PRACH Burst For- mat 4
15	75	-18.75	-11.10	-11.13
20	100	-20.00	-12.34	-12.37

The wanted signal power level is calculated according to the following formula:

$$\text{Power Level}_{\text{WantedSignal}} = \text{Power Level}_{\text{AWGN}} + \text{SNR} + \text{SNR}_{\text{CorrectionFactor}}$$

#### Example: Test Case 8.2.1

"Channel Bandwidth" = 1.4 MHz

"Number of Rx Antennas" = 2

"Cyclic Prefix" = Normal

"Propagation Conditions" = EVA 5Hz

"FRC" = A3-1

"Fraction of maximum throughput" = 30%

According to [table 8-21](#) the SNR = -2.1 dB

According to [table 8-19](#) the SNR<sub>CorrectionFactor</sub> = -7.78 dB

According to [table 8-18](#) the Power Level<sub>AWGN</sub> = -92.7 dBm

$$\begin{aligned} \text{Power Level}_{\text{WantedSignal}} &= \text{Power Level}_{\text{AWGN}} + \text{SNR} + \text{SNR}_{\text{CorrectionFactor}} = -92.7 - 2.1 - 7.78 \\ &= -102.6 \text{ dB} \end{aligned}$$

#### HARQ-Feedback

Some of the performance requirements test cases require a feedback signal from the base station. The R&S Signal Generator equipped with the option R&S SMx-K69 is able to perform HARQ retransmissions and/or timing shifts according to the 3GPP specification.

Refer to [chapter 6, "Realtime Feedback for Closed Loop BS Tests"](#), on page 52 for explanation of the scope of this feature as well as for detailed description of the different feedback modes.

## 8.9.2 Realtime Feedback Configuration, AWGN and Propagation Condition Settings

### Realtime Feedback Configuration

Comprises the settings of the realtime feedback message and the feedback line.

### Realtime Feedback Mode ← Realtime Feedback Configuration

Determines the feedback mode.

- "Binary ACK/NACK" The ACK/NACK feedback is implemented as low/high voltage level on the feedback line connector.  
Timing Adjustments Feedback is not supported in this mode.
- "Serial" ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial protocol (see [chapter 6.2.2, "Serial Mode"](#), on page 54).
- "Serial 3x8" ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial commands, consisting of three serial packets (see [chapter 6.2.3, "Serial 3x8 Mode"](#), on page 54).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:MODE` on page 436

#### **Connector ← Realtime Feedback Configuration**

Determines the feedback line connector (LEVATT or USER1).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:CONnector` on page 436

#### **Additional User Delay ← Realtime Feedback Configuration**

Determines the point in time when the feedback can be sent to the instrument.

For more information see [chapter 6.3, "Timing Aspects"](#), on page 57.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:AUSDelay` on page 436

#### **Baseband Selector ← Realtime Feedback Configuration**

("Serial" and "Serial 3x8" mode only)

This parameter is required for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:BBSelector` on page 436

#### **Serial Rate ← Realtime Feedback Configuration**

(Serial and Serial 3x8 mode only)

Determines the bit rate of the serial transmission. Possible rates are 115.2 kbps, 1.6 Mbps and 1.92 Mbps.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:SERRate` on page 437

#### **ACK Definition ← Realtime Feedback Configuration**

("Binary ACK/NACK" mode only)

Determines whether a high or a low binary level on the feedback line connector represents an ACK.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:ACKDefinition` on page 436

**AWGN Configuration**

Comprises the settings of the AWGN signal.

**Power Level ← AWGN Configuration**

Displays the AWGN power level. The value is determined according to [table 8-18](#) by the selected channel bandwidth.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:AWGN:PLLevel` on page 430

**Propagation Conditions**

Selects a predefined multipath fading propagation conditions. The settings of the fading simulator are adjusted according to the corresponding channel model as defined in 3GPP TS 36.141, Annex B.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:WS:PROCondition` on page 441

### 8.9.3 Test Case 8.2.1: PUSCH in multipath fading propagation conditions

**Test Purpose**

The test shall verify the receiver's ability to achieve throughput under multipath fading propagation conditions for a given SNR [6].

**Required Options**

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Second Option Baseband Main Module (R&S SMU-B13)
- Frequency Options (R&S SMU-B20x: RF 100kHz - x GHz)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMU-K62)
- 2 Options Fading Simulator and Fading Simulator Extension (R&S SMU-B14/-B15)
- Option LTE closed loop BS Test (R&S SMU-K69)
- For test setups with four Rx antennas, a second generator is required. The required options are identical.

**Test Setup**

The test setup for PUSCH tests with two Rx antennas is performed according to [chapter 8.4.3, "Test Setup - Diversity Measurements"](#), on page 210.

The test setup with four Rx antennas require two two-paths instruments (e.g. two R&S SMU) and is performed according to [chapter 8.4.4, "Test Setup - Four Rx Antennas"](#), on page 210.

**Short Description**

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The throughput is measured by the base station under test and is

expressed as a fraction of maximum throughput for the FRC's. HARQ re-transmissions is assumed.

The characteristics of the wanted signal are adjust according to the pre-defined FRC and the test parameter given in [table 8-20](#).

**Table 8-20: Test parameters for testing PUSCH**

Parameter	Value
Maximum number of HARQ transmissions	4
RV sequence	0, 2, 3, 1, 0, 2, 3, 1
Uplink-downlink allocation for TDD	Configuration 1 (2:2)

The [table 8-21](#) shows an example of the test requirements (channel bandwidth 1.4 MHz). Similar requirements exist for the different FRCs, channel bandwidths and antenna configurations. Refer to 3GPP TS 36.141 for a detailed description of all test requirements.

**Table 8-21: Test requirements for PUSCH, 1.4 MHz Channel Bandwidth**

Cyclic prefix	Propagation conditions	FRC	Fraction of maximum throughput, %	SNR, dB 2 RX antennas	SNR, dB 4 RX antennas
Normal	EPA 5Hz	A3-2	30	-3.5	-6.0
			70	0.7	-2.5
		A4-3	70	11.2	7.7
	EVA 5Hz	A3-1	30	-2.1	-4.4
			70	2.4	-0.7
		A4-1	30	5.0	1.9
	EVA 70Hz	A3-2	30	-3.3	-5.7
			70	1.3	-2.1
		A4-3	30	4.6	1.4
	ETU 70Hz	A3-1	30	-1.6	-4.2
			70	3.5	-0.4
		ETU 300Hz	A3-1	30	-1.6
70	3.5			0.0	
Extended	ETU 70Hz	A4-2	30	5.4	2.2
			70	14.1	10.5

EUTRA/LTE: Test Case Wizard

Legend:

- UE1
- AWGN
- Channel BW
- Tx BW Conf
- WS RF Freq:  $f = 1.950\text{GHz}$

Test Case: TS 36.141: 8.2.1 PUSCH in Multipath Fading Propagation Conditions

General Settings

Trigger Configuration: Armed Auto (Ext. Trigger 1, Delay 0)

Marker Configuration: Radio Frame Start (Delay 0)

Number of RX Antennas: 2

Wanted Signal / Propagation Conditions

RF Frequency: 1.950 000 000 GHz

Duplexing: FDD

Channel Bandwidth: 1.4 MHz

Cell ID: 0

Cyclic Prefix: Normal

UE ID / n\_RNTI: 1

Propagation Conditions: EPA 5Hz

FRC: A3-2

Offset VRB: 0

Fraction of Max. Throughput: 30 %

Power Level: -96.2 dBm

Realtime Feedback Configuration

Realtime Feedback Mode: Serial

Connector: USER 1

Additional User Delay: 0.00 Subframes

Baseband Selector: 0

Serial Rate: 115.2 Kbps

AWGN Configuration

Power Level: -92.7 dBm (within 1.08 MHz BW)

Apply Settings

The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

**Fraction of Max. Throughput**

Selects the fraction of maximum throughput.

SCPI command:

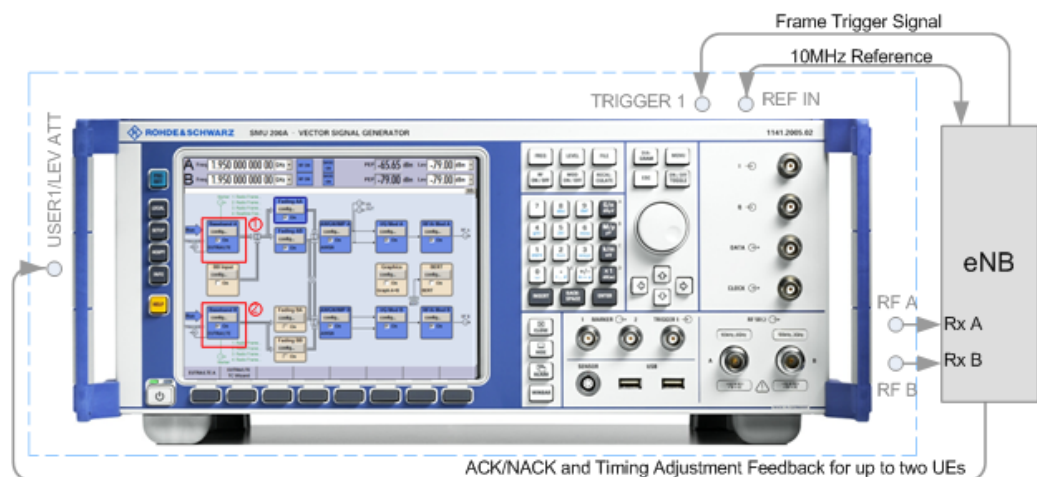
[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:FMThroughput on page 438

**8.9.4 Test Case 8.2.2: UL timing adjustment****Test Purpose**

The test shall verify the receiver's ability to achieve throughput measured for the moving UE at given SNR under moving propagation conditions [6].

**Required Options**

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Second Option Baseband Main Module (R&S SMU-B13)
- Frequency Options (R&S SMU-B20x: RF 100kHz - x GHz)
- Second Option Digital Standard EUTRA/LTE (R&S SMx-K55)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMU-K62)
- Options Fading Simulator, Fading Simulator Extension and MIMO (R&S SMU-B14/-B15/-K71/-K74)
- Option LTE closed loop BS Test (R&S SMU-K69)

**Test Setup**

**Fig. 8-12: Test Setup for test case 8.2.2 "UL Timing Adjustment"**

- 1 = Baseband A generates the signal of the stationary UE
- 2 = Baseband B generates the signal of the moving UE

### Short Description

For the UL timing adjustment test, the signal generator generated the signal of two user equipments (UEs); path A generates the signal of a moving UE and path B the signal of the stationary one. The throughput is measured by the base station under test.

The performance requirement of PUSCH is expressed as 70% of maximum throughput for the FRC measured for the moving UE at given SNR (see [table 8-23](#)). HARQ re-transmissions is assumed. The transmission of the sounding reference signal SRS is optional (see "[Transmit SRS](#)" on page 266).

Two moving propagation scenarios are defined; test with scenario 2 are optional. For detailed description of the moving propagation conditions, refer to the Operating Manual "Fading Simulator"

The characteristics of the wanted signal (transmitted by moving UE) are adjust according to the pre-defined FRC and the test parameter given in [table 8-22](#).

**Table 8-22: Test parameters for testing UL timing adjustment**

Parameter	Value
Maximum number of HARQ transmissions	4
RV sequence	0, 2, 3, 1, 0, 2, 3, 1
Uplink-downlink allocation for TDD	Configuration 1 (2:2)
Subframes in which PUSCH is transmitted	<ul style="list-style-type: none"> <li>For FDD: subframe #0, #2, #4, #6, and #8 in radio frames</li> <li>For TDD: Subframe #2, #3, #7, #8 in each radio frame</li> </ul>
Subframes in which SRS is transmitted (SRS transmission is optional)	<ul style="list-style-type: none"> <li>For FDD: subframe #1 in radio frames</li> <li>For TDD: UpPTS in each radio frame</li> </ul>

The [table 8-23](#) shows the test requirements. The test is performed with two Rx antennas and a normal cyclic prefix.

**Table 8-23: Test requirements for UL timing adjustment (two Rx antennas and normal cyclic prefix)**

Channel Bandwidth, MHz	Moving propagation conditions	FRC	SNR, dB
1.4	Scenario 1	A7-1	13.7
	Scenario 2	A8-1	-1.6
3	Scenario 1	A7-2	14.0
	Scenario 2	A8-2	-1.2
5	Scenario 1	A7-3	13.8
	Scenario 2	A8-3	-1.3
10	Scenario 1	A7-4	14.4
	Scenario 2	A8-4	-1.5

Channel Bandwidth, MHz	Moving propagation conditions	FRC	SNR, dB
15	Scenario 1	A7-5	14.6
	Scenario 2	A8-5	-1.5
20	Scenario 1	A7-6	14.5
	Scenario 2	A8-6	-1.5



EUTRA/LTE: Test Case Wizard
[Min] [Max] [Close]

- UE1
- UE2
- AWGN
- Channel BW
- Tx BW Conf
- WS RF Freq:  
f = 1.950GHz

Test Case TS 36.141: 8.2.2 UL Timing Adjustment

General Settings

Trigger Configuration	Armed Auto (Ext. Trigger 1, Delay 0)
Marker Configuration	Radio Frame Start (Delay 0)
Number of RX Antennas	2

Frequency Allocation

Stationary UE	At Higher Resource Blocks
---------------	---------------------------

Cell Specific Settings

RF Frequency	1.950 000 000 GHz
Duplexing	FDD
Channel Bandwidth	1.4 MHz
Cell ID	0
Cyclic Prefix	Normal

Moving UE / Propagation Conditions

UE ID / n_RNTI	1
Propagation Conditions	ETU 200Hz Moving (Scenario 1)
FRC	A7-1
Transmit SRS	<input type="checkbox"/>
Offset VRB	0
Power Level	-82.01 dBm

Stationary UE

UE ID / n_RNTI	2
FRC	A7-1
Transmit SRS	<input type="checkbox"/>
Offset VRB	3
Power Level	-82.01 dBm

The screenshot shows a configuration window with two main sections. The top section, titled "Realtime Feedback Configuration", contains several dropdown menus and text boxes: "Realtime Feedback Mode" is set to "Serial", "Serial Rate" is "115.2 Kbps", "Additional User Delay" is "0.00" with a "Subframes" dropdown, "Connector Moving UE" is "USER 1", "Baseband Selector Moving UE" is "0", and "Connector Stationary UE" is "No Feedback". The bottom section, titled "AWGN Configuration", has a "Power Level" dropdown set to "-92.7 dBm (within 1.08 MHz BW)". An "Apply Settings" button is centered at the bottom of the window.

The cell specific settings and the settings of the moving UE are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 259 and ["AWGN Configuration"](#) on page 259.

#### UE ID/n\_RNTI

Sets the UE ID/n\_RNTI.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:MUE:UEID on page 442

[ :SOURce<hw> ] :BB:EUTRa:TCW:SUE:UEID on page 442

#### Transmit SRS

Enables/disables the transmission of the SRS.

The SRS transmission is optional for this test case.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:MUE:TSRS on page 435

[ :SOURce<hw> ] :BB:EUTRa:TCW:SUE:TSRS on page 435

#### Offset VRB

Displays the number of RB the allocated RB(s) are shifted with.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:MUE:OVRB on page 440

[ :SOURce<hw> ] :BB:EUTRa:TCW:SUE:OVRB on page 440

#### Connector Moving UE/Stationary UE

Determines the feedback line connector (LEVATT or USER1).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:RTF:CONMue on page 436

[ :SOURce<hw> ] :BB:EUTRa:TCW:RTF:CONSue on page 436

#### Baseband Selector Moving UE

("Serial" and "Serial 3x8" mode only)

This parameter is required for multiplexing serial commands for different baseband units to one feedback line. If the selector *n* is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector *n*.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:RTF:BBSMue on page 436

[ :SOURce<hw> ] :BB:EUTRa:TCW:RTF:BBSSue on page 436

## 8.9.5 Test Case 8.2.3: HARQ-ACK multiplexed on PUSCH

### Test Purpose

The test shall verify the receiver's ability to detect HARQ-ACK information multiplexed on PUSCH under multipath fading propagation conditions for a given SNR [6].

### Required Options

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Second Option Baseband Main Module (R&S SMU-B13)
- Frequency Options (R&S SMU-B20x: RF 100kHz - x GHz)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMU-K62)
- 2 Options Fading Simulator and Fading Simulator Extension (R&S SMU-B14/-B15)

### Test Setup

See [chapter 8.4.3, "Test Setup - Diversity Measurements"](#), on page 210 (HARQ feedback line is not required).

### Short Description

The performance requirement of HARQ-ACK multiplexed on PUSCH is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The [table 8-24](#) shows the test requirements. The test are performed with two Rx antennas, normal cyclic prefix and propagation condition ETU70.

**Table 8-24: Test requirements for HARQ-ACK multiplexed on PUSCH (two Rx antennas, normal cyclic prefix and propagation condition ETU70)**

Channel Bandwidth, MHz	FRC	Index HARQ Offset	SNR, dB
1.4	A3-1	8	7.2
	A4-3	5	14.4
3	A3-1	8	7.2
	A4-4	5	13.5
5	A3-1	8	7.1
	A4-5	5	13.1

Performance Requirements (TS 36.141, Chapter 8)

Channel Bandwidth, MHz	FRC	Index HARQ Offset	SNR, dB
10	A3-1	8	7.2
	A4-6	5	12.9
15	A3-1	8	7.3
	A4-7	5	12.7
20	A3-1	8	7.1
	A4-8	5	12.6

EUTRA/LTE: Test Case Wizard
□ □ ×

— UE1

— AWGN

— Channel BW

— Tx BW Conf

— WS RF Freq:  
f = 1.950GHz

Test Case
TS 36.141: 8.2.3 HARQ-ACK Multiplexed on PUSCH

General Settings

Trigger Configuration: Armed Auto (Ext. Trigger 1, Delay 0)

Marker Configuration: Radio Frame Start (Delay 0)

Number of RX Antennas: 2

---

Wanted Signal / Propagation Conditions

RF Frequency: 1.950 000 000 GHz

Duplexing: FDD

Channel Bandwidth: 1.4 MHz

Cell ID: 0

Cyclic Prefix: Normal

UE ID / n\_RNTI: 1

Propagation Conditions: ETU 70Hz

FRC: A3-1

Offset VRB: 2

Power Level: -93.28 dBm

---

AWGN Configuration

Power Level: -92.7 dBm (within 1.08 MHz BW)

Apply Settings

The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 259 and ["AWGN Configuration"](#) on page 259.

## 8.9.6 Test Case 8.2.4: High Speed Train conditions

### Test Purpose

The test shall verify the receiver's ability to achieve throughput under High Speed Train conditions for a given SNR [6].

### Required Options

The following options are sufficient for tests with one Rx Antenna:

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Option Additive White Gaussian Noise AWGN (R&S SMU-K62)
- Option Fading Simulator and Fading Simulator Extension (R&S SMU-B14/-K71)
- Option LTE closed loop BS Test (R&S SMU-K69)

For tests with more than one Rx Antennas, the following options are required additionally:

- Second Option Additive White Gaussian Noise AWGN (R&S SMU-K62)
- Second Baseband Main Module (R&S SMU-B13)
- Option Fading Simulator Extension (R&S SMU-B15)

### Test Setup

See [chapter 8.4.3, "Test Setup - Diversity Measurements"](#), on page 210 and [chapter 8.4.1, "Standard Test Setup - One Path"](#), on page 208 (additionally, a feedback line is required).

### Short Description

The performance requirement is determined by a minimum throughput for a given SNR. The requirement throughput is expressed as 30% and 70% of the maximum throughput for the FRC (see [table 8-25](#)). HARQ retransmission is assumed. The tests are performed with one or two Rx antennas, normal cyclic prefix and propagation condition HST.

The test is optional.

The characteristics of the wanted signal are adjusted according to the pre-defined FRC and the test parameter given in [table 8-26](#).

**Table 8-25: Test parameters for High Speed Train conditions**

Parameter	Value
Maximum number of HARQ transmissions	4
RV sequence	0, 2, 3, 1, 0, 2, 3, 1
Uplink-downlink allocation for TDD	Configuration 1 (2:2)
Subframes in which PUSCH is transmitted	For FDD: <ul style="list-style-type: none"> <li>subframe #0 and #8 in radio frames for which SFN mod 4 = 0</li> <li>subframe #6 in radio frames for which SFN mod 4 = 1</li> <li>subframe #4 in radio frames for which SFN mod 4 = 2</li> <li>subframe #2 in radio frames for which SFN mod 4 = 3</li> </ul> For TDD: <ul style="list-style-type: none"> <li>Subframe #2 in each radio frames</li> </ul>
Subframes in which PUCCH is transmitted *	For FDD: <ul style="list-style-type: none"> <li>subframe #5 in radio frames</li> </ul> For TDD: <ul style="list-style-type: none"> <li>Subframe #3 in each radio frame</li> </ul>
<p>) The configuration of PUCCH (format 2) is optional; The SNR values per antenna shall be set to [-4.5 dB and -1.5 dB] for Scenario 1 and 3, respectively.</p>	

**Table 8-26: Test requirements for High Speed Train conditions**

Channel Bandwidth, MHz	FRC	Number of RX antennas	Propagation conditions	Fraction of maximum throughput, %	SNR, dB
1.4	A3-2	1	HST Scenario 3	30 70	-1.2 2.2
		2	HST Scenario 1	30 70	-3.6 -0.3
3	A3-3	1	HST Scenario 3	30 70	-1.8 1.9
		2	HST Scenario 1	30 70	-4.2 -0.7
5	A3-4	1	HST Scenario 3	30 70	-2.3 1.6
		2	HST Scenario 1	30 70	-4.8 -1.1
10	A3-5	1	HST Scenario 3	30 70	-2.4 1.5
		2	HST Scenario 1	30 70	-5.1 -1.2

Channel Bandwidth, MHz	FRC	Number of RX antennas	Propagation conditions	Fraction of maximum throughput, %	SNR, dB
15	A3-6	1	HST Scenario 3	30 70	-2.4 1.5
		2	HST Scenario 1	30 70	-4.9 -1.1
20	A3-7	1	HST Scenario 3	30 70	-2.4 1.5
		2	HST Scenario 1	30 70	-5.0 -1.1

EUTRA/LTE: Test Case Wizard

Legend:

- UE1
- AWGN
- Channel BW
- Tx BW Conf
- WS RF Freq:  $f = 1.950\text{GHz}$

Test Case: TS 36.141: 8.2.4 High Speed Train Conditions

General Settings

Trigger Configuration: Armed Auto (Ext. Trigger 1, Delay 0)

Marker Configuration: Radio Frame Start (Delay 0)

Number of RX Antennas: 1

Wanted Signal / Propagation Conditions

RF Frequency: 1.950 000 000 GHz

Duplexing: FDD

Channel Bandwidth: 1.4 MHz

Cell ID: 0

Cyclic Prefix: Normal

UE ID / n\_RNTI: 1

Propagation Conditions: High Speed Train 3

FRC: A3-2

Fraction of Max. Throughput: 30 %

Additionally Configure PUCCH:

Power Level (PUSCH): -93.90 dBm

Realtime Feedback Configuration

Realtime Feedback Mode: Serial

Connector: USER 1

Additional User Delay: 0.00 Subframes

Baseband Selector: 0

Serial Rate: 115.2 Kbps

AWGN Configuration

Power Level: -92.7 dBm (within 1.08 MHz BW)

Apply Settings

The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.



For description of the propagation conditions settings and the AWGN configuration, refer to "[Propagation Conditions](#)" on page 259 and "[AWGN Configuration](#)" on page 259.

The realtime feedback settings are described in "[Realtime Feedback Configuration](#)" on page 257.

#### **Additionally Configure PUCCH**

Enables the optional transmission of PUCCH format 2.

The settings are configured according to [table 8-26](#); the [PUCCH Power Level](#) is calculated automatically.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:ACPucch on page 437

#### **Power Level (PUSCH)**

Displays the resulting PUSCH power level.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:PLPS on page 440

#### **PUCCH Power Level**

(enabled for activated optional transmission of PUCCH format 2)

Displays the resulting PUCCH power level.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:PLPC on page 440

### **8.9.7 Test Case 8.3.1: ACK missed detection for single user PUCCH format 1a**

#### **Test Purpose**

The test shall verify the receiver's ability to detect ACK under multipath fading propagation conditions for a given SNR [6].

#### **Required Options**

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Second Option Baseband Main Module (R&S SMU-B13)
- Frequency Options (R&S SMU-B20x: RF 100kHz - x GHz)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMU-K62)
- 2 Options Fading Simulator and Fading Simulator Extension (R&S SMU-B14/-B15)
- For test setups with four Rx antennas, a second generator is required. The required options are identical.

### Test Setup

The test setup with two Rx antennas is performed according to the standard setup, see [chapter 8.4.3, "Test Setup - Diversity Measurements"](#), on page 210 (HARQ feedback line is not required).

The test setup with four Rx antennas require two two-paths instruments, see [chapter 8.4.4, "Test Setup - Four Rx Antennas"](#), on page 210 (HARQ feedback line is not required).

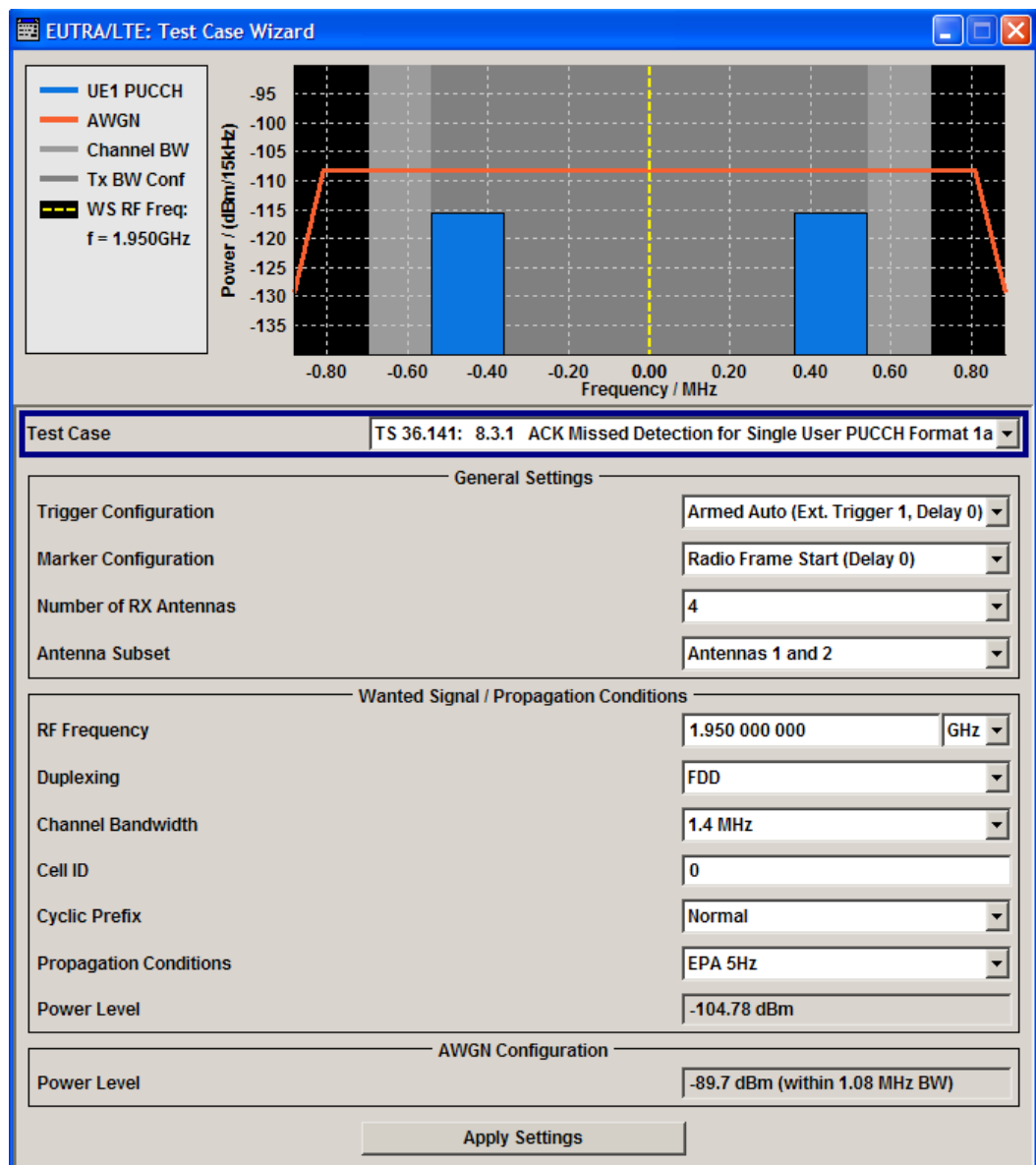
### Short Description

The performance requirement of single user PUCCH for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The [table 8-27](#) shows the test requirements for two and four Rx antennas.

**Table 8-27: Required SNR for single user PUCCH format 1a demodulation tests**

Number of RX antennas	Cyclic Prefix	Propagation Conditions	BW=1.4 MHz	BW=3MHz	BW=5MHz	BW=10M Hz	BW=15M Hz	BW=20M Hz
2	Normal	EPA 5	-1.9	-3.3	-4.2	-4.8	-4.7	-4.5
		EVA 5	-3.9	-4.5	-4.5	-4.4	-4.5	-4.5
		EVA 70	-4.3	-4.6	-4.6	-4.5	-4.6	-4.5
		ETU 300	-4.4	-4.5	-4.3	-4.4	-4.6	-4.6
	Extended	ETU 70	-3.6	-3.7	-3.5	-3.7	-3.6	-3.7
4	Normal	EPA 5	-7.3	-7.8	-8.1	-8.3	-8.3	-8.4
		EVA 5	-8.2	-8.5	-8.5	-8.2	-8.3	-8.3
		EVA 70	-8.3	-8.4	-8.4	-8.2	-8.4	-8.2
		ETU 300	-8.1	-8.3	-8.1	-8.1	-8.3	-8.2
	Extended	ETU 70	-7.3	-7.5	-7.3	-7.5	-7.4	-7.4



The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 259 and ["AWGN Configuration"](#) on page 259.

### 8.9.8 Test Case 8.3.2: CQI missed detection for PUCCH format 2

#### Test Purpose

The test shall verify the receiver's ability to detect CQI under multipath fading propagation conditions for a given SNR [6].

**Required Options**

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Second Option Baseband Main Module (R&S SMU-B13)
- Frequency Options (R&S SMU-B20x: RF 100kHz - x GHz)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMU-K62)
- 2 Options Fading Simulator and Fading Simulator Extension (R&S SMU-B14/-B15)

**Test Setup**

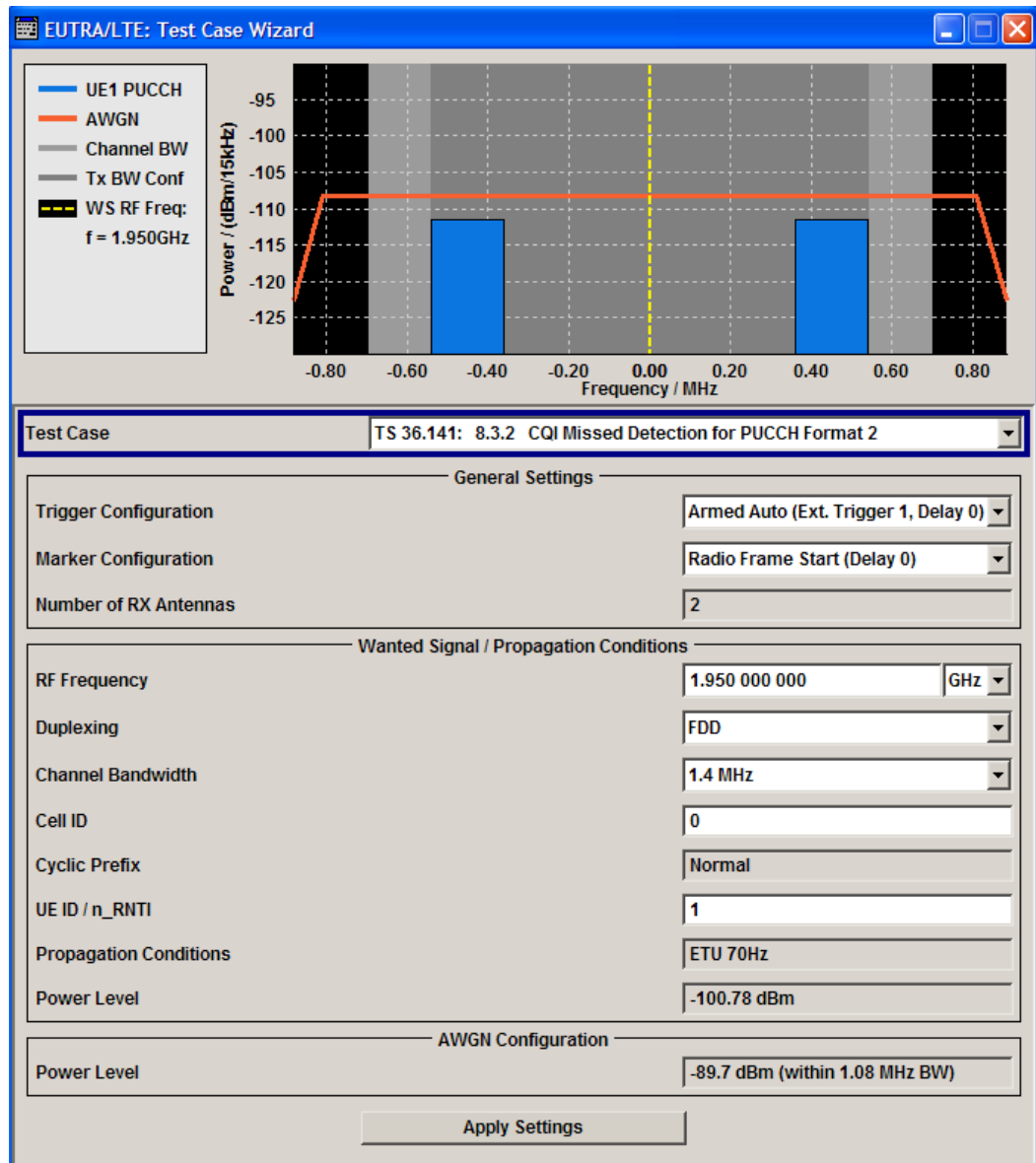
See [chapter 8.4.3, "Test Setup - Diversity Measurements"](#), on page 210 (HARQ feedback line is not required).

**Short Description**

The performance requirement of PUCCH for CQI missed detection is determined by the BLER probability of detection of CQI. The performance is measured by the required SNR at BLER probability of detection equal to 0.99.

**Table 8-28: Required SNR for PUCCH format 2 demodulation tests**

Number of RX antennas	Cyclic Prefix	Propagation Conditions	BW=1.4 MHz	BW=3MHz z	BW=5MHz z	BW=10M Hz	BW=15M Hz	BW=20M Hz
2	Normal	ETU70	-3.3	-3.8	-3.6	-3.8	-3.8	-3.8



The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 259 and ["AWGN Configuration"](#) on page 259.

### 8.9.9 Test Case 8.3.3: ACK missed detection for multi user PUCCH format 1a

#### Test Purpose

The test shall verify the receiver's ability to detect ACK on the wanted signal at presence of three interfering signals under multipath fading propagation conditions for a given SNR [6].

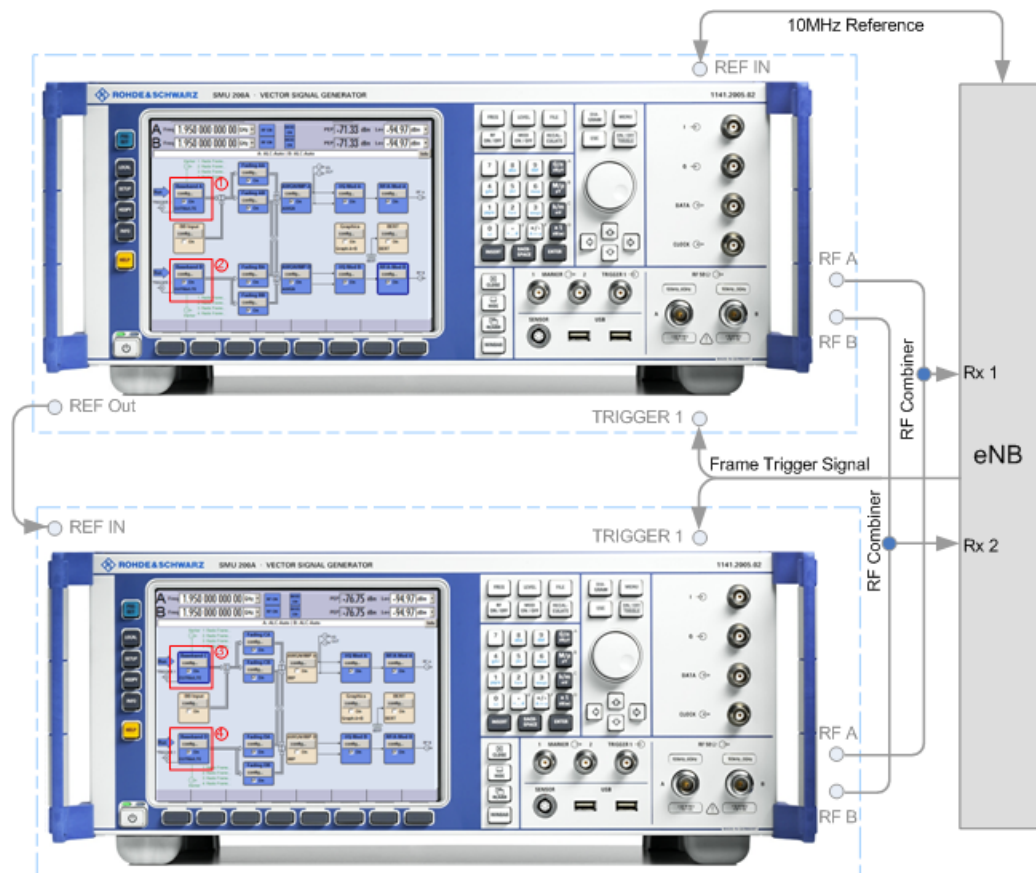
#### Required Options

Two R&S SMU equipped with:

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Second Option Baseband Main Module (R&S SMU-B13)
- Frequency Options (R&S SMU-B20x: RF 100kHz - x GHz)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMU-K62)  
AWGN options are not required in the second R&S SMU.
- Second Option Digital Standard EUTRA/LTE (R&S SMx-K55)
- 2 Options Fading Simulator, Fading Simulator Extension and MIMO (R&S SMU-B14/-B15/-K74)

#### Test Setup

The test setup requires two two-paths instruments (e.g. two R&S SMU), synchronized via a reference frequency (see [figure 8-13](#)). The base station provides its frame trigger signal to the signal generators (input TRIGGER 1).



**Fig. 8-13: Test Setup for test case 8.3.3 "ACK missed detection for multi user PUCCH format 1a"**

- 1 = SMU#1: Baseband A generates the wanted UE signal
- 2 = SMU#1: Baseband B generates the interferer 1 signal
- 3 = SMU#2: Baseband A generates the interferer 2 signal
- 4 = SMU#2: Baseband B generates the interferer 3 signal

**Short Description**

The performance is measured on the wanted signal by the required SNR at probability of detection equal to or greater than 0.99. The probability of false detection of the ACK shall be 0.01 or less. The statistics are kept by the base station under test.

Multi user PUCCH test is performed only for 2 Rx antennas, Normal CP and for ETU70 propagation conditions (see table 8-29). ACK/NAK repetitions are disabled for PUCCH transmission.

**Table 8-29: Required SNR for multi user PUCCH demodulation tests**

Number of RX antennas	Cyclic Prefix	Propagation Conditions	Chan. BW 1.4MHz	Chan. BW 3MHz	Chan. BW 5MHz	Chan. BW 10MHz	Chan. BW 15MHz	Chan. BW 20MHz
2	Normal	ETU70	-3.5	-3.8	-3.8	-4.0	-4.0	-3.8

In multi user PUCCH test, four signals are configured: one wanted signal and three interferers, which are transmitted via separate fading paths using relative power settings as defined in table 8-30.

**Table 8-30: Test parameters for multi user PUCCH case**

	Cyclic shift index ( $\delta = 0$ )	Orthogonal cover index	RS orthogonal cover / ACK/NACK orthogonal cover	Relative power, dB	Relative timing, ns
Tested signal	4	0	2	-	-
Interferer 1	2	0	1	0	0
Interferer 2	3	1	7	-3	0
Interferer 3	4	2	14	3	0

Presented resource index mapping for orthogonal cover and cyclic shift indices are for the first slot of the subframe. All above listed signals are transmitted on the same PUCCH resources, with different PUCCH channel indices as defined in [table 8-30](#).



**EUTRA/LTE: Test Case Wizard**

Legend:

- UE1 PUCCH
- UE2 PUCCH
- UE3 PUCCH
- UE4 PUCCH
- AWGN
- Channel BW
- Tx BW Conf
- WS RF Freq: f = 1.950GHz

Test Case: TS 36.141: 8.3.3 ACK Missed Detection for Multi User PUCCH Format 1a

**General Settings**

Trigger Configuration: Armed Auto (Ext. Trigger 1, Delay 0)

Marker Configuration: Radio Frame Start (Delay 0)

Number of RX Antennas: 2

Generated Signal: Wanted Signal, Interferer 1 and AWGN

**Cell Specific Settings**

RF Frequency: 1.950 000 000 GHz

Duplexing: FDD

Channel Bandwidth: 1.4 MHz

Cell ID: 0

Cyclic Prefix: Normal

**Wanted Signal (WS) / Propagation Conditions**

Propagation Conditions: ETU 70Hz

Orthogonal Cover (n\_PUCCH): 2

Power Level: -100.98 dBm

**Interfering Signal 1 / Propagation Conditions**

Propagation Conditions: ETU 70Hz

Orthogonal Cover (n\_PUCCH): 1

Power Level: -100.98 dBm

**AWGN Configuration**

Power Level: -89.7 dBm (within 1.08 MHz BW)

Apply Settings

The common settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 259 and ["AWGN Configuration"](#) on page 259.

In the R&S Signal Generator, the power level of the interferer 3 is used as a reference, i.e. the power level of the wanted signal and the interferer 1 is 3 dB lower and the power level of the interferer 2 is 6 dB lower than the reference.

### Generated Signal

Determines the signal is generated by the instrument. The first R&S SMU should generate the "Wanted Signal, Interfer 1 and AWGN" signal and the second R&S SMU, the signal of "Interferes 2 and 3".

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:GS:GENSignals](#) on page 430

### Propagation Conditions

Displays the propagation conditions of the interfering signal.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS:PRCondition](#) on page 441

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS2:PRCondition](#) on page 441

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS3:PRCondition](#) on page 441

### Orthogonal Cover (n\_PUCCH)

Displays the used resource index n\_PUCCH. The value is set automatically according to the RS orthogonal cover in [table 8-30](#).

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:WS:ORTCover](#) on page 439

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS:ORTCover](#) on page 439

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS2:ORTCover](#) on page 439

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS3:ORTCover](#) on page 439

### Interferer Type

Displays the type of the interfering signal.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS2:IFTYpe](#) on page 433

### RF Frequency

Displays the center frequency of interfering signal.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS2:RFFrequency](#) on page 434

### Power Level

Displays the power level of the interfering signals.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS2:PLevel](#) on page 434

[\[:SOURce<hw>\]:BB:EUTRa:TCW:IS3:PLevel](#) on page 434

## 8.9.10 Test Case 8.4.1: PRACH false alarm probability and missed detection

### Test Purpose

The test shall verify the receiver's ability to detect PRACH preamble under multipath fading propagation conditions for a given SNR [6].

### Required Options

- See [chapter 8.2, "Basic Configuration"](#), on page 206.
- Second Option Baseband Main Module (R&S SMU-B13)
- Frequency Options (R&S SMU-B20x: RF 100kHz - x GHz)
- 2 Options Additive White Gaussian Noise AWGN (R&S SMU-K62)
- 2 Options Fading Simulator and Fading Simulator Extension (R&S SMU-B14/-B15)

### Test Setup

The test setup with two Rx antennas is performed according to the standard setup, see [chapter 8.4.3, "Test Setup - Diversity Measurements"](#), on page 210 (HARQ feedback line is not required).

The test setup with four Rx antennas require two two-paths instruments, see [chapter 8.4.4, "Test Setup - Four Rx Antennas"](#), on page 210 (HARQ feedback line is not required).

### Short Description

The performance is measured by the total probability of false detection of the preamble ( $P_{fa}$ ) and the probability of detection of preamble ( $P_d$ ). For the SNRs defined in [table 8-31](#) and [table 8-32](#), the  $P_d$  shall be 99% or greater,  $P_{fa}$  shall be 0.1% or less. The statistics are kept by the base station under test. Ten preambles have to be transmitted.

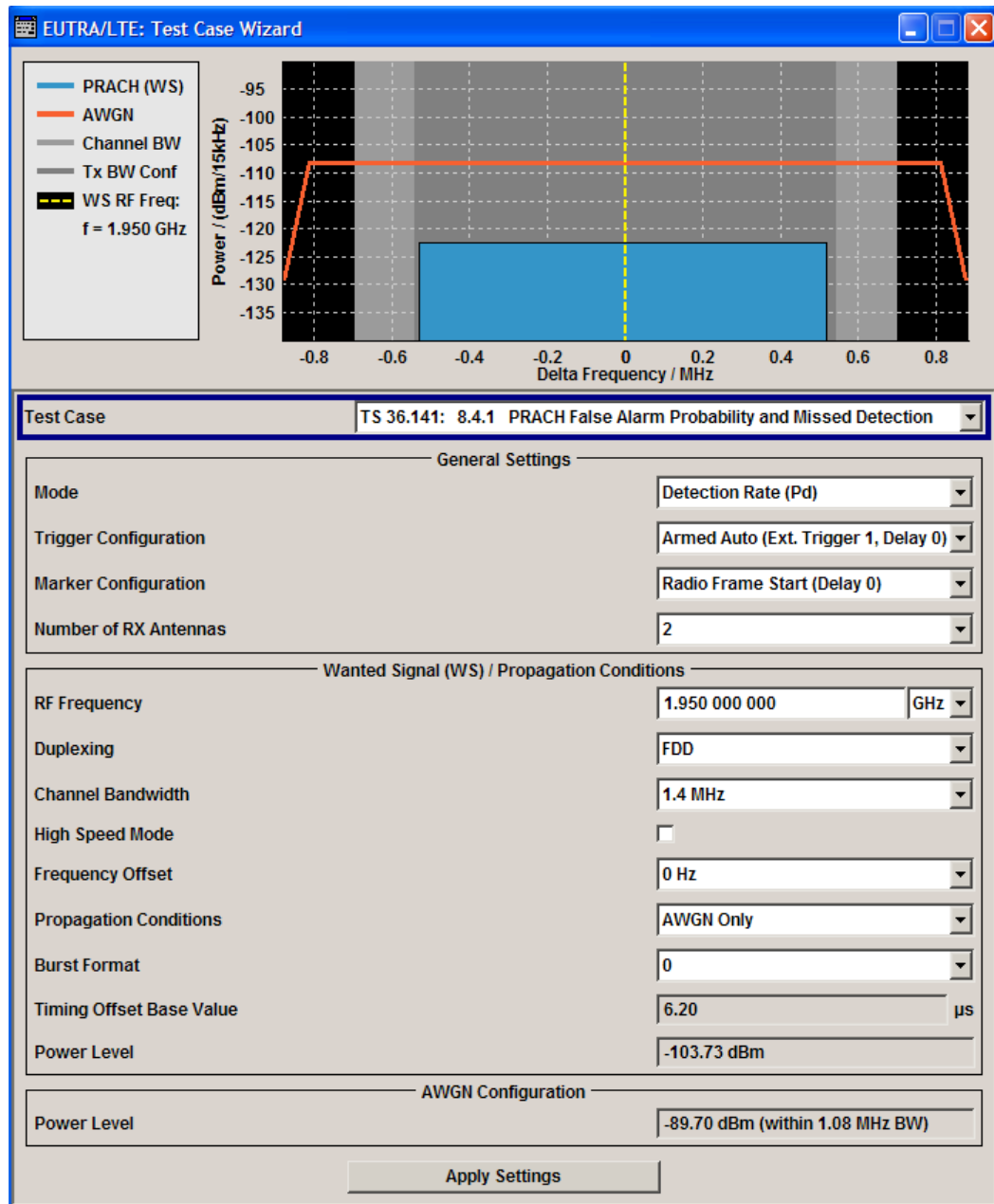
The normal mode test is applicable to all BS. The high speed mode test is applicable to high speed BS.

**Table 8-31: PRACH missed detection test requirements for Normal Mode; the SNR [dB] is given per burst format**

Number of RX antennas	Propagation conditions	Frequency offset, Hz	Burst format 0	Burst format 1	Burst format 2	Burst format 3	Burst format 4
2	AWGN	0	-13.9	-13.9	-16.1	-16.2	-6.9
	ETU 70	270	-7.4	-7.2	-9.4	-9.5	0.5
4	AWGN	0	-16.6	-16.4	-18.7	-18.5	-9.5
	ETU 70	270	-11.5	-11.1	-13.5	-13.3	-4.5

**Table 8-32: PRACH missed detection test requirements for High speed Mode; the SNR [dB] is given per burst format**

Number of RX antennas	Propagation conditions	Frequency offset, Hz	Burst format 0	Burst format 1	Burst format 2	Burst format 3
2	AWGN	0	-13.8	-13.9	-16.0	-16.3
	ETU 70	270	-6.8	-6.7	-8.7	-8.9
	AWGN	625	-12.1	-12.0	-14.1	-14.1
	AWGN	1340	-13.1	-13.2	-15.2	-15.4
4	AWGN	0	-16.6	-16.3	-18.6	-18.5
	ETU 70	270	-11.2	-10.8	-13.1	-13.1
	AWGN	625	-14.6	-14.3	-16.5	-16.5
	AWGN	1340	-15.6	-15.2	-17.5	-17.5



The common settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 218.

For detailed description of all available PRACH settings and the cross-reference between them, refer to [chapter 7.13.8, "PRACH Configuration"](#), on page 173.

### Mode

Determines the measurements type, Pfa or Pd, the signal is generated for.

In "Detection Rate (Pd)" and "Alternating Pd and Pfa" mode, the generated sequence is repeated cyclically. The first preamble is offset with start offset determined by [Timing Offset Base Value](#). From preamble to preamble, the timing offset ("Delta t") of the preambles is increased by 0.1 us.

"False Detection Rate (Pfa)" The generated signal is a noise like AWGN signal. This mode is intended for measurement of the total probability of false detection of the preamble (Pfa).

"Detection Rate (Pd)" The generated signal is a sequence of 10 preamble and noise. The duration of one single sequence is 5 frames in FDD and 10 frames in TDD duplexing mode.  
This mode is intended for measurement of the probability of detection of preamble (Pd).

"Alternating Pd and Pfa" The generated signal is a sequence of 10 enabled and 10 disabled preambles; during the latest only noise is transmitted. The duration of one single sequence is 10 FDD frames and 20 TDD frames.  
This mode is intended for measuring both the probability of detection of preamble (Pd) and the probability of false detection of the preamble (Pfa) in one run.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:GS:MODE on page 431

### Configuration of Special Subframe

(enabled for TDD duplexing mode only)

Sets the Special Subframe Configuration number (see also [chapter 3.2.1, "OFDMA Parameterization"](#), on page 17).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:WS:SPSFrame on page 441

### High Speed Mode

Enables a high speed mode (restricted preamble set) or the normal mode (unrestricted preamble set).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:WS:HSMODE on page 439

### Frequency Offset

Sets the frequency offset, as defined in [table 8-31](#) and [table 8-32](#).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:WS:FROffset on page 439

### Burst Format

Sets the burst format (see also ["Preamble Format \(Burst Format\)"](#) on page 173).

Burst format 4 is enabled only for TDD duplexing mode, special subframe configurations 5 to 8 and disabled high speed mode.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TCW:WS:BFormat on page 437

**Timing Offset Base Value**

The timing offset base value is set to 50% of the Ncs. This value determines the start timing offset of the first preamble. From preamble to preamble, the timing offset ("Delta t") of the preambles is increased by 0.1 us and this sequence of timing offsets is restarted after 10 preambles.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:TIOBase` on page 442

## 9 Remote-Control Commands

This subsystem contains commands for the primary and general settings of the EUTRA standard. These settings concern activation and deactivation of the standard, setting the transmission direction, filter, clock, trigger and clipping settings, defining the frame duration and the sequence length, as well as the preset setting.

The commands for defining the frame configuration for physical layer mode OFDMA and SC-FDMA are described in the next sections. The commands are divided up in this way to make the comprehensive `SOURce:BB:EUTRa` 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 `MME:CDIRectory`. The examples in this description use the placeholder `<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 instrument name, e.g. `smbv`.
- `/usb` - for selecting the memory stick which is inserted at the USB interface of Linux instrument.

## 9.1 Primary Commands

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---

### `[:SOURce<hw>]:BB:EUTRa:STATe <State>`

Activates modulation in accordance with the EUTRA/LTE 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.

**Note:** For two path instruments and configured antenna for path B, enabling the LTE signal simulation will disable all other digital standards and digital modulation modes even in the path B.

`BB:EUTRa:STAT ON` deactivates the other standards and digital modulation.

#### Parameters:

`<State>` ON|OFF

\*RST: OFF

#### Example:

`BB:EUTRa:STAT ON`  
activates modulation in accordance with the EUTRA/LTE standard.

---

### `[:SOURce<hw>]:BB:EUTRa:DUPLexing <Duplexing>`

Selects the duplexing mode. The duplexing mode determines how the uplink and downlink signal are separated.

#### Parameters:

`<Duplexing>` TDD|FDD

#### TDD

The same frequency is used for both directions of transmission (uplink and downlink). With one baseband, either only downlink or only uplink frames can be generated.

#### FDD

Different frequencies are used for downlink and uplink directions.

\*RST: FDD

#### Example:

`BB:EUTRa:DUPL FDD`  
selects frequency division duplexing.

**[[:SOURce<hw>]:BB:EUTRa:LINK <Link>**

Defines the transmission direction. The signal either corresponds to that of a base station (DOWN) or that of a subscriber station (UP).

**Parameters:**

<Link>                   DOWN|UP  
                           \*RST:       DOWN

**Example:**

BB:EUTR:LINK DOWN  
 the transmission direction selected is base station to subscriber station. The signal corresponds to that of a base station.

**[[:SOURce<hw>]:BB:EUTRa:PRESet**

The command produces a standardized default for the EUTRA/LTE standard. The settings correspond to the \*RST values specified for the commands.

All EUTRA/LTE settings are preset.

**Example:**

BB:EUTR:PRESet  
 resets all the EUTRA/LTE settings to default values.

**Usage:**

Event

**[[:SOURce<hw>]:BB:EUTRa:SETTing:CATalog? <Catalog>**

This command reads out the files with EUTRA/LTE settings in the default directory. The default directory is set using command MMEM:CDIRectory. Only files with the file extension \*.eutra will be listed.

**Parameters:**

<Catalog>               string

**Example:**

MMEM:CDIR '\user\eutra'  
 sets the default directory to <root>\user\eutra.  
 BB:EUTR:SETT:CAT?  
 reads out all the files with EUTRA/LTE settings in the default directory.  
 Response: 'eutra1', 'eutra2'  
 the files eutra1 and eutra2 are available.

**Usage:**

Query only

**[[:SOURce<hw>]:BB:EUTRa:SETTing:DEL <Del>**

Deletes the selected file with EUTRA/LTE 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 `*.eutra` will be deleted.

**Setting parameters:**

<Del>                    <file name>

**Example:**                `BB:EUTR:SETT:DEL 'eutra_1'`  
deletes file `eutra_1`.

**Usage:**                    Setting only

**[[:SOURce<hw>]:BB:EUTRa:SETTing:LOAD <Load>**

Loads the selected file with EUTRA/LTE 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 `*.eutra` will be loaded.

**Parameters:**

<Load>                    string

**Example:**                `BB:EUTR:SETT:LOAD 'eutra_1'`  
loads file `eutra_1`.

**[[:SOURce<hw>]:BB:EUTRa:SETTing:STORe <Store>**

Stores the current EUTRA/LTE 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. EUTRA/LTE settings are stored as files with the specific file extension `*.eutra`.

**Parameters:**

<Store>                    string

**Example:**                `BB:EUTR:SETT:STOR 'eutra_1'`  
stores the current settings into file `eutra_1`.

**[[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:TDD <Tdd>****[[:SOURce<hw>]:BB:EUTRa:SETTing:TMOD:DL <DI>**

The command selects an EUTRA test model (E-TM) defined by the standard for the downlink.

**Parameters:**

<DI>                    <test\_model\_name>

**Example:**

BB:EUTR:SETT:TMOD:DL 'E-TM1\_1\_20MHz'

selects the test model.

**[ :SOURce<hw>]:BB:EUTRa:SLENgth <Slength>**

Sets the sequence length of the signal in number of frames. The signal is calculated in advance and output in the arbitrary waveform generator. The maximum number of frames is calculated as follows:

Max. No. of Frames = Arbitrary waveform memory size/(sampling rate x 10 ms).

**Parameters:**

<Slength>                float

Range:            1 to Max. No. of Frames

\*RST:            1

**Example:**

BB:EUTR:SLEN 4

selects the generation of 4 frames.

**[ :SOURce<hw>]:BB:EUTRa:WAVeform:CREate <Create>**

This command creates a waveform using the current settings of the "EUTRA/LTE" 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.

**Note:** Even for enabled Realtime Feedback, the waveform file is generated as if this functionality is disabled.

**Setting parameters:**

<Create>                string

**Example:**

MMEM:CDIR '<root>\user\waveform

sets the default directory to <root>\user\waveform.

BB:EUTR:WAV:CRE 'eutra\_1'

creates the waveform file eutra\_1.wv in the default directory.

**Usage:**

Setting only

**[ :SOURce]:BB:EUTRa:VERSion?**

The command queries the version of the 3GPP standard underlying the definitions.

**Return values:**

<Version>                string

**Example:** `BB:EUTR:VERS?`  
queries the 3GPP version.

**Usage:** Query only

## 9.2 Filter/Clipping/Power Settings

### 9.2.1 Filter Settings

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---

**`[:SOURce<hw>]:BB:EUTRa:FILTer:TYPE <Type>`**

Selects the baseband filter type.

**Parameters:**

`<Type>` RCOSine|COSine|GAUSSs|LGAuss|CONE|COF705|  
COEQUALizer|COFEQUALizer|C2K3x|APCO25|SPHase|  
RECTangle|PGAuss|LPASSs|LPASSEVM|DIRac|ENPSHape|  
EWPSHape|USER|LTEFilter

\*RST: COSine

**Example:** `BB:EUTR:FILT:TYPE COS`  
sets the baseband filter type.

---

**[ :SOURce<hw>]:BB:EUTRa:FILTer:MODE <Mode>**

Selects an offline or realtime filter mode.

**Parameters:**

<Mode>                    RTime|OFFLine  
                              \*RST:         RTime

**Example:**

BB:EUTR:FILT:MODE RT  
 selects real time filter mode.

---

**[ :SOURce<hw>]:BB:EUTRa:FILTer:ILENgth <llength>**

**Note:** This command is available for WinIQSIM2 only.

Sets the impulse length (number of filter tabs).

**Parameters:**

<llength>                 float  
                              Range:         1 to 128  
                              Increment:    1  
                              \*RST:         10

**Example:**

BB:EUTR:FILT:ILEN 10  
 sets the number of filter tabs to 10.

---

**[ :SOURce<hw>]:BB:EUTRa:FILTer:ILENgth:AUTO <Auto>**

**Note:** This command is available for WinIQSIM2 only.

Activates/ deactivates the impulse length state. If activated, the most sensible parameter values are selected. The value depends on the coherence check.

**Parameters:**

<Auto>                    ON|OFF  
                              \*RST:         ON

**Example:**

BB:EUTR:FILT:ILEN:AUTO ON  
 the most sensible parameters are selected automatically.

---

**[ :SOURce<hw>]:BB:EUTRa:FILTer:OSAMpling <Osampling>**

**Note:** This command is available for WinIQSIM2 only.

Sets the upsampling factor.

**Parameters:**

<Osampling> float  
 Range: 1 to 32  
 \*RST: 32

**Example:**

BB:EUTR:FILT:OSAM 32  
 sets the upsampling factor to 32.

**[ :SOURce<hw> ]:BB:EUTRa:FILTer:OSAMpling:AUTO <Auto>**

**Note:** This command is available for WinIQSIM2 only.

Activates/ 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> ON|OFF  
 \*RST: ON

**Example:**

BB:EUTR:FILT:OSAM:AUTO ON  
 the most sensible parameters are selected automatically.

**[ :SOURce<hw> ]:BB:EUTRa:FILTer:PARAmeter:APCO25 <Apco25>**

Sets the roll-off factor for the APCO25 filter type.

**Parameters:**

<Apco25> float  
 Range: 0.05 to 0.99  
 \*RST: 0.20

**Example:**

BB:EUTR:FILT:PAR:APCO25 0.06  
 the roll-off factor is set to 0.06.

**[ :SOURce<hw> ]:BB:EUTRa:FILTer:PARAmeter:COSSine <Cosine>**

Sets the roll-off factor for the Cosine filter type.

**Parameters:**

<Cosine> float  
 Range: 0.05 to 0.99  
 Increment: 0.01  
 \*RST: 0.10

**Example:**

BB:EUTR:FILT:PAR:COS 0.4  
 the roll-off factor is set to 0.4.

---

**[ :SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:COsine:COFS <Cofs>**

Sets the "cut of frequency shift" value for the Cosine filter type.

**Parameters:**

<Cofs> float

Range: -1.0 to 1.0  
 Increment: 0.01  
 \*RST: -0.33

**Example:** BB:EUTR:FILT:PAR:COS:COFS 0.04  
 the "cut of frequency shift" value is set to 0.04.

---

**[ :SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:GAUSs <Gauss>**

Sets the BxT for the Gauss filter type (FSK).

**Parameters:**

<Gauss> float

Range: 0.15 to 2.5  
 \*RST: 0.50

**Example:** BB:EUTR:FILT:PAR:GAUS 0.5  
 the BxT is set to 0.5.

---

**[ :SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LPASs <Lpass>**

Sets the cut off frequency factor for the Lowpass (ACP optimization) filter type.

**Parameters:**

<Lpass> float

Range: 0.05 to 2.0  
 Increment: 0.01  
 \*RST: 0.50

**Example:** BB:EUTR:FILT:PAR:LPAS 0.5  
 the cut of frequency factor is set to 0.5.

---

**[ :SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LPASSEVM <Lpassevm>**

Sets the cut off frequency factor for the Lowpass filter (EVM optimization) type.

**Parameters:**

<Lpassevm> float

Range: 0.05 to 2.0  
 Increment: 0.01  
 \*RST: 0.5



**Example:** BB:EUTR:FILT:PAR:LPASSEVM 0.5  
the cut of frequency factor is set to 0.5.

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:COFFactor <Coffactor>**

Sets the cut off frequency factor for the LTE filter type.

**Parameters:**

<Coffactor> float  
Range: 0.05 to 2.00  
Increment: 0.01  
\*RST: 0.34

**Example:** BB:EUTR:FILT:PAR:LTE:COFF 0.35  
the cut-off frequency factor is set to 0.35.

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:COFS <Cofs>**

Sets the "cut of frequency shift" value for the LTE filter type.

**Parameters:**

<Cofs> float  
Range: -1.0 to 1.0  
Increment: 0.01  
\*RST: -0.35 (BW 1.25/1.4/2.5MHz); -0.39 (BW 3MHz);  
-0.33 (BW 5Mz); -0.34 (BW 10MHz); -0.26 (BW  
15MHz); -0.34 (BW 20MHz)

**Example:** BB:EUTR:FILT:PAR:LTE:COFS -0.3  
the cut-off frequency shift is set to -0.3.

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:OPTimization <Optimization>**

Defines whether used filter is optimized for ACP or EVM performance. If "standard" is selected, a trade-off between ACP and EVM is selected.

**Parameters:**

<Optimization> STD|EVM|ACP  
\*RST: EVM

**Example:** BB:EUTR:FILT:PAR:LTE:OPT ACP  
selects ACP optimization.

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:ROFactor <Rofactor>**

Sets the roll-off factor for the LTE filter type.

**Parameters:**

<Rofactor> float

Range: 0.05 to 0.99  
 Increment: 0.01  
 \*RST: 0.1

**Example:**

BB:EUTR:FILT:PAR:LTE:ROF 0.2  
 the roll-off factor is set to 0.2.

**[ :SOURce<hw> ]:BB:EUTRa:FILT:PAR:PGAuss <Pgauss>**

Sets the BxT for the Gauss filter type (pure).

**Parameters:**

<Pgauss> float

Range: 0.15 to 2.50  
 \*RST: 0.50

**Example:**

BB:EUTR:FILT:PAR:PGA 0.5  
 the BxT is set to 0.5.

**[ :SOURce<hw> ]:BB:EUTRa:FILT:PAR:RCOSine <Rcosine>**

Sets the roll-off factor for the Root Cosine filter type.

**Parameters:**

<Rcosine> float

Range: 0.00 to 0.99  
 \*RST: 0.22

**Example:**

BB:EUTR:FILT:PAR:RCOS 0.4  
 the roll-off factor is set to 0.4.

**[ :SOURce<hw> ]:BB:EUTRa:FILT:PAR:SPHase <Sphase>**

Sets the BxT for the Split Phase filter type.

**Parameters:**

<Sphase> float

Range: 0.15 to 2.5  
 \*RST: 2.00

**Example:**

BB:EUTR:FILT:PAR:SPH 2  
 the BxT is set to 2.0

**[ :SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:USER <User>**

The command selects the user-defined filter (\*.vaf).

The directory applicable to the following command is defined with the command `MMEMory:CDIR`. To access the files in this directory, only the file name is required, without the path and the file extension.

**Parameters:**

<User>                      string

**Example:**

```
BB:EUTR:FILT:TYPE USER
selects the User filter type.
MMEM:CDIR '<root>\Filter_List'
selects the directory for the user-defined filters.
BB:EUTR:FILT:PAR:USER etra_user_filter
selects the user-defined filter.
```

**[ :SOURce<hw>]:BB:EUTRa:SRATe:VARiation <Variation>**

Enters the output sample rate.

A variation of this parameter only affects the ARB clock rate; all other signal parameters remain unchanged. If the sampling rate in the "General Settings" menu is changed, this parameter is reset to the chosen sampling rate.

**Parameters:**

<Variation>                      float

Range:            400Hz to 40MHz  
Increment:        0.001Hz  
\*RST:             15.36MHz  
Default unit: Hz

**Example:**

```
BB:EUTR:SRAT:VAR 400Hz
sets the output sample rate to 400 Hz.
```

## 9.2.2 Clipping Settings

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**[ :SOURce<hw>]:BB:EUTRa:CLIPping:LEVel <Level>**

Sets the limit for level 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 `BB:EUTR:CLIP:STAT ON`

**Parameters:**

<Level> float

Range: 0PCT to 100PCT  
 Increment: 1PCT  
 \*RST: 100PCT

**Example:**

```
BB:EUTR:CLIP:LEV 80PCT
sets the limit for level clipping to 80% of the maximum level.
BB:EUTR:CLIP:STAT ON
activates level clipping.
```

**[[:SOURce<hw>]:BB:EUTRa:CLIPping:MODE <Mode>**

Sets the method for level 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: VECT

**Example:**

```
BB:EUTR:CLIP:MODE SCAL
selects the absolute maximum of all the I and Q values as the
reference level.
BB:EUTR:CLIP:LEV 80PCT
sets the limit for level clipping to 80% of this maximum level.
BB:EUTR:CLIP:STAT ON
activates level clipping.
```

**[[:SOURce<hw>]:BB:EUTRa:CLIPping:STATe <State>**

Activates level clipping (Clipping). The value is defined with the command  
 [SOURce:]BB:EUTRa:CLIPping:LEVel, the mode of calculation with the command  
 [SOURce:]BB:EUTRa:CLIPping:MODE.

**Parameters:**

<State> ON|OFF

\*RST: OFF

**Example:**

```
BB:EUTR:CLIP:STAT ON
activates level clipping.
```

### 9.2.3 Power Settings

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---

#### `[:SOURce<hw>]:BB:EUTRa:TDW:STATe <State>`

Activates/deactivates the time domain windowing.

##### Parameters:

`<State>`                    ON|OFF

                              \*RST:        OFF

**Example:**                `BB:EUTR:TDW:STAT ON`  
                              activates time domain windowing.

---

#### `[:SOURce<hw>]:BB:EUTRa:TDW:TRTime <Trtime>`

Sets the transition time when time domain windowing is active.

##### Parameters:

`<Trtime>`                    float

                              Range:        0.0us to 10.0us

                              Increment:   0.1us

                              \*RST:        5.0us

**Example:**                `BB:EUTR:TDW:TDT 2us`  
                              sets ths transition time to 2us.

---

#### `[:SOURce<hw>]:BB:EUTRa:POWC:LEVReference <Levreference>`

Defines the reference the instrument's global level display is referring to.

**Parameters:**

<Levreference> FRMS|DRMS|URMS|UEBurst

**FRMS**

The displayed RMS and PEP are measured during the whole frame. Note that all frames are taken into account, not only the first one.

**DRMS**

The displayed RMS and PEP are measured during the DL part of the frame (all DL subframes and the DwPTS).

Note that all frames are taken into account, not only the first one.

**URMS**

The displayed RMS and PEP are measured during the UL part of the frame (all UL subframes and the UpPTS).

Note that all frames are taken into account, not only the first one.

**UEBurst**

The displayed RMS and PEP are measured during a single subframe of a certain UE.

\*RST: FRMS

**Example:**

```
BB:EUTR:POWC:LEVR UEB
sets level reference to UE Burst RMS Power
```

**[[:SOURce<hw>]:BB:EUTRa:POWC:ORTLevel <Ortlevel>**

Sets the power offset of the according baseband relative to the RMS level displayed in the instrument's global Level display in the header of the instrument.

**Parameters:**

<Ortlevel> float

Range: -20.00dB to 0dB  
 Increment: 0.01dB  
 \*RST: 0dB

**Example:**

```
BB:EUTR:POWC:ORTL -1.0 dB
sets the power offset of the baseband part
```

**[[:SOURce<hw>]:BB:EUTRa:POWC:REFChannel?**

Queries the channel type the measured RMS and PEP is referring to.

**Return values:**

<Refchannel> NF|PUSCH|PUCCH|PRACH|SRS

\*RST: NF

**Example:** BB:EUTR:POWC:LEVRL UEB  
sets level reference to UE Burst RMS Power  
BB:EUTR:POWC:RUE?  
queries the channel type

**Usage:** Query only

#### **[:SOURCE<hw>]:BB:EUTRa:POWC:REFSubframe?**

Queries the subframe the measured RMS and PEP is referring to.

**Return values:**  
<Refsubframe> float  
Range: 0 to 39  
\*RST: 0

**Example:** BB:EUTR:POWC:LEVRL UEB  
sets level reference to UE Burst RMS Power  
BB:EUTR:POWC:REFS?  
queries the reference subframe

**Usage:** Query only

#### **[:SOURCE<hw>]:BB:EUTRa:POWC:RUE?**

Queries the UE the measured RMS and PEP is referring to.

**Return values:**  
<Rue> UE1|UE2|UE3|UE4  
\*RST: UE1

**Example:** BB:EUTR:POWC:LEVRL UEB  
sets level reference to UE Burst RMS Power  
BB:EUTR:POWC:RUE?  
queries the reference UE

**Usage:** Query only

## 9.3 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:EUTRa:CLOCK:MODE.....](#)304

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:CUSTom</code> .....	304
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:SOURce</code> .....	305
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:MULTiplier</code> .....	305
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:SYNChronization:EXECute</code> .....	306
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:SYNChronization:MODE</code> .....	306

---

### `[:SOURce<hw>]:BB:EUTRa:CLOCK:MODE <Mode>`

Enters the type of externally supplied clock (`BB:EUTRa:CLOCK:SOURce EXTernal`).

#### Parameters:

<Mode>                      SAMP|MSAMp | CUSTom

#### **SAMPlE**

The sample clock is supplied via the CLOCK connector.

#### **MSAMplE**

A multiple of the sample clock is supplied via the CLOCK connector and the sample clock is derived internally from this. The multiplier is entered with the command

`BB:EUTRa:CLOCK:MULTiplier`.

#### **CUSTom**

(not for R&S SMBV)

An external customer specific clock is supplied via the CLOCK connector. The sample clock is derived internally from it.

**Note:** Custom External Clock source in baseband B is only supported if baseband A is configured with EUTRA/LTE too.

Furthermore the same settings for clock source and clock mode have to be set in baseband A and B. The user needs to take care of the correct settings.

\*RST:              SAMP

#### Example:

`BB:EUTRa:CLOCK:MODE SAMP`

selects clock type "SAMPlE", i.e. the supplied clock is a sample clock.

---

### `[:SOURce<hw>]:BB:EUTRa:CLOCK:CUSTom <Custom>`

Specifies the sample clock for clock type Custom (`BB:EUTRa:CLOCK:MODE CUSTom`) in the case of an external clock source.

**Note:** Custom External Clock source in baseband B is only supported if baseband A is configured with EUTRA/LTE too. Furthermore the same settings for clock source and clock mode have to be set in baseband A and B. The user needs to take care of the correct settings.

#### Parameters:

<Custom>                      float

Range:              0.025MHz to 40MHz

\*RST:              38.4MHz



**Example:** `BB:EUTR:CLOC:SOUR EXT`  
 selects an external clock reference. The clock is supplied via the  
 CLOCK connector.  
`BB:EUTR:CLOC:MODE CUSTom`  
 selects clock type Custom.  
`BB:EUTR:CLOC:CUSTom 38400000`  
 the custom external clock is 38.4MHz.

---

**[:SOURce<hw>]:BB:EUTRa:CLOCK:SOURce <Source>**

Selects the clock source.

**Parameters:**

<Source> INTernal|EXTernal

**INTernal**

The internal clock reference is used.

**EXTernal**

The external clock reference is supplied to the CLOCK connector.  
 The type of the external clock is specified with command

`BB:EUTRa:CLOCK:MODE`

\*RST: INTernal

**Example:** `BB:EUTR:CLOC:SOUR EXT`  
 selects an external clock reference. The clock is supplied via the  
 CLOCK connector.  
`BB:EUTR:CLOC:MODE SAMP`  
 specifies that a sample clock is supplied via the CLOCK connector:

---

**[:SOURce<hw>]:BB:EUTRa:CLOCK:MULTIplier <Multiplier>**

Specifies the multiplier for clock type "Multiplied" (`BB:EUTRa:CLOCK:MODE MSAMple`)  
 in the case of an external clock source.

**Parameters:**

<Multiplier> float

Range: 1 to 64

Increment: 1

\*RST: 4

**Example:** `BB:EUTR:CLOC:SOUR EXT`  
 selects the external clock source. The clock is supplied via the  
 CLOCK connector.  
`BB:EUTR:CLOC:MODE MSAM`  
 selects clock type "Multiplied", i.e. the supplied clock has a rate  
 which is a multiple of the sample rate.  
`BB:EUTR:CLOC:MULT 12`  
 the multiplier for the external clock rate is 12.

**[[:SOURce<hw>]:BB:EUTRa:CLOCK:SYNChronization:EXECute**

For R&S SMBV only

Performs automatically adjustment of the instrument's settings required for the synchronization mode, set with the command `BB:EUTR:SYNC:MODE`.

**Example:**

```
BB:EUTR:CLOC:SYNC:MODE MAST
the instrument is configured to work as a master one.
BB:EUTR:CLOCK:SYNC:EXEC
all synchronization's settings are adjusted accordingly.
```

**[[:SOURce<hw>]:BB:EUTRa: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
	<b>NONE</b>
	The instrument is working in stand-alone mode.
	<b>MASTer</b>
	The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.
	<b>SLAVe</b>
	The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.
*RST:	NONE

**Example:**

```
BB:EUTR:CLOC:SYNC:MODE MAST
the instrument is configured to work as a master one.
```

## 9.4 Timing Configuration

**[[:SOURce<hw>]:BB:EUTRa:TIMC:NTAoffset <Ntaoffset>**

For R&S SMU and R&S AMU instruments only

Sets the parameter  $N_{TA\ offset}$  as defined in the 3GPP TS 36.211.

**Parameters:**

<Ntaoffset>            0|624  
                               \*RST:        0

**Example:**

BB:EUTR:TIMC:NTA 624  
 sets parameter  $N_{TA\ offset}$

## 9.5 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:EUTRa[:TRIGger]:SEQuence.....	307
[:SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute.....	308
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute.....	309
[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:SYNChronize:OUTPut.....	309
[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:DELay.....	310
[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:INHibit.....	310
[:SOURce<hw>]:BB:EUTRa:TRIGger:RMODE.....	311
[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth.....	311
[:SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit.....	312
[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce.....	313
[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:DELay.....	313
[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:INHibit.....	313

### [:SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence <Sequence>

Selects the trigger mode.

**Parameters:**

&lt;Sequence&gt;

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 `BB:EUTR: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 `RETR` mode. Every subsequent trigger event causes a restart. Signal generation is stopped with command `BB:EUTR:TRIG:ARM:EXEC` and started again when a trigger event occurs.

**SINGle**

The modulation signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified with command `BB:EUTR:TRIG:SLen`. Every subsequent trigger event causes a restart.

```
*RST:      AUTO
```

**Example:**

```
BB:EUTR: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:EUTRa:TRIGger:ARM:EXECute**

Stops signal generation for trigger modes "Armed\_Auto" and "Armed\_Retrigger". A subsequent internal or external trigger event restarts signal generation.

**Example:**

```
BB:EUTR:TRIG:SOUR INT
sets internal triggering.
BB:EUTR:TRIG:SEQ ARET
sets Armed_Retrigger mode, i.e. every trigger event causes signal
generation to restart.
BB:EUTR:TRIG:EXEC
executes a trigger, signal generation is started.
BB:EUTR:TRIG:ARM:EXEC
signal generation is stopped.
BB:EUTR:TRIG:EXEC
executes a trigger, signal generation is started again.
```

**Usage:** Event

---

#### **[:SOURce<hw>]:BB:EUTRa:TRIGger:EXECute**

Executes a trigger. The internal trigger source must be selected using the command `BB:EUTR:TRIG:SOUR INT` and a trigger mode other than AUTO must be selected using the command `BB:EUTR:TRIG:SEQ`.

**Example:**

```
BB:EUTR:TRIG:SOUR INT
sets internal triggering.
BB:EUTR:TRIG:SEQ RETR
sets Retrigger mode, i.e. every trigger event causes signal gen-
eration to restart.
BB:EUTR:TRIG:EXEC
executes a trigger.
```

**Usage:** Event

---

#### **[:SOURce<hw>]:BB:EUTRa: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 section "[Sync. Output to External Trigger](#)" on page 195 for a detailed description of the applications of this setting.

**Parameters:**

&lt;Output&gt; ON|OFF

**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.

\*RST: ON

**Example:**

BB:EUTR:TRIG:SOUR EXT

sets external triggering.

BB:EUTR:TRIG:EXT:SYNC:OUTP ON

enables synchronous output to external trigger

---

**[ :SOURce<hw> ]:BB:EUTRa:TRIGger:OBASeband:DELay <Delay>**

Specifies the trigger delay (expressed as a number of samples) for triggering by the trigger signal from the second path (two-path instruments only).

**Parameters:**

&lt;Delay&gt; float

Range: 0 to 65535

Increment: 1

\*RST: 0

**Example:**

BB:EUTR:TRIG:SOUR OBAS

sets for path A the internal trigger executed by the trigger signal from the second path (path B).

BB:EUTR:TRIG:OBAS:DEL 50

sets a delay of 50 samples for the trigger.

---

**[ :SOURce<hw> ]:BB:EUTRa:TRIGger:OBASeband:INHibit <Inhibit>**

Specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path.

**Parameters:**

&lt;Inhibit&gt; float

Range: 0 to 2<sup>32</sup>-1

Increment: 1

\*RST: 0

**Example:** `BB:EUTR:TRIG:SOUR OBAS`  
 sets for path A the internal trigger executed by the trigger signal from the second path (path B).  
`BB:EUTR:TRIG:OBAS:INH 200`  
 sets a restart inhibit for 200 samples following a trigger event.

---

### **[:SOURce<hw>]:BB:EUTRa:TRIGger:RMODE?**

The command queries the current status of signal generation for all trigger modes with EUTRA/LTE modulation on.

**Return values:**

<Rmode>                    RUN|STOP

**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:EUTRa:TRIG:ARM:EXECute` (armed trigger modes only).

**Example:** `BB:EUTR:TRIG:SOUR EXT`  
 sets external triggering via the TRIGGER 1 connector.  
`BB:EUTR:TRIG:SEQ ARET`  
 selects the Armed\_Retrigger mode.  
`BB:EUTR:TRIG:RMODE?`  
 queries the current status of signal generation.  
 Response: RUN  
 the signal is generated, an external trigger was executed.

**Usage:**                    Query only

---

### **[:SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth <Slength>**

Defines the length of the signal sequence to be output in the "Single" trigger mode (`BB:EUTRa:TRIG:SEQ SING`).

It is possible to output deliberately just part of the frame, an exact sequence of the frame, or a defined number of repetitions of the frame. The unit is defined with command `BB:EUTRa:TRIG:SLUNit`. If the selected unit is changed, the selected sequence length will be automatically recalculated in the new unit.

**Parameters:**

<Slength>                    float

Range:                    0 to 2<sup>32</sup>-1  
 Increment:                1  
 \*RST:                     1

**Example:**

```
BB:EUTR:TRIG:SEQ SING
sets the trigger mode Single.
BB:EUTR:TRIG:SLUN FRAM
sets the unit Frame length for the entry of the sequence length.
BB:EUTR:TRIG:SLEN 200
sets a sequence length of 200 frames. The first 200 samples of
the current frame will be output after the next trigger event.
BB:EUTR:TRIG:SLUN SLOT
sets the unit slot length for the entry of the sequence length
BB:EUTR:TRIG:SLEN?
queries the sequence length.
Response: 40
```

---

**[[:SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit <Slunit>**

Defines the unit for the entry of the length of the signal sequence (BB:EUTRa:TRIG:SLEN) to be output in the "Single" trigger mode (BB:EUTRa:TRIG:SEQ SING).

**Parameters:**

<Slunit>

SEquence|FRAMe|SUBFrame|SLOT|SAMPlE

**FRAMe**

Unit Frame. A single frame is generated after a trigger event.

**SEquence**

Unit Sequence Length. A single sequence is generated after a trigger event.

**SUBFrame**

Unit Subframe. A single subframe is generated after a trigger event.

**SLOT**

Unit Slot. A single slot is generated after a trigger event.

**SAMPlE**

Unit Sample. Number of samples are generated after a trigger event.

\*RST: SEquence

**Example:**

```
BB:EUTR:TRIG:SEQ SING
sets trigger mode "Single".
BB:EUTR:TRIG:SLUN FRAM
sets unit Frame length for the entry of sequence length.
BB:EUTR:TRIG:SLEN 2
sets a sequence length of 2 frames. Two frames will be output after
the next trigger event.
```



---

```
[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce <Source>
```

Selects the trigger source.

**Parameters:**

<Source>

INTernal|EXTernal|BEXTernal | OBASeband

**INTernal**

Triggering is executed by means of the Trigger command

BB:EUTR:TRIGger:EXECute 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:EUTR:TRIG:SOUR EXT
```

sets external triggering via the TRIGGER 1 connector.

---

```
[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:DELay <Delay>
```

Specifies the trigger delay (expressed as a number of samples) for external triggering.

**Parameters:**

<Delay>

float

Range: 0 to 65535

Increment: 1

\*RST: 0

**Example:**

```
BB:EUTR:TRIG:SOUR EXT
```

sets an external trigger via the TRIGGER 1 connector.

```
BB:EUTR:TRIG:DEL 50
```

sets a delay of 50 samples for the trigger.

---

```
[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>
```

Specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only in the case of external triggering.

**Parameters:**

<Inhibit> float  
 Range: 0 to 2<sup>32</sup>-1  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:TRIG:SOUR EXT  
 selects an external trigger via the TRIGGER 1 connector  
 BB:EUTR:TRIG:INH 200  
 sets a restart inhibit for 200 samples following a trigger event.

## 9.6 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:EUTRa:TRIGger:OUTPut:DELay:FIXed.....	314
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay.....	315
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum.....	315
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum.....	315
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE.....	316
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset.....	317
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset.....	317
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime.....	317
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime.....	317
[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod.....	317

### [:SOURce<hw>]:BB:EUTRa: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:EUTR:TRIG:OUTP:DEL:FIX ON  
 restricts the marker signal delay setting range to the dynamic range.

**[ :SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay <Delay>**

Defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of samples. Command

`BB:EUTRa: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 samples to  $2^{24}-1$  samples  
 Increment: 1 sample  
 \*RST: 0 samples

**Example:**

`BB:EUTR:TRIG:OUTP2:DEL 1600`  
 sets a delay of 1600 samples for the signal on connector MARKER 2.

**[ :SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MAXimum?**

The command queries the maximum marker delay for setting

`BB:EUTRa:TRIG:OUTP:DEL:FIX ON`.

**Return values:**

<Maximum> float

**Example:**

`BB:EUTR:TRIG:OUTP:DEL:FIX ON`  
 restricts the marker signal delay setting range to the dynamic range.  
`BB:EUTR:TRIG:OUTP:DEL:MAX`  
 queries the maximum of the dynamic range.  
 Response: 20000  
 the maximum for the marker delay setting is 2000 samples.

**Usage:** Query only

**[ :SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum?**

The command queries the minimum marker delay for setting

`BB:EUTRa:TRIGger:OUTPut:DELay:FIXed ON`.

**Return values:**

<Minimum> float

**Example:** `BB:EUTR:TRIG:OUTP:DEL:FIX ON`  
restricts the marker signal delay setting range to the dynamic range.

`BB:EUTR:TRIG:OUTP:DEL:MIN`  
queries the minimum of the dynamic range.

Response: 0  
the minimum for the marker delay setting is 0 samples.

**Usage:** Query only

---

**[ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : MODE <Mode>**

Defines the signal for the selected marker output.

**Parameters:**

<Mode> SUBFram|FRAM|REStart|PERiod|RATio

**SUBFram**

A marker signal is generated at the start of each subframe. The rise and fall offsets are defined with the commands [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : FOFFset and [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : ROFFset.

**FRAM**

A marker signal is generated at the start of each radio frame. The rise and fall offsets are defined with the commands [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : FOFFset and [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : ROFFset.

**REStart**

A marker signal is generated at the start of each ARB sequence. The rise and fall offsets are defined with the commands [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : FOFFset and [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : ROFFset.

**PERiod**

A marker signal is generated at the beginning of every user-defined period. The period is defined with the command [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : PERiod on page 317.

**RATio**

A marker signal corresponding to the Time Off / Time On specifications in the commands [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : ONTime and [ :SOURce<hw> ] : BB : EUTRa : TRIGger : OUTPut<ch> : OFFTime is generated.

\*RST: FRAM

**Example:** `BB:EUTR:TRIG:OUTP2:MODE FRAME`  
 selects the frame marker signal on output MARKER 2.  
`BB:EUTR:TRIG:OUTP2:ROFF 20`  
 sets a rise offset of 20 samples for marker signal 2.  
`BB:EUTR:TRIG:OUTP2:FOFF 2000`  
 sets a fall offset of 2000 samples for marker signal 2 on path A.

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset <Foffset>**  
**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset <Roffset>**

Sets the rise offset for on/off ratio marker in number of samples.

**Parameters:**

<Roffset> float  
 Range: -64000 samples to 64000 samples  
 Increment: 1 sample  
 \*RST: 0 samples

**Example:** `BB:EUTR:TRIG:OUTP2:ROFF 20`  
 sets a rise offset of 20 samples for marker signal 2.

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime <Offtime>**  
**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime <Ontime>**

Sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting `BB:EUTR:TRIGger:OUTPut:MODE RATio` on the marker outputs is ON.

**Parameters:**

<Ontime> float  
 Range: 1 sample to  $2^{24}-1$  samples  
 Increment: 1 sample  
 \*RST: 1 sample

**Example:** `BB:EUTR:TRIG:OUTP2:MODE RAT`  
 selects the ratio marker signal on output MARKER 2.  
`BB:EUTR:TRIG:OUTP2:ONT 200`  
 sets an ON time of 200 samples for marker 2.

---

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod <Period>**

Sets the repetition rate for the signal at the marker outputs, expressed in terms of samples. The setting is only valid for selection "USER" in `BB:EUTR:TRIG:OUTP:MODE`.

**Parameters:**

<Period> float

Range: 2 samples to 2<sup>32</sup>-1 samples  
 Increment: 1 sample  
 \*RST: 2 samples

**Example:**

BB:EUTR:TRIG:OUTP2:MODE PER  
 selects the user marker for the signal on connector MARKER 2.  
 BB:EUTR:TRIG:OUTP2:PER 1600  
 sets a period of 1600 samples, i.e. the marker signal is repeated every 1600th sample.

## 9.7 General EUTRA/LTE Settings

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[\[:SOURce<hw>\]:BB:EUTRa:TDD:UDConf](#).....318

---

**[\[:SOURce<hw>\]:BB:EUTRa:TDD:SPSConf](#) <Spsconf>**

(enabled for TDD duplexing mode only)

Sets the Special Subframe Configuration number, i.e. together with the parameter [\[:SOURce<hw>\]:BB:EUTRa:DL:CPC](#) defines the lengths of the DwPTS, the Guard Period and the UpPTS.

**Parameters:**

<Spsconf> float

Range: 0 to 8  
 \*RST: 0

**Example:**

BB:EUTR:TDD:SPSC 2  
 sets the special subframe configuration

---

**[\[:SOURce<hw>\]:BB:EUTRa:TDD:UDConf](#) <Udconf>**

(enabled for TDD duplexing mode only)

Sets the Uplink-Downlink Configuration number, i.e. defines which subframe is used for downlink respectively uplink, and where the special subframes are located.

**Parameters:**

<Udconf> float

Range: 0 to 6  
 \*RST: 0

**Example:** `BB:EUTR:TDD:UDC 2`  
sets the UL/DL configuration

## 9.8 General EUTRA/LTE Downlink Settings

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---

### `[:SOURCE<hw>]:BB:EUTRa:DL:CONF:MODE <Mode>`

Determines whether the configuration and scheduling of the different PDSCH allocations inside of the DL allocation table is performed manual or according to the configuration made for the DCIs.

**Note:** Switching from Auto/DCI mode to Manual mode enables all parameters in the DL allocation table for configuration without to change their values. Switching from Manual to Auto/DCI mode, however, triggers a reset of the frame prior to reconfiguration of the PDSCH allocations according to the settings made for the PDCCH DCIs, i.e. the settings made in the DL allocation table are lost.

**Parameters:**

<Mode>                   MANual|AUTO

**MANual**

In this default mode, there is no cross-reference between the settings made for the PDCCH DCIs and the PDSCHs settings. The PDSCH allocations have to be configured manually in the DL allocation table.

**AUTO**

Precoding for spatial multiplexing will be performed according to 3GPP TS 36.211 and the selected parameters.

This mode assures a 3GPP compliant EUTRA/LTE signal and the PDSCH allocations are configured automatically according to the configuration of the PDCCH DCIs.

For more information see "[PDSCH Scheduling](#)" on page 86.

\*RST:           MANual

**Example:**

```
BB:EUTR:DL:CONF:MODE AUTO
```

enables the generation of 3GPP compliant EUTRA/LTE signal and the PDSCH allocations are configured automatically according to the configuration of the PDCCH DCIs.

**[[:SOURCE<hw>]:BB:EUTRa:DL:MIMO:CONFIguration <Configuration>**

Sets the global MIMO configuration.

**Parameters:**

<Configuration>       TX1|TX2|TX4|SIBF

\*RST:           TX1

**Example:**

```
BB:EUTR:DL:MIMO:CONF TX2
```

sets the MIMO configuration to 2 TxAntennas.

**[[:SOURCE<hw>]:BB:EUTRa:DL:MIMO:ANTenna?**

Queries the simulated antenna.

This command is allowed for simulation mode set to 1 Tx Antenna only.

**Return values:**

<Antenna>               ANT1|ANT2|ANT3|ANT4

\*RST:           ANT1

**Example:**

```
BB:EUTR:DL:MIMO:CONF TX1
```

sets 1 TxAntenna simulation mode.

```
BB:EUTR:DL:MIMO:ANT?
```

queries the simulated antenna.

Response: ANT1



**Usage:** Query only

---

**[ :SOURce<hw> ]:BB:EUTRa:DL:MIMO:ANTA <Anta>**

Sets the simulated antenna for path A. The available selections depend on the current MIMO configuration.

**Parameters:**

<Anta> ANT1|ANT2|ANT3|ANT4  
 \*RST: ANT1

**Example:**

BB:EUTR:DL:MIMO:CONF TX2  
 sets the MIMO configuration to 2 TxAntennas.  
 BB:EUTR:DL:MIMO:ANTA ANT2  
 sets the configuration to antenna 2.

---

**[ :SOURce<hw> ]:BB:EUTRa:DL:MIMO:ANTB <Antb>**

Sets the simulated antenna for path B. The available selections depend on the current MIMO configuration.

**Parameters:**

<Antb> NONE|ANT1|ANT2|ANT3|ANT4  
 \*RST: NONE

**Example:**

BB:EUTR:DL:MIMO:CONF TX4  
 sets the MIMO configuration to 2 TxAntennas.  
 BB:EUTR:DL:MIMO:ANTB ANT3  
 sets the configuration to antenna 3.

---

**[ :SOURce<hw> ]:BB:EUTRa:DL:REFSig:POWER <Power>**

Sets the reference signal power.

**Parameters:**

<Power> float  
 Range: -80.00 dB to 10.00 dB  
 Increment: 0.01 dB  
 \*RST: 0.00 dB

**Example:**

BB:EUTR:DL:REFS:POW -10.00  
 sets the reference signal power to -10.00dB.

---

**[ :SOURce<hw> ]:BB:EUTRa:DL:REFSig:EPRE?**

Queries the RS Power per RE relative to Level Display.

**Parameters:**

<Epre> float

Range: -80.00 dB to 10.00 dB  
 Increment: 0.01 dB  
 \*RST: 0.00 dB

**Example:**

BB:EUTR:DL:REFS:EPRE?  
 queries the RS Power per RE relative to Level Display.

**Usage:**

Query only

**[:SOURCE<hw>]:BB:EUTRa:DL:SYNC:TXAntenna <Txantenna>**

Defines on which antenna port the P-/S-SYNC is transmitted.

The available values depend on the number of configured antennas.

**Parameters:**

<Txantenna> NONE|ANT1|ANT2|ANT3|ANT4|ALL

Increment: 0.01  
 \*RST: NONE

**Example:**

BB:EUTR:DL:SYNC:TXAN ALL  
 enables all antenna ports to transmit P-/S-SYNC

**[:SOURCE<hw>]:BB:EUTRa:DL:SYNC:PPOWer <Ppower>**

Sets the power of the primary synchronization signal (P-SYNC).

**Parameters:**

<Ppower> float

Range: -80.00 dB to 10.00 dB  
 Increment: 0.01 dB  
 \*RST: 0 dB

**Example:**

BB:EUTR:DL:SYNC:PPOWer -10.00  
 sets the P-SYNC power to -10.00dB.

**[:SOURCE<hw>]:BB:EUTRa:DL:SYNC:SPOWer <Spower>**

Sets the power of the secondary synchronization signal (S-SYNC).

**Parameters:**

<Spower> float

Range: -80.00 dB to 10.00 dB  
 Increment: 0.01 dB  
 \*RST: 0 dB

**Example:** `BB:EUTR:DL:SYNC:SPOWer -10.00`  
sets the S-SYNC power to -10.00dB.

---

**[:SOURCE<hw>]:BB:EUTRa:DL:BW <Bw>**

Sets the DL channel bandwidth.

**Parameters:**

<Bw> USER|BW1\_40|BW3\_00|BW5\_00|BW10\_00|BW15\_00|  
BW20\_00

\*RST: BW10\_00

**Example:** `BB:EUTR:DL:BW BW1_25`  
selects a downlink frequency band of 1.25 MHz.

---

**[:SOURCE<hw>]:BB:EUTRa:DL:NORB <Norb>**

Selects the number of physical resource blocks per slot.

**Parameters:**

<Norb> float

Range: 6 to 110

\*RST: 50

**Example:** `BB:EUTR:DL:BW USER`  
sets the bandwidth mode to USER in downlink.  
`BB:EUTR:DL:NORB 7`  
sets the number of resource blocks to 7.

---

**[:SOURCE<hw>]:BB:EUTRa:DL:SRATe?**

Displays the sampling rate. The value for the sampling rate is set automatically according to the selected number of resource blocks per slot.

**Return values:**

<Srate> float

Range: 1.92 MHz to 30.72 MHz

Increment: 0.001 MHz

\*RST: 15.36 MHz

**Example:** `BB:EUTR:DL:SRAT?`  
displays the automatically set sampling rate.

**Usage:** Query only

**[[:SOURce<hw>]:BB:EUTRa:DL:FFT <FTT>**

Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected number of resource blocks per slot.

**Parameters:**

<FTT> float  
 Range: 128 to 2048  
 \*RST: 1024

**Example:**

BB:EUTR:DL:FFT?  
 displays the automatically set fast Fourier transformation parameter.

**[[:SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth?**

Queries the of occupied bandwidth. This value is set automatically according to the selected number of resource blocks per slot.

**Return values:**

<Occbandwidth> float  
 Range: 1.095 MHz to 20.00 MHz  
 \*RST: 9.015 MHz

**Example:**

BB:EUTR:DL:OCCB?  
 displays the automatically set occupied bandwidth in downlink.

**Usage:**

Query only

**[[:SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers?**

Queries the occupied subcarriers. The value is set automatically according to the selected number of physical resource blocks.

**Return values:**

<Occsubcarriers> float  
 Range: 72 to 1321  
 \*RST: 601

**Example:**

BB:EUTR:DL:OCCS?  
 displays the number of occupied subcarriers.

**Usage:**

Query only

**[[:SOURce<hw>]:BB:EUTRa:DL:LGS?**

Displays the number of left guard subcarriers. The value is set automatically according to the selected number of physical resource blocks.

**Return values:**

<Lgs> float  
 Range: 28 to 364  
 \*RST: 212

**Example:** BB:EUTR:DL:LGS?  
 displays the number of left guard subcarriers.

**Usage:** Query only

**[ :SOURCE<hw>]:BB:EUTRa:DL:RGS?**

Queries the number of right guard subcarriers. The value is set automatically according to the selected channel bandwidth and the number of physical resource blocks.

**Parameters:**

<Rgs> float  
 Range: 27 to 364  
 \*RST: 211

**Example:** BB:EUTR:DL:RGS?  
 displays the number of right guard subcarriers.

**Usage:** Query only

**[ :SOURCE<hw>]:BB:EUTRa:DL[:PLCi]:CID <Cid>**

Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3\*Physical Cell ID Group + Physical Layer ID,

where Physical Cell ID Group is set with the command `[ :SOURCE<hw>]:BB:EUTRa:DL[:PLCi]:CIDGroup` and Physical Layer ID with the command `[ :SOURCE<hw>]:BB:EUTRa:DL[:PLCi]:PLID` respectively.

**Parameters:**

<Cid> float  
 Range: 0 to 503  
 \*RST: 0

**Example:** BB:EUTR:DL:PLC:CID 100  
 sets the Cell ID.

**[ :SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CIDGroup <Cidgroup>**

Sets the ID of the physical cell identity group.

There are 504 unique physical layer cell identities, grouped into 168 unique physical cell identity groups that contain three unique identities each.

To configure these identities, use the command `[ :SOURce<hw> ] :BB:EUTRa:DL [ :PLCi ] :PLID`.

**Parameters:**

<Cidgroup> float  
 Range: 0 to 167  
 \*RST: 0

**Example:**

`BB:EUTR:DL:PLC:CIDG 100`  
 sets the ID of the physical cell identity group.

**[ :SOURce<hw>]:BB:EUTRa:DL[:PLCi]:PLID <Plid>**

Sets the identity of the physical layer within the selected physical cell identity group, set with the command `[ :SOURce<hw> ] :BB:EUTRa:DL [ :PLCi ] :CIDGroup`.

**Parameters:**

<Plid> float  
 Range: 0 to 2  
 \*RST: 0

**Example:**

`BB:EUTR:DL:PLC:PLID 2`  
 sets the identity of the physical layer.

**[ :SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARnti <Rarnti>**

Sets the random-access response identity RA-RNTI.

The value selected here determined the value of the parameter "UE\_ID/n\_RNTI" in case a RA\_RNTI "User" is selected.

**Parameters:**

<Rarnti> float  
 Range: 1 to 60  
 \*RST: 1

**Example:**

`BB:EUTR:DL:PLC:CSET:RARN 5`  
 sets the RA-RNTI

**[ :SOURce<hw>]:BB:EUTRa:DL:CPC <Cpc>**

Sets the cyclic prefix length for all subframes.

**Parameters:**

<Cpc>                    NORMal|EXTended|USER  
 \*RST:                  NORMal

**Example:**

BB:EUTR:DL:CPC NORM  
 a normal prefix is added to all subframes in downlink.  
 BB:EUTR:DL:CPC USER  
 the cyclic prefix has to be adjusted on subframe basis.  
 BB:EUTR:DL:SUBF6:CYCP NORM  
 a normal prefix is added to subframe 6 in downlink.  
 BB:EUTR:DL:SUBF1:CYCP EXT  
 an extended prefix is added to subframe 1 in downlink.

**[ :SOURCE<hw> ]:BB:EUTRa:DL:PDSCh:PB <Pb>**

Sets the parameter PDSCH P\_B and defines the cell-specific ratio rho\_B/rho\_A according to 3GPP TS 36.213, Table 5.2-1.

**Parameters:**

<Pb>                    float  
 Range:                0 to 3  
 \*RST:                0

**Example:**

BB:EUTR:DL:PDSC:PB 1  
 sets the parameter PDSCH P\_B

**[ :SOURCE<hw> ]:BB:EUTRa:DL:PDSCh:RATBa <Ratba>**

Sets the transmit energy ratio among the resource elements allocated for PDSCH in the OFDM symbols containing reference signal (P\_B) and such not containing one (P\_A).

**Parameters:**

<Ratba>                float  
 Range:                -10.00 dB to 10.00 dB  
 \*RST:                0 dB

**Example:**

BB:EUTR:DL:PDSC:RATB -5.0  
 sets the transmit energie ratio

**[ :SOURCE<hw> ]:BB:EUTRa:DL:PDCCh:RATBa <Ratba>**

Sets the transmit energy ratio among the resource elements allocated for PDCCH in the OFDM symbols containing reference signal (P\_B) and such not containing one (P\_A).

**Parameters:**

<Ratba> float

Range: -10.00 dB to 10.00 dB

\*RST: 0 dB

**Example:**

BB:EUTR:DL:PDCC:RATB -5.0  
sets the transmit energie ratio

**[ :SOURce<hw> ] : BB : EUTRa : DL : PBCH : RATBa <Ratba>**

Sets the transmit energy ratio among the resource elements allocated for PBCH in the OFDM symbols containing reference signal (P\_B) and such not containing one (P\_A).

**Parameters:**

<Ratba> float

Range: -10.00 to 10.00

\*RST: 0

Default unit: dB

**Example:**

BB:EUTR:DL:PBCH:RATB -5.0  
sets the transmit energie ratio

**[ :SOURce<hw> ] : BB : EUTRa : DL : PHICH : DURation <Duration>**

Sets the PHICH duration, i.e. the allocation of the PHICH resource element groups over the OFDM symbols.

The value selected puts the lower limit of the size of the Control Region for PUCCH (**[ :SOURce<hw> ] : BB : EUTRa : DL [ :SUBF<st0> ] : ENCC : PCFich : CREGion**) that is signaled by the PCFICH.

**Parameters:**

<Duration> NORMal|EXTended

**NORMal**  
All ressource element groups of PHICH (**[ :SOURce<hw> ] : BB : EUTRa : DL [ :SUBF<st0> ] : ENCC : PHICH : NOGRoups**) are allocated on the first OFDM symbol (OFDM Symbol 0).

**EXTended**  
The ressource element groups of PHICH are distributed over three OFDM symbol (OFDM Symbols 0 .. 2).

\*RST: NORMal

**Example:**

BB:EUTR:DL:PHIC:DUR NORM  
sets PHICH normal duration



**[ :SOURce<hw>]:BB:EUTRa:DL:PHICH:NGParameter <Ngparameter>**

Sets the parameter N\_g according to 3GPP TS 36.211, section 6.9 or enables the selection of user-defined value for the parameter "Number of PHICH Groups" (command [ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:NOGRoups on page 363).

**Parameters:**

<Ngparameter> NG1\_6|NG1\_2|NG1|NG2|NGCustom

**NG1\_6 | NG1\_2 | NG1 | NG2**

the actual "Number of PHICH Groups" for the different subframes is calculated according to 3GPP TS 36.211, section 6.9.

**NGCustom**

enables the selection of user-defined value for the parameter "Number of PHICH Groups".

\*RST: NG1\_6

**Example:**

BB:EUTRa:DL:PHICH:NGP NG1\_2  
sets PHICH N\_g

## 9.9 General EUTRA/LTE Uplink Settings

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---

### `[SOURce<hw>]:BB:EUTRa:UL:BW <Bw>`

Sets the UL channel bandwidth.

#### Parameters:

`<Bw>` USER|BW1\_40|BW3\_00|BW5\_00|BW10\_00|BW15\_00|  
BW20\_00

\*RST: BW10\_00

#### Example:

`BB:EUTRa:UL:BW BW1_25`  
selects a uplink frequency band of 1.25 MHz.

---

### `[SOURce<hw>]:BB:EUTRa:UL:NORB <Norb>`

Selects the number of physical resource blocks per slot.

#### Parameters:

`<Norb>` float

Range: 6 to 110

\*RST: 50

#### Example:

`BB:EUTRa:UL:BW USER`  
sets the bandwidth mode to USER in downlink.

`BB:EUTRa:UL:NORB 7`  
sets the number of resource blocks to 7.

---

### `[SOURce<hw>]:BB:EUTRa:UL:SRATe?`

Queries the sampling rate. The value for the sampling rate is set automatically according to the selected number of resource blocks per slot.

**Return values:**

<Srate> float

Range: 1.92 to 30.72  
 Increment: 0.001 MHz  
 \*RST: 15.36  
 Default unit: MHz

**Example:**

BB:EUTR:UL:SRAT?  
 displays the automatically set sampling rate.

**Usage:**

Query only

**[:SOURCE<hw>]:BB:EUTRa:UL:FFT <FFT>**

Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected number of resource blocks per slot.

**Parameters:**

<FFT> float

Range: 128 to 2048  
 \*RST: 1024

**Example:**

BB:EUTR:UL:FFT?  
 displays the automatically set FFT size.

**[:SOURCE<hw>]:BB:EUTRa:UL:OCCBandwidth?**

Queries the occupied bandwidth. This value is set automatically according to the selected number of resource blocks per slot.

**Return values:**

<Occbandwidth> float

Range: 1.095 MHz to 30.72 MHz  
 \*RST: 9.015 MHz

**Example:**

BB:EUTR:UL:OCCB?  
 displays the automatically set occupied bandwidth in uplink.

**Usage:**

Query only

**[:SOURCE<hw>]:BB:EUTRa:UL:OCCSubcarriers?**

Queries the occupied subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

**Return values:**

<Occsubcarriers> float  
 Range: 72 to 1320  
 \*RST: 600

**Example:**

BB:EUTR:UL:OCCS?  
 displays the number of occupied subcarriers.

**Usage:**

Query only

**[[:SOURce<hw>]:BB:EUTRa:UL:LGS?**

Queries the number of left guard subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

**Return values:**

<Lgs> float  
 Range: 28 to 364  
 \*RST: 212

**Example:**

BB:EUTR:UL:LGS?  
 displays the number of left guard subcarriers.

**Usage:**

Query only

**[[:SOURce<hw>]:BB:EUTRa:UL:RGS?**

Displays the number of right guard subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

**Return values:**

<Rgs> float  
 Range: 28 to 364  
 \*RST: 212

**Example:**

BB:EUTR:UL:RGS?  
 displays the number of right guard subcarriers.

**Usage:**

Query only

**[[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CID <Cid>**

Sets the cell identity.

There are 504 unique physical layer cell identities (Cell ID), grouped into 168 unique physical cell identity groups that contain three unique identities each. The Cell ID is calculated as following:

Cell ID = 3\*Physical Cell ID Group + Physical Layer ID,

where Physical Cell ID Group is set with the command `[ :SOURCE<hw> ] :BB:EUTRa:UL[:PLCi]:CIDGroup` and Physical Layer ID with the command `[ :SOURCE<hw> ] :BB:EUTRa:UL[:PLCi]:PLID` respectively.

**Parameters:**

<Cid> float  
 Range: 0 to 503  
 \*RST: 0

**Example:** `BB:EUTR:UL:PLC:CID 100`  
 sets the Cell ID.

**[ :SOURCE<hw> ] :BB:EUTRa:UL[:PLCi]:CIDGroup <Cidgroup>**

Sets the ID of the physical cell identity group.

**Parameters:**

<Cidgroup> float  
 Range: 0 to 167  
 \*RST: 0

**Example:** `BB:EUTR:UL:PLC:CIDG 100`  
 sets the UL physical cell ID group

**[ :SOURCE<hw> ] :BB:EUTRa:UL[:PLCi]:PLID <Plid>**

Sets the identity of the physical layer within the selected physical cell identity group, set with the command `[ :SOURCE<hw> ] :BB:EUTRa:UL[:PLCi]:CIDGroup`.

**Parameters:**

<Plid> float  
 Range: 0 to 2  
 \*RST: 0

**Example:** `BB:EUTR:UL:PLC:PLID 2`  
 sets the UL physical layer ID

**[ :SOURCE<hw> ] :BB:EUTRa:UL:CPC <Cpc>**

Sets the cyclic prefix length for all subframes.

**Parameters:**

<Cpc> NORMal|EXTended|USER  
 \*RST: USER

**Example:** `BB:EUTR:UL:CPC NORM`  
a normal prefix is added to all subframes in uplink.

**Example:** `BB:EUTR:UL:CPC USER`  
the cyclic prefix has to be adjusted on subframe basis.  
`BB:EUTR:UL:SUBF6:CYCP NORM`  
a normal prefix is added to subframe 6 in uplink.  
`BB:EUTR:UL:SUBF1:CYCP EXT`  
an extended prefix is added to subframe 1 in uplink.

---

**[:SOURCE<hw>]:BB:EUTRa:UL:REFSig:GRPHopping <Grphopping>**

Enables/disables group hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

**Parameters:**  
<Grphopping> 0|1|OFF|ON  
  
\*RST: OFF

**Example:** `BB:EUTR:UL:REFS:GRPH ON`  
enables group hopping

---

**[:SOURCE<hw>]:BB:EUTRa:UL:REFSig:SEQHopping <Seqhopping>**

Enables/disables sequence hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

**Parameters:**  
<Seqhopping> 0|1|OFF|ON  
  
\*RST: OFF

**Example:** `BB:EUTR:UL:REFS:SEQH ON`  
enables sequence hopping

---

**[:SOURCE<hw>]:BB:EUTRa:UL:REFSig:DSSHift <Dsshift>**

Sets the delta sequence shift for PUSCH needed for the calculation of the group hopping pattern.

**Parameters:**  
<Dsshift> float  
  
Range: 0 to 11  
\*RST: 0

**Example:** `BB:EUTR:UL:REFS:DSSH 3`  
sets the delta sequence shift for PUSCH

**[[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DMRS <Dmrs>**

Sets the part of the demodulation reference signal (DMRS) index which is broadcasted and therefore valid for the whole cell. This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

**Parameters:**

<Dmrs> float  
 Range: 0 to 11  
 \*RST: 0

**Example:**

BB:EUTR:UL:REFS:DMRS 4  
 sets the demodulation reference signal index to 4

**[[:SOURce<hw>]:BB:EUTRa:UL:REFSig:ENPRs <Enprs>**

Enables the use of the pseudo-random sequence `n_PRS` in the calculation of the demodulation reference signal (DMRS) index as defined in 3GPP TS 36.211.

If `n_PRS` is disabled, it is possible to set the cyclic shift to 0 for all subframes.

**Parameters:**

<Enprs> 0|1|OFF|ON  
 \*RST: OFF

**Example:**

BB:EUTR:UL:REFS:ENPR ON  
 enables `n_PRS`

**[[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx <Anstx>**

Enables/disables simultaneous transmission of SRS (sounding reference signal) and ACK/NACK messages, i.e. simultaneous transmission of SRS and PUCCH.

**Parameters:**

<Anstx> 0|1|OFF|ON  
 \*RST: OFF

**Example:**

BB:EUTR:UL:REFS:SRS:ANST ON  
 enables the A/N ans SRS simultaneous transmission for UE2

**[[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:MUPTs <Mupts>**

Enables/disables the cell specific parameter `srsMaxUpPts`.

If enabled, a SRS transmission in the `UpPTS` field (TDD) is made only in the frequency area that does not overlap with the frequency resources reserved for a possible PRACH preamble format 4 transmission.

This is done by reconfiguring the number of SRS resource blocks in the special sub-frames, which would otherwise be determined by C\_SRS and B\_SRS.

**Parameters:**

<Mupts> 0|1|OFF|ON  
\*RST: OFF

**Example:**

BB:EUTR:UL:REFS:SRS:MUPT ON  
enables the parameter srsMaxUpPts

**[ :SOURCE<hw> ]:BB:EUTRa:UL:REFSig:SRS:CSRS <Csrs>**

Sets the cell specific parameter SRS Bandwidth Configuration ( $C_{SRS}$ ).

**Parameters:**

<Csrs> float  
Range: 0 to 7  
\*RST: 0

**Example:**

BB:EUTR:UL:REFS:SRS:CSRS 4  
sets the SRS bandwidth configuration

**[ :SOURCE<hw> ]:BB:EUTRa:UL:REFSig:SRS:DSFC?**

Queries the value for the cell specific parameter transmission offset  $\Delta_{SFC}$  in sub-frames, depending on the selected SRS Subframe Configuration (`[ :SOURCE<hw> ]:BB:EUTRa:UL:REFSig:SRS:CSRS`) and the Duplexing mode (`[ :SOURCE<hw> ]:BB:EUTRa:DUPLexing`).

**Return values:**

<Dsfc> string

**Example:**

BB:EUTR:UL:REFS:SRS:SUC 4  
sets the SRS configuration  
BB:EUTR:UL:REFS:SRS:DSFC?  
queries the  $\Delta_{SFC}$  parameter

**Usage:**

Query only

**[ :SOURCE<hw> ]:BB:EUTRa:UL:REFSig:SRS:SUConfiguration <Suconfiguration>**

Sets the cell specific parameter SRS subframe configuration.

**Parameters:**

<Suconfiguration> float  
Range: 0 to 15  
\*RST: 0



**Example:** `BB:EUTR:UL:REFS:SRS:SUC 4`  
sets the SRS configuration

---

**[ :SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:TSFC?**

Queries the value for the cell specific parameter configuration period  $T_{SFC}$  in subframes, depending on the selected SRS Subframe Configuration (`[ :SOURce<hw> ] :BB:EUTRa:UL:REFSig:SRS:CSRS`) and the Duplexing mode (`[ :SOURce<hw> ] :BB:EUTRa:DUPLexing`).

**Return values:**

<Tsf> string

**Example:** `BB:EUTR:UL:REFS:SRS:SUC 4`  
sets the SRS configuration  
`BB:EUTR:UL:REFS:SRS:TSFC?`  
queries the  $T_{SFC}$  parameter

**Usage:** Query only

---

**[ :SOURce<hw>]:BB:EUTRa:UL:PRACH:CONFIguration <Configuration>**

Sets the PRACH configuration number as defined in the 3GPP TS 36.211, i.e. defines the subframes in which random access preamble transmission is allowed.

**Parameters:**

<Configuration> float  
Range: 0 to 63  
\*RST: 0

**Example:** `BB:EUTR:UL:PRAC:CONF 10`  
sets the PRACH configuration

---

**[ :SOURce<hw>]:BB:EUTRa:UL:PRACH:FOFFset <Foffset>**

For preamble formats 0-3, sets the prach-FrequencyOffset  $n_{PRBoffset}^{RA}$  as defined in the 3GPP TS 36.211, i.e. determines the first physical resource block available for PRACH expressed as a physical resource block number that fulfills the equation:

$$0 \leq n_{PRBoffset}^{RA} \leq \text{Number of UL Resource Blocks} - 6$$

**Parameters:**

<Foffset> float  
Range: 0 to 103  
\*RST: 0

**Example:** `BB:EUTR:UL:PRAC:FOFF 2`  
sets the frequency offset

---

**[:SOURCE<hw>]:BB:EUTRa:UL:PRACH:RSET <Rset>**

Enables/disables using of a restricted preamble set.

**Parameters:**

<Rset> 0|1|OFF|ON  
\*RST: ON

**Example:** `BB:EUTR:UL:PRAC:RSET ON`  
enables using of restricted set

---

**[:SOURCE<hw>]:BB:EUTRa:UL:PUSCh:FHMode <Fhmode>**

Sets the frequency hopping mode for PUSCH.

Frequency hopping is applied according to 3GPP TS36.213.

**Parameters:**

<Fhmode> INTRa|INTer  
**INTer**  
An inter subframe hopping is performed.  
**INTRa**  
Both intra- and inter-subframe subframe hopping are performed.  
\*RST: INTRa

**Example:** `BB:EUTR:UL:PUSC:FHM INT`  
selects inter subframe hopping mode

---

**[:SOURCE<hw>]:BB:EUTRa:UL:PUSCh:FHOFFset <Fhoffset>**

Sets the PUSCH Hopping Offset  $N_{RB}^{HO}$ .

The PUSCH Hopping Offset determines the first physical resource block and the maximum number of physical resource blocks available for PUSCH transmission if PUSCH frequency hopping is used.

**Parameters:**

<Fhoffset> float  
Range: 0 to 100000  
Increment: 1  
\*RST: 0

**Example:** `BB:EUTR:UL:PUSC:FHOF 2`  
set the PUSCH hopping offset

**[ :SOURce<hw>]:BB:EUTRa:UL:PUSCh:NOSM <Nosm>**

Sets the number of sub-bands (Nsb) into that the total range of physical resource blocks available for PUSCH transmission is divided. The frequency hopping is performed at sub-band level.

**Parameters:**

<Nosm> float

Range: 1 to 50  
 Increment: 1  
 \*RST: 4

**Example:**

BB:EUTR:UL:PUSC:NOSM 3  
 sets the number of sub-bands

**[ :SOURce<hw>]:BB:EUTRa:UL:PUCCh:NORB <Norb>**

Sets the PUCCH region in terms of reserved resource blocks, located at the edges of the channel bandwidth.

**Parameters:**

<Norb> float

Range: 0 to 6  
 Increment: 1  
 \*RST: 4

**Example:**

BB:EUTR:UL:PUCCH:NORB 3  
 reserves 3 RBs for PUCCH

**[ :SOURce<hw>]:BB:EUTRa:UL:PUCCh:DESHift <Deshift>**

Sets the delta shift parameter.

**Parameters:**

<Deshift> float

Range: 1 to 3  
 Increment: 1  
 \*RST: 2

**Example:**

BB:EUTR:PUCCH:DESH 3  
 sets the delta shift parameter

**[ :SOURce<hw>]:BB:EUTRa:UL:PUCCh:DEOffset <Deoffset>**

Sets the PUCCH delta offset parameter. The value range depends on the selected delta shift ([\[ :SOURce<hw>\]:BB:EUTRa:UL:PUCCh:DESHift](#)).

**Parameters:**

<Deoffset> float  
 Range: 0 to 2  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:PUCCh:DEOF 1  
 sets the delta offset

**[ :SOURCE<hw> ]:BB:EUTRa:UL:PUCCh:N1CS <N1cs>**

Sets the number of cyclic shifts used for PUCCH format 1/1a/1b in a resource block used for a combination of the formats 1/1a/1b and 2/2a/2b.

**Parameters:**

<N1cs> float  
 Range: 0 to 8  
 \*RST: 8

**Example:**

BB:EUTR:UL:PUCCh:N1CS 5  
 5 cyclic shifts will be used for PUCCH format 1/1a/1b in a RB used for a combination of the PUCCH formats 1/1a/1b and 2/2a/2b

**[ :SOURCE<hw> ]:BB:EUTRa:UL:PUCCh:N2RB <N2rb>**

Sets bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

**Parameters:**

<N2rb> float  
 Range: 0 to 5  
 Increment: 1  
 \*RST: 1

**Example:**

BB:EUTR:UL:PUCCh:N2RB 3  
 reserves 3 RB for PUCCH formats 2/2a/2b

**[ :SOURCE<hw> ]:BB:EUTRa:UL:PUCCh:N1NMax?**

Queries the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of normal CP.

**Return values:**

<N1nmax> float  
 Range: 0 to 110

**Example:** BB:EUTR:UL:PUCCH:N1NM?  
queries the range of the possible PUCCH formats 1/1a/1b transmissions.  
Response: 24

**Usage:** Query only

#### **[ :SOURCE<hw> ]:BB:EUTRa:UL:PUCCh:N1EMax?**

Queries the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of extended CP.

**Return values:**

<N1emax> float  
Range: 0 to 110

**Example:** BB:EUTR:UL:PUCCH:N1EM?  
queries the range of the possible PUCCH formats 1/1a/1b transmissions.  
Response: 10

**Usage:** Query only

#### **[ :SOURCE<hw> ]:BB:EUTRa:UL:PUCCh:N2Max?**

Queries the range of possible number of PUCCH format 2/2a/2b transmissions from different users in one subframe.

**Return values:**

<N2max> float  
Range: 0 to 110

**Example:** BB:EUTR:UL:PUCCH:N2M?  
queries the range of the possible PUCCH formats 2/2a/2b transmissions.  
Response: 16

**Usage:** Query only

## 9.10 DL Frame Configuration

### **SUBF<st0>**

Defines the subframe number. Value range <st0>= 0 .. 39. The maximum value depends on the selected sequence length (see [ :SOURCE<hw> ]:BB:EUTRa:SEnGth on page 292).

**ALLoc<ch0>**

Determines the allocation number.

Value range

- for subframes with PBCH, i.e. SUBF0, SUBF10, SUBF20 and SUBF30:  
<ch0> = 0 .. 111
- for all other subframes:  
<ch0> = 0 .. 110

**CW<user>**

Determines the code word. Value range <user>= 1 | 2

[SOURce<hw>]:BB:EUTRa:DL:VIEW:MODE.....	342
[SOURce<hw>]:BB:EUTRa:DL:BUR.....	342
[SOURce<hw>]:BB:EUTRa:DL:CONSubframes.....	343
[SOURce<hw>]:BB:EUTRa:DL:RSTFrame.....	343
[SOURce<hw>]:BB:EUTRa:DL:SFSelection.....	343
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix.....	343
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount.....	344
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords.....	344
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:MODulation.....	345
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP.....	345
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount.....	346
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMCount.....	346
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOffset.....	347
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMOffset.....	347
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC.....	348
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits.....	348
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA.....	348
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PATTern.....	349
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSElect.....	349
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWER.....	350
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONType.....	350
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATE.....	351
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFLict.....	351

**[SOURce<hw>]:BB:EUTRa:DL:VIEW:MODE <Mode>**

Determines whether the time plan shows the allocated Virtual Resource Blocks (VRBs) or the Physical Resource Blocks (PRBs).

**Parameters:**

<Mode> PRB|VRB  
\*RST: PRB

**[SOURce<hw>]:BB:EUTRa:DL:BUR <Bur>**

Selects either to fill unscheduled resource elements and subframes with dummy data or DTX.

**Parameters:**

<Bur> DUData|DTX  
 \*RST: DUData

**Example:**

BB:EUTR:DL:BUR DUD  
 the unscheduled resource elements are filled with dummy data.

**[:SOURCE<hw>]:BB:EUTRa:DL:CONSubframes <Consubframes>**

Sets the number of configurable subframes. All downlink/special subframes are filled periodically with the configured subframes with the exception of the SYNC signals which are set globally in the "General Settings" menu and the PBCH channel, which can only be configured in subframe 0.

**Parameters:**

<Consubframes> float  
 Range: 1 to 40  
 \*RST: 10

**Example:**

BB:EUTR:DL:CONS 10  
 ten subframes of a frame are configurable in downlink.

**[:SOURCE<hw>]:BB:EUTRa:DL:RSTFrame**

Resets all subframe settings of the selected link direction to the default values.

**Example:**

BB:EUTR:DL:RSTF  
 resets the downlink subframe parameters of path A to the default settings.

**Usage:**

Event

**[:SOURCE<hw>]:BB:EUTRa:DL:SfSelection <Sfselection>**

Sets the subframes to be configured in the resource allocation table.

**Parameters:**

<Sfselection> float  
 Range: 0 to 39  
 \*RST: 0

**Example:**

BB:EUTR:DL:SFS 0  
 displays subframe 0 in the allocation list view.

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix <Cycprefix>**

(enabled for BB:EUTR:DL:CPC USER only)

Sets the cyclic prefix for the according subframe.

**Parameters:**

<Cycprefix>            NORMal|EXTended  
                                  \*RST:        NORMal

**Example:**

BB:EUTR:DL:CPC USER  
 the cyclic prefix has to be adjusted on subframe basis.  
 BB:EUTR:DL:SUBF6:CYCP NORM  
 a normal prefix is added to subframe 6 in downlink.

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount <Alcount>**

Sets the number of scheduled allocations in the selected subframe. The maximum number of allocations that can be scheduled depends on the number of the selected resource blocks.

**Parameters:**

<Alcount>                float  
                                  Range:        1 to 112  
                                  \*RST:        2 (SUBF0, SUBF10, SUBF20, SUBF30); 1(all other subframes)

**Example:**

BB:EUTR:DL:SUBF4:ALC 5  
 five scheduled allocations are assigned to subframe four.

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords <Codwords>**

Sets the number of code word for an allocation.

Two code words are available for global MIMO configuration with two or more antennas.

**Parameters:**

<Codwords>                1|2  
                                  Range:        1 to 2  
                                  \*RST:        1

**Example:**

BB:EUTR:DL:MIMO:CONF TX2  
 sets the MIMO configuration to 2 TxAntennas.  
 BB:EUTR:DL:SUBF4:ALL5:CODW?  
 queries the number of code words used for allocation 5 in subframe 4.  
 Response:    2  
 two code words are used for allocation 5 in subframe 4.



**Example:** In case the data source for an allocation is set to User, changing this parameter will set also the parameter "Code Word" of all allocations, belonging to the same User in the corresponding sub-frame.

```
SOUR:BB:EUTR:DL:SUBF1:ALL5:CODW 2
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL7:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL7:CODW?
Response: 2
```

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:  
MODulation <Modulation>**

Selects the modulation scheme for the allocation.

**Parameters:**

<Modulation> QPSK|QAM16|QAM64  
\*RST: QPSK

**Example:** BB:EUTR:DL:SUBF4:ALL5:CW2:MOD QPSK  
selects QPSK as modulation scheme for the allocation.

**Example:** In case the data source for an allocation is set to User, changing this parameter will set also the parameter "Modulation" of all allocations, belonging to the same User in the corresponding sub-frame.

```
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW2:MOD QPSK
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL7:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW2:MOD?
Response: QPSK
```

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP  
<Gap>**

Enables/disables the utilization of distributed Virtual Resource Blocks (VBR) and determines whether the first or the second VRB gap is applied. The VRB-to-PRB mapping and the calculation of the VRB gap values are performed according to 3GPP TS 36.211.

**Parameters:**

<Gap>	float
<b>0</b>	A <b>localized distribution</b> is applied, i.e. the PDSCH mapping is performed on a direct VRB-to-PRB mapping.
<b>1</b>	Enables a <b>distributed</b> resource block allocation. The first VRB gap is used.
<b>2</b>	Enabled for "Channel Bandwidths" greater than 50 RBs. The mapping is based on the second (smaller) VRB gap.
Range:	0 to 2
*RST:	0

**Example:**

```
SOUR:BB:EUTR:DL:BW BW10_00
SOUR:BB:EUTR:SUBF0:ALL2:GAP2
```

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount <Rbcount>**

Sets the size of the selected allocation in resource blocks (per slot).

For allocations with two code words, the number of resource blocks for the second code word is automatically set to the number of resource blocks set for CW#1.

**Parameters:**

<Rbcount>	float
Range:	0 to 110
*RST:	1

**Example:**

```
BB:EUTR:DL:SUBF4:ALL5:CW:RBC 3
```

the size of allocation five for subframe 4 is set to three resource blocks.

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]: SYMCount <Symcount>**

Sets the size of the selected allocation in OFDM symbols.

For content type PBCH, PDCCH and PDSCH, this value is set automatically.

For allocations with two code words, the number of symbols for the second code word is automatically set to number of symbols set for CW#1.

**Parameters:**

<Symcount>	float
Range:	1 to 14
*RST:	6 (PBCH); 12 (PDSCH)

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:CONT RSVD`  
 selects reserved as type for the selected allocation.  
`BB:EUTR:DL:SUBF4:ALL5:CW:SYMC 6`  
 the size of allocation five for subframe 4 is set to six OFDM symbols.

**Example:** For FDD mode and content type PDSCH, this value is set automatically in a way that the allocation always fills the complete subframe with consideration of the symbol offset.  
`SOUR:BB:EUTR:DL:SUBF1:CYCP NORM`  
`SOUR:BB:EUTR:DL:SUBF2:ALL2:CW2:SYM 2`  
`SOUR:BB:EUTR:DL:SUBF1:ALL2:CW2:SYMC 12`

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOffset**  
 <Rboffset>

Queries the start resource block of the selected allocation.

This parameter is only configurable for content type Reserved.

**Note:** If the Auto Offset Calculation mode is activated, this value is read only.

**Parameters:**

<Rboffset> float  
 Range: 0 to 109  
 \*RST: 0

**Example:** `BB:EUTR:DL:SUBF4:ALL5:CW:CONT RSVD`  
 selects reserved as type for the selected allocation.  
`BB:EUTR:DL:SUBF4:ALL5:CW:RBOF 6`  
 resource block six is the start resource block for allocation five in subframe four.

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMoffset**  
 <Symoffset>

Sets the start OFDM symbol of the selected allocation.

The allowed values depend on the selected Content Type, Number of Symbols and Cycic Prefix.

For allocations with two code words, the symbol offset for the second code word is automatically set to the symbol offset set for CW#1.

**Note:** If the Auto Offset Calculation mode is activated, this value is read only.

**Parameters:**

<Symoffset> float  
 Range: 0 to 13  
 \*RST: 2(PDSCH)

**Example:** BB:EUTR:DL:SUBF4:ALL5:CW:SYM 5  
OFDM symbol five is the start OFDM symbol for allocation five in subframe four.

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC**

Sets whether automatic offset calculation is used or not.

**Parameters:**

<Aoc> 0|1|OFF|ON  
\*RST: ON

**Example:** BB:EUTR:DL:SUBF4:ALL5:CW:AOC ON  
activates the automatic offset calculation for the selected allocation.

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits?**

Queries the number of physical bits for the selected allocation. The value is set automatically according to the current allocation settings.

**Return values:**

<Physbits> float  
Range: 0 to 105600

**Example:** BB:EUTR:DL:SUBF4:ALL5:CW:PHYS?  
queries the number of physical bits for allocation five in subframe four.

**Usage:** Query only

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA<Data>**

Sets the data source for the selected allocation.

For allocations with two code words, the data source for the second code word is automatically set to the data source set for CW#1.

**Parameters:**

<Data> USER1|USER2|USER3|USER4|PN9|PN11|PN15|PN16|PN20|  
PN21|PN23|PATTern|DLISt|ZERO|ONE|MIB

**MIB**

for PBCH allocation only

Indicates that the PBCH transmits real MIB data (see also [ :  
SOURce<hw> ] :BB:EUTRa:DL:PBCH:MIB on page 352).

\*RST: PN9

**Example:**

BB:EUTR:DL:SUBF4:ALL5:CW:DATA PN9  
PN9 is the data source for the selected allocation.

**Example:**

PBCH  
SOUR:BB:EUTR:DL:PBCH:MIB ON  
SOUR:BB:EUTR:DL:SUBF0:ALL0:CW:DATA?  
Response: MIB

---

**[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :PATTern  
<Pattern>**

Selects the bit pattern for the PATTern selection. The maximum length is 64 bits.

For allocations with two code words, the data source for the second code word is automatically set to the data source set for CW#1.

**Parameters:**

<Pattern> <bit pattern>

\*RST: #H0,1

**Example:**

BB:EUTR:DL:SUBF4:ALL5:CW:DATA PATT  
BB:EUTR:DL:SUBF4:ALL5:CW:PATT #H3F,8  
defines the bit pattern.

---

**[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :DSElect  
<Dselect>**

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 allocations with two code words, the data source for the second code word is automatically set to the data source set for CW#1.

**Parameters:**

<Dselect> string

**Example:** BB:EUTR:DL:SUBF2:ALL5:CW:DATA DLIST  
selects the Data Lists data source.  
MMEM:CDIR '<root>\Lists\DM\IqData'  
selects the directory for the data lists.  
BB:EUTR:DL:SUBF2:ALL5:CW:DSElect 'eutra\_list1'  
selects file 'eutra\_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:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWER  
<Power>**

Sets the power  $P_{\text{PDSCH}}$  respectively  $P_{\text{PBCH}}$  for the selected allocation. The power of the PDCCH allocation  $P_{\text{PDCCH}}$  is read-only. The value is set with the command [ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCCh:POWER.

For allocations with two code words, the power for the second code word is automatically set to the power set for CW#1.

**Parameters:**

<Power> float  
Range: -80.00 dB to 10.00 dB  
Increment: 0.01 dB  
\*RST: 0 dB

**Example:**  $P_{\text{PDSCH}}, P_{\text{PBCH}}$   
SOUR:BB:EUTR:DL:SUBF1:ALL2:POW 10.00

**Example:**  $P_{\text{PDCCH}}$   
SOUR:BB:EUTR:DL:SUBF1:ENCC:PDCC:POW 2.00  
SOUR:BB:EUTR:DL:SUBF1:ALL1:POW?  
Response: 2

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONTType  
<Contype>**

Selects the type for the selected allocation.

PBCH can be configured in subframe 0 only.

**Parameters:**

<Contype> PDSch|PBCH|PDCCh|RSVD  
\*RST: PDSch

**Example:** BB:EUTR:DL:SUBF4:ALL5:CW:CONT PDSCh  
selects PDSCH as type for the selected allocation.

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATe**  
 <State>

Sets the allocation state to active or inactive.

**Parameters:**

<State>                    0|1|OFF|ON  
                               \*RST:        OFF

**Example:**                BB:EUTR:DL:SUBF4:ALL5:CW:STAT OFF  
 deactivates the selected allocation.

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFlIct?**

Indicates a conflict between two allocations.

**Return values:**

<Conflict>                0|1|OFF|ON  
                               \*RST:        OFF

**Example:**                BB:EUTR:DL:SUBF4:ALL5:CW2:CONF?  
 queries for the selected allocation whether there is a conflict with  
 another allocation.

**Usage:**                 Query only

## 9.11 DL Enhanced Settings

**SUBF<st0>**

Defines the subframe number. Value range <st0>= 0 .. 39. The maximum value depends on the selected sequence length (see [ :SOURce<hw>]:BB:EUTRa:SLENgth on page 292).

**ALLoc<ch0>**

Determines the allocation number.

Value range

- for subframes with PBCH, i.e. SUBF0, SUBF10, SUBF20 and SUBF30:  
    <ch0> = 0 .. 111
- for all other subframes:  
    <ch0> = 0 .. 110

[ :SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB.....	352
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: ISBSize.....	352
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: RVIndex.....	353

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: STATE.....	353
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: TBSize.....	353
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TYPE.....	354
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: CBIndex.....	354
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: CDD.....	355
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: NOLayers.....	355
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: SCHeme.....	355
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling: STATE.....	356
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling: UEID.....	357

---

### [:SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB <State>

(for PBCH only)

Enables/disables transmission of real MIB data.

#### Parameters:

<State>                    0|1|OFF|ON  
 \*RST:                    ON

**Example:**                    SOUR:BB:EUTR:DL:PBCH:MIB ON

---

### [:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: ISBSize <Isbsize>

Sets the size of the IR soft buffer.

#### Parameters:

<Isbsize>                    float  
 Range:                    800 to 30400  
 Increment:                800  
 \*RST:                    800

**Example:**                    SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:DATA USER3  
 SOUR:BB:EUTR:DL:SUBF9:ALL5:PHYS?  
 Response: 2400  
 SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:TBS 1500  
 SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:ISBS 1600  
 SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:DATA USER3  
 SOUR:BB:EUTR:DL:SUBF9:ALL4:CW2:CCOD:ISBS?  
 Response: 1600



---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:RVINdex <Rvindex>**

Sets the redundancy version index.

**Parameters:**

<Rvindex>                      float

Range:                      0 to 3

Increment:                      1

\*RST:                      0

**Example:**                      BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:RVIN 2  
sets the redundancy version index to 2

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:STATe <State>**

Enables/disables channel coding for the selected allocation and code word.

**Parameters:**

<State>                      0|1|OFF|ON

\*RST:                      OFF

**Example:**                      BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:STAT OFF  
disables channel coding for allocation 5 and code word 2

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TBSize <Tbsize>**

Sets the size of the transport block.

**Note:** The parameter depends on the content type and the global MIMO configuration.

**Parameters:**

<Tbsize>                      float

Range:                      1 to 100000

\*RST:                      0

**Example:**                      BB:EUTR:DL:SUBF9:ALL5:PHYS?  
queries the number of physical bits of allocation 5  
Response: 2400  
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:TBS 1500  
sets the transport block size to of allocation 5 to 1500 bits

**Example:**

```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL5:PHYS?
Response: 2400
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW:CCOD:TBS 1000
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:TBS 1500
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW:CCOD:TBS?
Response: 1000
SOUR:BB:EUTR:DL:SUBF9:ALL4:CW2:CCOD:TBS?
Response: 1500
```

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TYPE?**

Queries the used channel coding scheme and channel coding rate.

**Note:** The parameter depends on the allocation's content type.

**Return values:**

<Type> NONE|CONV|TC  
\*RST: NONE

**Example:**

```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:TYPE?
queries the used channel coding scheme and channel coding rate
Response: TC1/3
the used coding is turbo coding with 1/3 coding rate
```

**Usage:** Query only

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CBINdex <Cbindex>**

Sets the codebook index for the selected allocation.

The combination of codebook index and the selected number of layers determines the codebook matrix used for precoding.

**Parameters:**

<Cbindex> float  
Range: 0 to 15  
\*RST: 0

**Example:**

```
BB:EUTR:DL:SUBF4:ALL5:CW:PREC:CBIN 2
sets the codebook index to 2
```

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:
  PRECoding:CDD <Cdd>
```

Sets the CDD for the selected allocation.

The combination of cyclic delay diversity and the selected number of layers determines the precoding parameters for spatial multiplexing.

**Parameters:**

<Cdd> NOCDd|SMDelay|LADelay

**NOCDd**  
Zero CDD

**SMDelay**  
Small CDD

**LADelay**  
Large CDD

\*RST: NOCDd

**Example:** BB:EUTR:DL:SUBF4:ALL5:CW:PREC:CDD SMD  
selects small CDD

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:
  PRECoding:NOLayers <Nolayers>
```

Sets the number of layers for the selected allocation.

The combination of number of code words and number of layers determines the layer mapping for the selected precoding scheme.

**Note:** The number of available layers depends on the selected content type and the precoding scheme.

**Parameters:**

<Nolayers> 1|2|3|4

Range: 1 to 4

\*RST: 1

**Example:** BB:EUTR:DL:SUBF4:ALL5:CW:PREC:NOL 2  
sets the number of layers to 2

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:
  PRECoding:SCHEME <Scheme>
```

Selects the precoding scheme.

This parameter is available for the first code word only.

**Note:** The available selections depend on the selected content type.

**Parameters:**

&lt;Scheme&gt;

NONE|SPM|TXD|TXMS

**NONE**

Disables precoding.

**SPM**

Precoding for spatial multiplexing will be performed according to 3GPP TS 36.211, Version 8.1.0 onwards and the selected parameters.

**TXD**

Precoding for transmit diversity will be performed according to 3GPP TS 36.211, Version 8.1.0 onwards and the selected parameters

**TXMS**

Sets the PDSCH to transmission mode 7, as described in 3GPP TS 36.213, i.e. UE-specific RS will be added to the PDSCH.

\*RST: NONE

**Example:**

```
SOUR:BB:EUTR:DL:SUBF4:ALL5:CONT PDSC
BB:EUTR:DL:SUBF4:ALL5:CW:PREC:SCH SPM
sets the precoding scheme to spatial multiplexing
```

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLOc<ch0>[:CW<user>]:  
SCRambling:STATe <State>**

Enables/disables the bit-level scrambling.

**Parameters:**

&lt;State&gt;

ON|OFF

\*RST: OFF

**Example:**

```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:DATA PN9
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:SCR:STAT ON
enables scrambling
```

**Example:**

If a "User 1..4" is selected for the Data Source for the corresponding allocation, this command is query only and the return value corresponds the state determined with the command [ :

[SOURCE<hw>\]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe.](#)

```
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:DATA USER3
```

```
SOUR:BB:EUTR:DL:USER3:SCR:STAT ON
```

```
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:SCR:STAT?
```

```
Response: On
```

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:  
SCRambling:UEID <Ueid>**

Sets the user equipment identifier (n\_RNTI) of the user to which the PDSCH transmission is intended. The UE ID is used to calculate the scrambling sequence.

**Parameters:**

<Ueid> float  
Range: 0 to 65535  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF0:ALL5:CW:UEID 120  
sets the user equipment identifier.

## 9.12 PCFICH, PHICH and PDCCH Configuration

### SUBF<st0>

Defines the subframe number. Value range <st0>= 0 .. 39. The maximum value depends on the selected sequence length (see [ :SOURce<hw>]:BB:EUTRa:SLENgth on page 292).

### ITEM<ch0>

Value range <ch0>= 0 .. 19

[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe.....	359
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHeme.....	360
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers.....	360
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWEr.....	360
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:SCRambling:STATe.....	361
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion.....	361
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:PMODE.....	361
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:POWEr.....	362
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:GROup<ch0>: ITEM<user0>:POW.....	362
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:NOGRoups.....	363
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:ANPattern<ch0>.....	363
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWEr.....	363
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:SCRambling:STATe.....	364
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS.....	364
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVRegs.....	364
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVCCes.....	365
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:FORMat.....	365
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:NOPDcchs.....	366
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:ALRegs.....	367
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DREGs.....	367
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DATA.....	368
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern.....	368

[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DSElect.....	368
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource.....	369
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA.....	369
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSElect.....	369
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATtern.....	370
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem.....	370
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:APPend.....	371
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:INSert.....	371
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DELeTe.....	371
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN.....	371
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UP.....	371
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:RESet.....	372
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIFmt.....	372
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:UEID.....	372
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PFMT.....	373
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NCCes.....	373
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: NCCes.....	374
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: CONFlict.....	374
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:USER.....	374
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: SESPace.....	375
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:BITData.....	375
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:F1AMode.....	375
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PRACH:PRINdex.....	376
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PRACH:MINdex.....	376
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:CQIRequest.....	377
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:CSDMrs.....	377
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:DLAindex.....	378
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:DPOffset.....	378
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:GAP.....	378
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:HPN.....	379
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:MCSR.....	379
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:NDI.....	380
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PFHopping.....	380

[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PMI.....	380
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PREInfo.....	381
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RAH.....	381
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RAHR.....	382
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RBA.....	382
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RV.....	382
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---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe <State>**

Enables/disables the PDCCH, PCFICH and PHICH allocation.

**Parameters:**

<State>                    0|1|OFF|ON  
 \*RST:                    OFF

**Example:**

BB:EUTRa:DL:SUBF1:ENCC:STAT ON  
 enables PDCCH

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHEME  
<Scheme>**

Selects the precoding scheme for PDCCH.

**Parameters:**

<Scheme> NONE|TXD

**NONE**  
Disables precoding.

**TXD**  
Precoding for transmit diversity will be performed according to 3GPP TS 36.211 and the selected parameters

\*RST: NONE

**Example:** BB:EUTR:DL:SUBF1:ENCC:PREC:SCH TXD  
selects the precoding scheme

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers?**

Queries the number of layers for PDCCH.

This value is fixed to 1 for PDCCH.

**Return values:**

<Nolayers> float

Range: 1 to 2

**Example:** BB:EUTR:DL:SUBF1:ENCC:PREC:NOL?  
queries the number of layers  
Response: 1

**Usage:** Query only

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWER <Power>**

Sets the power of the PCFICH ( $P_{PCFICH}$ ).

**Parameters:**

<Power> float

Range: -80.00 to 10.00

\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PCF:POW -5  
sets the power of the PCFICH to -5 dBm



**[ :SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:SCRambling:STATe**  
 <State>

Enables/disables the scrambling of the PCFICH.

**Parameters:**

<State>                    0|1|OFF|ON  
                                  \*RST:        ON

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PCF:SCR:STAT ON  
 enables scrambling of the PCFICH

**[ :SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion** <Cregion>

Sets the number of OFDM Symbols to be used for PDCCH.

Whether 1, 2, 3 or 4 OFDM Symbols can be reserved for PDCCH depends on the parameters given in the following table.

Channel Band-width	PHICH Duration	Duplexing Mode	Normal Subframe	Special Subframe
No RB > 10	Normal	FDD	1,2,3	-
	Normal	TDD	1,2,3	1,2
	Extended	FDD	3	-
	Extended	TDD	3	2
	Normal	FDD	2,3,4	-
No RB <=10	Normal	TDD	2,3,4	2
	Extended	FDD	3,4	-
	Extended	TDD	3,4	2

**Parameters:**

<Cregion>                    float  
                                  Range:        1 to 3  
                                  \*RST:        2

**Example:**

BB:EUTR:PHIC:DUR NORM  
 selects PHICH normal duration  
 BB:EUTR:DL:SUBF1:ENCC:PCF:CREG 1  
 sets the control region

**[ :SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHIch:PMODE** <Pmode>

Determines whether all PHICH in a PHICH group are send with the same power or enables the adjustment of each  $P_{PHICH}$  individually.

**Parameters:****<Pmode>**            CONST|IND**CONST**

The power of a PHICH (PPHICH) in a PHICH group is set with the command `SOUR:BB:EUTR:DL:ENCC:PHIC:POW`.

**IND**

The power of the individual PHICHs is set with the command

```
*RST:        CONST
```

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PHIC:PMOD CONS
```

sets the power mode

```
BB:EUTR:DL:SUBF1:ENCC:PHIC:POW -5
```

sets the power of one PHICHs to -5 dB; all PHICHs in the PHICH group are send with this power.

```
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:POWer <Power>
```

Sets the power of one PHICH ( $P_{\text{PHICH}}$ ) in a PHICH group, i.e. the total power of one PHICH group is the sum of the power of the transmitted PHICHs whitin this group.

**Parameters:****<Power>**            float

Range:        -80.00 dB to 10.00 dB

\*RST:        0 dB

**Example:**

```
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:PMOD CONS
```

```
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:NOGR 1
```

```
SOUR:BB:EUTR:DL:SUBF2:CYCP NORM
```

```
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:ANP1 '1---1---'
```

```
SOUR:BB:EUTR:DL:SUBF2:ENCC:PHIC:POW - 3
```

sets the power of one PHICHs in a PHICH group to -3 dB

```
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:GROup<ch0>:
ITEM<user0>:POW <Index>
```

Sets the power of the individual PHICHs.

**Suffix:****<ch0>**            0 .. 56**<user0>**        0 .. 7

**Parameters:**

<Index> float  
 Range: -80.00 dB to 10.00 dB  
 \*RST: 0 dB

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PHIC:PMOD IND  
 sets the power mode  
 BB:EUTR:DL:SUBF1:ENCC:PHIC:GRO1:ITEM4:POW -5  
 sets the power of the PHICH#5 in the second PHICH group to -5 dB

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:NOGRoups**  
 <Nogroups>

Sets the number of available PHICH groups.

**Parameters:**

<Nogroups> float  
 Range: 0 to 56  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PHIC:NOGR 4  
 sets the number of PHICH groups

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:ANPattern<ch0>**  
 <Anpattern>

Sets the ACK/NACK pattern for the corresponding PHICH group.

A "1" indicates an ACK, a "0" - a NACK, a "-" indicates DTX.

**Suffix:**

<ch0> 0 .. 59

**Parameters:**

<Anpattern> string  
 Range: 0 to 15  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PHIC:ANP2 '1010--11'  
 sets the ACK/NACK pattern for PHICH Group number 2

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer <Power>**

Sets the power of the PDCCH ( $P_{PDCCH}$ ).

The value set with this parameter is also displayed in the allocation table for the corresponding allocation.

**Parameters:**

<Power> float  
 Range: -80.00 to 10.00  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:POW -5  
 sets the power of the PDCCH to -5dB

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:SCRambling:STATe**  
 <State>

Enables/disables the scrambling.

**Parameters:**

<State> 0|1|OFF|ON  
 \*RST: ON

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:SCR:STAT ON  
 enables scrambling

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS?**

Queries the number of bits allocated for PDCCH.

**Return values:**

<Bits> float  
 Range: 0 to 100000  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:STAT ON  
 enables PDCCH.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:BITS?  
 queries the number of bits  
 Response: 3144

**Usage:** Query only

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVRRegs?**

Queries the number of the REGs that are available for the PDCCH allocation.

**Return values:**

<Avregs> float  
 Range: 0 to 100000  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:STAT ON  
 enables PDCCH.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:AVR?  
 queries the number of REGs  
 Response: 393

**Usage:** Query only

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:AVCCes?**

Queries the number of the control channel elements (CCEs) that are available for the PDCCH allocation.

**Return values:**

<Avcces> float  
 Range: 0 to 100000  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:STAT ON  
 enables PDCCH.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:AVCC?  
 queries the number of CCEs  
 Response 43

**Usage:** Query only

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:FORMat <Format>**

Sets the PDCCH format.

The PDCCH format determines how many CCEs (control channel elements) will be used for the transmission of the PDCCH.

**Parameters:**

&lt;Format&gt;

VAR | -1 | 0 | 1 | 2 | 3

**VAR**

Enables full flexibility by the configuration of the downlink control information (DCI) format and content.

**-1**

R&S Signal Generator's proprietary format for legacy support.

Disables precoding.

This format corresponds to the transmission of one PDCCH on all available REGs, i.e.

# REGs available<sub>PDCCH</sub> = #REGs allocated<sub>PDCCH</sub>,

#PDCCH=1,

#DummyREGs=0.

This format has to be used while performing signal analysis with R&S FSQ.

**0**

One PDCCH is transmitted on one CCE, i.e. 9 REGs.

**1**

One PDCCH is transmitted on two CCEs, i.e. 18 REGs.

**2**

One PDCCH is transmitted on four CCEs, i.e. 36 REGs.

**3**

One PDCCH is transmitted on eight CCEs, i.e. 72 REGs.

\*RST: 0

**Example:**

BB: EUTR: DL: SUBF2: ENCC: PDCC: FORM 0

sets the PDCCH format.

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:FORM 0:NOPDcchs**  
<Nopdcchs>

Sets the number of PDCCHs to be transmitted.

The maximum number PDCCH that can be transmitted on the available REGs for PDCCH depends on the number of REGs (#REG) reserved for the transmission of one PDCCH, i.e. depends on the selected PDCCH format and is calculated as follow:

#PDCCH = # REGs available<sub>PDCCH</sub> / #REG.

**Parameters:**

&lt;Nopdcchs&gt;

float

Range: 0 to 1000

\*RST: 0

**Example:** BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0  
sets the PDCCH format.  
BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20  
sets the number of PDCCHs.

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:ALRegs?**

Queries the number of REGs that are actually allocated for PDCCH transmission (#REGs allocated<sub>PDCCH</sub>).

**Return values:**

<Alregs> float  
Range: 0 to 100000  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0  
sets the PDCCH format.  
BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20  
sets the number of PDCCHs.  
BB:EUTR:DL:SUBF2:ENCC:PDCC:ALR?  
queries the number of REGs  
Response: 180

**Usage:** Query only

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:DREGs?**

Queries the the number of REGs that are available for the PDCCH allocation but are not allocated.

**Return values:**

<Dregs> float  
Range: 0 to 100000  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0  
sets the PDCCH format.  
BB:EUTR:DL:SUBF2:ENCC:PDCC:NOPD 20  
sets the number of PDCCHs.  
BB:EUTR:DL:SUBF2:ENCC:PDCC:ALR?  
queries the number of REGs  
Response: 180  
BB:EUTR:DL:SUBF2:ENCC:PDCC:DREG?  
queries the number of dummy REGs  
Response: 213

**Usage:** Query only

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:h:DATA <Data>**

Selects the data source for PDCCH.

**Parameters:**

<Data> PN9|PN11|PN15|PN16|PN20|PN21|PN23|PATTern|DLISt|  
ZERO|ONE

\*RST: PN9

**Example:**

BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0

sets the PDCCH format.

BB:EUTR:DL:SUBF1:ENCC:PDCC:DATA PN9

PN9 is selected as data source

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:h:PATTern <Pattern>**

Selects the bit pattern for the PATT selection.

**Parameters:**

<Pattern> <bit pattern>

**Example:**

BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0

sets the PDCCH format.

BB:EUTR:DL:SUBF1:ENCC:PDCC:DATA PATT

Pattern is selected as data source

BB:EUTR:DL:SUBF1:ENCC:PDCC:PATT #H3F,8

defines the bit pattern.

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:h:DSElect <Dselect>**

Selects the data list for the DLISt data source selection.

The lists are stored 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> string



**Example:** BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:DATA DLIS  
selects the Data Lists data source.  
MMEM:CDIR '<root>\Lists'  
selects the directory for the data lists.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:DSEL 'eutra\_pdcch'  
selects file eutra\_pdcch as the data source. This file must be in  
the directory <root>\Lists

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:DCRegs:TRSource**  
<Trsource>

Sets the behavior of the dummy REGs, i.e. determines whether dummy data or DTX is transmitted.

**Parameters:**

<Trsource> DATA|DTX  
\*RST: DATA

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:TRS DATA  
DATA will be transmitted

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:DCRegs:DATA**  
<Data>

Selects the data source for PDCCH.

**Parameters:**

<Data> PN9|PN11|PN15|PN16|PN20|PN21|PN23|PATTERN|DLIST|  
ZERO|ONE  
\*RST: PN9

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DATA PN9  
PN9 is selected as data source

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:DCRegs:DSElect**  
<Dselect>

Selects the data list for the DLIS data source selection.

The lists are stored 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>                    string

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
sets the PDCCH format.
BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DATA DLIS
selects the Data Lists data source.
MMEMoRY:CDIR '<root>\Lists'
selects the directory for the data lists.
BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DSEL
'eutra_pdcch'
selects file eutra_pdcch as the data source. This file must be in
the directory <root>\Lists
```

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:DCR:REGs:PATTern**  
<Pattern>

Selects the bit pattern for the `PATT` selection.

**Parameters:**

<Pattern>                    <bit pattern>

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
sets the PDCCH format.
BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:DATA PATT
Pattern is selected as data source
BB:EUTR:DL:SUBF1:ENCC:PDCC:DCR:PATT #H3F,8
defines the bit pattern.
```

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:SITem** <Sitem>

Selects an PDCCH item, i.e. a row in the DCI table.

**Parameters:**

<Sitem>                    float

Range:                    0 to 19

Increment:                1

\*RST:                     0

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`  
sets the PDCCH format.  
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`  
selects the third row in the DCI table

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:APPend**

Adds a new row at the end of the DCI table.

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`  
sets the PDCCH format.  
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:APP`  
adds a new row

**Usage:** Event

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:INSert**

Insert a new row before the currently selected item.

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`  
sets the PDCCH format.  
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`  
selects the third row in the DCI table  
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:INS`  
inserts a new row before the third one

**Usage:** Event

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:DELete**

Deletes the selected row.

**Example:** `BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR`  
sets the PDCCH format.  
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2`  
selects the third row in the DCI table  
`BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:DEL`  
delets the third row

**Usage:** Event

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:DOWN**  
**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:UP**

Moves the selected row down or up.

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:SIT 2  
selects the third row in the DCI table  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:UP  
moves the third row one row up

**Usage:** Event

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:RESet**

Resets the table.

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:RES  
resets the table

**Usage:** Event

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIFmt <Dcifmt>**

Sets the DCI format for the selected PDCCH.

**Parameters:**

<Dcifmt> F0|F1|F1A|F1B|F1C|F1D|F2|F2A|F3|F3A  
\*RST: F0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1  
sets the DCI format

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
UEID <Ueid>**

Sets the n<sub>RNTI</sub> for the selected PDCCH.

**Parameters:**

<Ueid> float  
Range: 0 to 65535  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:UEID 100  
sets the n\_RNTI

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
PFMT <Pfmt>**

Sets the PDCCH format for the selected PDCCH.

**Parameters:**

<Pfmt> float  
Range: 0 to 3  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets PDCCH format variable.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:PFT 0  
sets the PDCCH format.

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
NCCes?**

Queries the number of control channel elements used for the transmission of the PDCCH.

**Return values:**

<Ncces> float  
Range: 0 to 100000  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:NCC?  
queries the number of CCEs

**Usage:** Query only

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
CINDEX <Cindex>**

Sets the CCE start index.

**Parameters:**

<Cindex> float  
 Range: 0 to 100000  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
 sets the PDCCH format.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:CIND 10  
 sets the CCE start index

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 NDCCes?**

Queries the number of dummy CCEs that are appended to the PDCCH.

**Return values:**

<Ndcces> float  
 Range: 0 to 100000  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
 sets the PDCCH format.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:NDCC?  
 queries the number of dummy CCEs

**Usage:** Query only

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 CONFLict?**

Indicates a conflict between two DCI formats.

**Query parameters:**

<Conflict> ON|OFF  
 \*RST: OFF

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:CONF?  
 queries whether there is a conflict or not.

**Usage:** Query only

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 USER <User>**

Selects the User the DCI is dedicated to.

The available "DCI Formats" depend on the value of this parameter.

**Parameters:**

<User> USER1|USER2|USER3|USER4|PRNTi|SIRNTi|RARNTi|NONE  
 \*RST: USER1

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:USER USER2  
 the DCI is dedicated to User 2

**[ :SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 SESPace <Sespace>**

If enabled, this parameter configures the PDCCH DCI to be transmitted within the common or UE-specific search space.

**Parameters:**

<Sespace> 0|1|OFF|ON  
 \*RST: OFF

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:SESP ON  
 the DCI is transmitted within the common or UE-specific search space.

**[ :SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 DCIConf:BITData?**

Queries the resulting bit data as selected with the DCI format parameters.

**Return values:**

<Bitdata> string

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
 sets the PDCCH format.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:  
 BITD?  
 queries the bit data

**Usage:**

Query only

**[ :SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 DCIConf:F1AMode <F1amode>**

Selects the mode of the DCI format.

**Parameters:**

<F1amode> PDSCh|PRACH  
 \*RST: PDSCh

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:F1AM  
PRAC  
sets the mode

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:PRACH:PRINDEX <Prindex>**

(PRACH mode only)

Sets the DCI Format 1A field Preamble index.

**Parameters:**

<Prindex> float  
Range: 0 to 63  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:F1AM PRAC  
sets the mode  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:  
PRAC:PRIN 10  
sets the preamble index

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:PRACH:MINDex <Mindex>**

(PRACH mode only)

Sets the DCI Format 1A field PRACH Mask Index.

**Parameters:**

<Mindex> float  
Range: 0 to 15  
Increment: 1  
\*RST: 0



**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1A  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:F1AM PRAC  
sets the mode  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:  
PRAC:MIND 10  
sets the preamble indexe

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:CQIRequest <Cqirequest>**

Sets the DCI Format 0 field CQI Request.

**Parameters:**

<Cqirequest> ON|OFF  
\*RST: OFF

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:CQIR  
ON  
enables CQI request

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:CSDMrs <Csdmrs>**

Sets the DCI Format 0 field cyclic shift for DMRS.

**Parameters:**

<Csdmrs> float  
Range: 0 to 7  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:CSDM  
1  
sets the cyclic shift

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:DLAindex <Dlindex>**

(Enabled for TDD mode only)

Sets the DCI Format 0/1A/1B/1D/2/2A field downlink assignment index.

**Parameters:**

<Dlindex> float  
Range: 0 to 3  
Increment: 1  
\*RST: 0

**Example:**

BB:EUTR:DUPL TDD  
selects TDD mode.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:DLA  
1  
sets the downlink assignment index

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:DPOffset <Dpoffset>**

Sets the DCI Format 1D field downlink power offset.

**Parameters:**

<Dpoffset> ON|OFF  
\*RST: OFF

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1D  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:DPOF  
ON  
enables downlink power offset

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:GAP <Gap>**

Sets the DCI Format 1A/1B/1C/1D field GAP value.

**Parameters:**

<Gap> ON|OFF  
\*RST: OFF

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1C  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:GAP  
ON  
enables gap value

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:HPN <Hpn>**

Sets the DCI Format 1/1A/1B/1D/2/2A field HARQ process number.

**Parameters:**

<Hpn> float  
Range: 0 to 15  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:HPN  
5  
sets the HARQ process number

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:MCSR <Mcsr>**

Sets the DCI Format 0/1/1A/1B/1D field Modulation and Coding Scheme.

**Parameters:**

<Mcsr> float  
Range: 0 to 31  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:MCSR  
5  
sets the Modulation and Coding Scheme

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:NDI <Ndi>**

Sets the DCI Format 0/1/1A/1B/1D field New Data Indicator.

**Parameters:**

<Ndi> ON|OFF  
\*RST: OFF

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
sets the PDCCH format.
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B
sets the DCI format
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:NDI
ON
sets the New Data Indicator
```

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:PFHopping <Pfhopping>**

Sets the DCI Format 0 field PUSCH Frequency Hopping.

**Parameters:**

<Pfhopping> ON|OFF  
\*RST: OFF

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
sets the PDCCH format.
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0
sets the DCI format
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PFH
ON
enables PUSCH Frequency Hopping
```

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:PMI <Pmi>**

Sets the DCI Format 1B field PMI Confirmation for Precoding.

**Parameters:**

<Pmi> ON|OFF  
\*RST: OFF

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PMI  
ON  
enebles PMI Confirmation for Precoding

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:PRECinfo <Precinfo>**

Sets the DCI Format 2/2A field Precoding Information.

**Parameters:**

<Precinfo> float  
Range: 0 to 63  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:PREC  
10  
sets Precoding Information

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:RAH <Rah>**

(Enabled for Channel Bandwidth > 10RBs)

Sets the DCI Format 1/2/2A field Resource Allocation Header.

**Parameters:**

<Rah> ON|OFF  
\*RST: OFF

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RAH  
ON  
enebles Resource Allocation Header

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
DCIConf:RAHR <Rahr>**

Sets the DCI Format 0 field Resource Block Assignment and Hopping Resource Allocation.

**Parameters:**

<Rahr> float  
 Range: 0 to 100000  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
 sets the PDCCH format.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0  
 sets the DCI format  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RAHR  
 100  
 sets Resource Block Assignment and Hopping Resource Allocation

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
DCIConf:RBA <Rba>**

Sets the DCI Format 0/1/1A/1B/1C/1D/2/2A field Resource Block Assignment.

**Parameters:**

<Rba> float  
 Range: 0 to 100000  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
 sets the PDCCH format.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0  
 sets the DCI format  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RBA  
 100  
 sets Resource Block Assignment

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
DCIConf:RV <Rv>**

Sets the DCI Format 1/1A/1B/1D field Redundancy Version.

**Parameters:**

<Rv> float  
 Range: 0 to 3  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
 sets the PDCCH format.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1  
 sets the DCI format  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:RV 1  
 sets the Redundancy Version

---

**[[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 DCIConf:SWAPflag <Swapflag>**

Sets the DCI Format 2/2A field Transport Block to Codeword Swap Flag.

**Parameters:**

<Swapflag> ON|OFF  
 \*RST: OFF

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
 sets the PDCCH format.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1  
 sets the DCI format  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:SWAP  
 ON  
 enables Transport Block to Codeword Swap Flag

---

**[[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 DCIConf:TB1:MCS <Mcs>**  
**[[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 DCIConf:TB2:MCS <Mcs>**

Sets the DCI Format 2/2A field Modulation and Coding Scheme.

**Parameters:**

<Mcs> float  
 Range: 0 to 31  
 Increment: 1  
 \*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB1:  
MCS 5  
sets the Modulation and Coding Scheme for TB1

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:TB1:NDI <Ndi>**  
**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:TB2:NDI <Ndi>**

Sets the DCI Format 2/2A field New Data Indicator.

**Parameters:**

<Ndi> ON|OFF  
  
\*RST: OFF

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB2:  
NDI ON  
sets the New Data Indicator for TB2

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:TB1:RV <Rv>**  
**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:TB2:RV <Rv>**

Sets the DCI Format 2/2A field Redundancy Version.

**Parameters:**

<Rv> float  
  
Range: 0 to 3  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TB1:  
RV 1  
sets the Redundancy Version for TB1



---

```
[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TBSI <Tbsi>
```

Sets the DCI Format 1C field Transport Block Size Index.

**Parameters:**

```
<Tbsi>          float
                Range:    0 to 31
                Increment: 1
                *RST:     0
```

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
sets the PDCCH format.
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1C
sets the DCI format
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TBSI
1
sets the Transport Block Size Index
```

---

```
[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TPCC <Tpcc>
```

Sets the DCI Format 0/1/1A/1B/1D/2/2A field TPC Command for PUSCH.

**Parameters:**

```
<Tpcc>          float
                Range:    0 to 3
                Increment: 1
                *RST:     0
```

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
sets the PDCCH format.
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B
sets the DCI format
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPCC
1
sets the TPC Command for PUSCH
```

---

```
[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TPCinstr <Tpcinstr>
```

Sets the DCI Format 3/3A field TPC Command.

**Parameters:**

```
<Tpcinstr>      integer
```

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F3  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPC  
'10100000'  
sets the TPC Command

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:TPMI <Tpmi>**

Sets the DCI Format 1B/1D field TPMI Information for Precoding.

**Parameters:**

<Tpmi> float  
Range: 0 to 15  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
sets the PDCCH format.  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B  
sets the DCI format  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:TPMI  
10  
sets the TPMI Information for Precoding

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:ULINDEX <Ulindex>**

(Enabled for TDD mode and UL/DL Configuration 0)

Sets the DCI Format 1B/1D field UL Index.

**Parameters:**

<Ulindex> float  
Range: 0 to 3  
Increment: 1  
\*RST: 0

**Example:**

```

BB:EUTR:DUPL TDD
selects TDD mode.
BB:EUTR:TDD:UDC 0
sets the UL/DL configuration
BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
sets the PDCCH format.
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B
sets the DCI format
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:ULIN
1
sets the UL Index

```

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:VRBA <Vrba>**

Sets the DCI Format 1A/1B/1D field Localized/Distributed VRB Assignment.

**Parameters:**

<Vrba> ON|OFF  
\*RST: OFF

**Example:**

```

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR
sets the PDCCH format.
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B
sets the DCI format
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:VRBA
ON
enables the Localized VRB Assignment

```

## 9.13 UL Frame Configuration

**SUBF<st0>**

Defines the subframe number. Value range <st0>= 0 .. 39. The maximum value depends on the selected sequence length (see [:SOURCE<hw>]:BB:EUTRa:SLENgth on page 292).

**ALLoc<ch0>**

Determines the allocation number. Value range <ch0> = 0 .. 3

<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL:CONSubframes</a> .....	388
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL:RSTFrame</a> .....	388
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL:SFSelection</a> .....	388
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:CYCPrefix</a> .....	389
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:MODulation</a> .....	389
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:FORMat</a> .....	389
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:RBCount</a> .....	389

<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:VRBoffset</code>	390
<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:SLOT&lt;user0&gt;:ALLoc&lt;ch0&gt;:RBOffset</code>	390
<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:RBCount</code>	390
<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PHYSbits</code>	391
<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:POWer</code>	391
<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:CONType</code>	391
<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:STATe</code>	392
<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:CONFlict</code>	392
<code>[:SOURCE&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:UEType</code>	392

---

### **`[:SOURCE<hw>]:BB:EUTRa:UL:CONSubframes` <Consubframes>**

Sets the number of configurable subframes. All uplink subframes are filled periodically with the configured subframes with the exception of the Sounding Reference Signal which are set individually for each UE in the "User Equipment" dialog.

#### **Parameters:**

`<Consubframes>` float

Range: 1 to 40  
\*RST: 1

**Example:** `BB:EUTR:UL:CONS 10`  
ten UL subframes of a frame are configurable.

---

### **`[:SOURCE<hw>]:BB:EUTRa:UL:RSTFrame`**

Resets all subframe settings of the selected link direction to the default values.

**Example:** `BB:EUTR:UL:RSTF`  
resets the uplink subframe parameters of path A to the default settings.

**Usage:** Event

---

### **`[:SOURCE<hw>]:BB:EUTRa:UL:SFSselection` <Sfselection>**

Sets the subframes to be displayed in the resource allocation table.

#### **Parameters:**

`<Sfselection>` float

Range: 0 to 39  
\*RST: 0

**Example:** `BB:EUTR:UL:SFS 0`  
displays subframe 0 in the allocation list view.

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix <Cycprefix>**

(enabled for BB:EUTR:UL:CPC USER only)

Sets the cyclic prefix for the selected subframe.

**Parameters:**

<Cycprefix>            NORMAl|EXTended  
 \*RST:            NORMAl

**Example:**

BB:EUTR:UL:CPC USER  
 the cyclic prefix has to be adjusted on subframe basis.  
 BB:EUTR:UL:SUBF6:CYCP NORM  
 a normal prefix is added to subframe 6 in uplink.

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:MODulation  
 <Modulation>**

Selects the modulation scheme for the allocation.

**Parameters:**

<Modulation>            QPSK|QAM16|QAM64  
 \*RST:            QPSK

**Example:**

SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT PUSC  
 SOUR:BB:EUTR:UL:SUBF4:ALL2:MOD QPSK  
 selects QPSK as modulation scheme for the allocation.

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:FORMat <Format>**

Sets the PUCCH Format (1/1a/1b/2/2a/2b).

**Parameters:**

<Format>            F1|F1A|F1B|F2|F2A|F2B  
 \*RST:            F1

**Example:**

SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT PUC C  
 SOUR:BB:EUTR:UL:SUBF4:ALL2:FORM F2A  
 sets the PUCCH format

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:RBCount?**

Sets the size of the selected allocation in resource blocks (per slot).

**Return values:**

<Rbcount>            float  
 Range:            1 to 110  
 \*RST:            11 (for UE1 in subframe 0)

**Example:** BB:EUTR:UL:SUBF4:ALL2:RBC 3  
the size of allocation two for subframe 4 is set to three resource blocks.

**Usage:** Query only

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:VRBoffset <Vrboffset>**

Sets the virtual resource block offset of the selected subframe.

**Parameters:**

<Vrboffset> float  
Range: 0 to 109  
\*RST: 2

**Example:** BB:EUTR:UL:SUBF4:ALL2:VRB 6  
sets the VRB Offset

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLOc<ch0>:RBOFset?**

Queries the start resource block of the selected allocation in slot n of the subframe.

The start physical resource block in slot n is set automatically and can deviate from the offset VBR (`[ :SOURCE<hw> ] :BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:VRBoffset`) if frequency hopping is used.

**Return values:**

<Rboffset> float  
Range: 0 to 109  
\*RST: 2 (for UE1 in subframe 0)

**Example:** BB:EUTR:UL:SUBF4:SLOT0:ALL2:RBOF 6  
resource block six is the start resource block for the second allocation in the fort subframe, slot 0.  
BB:EUTR:UL:SUBF4:SLOT:ALL2:RBOF 5  
resource block five is the start resource block for second allocation in the fort subframe, slot 1.

**Usage:** Query only

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:RBCoount?**

Sets the size of the selected allocation in resource blocks (per slot).

**Return values:**

<Rbcount> float  
 Range: 1 to 110  
 \*RST: 11 (for UE1 in subframe 0)

**Example:**

BB:EUTR:UL:SUBF4:ALL2:RBC 3  
 the size of allocation two for subframe 4 is set to three resource blocks.

**Usage:** Query only

**[ :SOURCE<hw> ]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:PHYSbits?**

Queries the number of physical bits for the selected allocation. The value is set automatically according to the current allocation settings.

**Return values:**

<Physbits> float  
 Range: 0 to 105600  
 \*RST: 0

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PHYS?  
 displays the number of physical bits for allocation two in subframe four.

**Usage:** Query only

**[ :SOURCE<hw> ]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:POWER <Power>**

Sets the power for the selected allocation.

**Parameters:**

<Power> float  
 Range: -80.00 dB to 10.00 dB  
 Increment: 0.01 dB  
 \*RST: 0 dB

**Example:**

BB:EUTR:UL:SUBF4:ALL2:POW 10.00  
 sets the power for the selected allocation to 10 dB.

**[ :SOURCE<hw> ]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:CONTType <Contype>**

Selects the content type for the selected allocation.

**Parameters:**

<Contype> PUSCh|PUCCh  
 \*RST: PUSCh

**Example:** `BB:EUTR:UL:SUBF4:ALL2:CONT PUSC`  
selects PUSCH as type for the selected allocation.

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe <State>**

Sets the allocation state to active or inactive.

**Note:** Disabling an allocation deactivate the PUSCH/PUCCH and the corresponding demodulation reference signal, but does not affect other allocations of the UE or the sounding reference signal.

**Parameters:**

<State> 0|1|OFF|ON  
\*RST: OFF

**Example:** `BB:EUTR:UL:SUBF4:ALL2:STAT OFF`  
deactivates the selected allocation and the corresponding PUSCH/PUCCH and demodulation reference signal. However the sounding reference signal of this allocation remains active.

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFLict?**

Indicates a conflict between two allocations.

**Return values:**

<Conflict> 0|1|OFF|ON  
\*RST: OFF

**Example:** `BB:EUTR:UL:SUBF4:ALL2:CONF?`  
displays for the selected allocation whether there is a conflict with another allocation.

**Usage:** Query only

---

**[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:UEType <Uetype>**

Sets the UE type for the selected allocation.

**Parameters:**

<Uetype> UE1|UE2|UE3|UE4  
\*RST: UE1 (for allocation 0); UE2 (for allocation 1); UE3 (for allocation 2); UE4 (for allocation 3)

**Example:** `BB:EUTR:UL:SUBF4:ALL1:UET UE2`  
selects UE2 for the selected allocation.



## 9.14 UL Enhanced Settings

### SUBF<st0>

Defines the subframe number. Value range <st0>= 0 .. 39. The maximum value depends on the selected sequence length (see [:SOURce<hw>]:BB:EUTRa:SLENgth on page 292).

### ALLoc<ch0>

Determines the allocation number. Value range <ch0> = 0 .. 3

[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:NDMRs.....	393
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATE.....	394
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE.....	394
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits.....	394
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE.....	395
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled.....	395
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS.....	395
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:CBITs.....	395
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:PATTErn.....	396
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs.....	396
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS.....	396
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATTErn.....	397
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:CBITs.....	397
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS.....	397
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATTErn.....	398
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSCh:BITS.....	398
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:TBSize.....	398
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:RVINdex.....	399
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAR.....	399
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:PATTErn.....	399
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITs.....	399
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS.....	400
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATTErn.....	400

### [:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:NDMRs <Ndmrs>

Sets the part of the demodulation reference signal (DMRS) index which is part of the uplink scheduling assignment and therefore only valid for the according UE in the according subframe.

This index applies when multiple shifts within a cell are used and is used by the calculation of the DMRS sequence.

#### Parameters:

<Ndmrs>	float
Range:	0 to 11
*RST:	0

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUSC:NDMR 3  
sets the n\_DRMS

---

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe**  
<State>

Enables/disabled frequency hopping for PUSCH.

**Parameters:**  
<State> 0|1|OFF|ON  
\*RST: OFF

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:STAT ON  
enables frequency hopping

---

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE?**

Queries the frequency hopping type used, as defined in 3GPP TS36.213.

**Return values:**  
<Type> TP1|TP2  
\*RST: NONE

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE?  
queries the frequency hopping type  
Response: T2

**Usage:** Query only

---

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits**  
<lihbits>

Sets the information in hopping bits according to the PDCCH DCI format 0 hopping bit definition. This information determines whether type 1 or type 2 hopping is used in the subframe, and - in case of type 1 - additionally determines the exact hopping function to use.

**Parameters:**  
<lihbits> float  
Range: 0 to 3

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:IIHB 0  
sets the information in hopping bits

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE**  
 <Mode>

Sets the ACK/NACK mode to Multiplexing or Bundling according to 3GPP TS 36.212, chapter 5.2.2.6.

ACK/NACK Mode Bundling is defined for TDD duplexing mode only and is the only one available mode for TDD UL/DL Configuration 5.

**Parameters:**

<Mode>                    MUX|BUNDling  
 \*RST:                    MUX

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:MODE MUX  
 selects multiplexing HARQ mode

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:**  
**NBUNDled <N\_bundled>**

For "ACK/NACK Mode Bundling", sets the parameter N\_bundled according to 3GPP TS36.212, section 5.2.2.6.

**Parameters:**

<N\_bundled>                integer  
 Range:                    1 to 6

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:MODE BUND  
 BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:NBUN 2

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS**  
 <Bits>

Sets the number of ACK/NACK bits.

Set this parameter to 0 to deactivate the ACK/NACK transmission for the corresponding subframe.

**Parameters:**

<Bits>                    float  
 Range:                    0 to 4  
 \*RST:                    0

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:BITS 2  
 sets the number of A/N bits

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:CBITs?**

Queries the number of coded ACK/NACK bits.

**Return values:**

<Cbits> float  
 Range: 0 to 100000

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:BITS 2  
 sets the number of A/N bits  
 BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:CBIT?  
 Response: 8

**Usage:**

Query only

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:PUSCh:HARQ:  
 PATtern <Pattern>**

Sets the ACK/NACK pattern for the PUSCH.

**Parameters:**

<Pattern> <bit pattern>

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT BIT2  
 selects 2-bit HARQ-ACK control information  
 BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:PATT #B10,2  
 sets the ACK/NACK Pattern

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:PUSCh:CQI:CBITs?**

Queries the number of coded CQI bits.

**Return values:**

<Cbits> float  
 \*RST: 20

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:CBIT?  
 queries the number of coded CQI bits

**Usage:**

Query only

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:PUSCh:CQI:BITS  
 <Bits>**

Sets the number of CQI bits before channel coding.

**Parameters:**

<Bits> float  
 Range: 0 to 32  
 \*RST: 4

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 30`  
sets the number of CQI bits

---

**[ :SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATtern**  
**<Pattern>**

Sets the CQI pattern for the PUSCH.

The length of the pattern is determined by the number of CQI bits (`[ :SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS`).

**Parameters:**

**<Pattern>** <bit pattern>  
**\*RST:** #B0,1

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 6`  
sets the number of CQI bits  
`BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:PATT #B100100,6`  
sets the CQI pattern

---

**[ :SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:CBITs?**

Queries the number of coded RI bits.

**Return values:**

**<Cbits>** float  
**Range:** 0 to 100000  
**\*RST:** 0

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:BITS 2`  
sets the number of RI bits  
`BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:CBIT?`  
Response: 6

**Usage:** Query only

---

**[ :SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS <Bits>**

Sets the number of rank indication (RI) bits.

Set this parameter to 0 to deactivate the RI for the corresponding subframe.

**Parameters:**

**<Bits>** float  
**Range:** 0 to 2  
**\*RST:** 0

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 2`  
sets the number of RI bits

---

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATtern**  
**<Pattern>**

Sets the RI pattern for the PUSCH.

**Parameters:**

<Pattern> <bit pattern>  
\*RST: #B0,1

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:BITS 2`  
sets the number of RI bits  
`BB:EUTR:UL:SUBF4:ALL2:PUSC:RI:PATT #B10,2`  
sets the RI pattern

---

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSCH:BITS?**

Queries the number of physical bits used for UL-SCH transmission.

**Parameters:**

<Bits> float

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:ULSC:BITS?`  
queries the number of physical bits for UL-SCH  
Response: 2000

**Usage:** Query only

---

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:**  
**TBSize <Tbsize>**

Sets the size of the transport block.

**Parameters:**

<Tbsize> float  
Range: 0 to 100000  
\*RST: 1500

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:TBS 1500`  
sets the size of the transport block

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:RVINdex <Rvindex>**

Sets the redundancy version index.

**Parameters:**

<Rvindex> float  
 Range: 0 to 3  
 \*RST: 0

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:RVIN 2  
 sets the redundancy version index

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAr <Npar>**

Sets the resource index for PUCCH format 1/1a/1b respectively 2/2a/2b.

**Parameters:**

<Npar> float  
 Range: 0 to  $n(1)_{PUCCH\_max} / n(2)_{PUCCH\_max}$   
 \*RST: 0

**Example:** BB:EUTR:UL:SUBF1:ALL2:PUC:NPAr 10  
 sets the n\_PUCCH parameter

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:PATtern <Pattern>**

Sets the PUCCH ACK/NACK pattern per subframe.

To enable the generation of signal with ACK/NACK information that vary not only per subframe but also differs over the frames, set an ACK/NACK pattern with more than 1 bit for the PUCCH formats 1a/2a and respectively 2 bits for formats 1b/2b.

The ACK/NACK pattern has a maximal length of 32 bits and is read out cyclically.

**Parameters:**

<Pattern> <32-bit pattern>

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUC:HARQ:PATT #B10,2  
 sets the ACK/NACK Pattern

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITs?**

Queries the number of coded CQI bits.

**Return values:**

<Cbits> float  
 \*RST: 20

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUCCh:CQI:CBIT?  
 queries sets the number of coded CQI bits  
 Response: 20  
 The number of coded CQI bits for PUCCH is always 20.

**Usage:**

Query only

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS**  
 <Bits>

Sets the number of CQI bits before channel coding.

**Parameters:**

<Bits> float  
 Range: 0 to 32  
 \*RST: 4

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUCCh:CQI:BITS 30  
 sets the number of CQI bits

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATtern**  
 <Pattern>

Sets the CQI pattern for the PUCCH.

The length of the pattern is determined by the number of CQI bits  
 (BB:EUTR:UL:SUBF:ALL:PUCCh:CQI:BITS).

**Parameters:**

<Pattern> <bit pattern>  
 \*RST: #B0,1

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUCCh:CQI:BITS 6  
 sets the number of CQI bits  
 BB:EUTR:UL:SUBF4:ALL2:PUCCh:CQI:PATT #B100100,6  
 sets the CQI pattern

## 9.15 Configure User

**USER<ch>**

Value range <ch>= [1]|2|3|4



<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:CCODing:STATe</code> .....	401
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:SCRambling:STATe</code> .....	401
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:UEID</code> .....	401
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:DATA</code> .....	402
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:DSElect</code> .....	402
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:PA</code> .....	402
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:PATTern</code> .....	403

---

#### **`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe <State>`**

Enables/disables channel coding for all allocations belonging to the selected user.

In the allocation table, the Channel Coding State of all allocations for which User 1...4 is selected as "Data Source" is set to the value set with this parameter.

##### **Parameters:**

`<State>`                    0|1|OFF|ON

                              \*RST:        OFF

##### **Example:**

```
BB:EUTR:DL:USER2:CCOD:STAT ON
enables channel coding for allocations belonging to user 2.
```

---

#### **`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRambling:STATe <State>`**

Enables/disables scrambling for all allocations belonging to the selected user.

In the allocation table, the scrambling state of all allocations for which User 1...4 is selected as "Data Source" is set to the value set with this parameter.

##### **Parameters:**

`<State>`                    0|1|OFF|ON

                              \*RST:        OFF

##### **Example:**

```
SOUR:BB:EUTR:DL:USER3:SCR:STAT OFF
disables scrambling for allocations belonging to user 3.
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:DATA USER3
SOUR:BB:EUTR:DL:SUBF0:ALL4:CW:SCR:STAT?
Response: Off
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:SCR:STAT?
Response: Off
```

---

#### **`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID <Ueid>`**

Sets the user equipment ID.

**Parameters:**

<Ueid> float  
 Range: 0 to 65535  
 \*RST: 0

**Example:** BB:EUTR:DL:USER2:UEID 3308  
 sets the UE ID.

**[:SOURCE<hw>]:BB:EUTRa:DL:USER<ch>:DATA <Data>**

Selects the data source for the selected user configuration.

**Parameters:**

<Data> PN9|PN11|PN15|PN16|PN20|PN21|PN23|PATT|DLIS|ZERO|ONE  
 \*RST: PN9

**Example:** BB:EUTR:DL:USER2:DATA PN9  
 PN9 is selected as data source for the user configuration.

**[:SOURCE<hw>]:BB:EUTRa:DL:USER<ch>:DSElect <Dselect>**

Selects the data list for the DLIS 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> string

**Example:** BB:EUTR:DL:USER2:DATA DLIS  
 selects the Data Lists data source.  
 MMEM:CDIR '<root>\Lists\DM\IqData'  
 selects the directory for the data lists.  
 BB:EUTR:DL:USER2:DSEL 'eutra\_list1'  
 selects file eutra\_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:EUTRa:DL:USER<ch>:PA <Pa>**

Sets PDSCH power factor according to 3GPP TS 36.213, chapter 5.2.

**Parameters:**

<Pa> -6.02 | -4.77 | -3.01 | -1.77 | 0 | 0.97 | 2.04 | 3.01  
 \*RST: 0

**Example:**

BB:EUTR:DL:USER2:PA 2.04  
 selects the P\_A

---

**[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PATTern <Pattern>**

Selects the bit pattern for the PATT selection. The maximum length is 64 bits.

**Parameters:**

<Pattern> <64-bit pattern>

**Example:**

BB:EUTR:DL:USER2:PATT #H3F,8  
 defines the bit pattern.

## 9.16 Dummy Data Configuration

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:MODulation.....</a>	403
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:POWER.....</a>	403
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:DATA.....</a>	404
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:DSElect.....</a>	404
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:PATTern.....</a>	404

---

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation <Modulation>**

Selects modulation for dummy data.

**Parameters:**

<Modulation> QPSK|QAM16|QAM64  
 \*RST: QPSK

**Example:**

BB:EUTR:DL:DUMD:MOD QAM16  
 QAM16 is selected as modulation for dummy data.

---

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:POWER <Power>**

Sets the power for dummy data.

**Parameters:**

<Power> float  
 Range: -80.00 dB to 10.00 dB  
 Increment: 0.01 dB  
 \*RST: 0 dB

**Example:** `BB:EUTR:DL:DUMD:POWer 10.00`  
sets the power for dummy data to 10 dB.

---

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA <Data>**

Selects the data source for dummy data.

**Parameters:**

<Data> PN9|PN11|PN15|PN16|PN20|PN21|PN23|PATT|DLIS|ZERO|ONE

\*RST: PN9

**Example:** `BB:EUTR:DL:DUMD:DATA PN9`  
PN9 is selected as data source for dummy data.

---

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DSElect <Dselect>**

Selects the data list for the DLIS 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> string

**Example:** `BB:EUTR:DL:DUMD:DATA DLIS`  
selects the Data Lists data source.  
`MMEMoRY:CDIR '<root>\Lists\DM\IqData'`  
selects the directory for the data lists.  
`BB:EUTR:DL:DUMD:DSElect 'eutra_list1'`  
selects file `eutra_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:EUTRa:DL:DUMD:PATtern <Pattern>**

Selects the bit pattern for the PATtern selection. The maximum length is 64 bits.

**Parameters:**

<Pattern> <bit pattern>

\*RST: #H0,1

**Example:** `BB:EUTR:DL:DUMD:PATtern #H1E,8`  
defines the bit pattern to #H1E,8.

## 9.17 User Equipment

### UE<ch>

Determines the User Equipment. Value range <ch>= [1]|2|3|4

### SUBF<ch0>

Value range <ch0>= 0 .. 99

[SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart.....	406
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID.....	406
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:STATe.....	406
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE.....	406
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer.....	407
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:ALRB.....	407
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:MODulation.....	407
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:N2DMrs.....	408
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:PASize.....	408
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:STATe.....	409
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TNOBits.....	409
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE.....	409
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:VRBoffset.....	410
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRStAte.....	410
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRTT.....	410
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRFormat.....	411
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:CFRames.....	411
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RBOffset.....	411
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:FRINdex.....	412
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:POWer.....	412
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:NCSConf.....	412
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[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:STATe.....	413
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DATA.....	414
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:PATtern.....	414
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DSElect.....	414
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:SCRambling:STATe.....	415
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:STATe.....	415
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:MODE.....	415
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[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IHARqoffset.....	416
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IRloffset.....	417
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:DRS:POWoffset.....	417
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:STATe.....	417
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:POWoffset.....	418
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:CYCShift.....	418
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BHOP.....	418
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BSRS.....	418

<code>[SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:REFSig:SRS:ISRS</code> .....	419
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:REFSig:SRS:TSRS</code> .....	419
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<code>[SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:REFSig:SRS:TOFFset</code> .....	420
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---

#### `[SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart <Dacrestart>`

If activated, the data source, the ACK/NACK pattern, the CQI pattern and RI are restarted every subframe.

##### Parameters:

`<Dacrestart>`            0|1|OFF|ON  
                               \*RST:        OFF

**Example:**            `BB:EUTR:UL:UE2:PUSC:DACR ON`  
                               enables restarting of the data source every subframe

---

#### `[SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID <Id>`

Sets the radio network temporary identifier (RNTI) of the UE.

##### Parameters:

`<Id>`                      float  
                               Range:        0 to 65535  
                               \*RST:        0

**Example:**            `BB:EUTR:UL:UE3:ID 303`  
                               sets the UE ID

---

#### `[SOURce<hw>]:BB:EUTRa:UL:UE<st>:STATE <State>`

Selects the user equipment state.

##### Parameters:

`<State>`                 0|1|OFF|ON  
                               \*RST:        ON (UE1); OFF (UE2..UE4)

**Example:**            `BB:EUTR:UL:UE2:STAT ON`  
                               activates UE2.

---

#### `[SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE <Mode>`

Selects whether the user equipment is in standard or in PRACH mode.

**Note:** PRACH mode will be supported in later version.

**Parameters:**

&lt;Mode&gt; STD|PRACH

**STD**

Sets the operational mode of the user equipment to standard.

**PRACH**

Sets the operational mode of the user equipment to PRACH mode.

\*RST: STD

**Example:**

```
BB:EUTR:UL:UE:MODE STD
selects the standard mode for UE1.
```

```
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer <Power>
```

Sets the power level of the selected UE.

**Parameters:**

&lt;Power&gt; float

Range: -80.00 to 10.00

\*RST: 0

**Example:**

```
BB:EUTR:UL:UE2:POW -5.0
sets the power of UE2
```

```
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:ALRB?
```

Queries the number of the allocated resource blocks for the selected FRC ([ :  
[SOURce<hw>](#)]:[BB:EUTRa:UL:UE<st>](#):[FRC:TYPE](#) on page 409).

**Return values:**

&lt;Alrb&gt; float

Range: 0 to 110

\*RST: 0

**Example:**

```
BB:EUTR:UL:UE2:FRC:TYPE A34
sets the FRC
BB:EUTR:UL:UE2:FRC:ALRB?
Response: 25
```

**Usage:** Query only

```
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:MODulation?
```

Queries the modulation for the selected FRC ([ :[SOURce<hw>](#)]:[BB:EUTRa:UL:](#)  
[UE<st>](#):[FRC:TYPE](#) on page 409).

**Return values:**

<Modulation> QPSK|QAM16|QAM64

\*RST: QPSK

**Example:**

BB:EUTR:UL:UE2:FRC:TYPE A34

sets the FRC

BB:EUTR:UL:UE2:FRC:MOD?

Response: QPSK

**Usage:**

Query only

**[ :SOURCE<hw>]:BB:EUTRa:UL:UE<st>:FRC:N2DMrs <N2dmrs>**

Sets the UE specific part of the demodulation reference signal (DMRS) index for all PUSCH allocation of the selected UE in all subframes.

n(2)\_DMRS set for the individual subframes with the command `[ :SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:PUSCh:NDMRs` for the corresponding UE is overwritten.

**Parameters:**

<N2dmrs> float

Range: 0 to 110

\*RST: 0

**Example:**

SOUR:BB:EUTR:UL:SUBF4:ALL0:PUSC:NDMR 3

sets the n(2)\_DMRS

SOUR:BB:EUTR:UL:UE1:FRC:STAT ON

enables FRC

SOUR:BB:EUTR:UL:UE1:FRC:N2DM 5

sets the DMRS index for all PUSCH allocation of the selected UE in all subframes

SOUR:BB:EUTR:UL:SUBF4:ALL0:PUSH:N2DM?

Response: 5

**[ :SOURCE<hw>]:BB:EUTRa:UL:UE<st>:FRC:PASize?**

Queries the payload size for the selected FRC (`[ :SOURCE<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE` on page 409).

**Parameters:**

<Pasize> float

Range: 0 to 200000

\*RST: 0



**Example:** BB:EUTR:UL:UE2:FRC:TYPE A34  
sets the FRC  
BB:EUTR:UL:UE2:FRC:PAS?  
Response: 2216

**Usage:** Query only

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:FRC:STATE <State>**

Enables/disables FRC configuration.

Enabling RFC configuration sets some parameters to their predefined values, i.e. several parameters are displayed as read-only. Reconfiguration of the values of this parameters is possible only after disabling the FRC configuration.

The FRC State is disabled and can not be enabled, if a user defined cyclic prefix (BB:EUTR:UL:CPC USER) is selected.

**Parameters:**  
<State> 0|1|OFF|ON  
\*RST: OFF

**Example:** BB:EUTR:UL:UE2:FRC:STAT ON  
enables FRC

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:FRC:TNOBits?**

Queries the total number of physical bits available for the PUSCH allocation per subframe in case the PUSCH is not shortened because of SRS or because it is transmitted in a cell specific SRS subframe.

**Return values:**  
<Tnbits> float  
Range: 0 to 200000  
\*RST: 0

**Example:** BB:EUTR:UL:UE2:FRC:TYPE A34  
sets the FRC  
BB:EUTR:UL:UE2:FRC:TNOB?  
Response: 7200

**Usage:** Query only

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE <Type>**

Selects a predefined fixed reference channel according to 3GPP TS 36.141, Annex A.

**Parameters:**

<Type> A11|A12|A13|A14|A15|A21|A22|A23|A31|A32|A33|A34|A35|A36|  
A37|A41|A42|A43|A44|A45|A46|A47|A48|A51|A52|A53|A54|A55|  
A56|A57|A71|A72|A73|A74|A75|A76|A81|A82|A83|A84|A85|A86

\*RST: A11

**Example:**

BB:EUTR:UL:UE2:FRC:TYPE A34  
selects FRC A3\_4

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:VRBoffset <Vrboffset>**

Sets the virtual resource block (VRB) offset for all PUSCH allocation of the selected UE in all subframes.

VRB Offset set for the individual subframes with the command `[ :SOURce<hw> ] :BB:EUTRa:UL[ :SUBF<st0> ] :ALLoc<ch0>:VRBoffset` are overwritten.

**Parameters:**

<Vrboffset> float

Range: 0 to 110

\*RST: 2

**Example:**

SOUR:BB:EUTR:UL:SUBF4:ALL0:VRB 6  
sets the VRB

SOUR:BB:EUTR:UL:UE1:FRC:STAT ON  
enables FRC

SOUR:BB:EUTR:UL:UE1:FRC:VRB 3  
sets the VRB offset for all PUSCH allocation of the UE1

SOUR:BB:EUTR:UL:SUBF4:ALL0:VRB?

Response: 3

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRSTate <State>**

Activates Power Ramping for the PRACH preamble. The start and the end of the preamble is cyclically extended and multiplied with a ramping function ( $\sin^2$ ).

**Parameters:**

<State> 0|1|OFF|ON

**Example:**

BB:EUTR:UL:UE1:MODE PRAC

BB:EUTR:UL:UE1:PRAC:PRST ON

---

**[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRTT <TransitionTime>**

Defines the transition time from beginning of the extended preamble to the start of the preamble itself.

**Parameters:**

<TransitionTime> float

Range: 0 to 0.000030  
 Increment: 0.0000001  
 \*RST: 0.000020  
 Default unit: s

**Example:**

```
BB:EUTR:UL:UE1:MODE PRAC
BB:EUTR:UL:UE1:PRAC:PRST ON
BB:EUTR:UL:UE1:PRAC:PRTT 15us
```

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRAC:PRFormat?**

Queries the preamble format.

**Return values:**

<Prformat> float

Range: 0 to 4  
 \*RST: 0

**Example:**

```
BB:EUTR:UL:UE1:PRAC:PRF?
queries the preamble format.
```

**Usage:**

Query only

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRAC:CFRames?**

Queries the number of configurable frames.

**Parameters:**

<Cframes> float

Range: 0 to 20  
 \*RST: 1

**Example:**

```
BB:EUTR:UL:UE1:PRAC:CRF?
queries the number of frames
```

**Usage:**

Query only

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRAC:SUBF<ch0>:RBOffset?**

Queries the starting RB, as set with the command `[ :SOURce<hw>]:BB:EUTRa:UL:PRAC:FOFFset`.

**Return values:**

<Rboffset> float  
 Range: 0 to 109  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:RBOF?  
 queries the RB offset.

**Usage:**

Query only

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:FRINDEX <Frindex>**

(enabled in TDD duplexing mode only)

Sets the frequency resource index  $f_{RA}$  for the selected subframe.

**Parameters:**

<Frindex> float  
 Range: 0 to 109  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:FRIN 2  
 sets the frequency resource index

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:POWER <Power>**

Sets the PRACH power relative to the UE power. The PRACH power can be adjusted independently for every configured preamble.

**Parameters:**

<Power> float  
 Range: -80.000 to 10.000  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:POW -3  
 sets the power

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:NCSCONF <Ncsconf>**

Selects the Ncs configuration of the selected subframe, i.e. determines the Ncs value for the selected preamble set.

**Parameters:**

<Ncsconf> float  
 Range: 0 to 15  
 \*RST: 0

**Example:** BB:EUTR:UL:UE1:PRAC:SUBF2:NCSC 2  
sets the Ncs Configuration

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RSEQUENCE**  
<Rsequence>

Selects the logical root sequence index for the selected subframe.

**Parameters:**

<Rsequence> float  
Range: 0 to 838  
\*RST: 0

**Example:** BB:EUTR:UL:UE1:PRAC:SUBF2:RSEQ 200  
sets the root sequence

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:SINDEX** <Sindex>

Selects the sequence index v for the selected subframe, i.e. selects which one of the 64 preambles available in a cell will be used.

**Parameters:**

<Sindex> float  
Range: 0 to 63  
\*RST: 0

**Example:** BB:EUTR:UL:UE1:PRAC:SUBF2:SIND 30  
sets the sequence index

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:DT** <Dt>

Sets the parameter delta\_t in us.

**Parameters:**

<Dt> float  
Range: 0 us to 1000 us  
\*RST: 0 us

**Example:** BB:EUTR:UL:UE1:PRAC:SUBF2:DT 300  
sets the parameter delta t

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:STATE** <State>

Enables/disables the PRACH for the selected subframe.

The subframes available for configuration depend on the selected PRACH configuration.

**Parameters:**

<State> 0|1|OFF|ON  
 \*RST: ON

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:STAT ON  
 activates PRACH in subframe 2 for UE1.

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DATA <Data>**

Selects the data source for Physical Uplink Shared Channel (PUSCH) of the selected UE. For the selected UE, this data source will be used for the PUSCH channel in every subframe where this channel is configured.

**Parameters:**

<Data> PN9|PN11|PN15|PN16|PN20|PN21|PN23|PATT|DLIS|ZERO|ONE  
 \*RST: PN9

**Example:**

BB:EUTR:UL:SUBF4:ALL2:CONT PUSC  
 sets the content type for the allocation 2 (UE3) to PUSCH.  
 BB:EUTR:UL:UE3:PUSC:DATA PN11  
 PN11 is selected as data source for PUSCH channel of UE3.

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:PATtern <Pattern>**

Selects the bit pattern for the PATtern selection. The maximum length is 64 bits.

**Parameters:**

<Pattern> <bit pattern>

**Example:**

BB:EUTR:UL:UE2:PUSC:DATA PATT  
 selectes pattern data as data source for PUSCH channel.  
 BB:EUTR:UL:UE2:PUSC:PATT #H3F,8  
 defines the bit pattern.

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DSElect <Dselect>**

Selects the data list for the DLIS 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> string

**Example:** BB:EUTR:UL:UE:PUSC:DATA DLIS  
selects the Data Lists data source.  
MMEM:CDIR '<root>\Lists\DM\IqData'  
selects the directory for the data lists.  
BB:EUTR:UL:UE:PUSC:DSElect 'eutra\_list1'  
selects file eutra\_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:EUTRa:UL:UE<st>:PUSCh:SCRambling:STATe <State>**

Enables/disables scrambling for all PUSCH allocations of the corresponding UE.

**Parameters:**

<State> 0|1|OFF|ON  
\*RST: OFF

**Example:** BB:EUTR:UL:UE2:PUSC:SCR:STAT ON  
enables scrambling for UE2

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:STATe <State>**

Enables/disables channel coding and multiplexing of data and control information for all PUSCH allocations of the corresponding UE.

**Parameters:**

<State> 0|1|OFF|ON  
\*RST: OFF

**Example:** BB:EUTR:UL:UE2:PUSC:CCOD:STAT ON  
enables channel coding for UE2

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:MODE <Mode>**

Defines the information transmitted on the PUSCH.

**Parameters:**

<Mode> COMBined|ULSChonly|UCIonly  
**COMBined**  
Control information and data is multiplexed into the PUSCH.  
**ULSChonly**  
Only data is transmitted on PUSCH.  
**UCIonly**  
Only uplink control information is transmitted on PUSCH.  
\*RST: ULSChonly

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`  
enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:INTerleaver**  
**<Interleaver>**

Enables/disables channel interleaving.

**Parameters:**  
**<Interleaver>** 0|1|OFF|ON  
**\*RST:** ON

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:INT OFF`  
disables channel interleaving for UE2

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:ICQioffset <Icqioffset>**

Sets the CQI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

**Parameters:**  
**<Icqioffset>** float  
**Range:** 0 to 15  
**\*RST:** 0

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`  
enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2  
`BB:EUTR:UL:UE2:PUSC:CCOD:ICQ 5`  
sets the CQI offset index

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IHARqoffset**  
**<Iharqoffset>**

Sets the HARQ-ACK offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

**Parameters:**  
**<Iharqoffset>** float  
**Range:** 0 to 14  
**\*RST:** 0



**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`  
enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2  
`BB:EUTR:UL:UE2:PUSC:CCOD:IHAR 5`  
sets the HARQ-ACK offset index

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IRIoffset <Irioffset>**

Sets the RI offset index for control information MCS offset determination according to 3GPP TS 36.213, chapter 8.6.3.

**Parameters:**

<Irioffset> float  
Range: 0 to 12  
\*RST: 0

**Example:** `BB:EUTR:UL:UE2:PUSC:CCOD:MODE COMB`  
enables multiplexing of the control information (UCI) and data (UL-SCH) on the PUSCH for UE2  
`BB:EUTR:UL:UE2:PUSC:CCOD:IRI 5`  
sets the RI offset index

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:DRS:POWoffset <Powoffset>**

Sets the power offset of the Demodulation Reference Signal (DRS) relative to the power level of the PUSCH/PUCCH allocation of the corresponding subframe.

**Parameters:**

<Powoffset> float  
Range: -80.00 dB to 10.00 dB  
Increment: 0.01 dB  
\*RST: 0 dB

**Example:** `BB:EUTR:UL:UE2:REFS:DRS:POW -2`  
sets the demodulation reference symbol power offser to -2dB.

---

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:STATe <State>**

Enables/disables sending of SRS for the corresponding UE.

**Parameters:**

<State> ON|OFF  
\*RST: OFF

**Example:** `BB:EUTR:UL:UE2:REFS:SRS:STAT ON`  
enables the SRS for UE2

---

**[[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:POWoffset <Powoffset>**

Sets the power offset of the Sounding Reference Signal (SRS) relative to the power of the corresponding UE.

**Parameters:**

<Powoffset>                      float

Range:                      -80.00 dB to 10.00 dB

Increment:                      0.01 dB

\*RST:                      0 dB

**Example:**                      BB:EUTR:UL:UE2:REFS:SRS:POW -2  
sets the sounding reference symbol power offset to -2 dB.

---

**[[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:CYCShift <Cycshift>**

Sets the cyclic shift used for the generation of the sounding reference signal CAZAC sequence.

**Parameters:**

<Cycshift>                      float

Range:                      0 to 11

\*RST:                      0

**Example:**                      BB:EUTR:UL:UE2:REFS:SRS:CYCS 5  
sets the SRS cyclic shift for UE2

---

**[[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BHOP <Bhop>**

Sets the UE specific parameter frequency hopping bandwidth  $b_{hop}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

SRS frequency hopping is enabled, if  $b_{HOP} < B_{SRS}$ .

**Parameters:**

<Bhop>                      float

Range:                      0 to 3

\*RST:                      0

**Example:**                      BB:EUTR:UL:UE2:REFS:SRS:BHOP 2  
sets the SRS hopping bandwidth

---

**[[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BSRS <Bsrs>**

Sets the UE specific parameter SRS Bandwidth  $B_{SRS}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

**Parameters:**

<Bsrs> float  
 Range: 0 to 3  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE2:REFS:SRS:BSRS 2  
 sets the SRS bandwidth configuration

**[ :SOURCE<hw> ] : BB : EUTRa : UL : UE <st> : REFSig : SRS : ISRS <lsrs>**

Sets the UE specific parameter SRS configuration index  $I_{SRS}$ . Depending on the selected duplexing mode (`[ :SOURCE<hw> ] : BB : EUTRa : DUPLexing`), this parameter determines the parameters SRS Periodicity  $T_{SRS}$  and SRS Subframe Offset  $T_{offset}$  as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

**Parameters:**

<lsrs> float  
 Range: 0 to 644  
 \*RST: 0

**Example:**

BB:EUTR:DUPL FDD  
 sets the duplexing mode  
 BB:EUTR:UL:UE2:REFS:SRS:ISRS 22  
 sets the SRS configuration index

**[ :SOURCE<hw> ] : BB : EUTRa : UL : UE <st> : REFSig : SRS : TSRS?**

Queries the UE specific parameter SRS periodicity  $T_{SRS}$ .

The value depends on the selected SRS configuration index  $I_{SRS}$  (`[ :SOURCE<hw> ] : BB : EUTRa : UL : UE <st> : REFSig : SRS : ISRS`) and duplexing mode (`[ :SOURCE<hw> ] : BB : EUTRa : DUPLexing`) as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

**Return values:**

<Tsrs> float  
 Range: 0 to 100000  
 \*RST: 0

**Example:**

BB:EUTR:DUPL FDD  
 sets the duplexing mode  
 BB:EUTR:UL:UE2:REFS:SRS:ISRS 22  
 sets the SRS configuration index  
 BB:EUTR:UL:UE2:REFS:SRS:TSRS?  
 queries the SRS periodicity  
 Response: 20 ms

**Usage:**

Query only

**[ :SOURCE<hw> ] : BB : EUTRa : UL : UE<st> : REFSig : SRS : TOFFset ?**

Queries the UE specific parameter SRS subframe offset  $T_{\text{offset}}$ .

The value depends on the selected SRS configuration index  $I_{\text{SRS}}$  (`[ :SOURCE<hw> ] : BB : EUTRa : UL : UE<st> : REFSig : SRS : ISRS`) and duplexing mode (`[ :SOURCE<hw> ] : BB : EUTRa : DUPLexing`) as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

**Return values:**

<Toffset>                      float  
                                          Range:        0 to 320

**Example:**

```
BB:EUTR:DUPL FDD
sets the duplexing mode
BB:EUTR:UL:UE2:REFS:SRS:ISRS 22
sets the SRS configuration index
BB:EUTR:UL:UE2:REFS:SRS:TOFF?
queries the SRS subframe offset
Response: 5
```

**Usage:**                      Query only

**[ :SOURCE<hw> ] : BB : EUTRa : UL : UE<st> : REFSig : SRS : TOFFset ?**

Queries the UE specific parameter SRS subframe offset  $T_{\text{offset}}$ .

The value depends on the selected SRS configuration index  $I_{\text{SRS}}$  (`[ :SOURCE<hw> ] : BB : EUTRa : UL : UE<st> : REFSig : SRS : ISRS`) and duplexing mode (`[ :SOURCE<hw> ] : BB : EUTRa : DUPLexing`) as defined in the 3GPP TS 36.213, Table 8.2-1 (FDD) and 8.2-2 (TDD) respectively.

**Return values:**

<Toffset>                      float  
                                          Range:        0 to 320

**Example:**

```
BB:EUTR:DUPL FDD
sets the duplexing mode
BB:EUTR:UL:UE2:REFS:SRS:ISRS 22
sets the SRS configuration index
BB:EUTR:UL:UE2:REFS:SRS:TOFF?
queries the SRS subframe offset
Response: 5
```

**Usage:**                      Query only

---

**[[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TRComb <Trcomb>**

Sets the UE specific parameter transmission combination  $k_{TC}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

**Parameters:**

<Trcomb>                    0 | 1

Range:                    0 to 1

\*RST:                    0

**Example:**

BB:EUTR:UL:UE2:REFS:SRS:TRC 1  
sets the SRS transmission combination

---

**[[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:NRRC <Nrrc>**

Sets the UE specific parameter frqDomainPosition  $n_{RRC}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

**Parameters:**

<Nrrc>                    float

Range:                    0 to 100

\*RST:                    0

**Example:**

BB:EUTR:UL:UE2:REFS:SRS:NRRC 10  
sets the SRS frequency domain position

## 9.18 Realtime Feedback



The Realtime Feedback Configuration is enabled only for UE1 in instruments equipped with the option R&S SMx/AMU-K69.



Realtime Feedback Configuration is not available for the R&S Signal Generator SMBV and for the simulation software R&S WinIQSIM2.

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:ACKDefinition.....</a>	422
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:ADUDelay.....</a>	422
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:BBSelector.....</a>	422
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:BEInsertion.....</a>	423
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<code>[SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:SERate</code> .....	425

---

**`[SOURce<hw>]:BB:EUTRa:UL:RTFB:ACKDefinition` <Ackdefinition>**

(Binary ACK/NACK mode only)

Determines whether a high or a low binary level on the feedback line connector represents an ACK.

**Parameters:**

<Ackdefinition>      HIGH|LOW  
                              \*RST:      HIGH

**Example:**

```
BB:EUTR:UL:RTFB:MODE BAN
enables realtime feedback on a serial line
BB:EUTR:UL:RTFB:ACKD HIGH
a high voltage level on the feedback line means an ACK
```

---

**`[SOURce<hw>]:BB:EUTRa:UL:RTFB:ADUDelay` <Adudelay>**

Determines the point in time when the feedback can be sent to the instrument.

Mode	Value Range	
Binary	3GPP Distance Mode	-1.00 .. 2.99 subframes
	Direct Response Distance Mode	+1.00 .. 6.99 subframes
Serial and Serial 3x8	-	-1.00 .. 1.99 subframes

**Parameters:**

<Adudelay>      float  
                              Range:      0 ms to 2.99 ms  
                              \*RST:      0 ms

**Example:**

```
BB:EUTR:UL:RTFB:ADUD 1
sets the additional user delay
```

---

**`[SOURce<hw>]:BB:EUTRa:UL:RTFB:BBSelector` <Bbselector>**

(Serial mode only)

Needed for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

**Parameters:**

<Bbselector> float

Range: 0 to 3  
 \*RST: 0 (for Baseband A); 1 (for Baseband B)

**Example:**

```
BB:EUTR:UL:RTFB:MODE SER
enables realtime feedback on a serial line
BB:EUTR:UL:RTFB:BBS 1
sets the baseband selector
```

**[:SOURCE<hw>]:BB:EUTRa:UL:RTFB:BEINsertion <Beinsertion>**

Enables/disables the statistical insertion of block errors into PUSCH packets.

The block error insertion can be enabled for a single HARQ process or for all processes.

In the single HARQ process case, the used process is always the one that corresponds to the first activated PUSCH.

**Parameters:**

<Beinsertion> OFF|FPRocess|APRocesses

\*RST: OFF

**Example:**

```
BB:EUTR:UL:RTFB:BEIN FPR
enables block error insertion for the first process
```

**[:SOURCE<hw>]:BB:EUTRa:UL:RTFB:BERate <Berate>**

Block error rate for the statistical insertion of block errors.

**Parameters:**

<Berate> float

Range: 0.0001 to 1.0  
 Increment: 0.0001  
 \*RST: 0.0001

**Example:**

```
BB:EUTR:UL:RTFB:BER 0.5
sets the block error rate
```

**[:SOURCE<hw>]:BB:EUTRa:UL:RTFB:CONNector <Connector>**

Determines the feedback line connector (LEVATT or USER1).

**Parameters:**

<Connector> LEVatt|USER1

\*RST: USER1

**Example:** `BB:EUTR:UL:RTFB:CONN USER1`  
sets the connector

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:DMODE <Dmode>**

Determines how the number of the uplink subframe is calculated, in which the signaled feedback has the desired effect.

**Parameters:**

<Dmode>           STD|DIRect  
\*RST:            STD

**Example:** `BB:EUTR:UL:RTFB:DMOD DIR`  
sets direct distance mode

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ITADvance <Itadvance>**

The initial timing advance of the uplink signal (at the output of the instrument's baseband unit) in units of  $16 T_S$ .

**Parameters:**

<Itadvance>       float  
Range:            0 ms to 1282 ms  
\*RST:            0 ms

**Example:** `BB:EUTR:UL:RTFB:ITAD 16`  
sets the initial timing advance

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:MAXTrans <Maxtrans>**

After this maximum number of transmissions (incl. first transmission), the first redundancy version of the redundancy version sequence is used even in case of NACK.

**Parameters:**

<Maxtrans>       float  
Range:            1 to 20  
\*RST:            4

**Example:** `BB:EUTR:UL:RTFB:MAXT 5`  
sets the maximum number of transmissions

---

**[:SOURce<hw>]:BB:EUTRa:UL:RTFB:MODE <Mode>**

Enables realtime feedback and determines the mode (binary or serial).



**Parameters:**

<Mode> OFF|BAN|SERIAL|S3X8  
 \*RST: OFF

**Example:**

BB:EUTR:UL:RTFB:MODE SER  
 enables realtime feedback on a serial line

**[:SOURCE<hw>]:BB:EUTRa:UL:RTFB:RVSequence <Rvsequence>**

Determines the sequence of redundancy versions for the individual HARQ processes.

Unless otherwise requested by serial feedback commands, the first value in the sequence of redundancy versions is used each time an ACK is received or for the very first transmission of a process.

The sequence of redundancy versions is read out cyclically, i.e. whenever a NACK is received and a retransmission is requested, the next redundancy version in the sequence is used.

The first value in the sequence is used again even in case a NACK is received, if the maximum number of transmissions (BB:EUTR:UL:RTFB:MAXT) in a process was reached.

**Parameters:**

<Rvsequence> string

**Example:**

BB:EUTR:UL:RTFB:RVS '0,2,3,1'  
 sets the redundancy version sequence

**[:SOURCE<hw>]:BB:EUTRa:UL:RTFB:SERate <Serate>**

(Serial mode only)

Determines the bit rate of the serial transmission.

**Parameters:**

<Serate> SR115\_2K|SR1\_92M|SR1\_6M  
 \*RST: SR115\_2K

**Example:**

BB:EUTR:UL:RTFB:MODE SER  
 enables realtime feedback on a serial line  
 BB:EUTR:UL:RTFB:SER SR115\_2K  
 sets the serial rate

## 9.19 LTE Logfiles Generation



Logfile Generation requires an additional SW option and is enabled only for instruments equipped with R&S SMx/AMU-K81.

### Example: Logfiles Generation

```
SOUR:BB:EUTR:LOGG:OUTP "<root>/logfiles"
SOUR:BB:EUTR:LOGG:LFP "201008Log"
SOUR:BB:EUTR:LOGG:DL:EDL ON
SOUR:BB:EUTR:LOGG:DL:PBCH ON
SOUR:BB:EUTR:LOGG:DL:LOGP9 ON
SOUR:BB:EUTR:LOGG:STAT ON
SOUR:BB:EUTR:STAT ON
```

**[:SOURce<hw>]:BB:EUTRa:LOGGen:STATe <LoggingState>**

Enables/disables logfile generation.

#### Parameters:

<LoggingState> 0|1|OFF|ON  
\*RST: OFF

**Example:** [example "Logfiles Generation"](#) on page 426

**[:SOURce<hw>]:BB:EUTRa:LOGGen:OUTPut <OutputPath>**

Selects the network directory the logged files are stored in.

#### Parameters:

<OutputPath> string  
\*RST: C:\Documents and Settings\<user>\Application Data  
\Rohde-Schwarz\SMUFirmware\Log

**Example:** [example "Logfiles Generation"](#) on page 426

**[:SOURce<hw>]:BB:EUTRa:LOGGen:LFP <Preamble>**

An optional preamble may be added to the file name. Refer to [chapter 7.2.2.1, "File Names"](#), on page 71 for a description of the file naming convention used.

#### Parameters:

<Preamble> string  
\*RST: K55Log

**Example:** [example "Logfiles Generation"](#) on page 426

---

```
[ :SOURce<hw>]:BB:EUTRa:LOGGen:DL:EDLogging <ExtDciLog>
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:EULogging <ExtUciLog>
```

Enables the generation of a logfile with extended information regarding the DCI/UCI mapping.

**Parameters:**

```
<ExtUciLog>      0|1|OFF|ON
                  *RST:      OFF
```

**Example:** [example "Logfiles Generation"](#) on page 426

---

```
[ :SOURce<hw>]:BB:EUTRa:LOGGen:DL:EALL
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:EALL
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:DALL
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:DALL
```

Enables/disables all logging points.

**Example:** [example "Logfiles Generation"](#) on page 426

---

```
[ :SOURce<hw>]:BB:EUTRa:LOGGen:DL:LOGPoint<ch0> <LogPointState>
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:LOGPoint<ch0> <LogPointState>
```

Enables/disables one particular logging point.

Refer to [chapter 7.2.1, "Signal Processing Chains and Logging Points"](#), on page 68 for description on the available logging points.

**Suffix:**

```
<ch0>            DL: 0 - 9, UL: 0 - 12
                  Logging point number
```

**Parameters:**

```
<LogPointState> 0|1|OFF|ON
                  *RST:      OFF
```

**Example:** [example "Logfiles Generation"](#) on page 426

---

```
[ :SOURce<hw>]:BB:EUTRa:LOGGen:DL:ENCC <EnccLogState>
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:PBCH <PbchLogState>
[:SOURce<hw>]:BB:EUTRa:LOGGen:DL:PDSch <PdschLogState>
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:PUSCh <PuschLogState>
```

Enables the channel for that logfiles are generated.

**Parameters:**

&lt;PuschLogState&gt; 0|1|OFF|ON

\*RST: ON

**Example:** [example "Logfiles Generation"](#) on page 426

## 9.20 Test Case Wizard Remote-Control Commands



The "Test Case Wizard" is supported by R&S SMU, R&S SMATE, R&S SMJ and R&S SMBV.

The signal generator gives you the opportunity to generate predefined settings which enable tests on base stations in conformance with the 3G standard EUTRA/LTE. It offers a selection of predefined settings according to Test Cases in TS 36.141. The settings take effect only after execution of command

```
[SOURce<hw>:]BB:EUTRa:TCW:APPLysettings.
```

The test setups and equipment requirements for each Test Case are described in [chapter 8, "Test Case Wizard"](#), on page 204.

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:APPLysettings</a> .....	430
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<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:FA:FRALlocation</a> .....	430
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:FA:RBALlocation</a> .....	430
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:ANTSubset</a> .....	430
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:GENSignals</a> .....	430
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<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS:RBCFrequency</a> .....	434

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---

### `[:SOURce<hw>]:BB:EUTRa:TCW:APPLysettings`

Activates the current settings of the test case wizard.

**Note:** The settings of the selected test case becomes active only after executing this command.

**Usage:** Event

---

### `[:SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLevel?`

Queries the AWGN power level.

**Return values:**

<PowerLevel> string

**Usage:** Query only

---

### `[:SOURce<hw>]:BB:EUTRa:TCW:FA:FRAllocation` <FrequencyAlloc>

### `[:SOURce<hw>]:BB:EUTRa:TCW:FA:RBAllocation` <ResBlockAlloc>

Determines the frequency position of the wanted and interfering signal.

**Parameters:**

<ResBlockAlloc> HIGHer|LOWer

---

### `[:SOURce<hw>]:BB:EUTRa:TCW:GS:ANtSubset` <AntennaSubset>

Enabled for test setups with four Rx antennas

Determines the signal of which antenna couple, Antenna 1 and 2 (AS12) or Antenna 3 and 4 (AS34), is generated by the instrument.

**Parameters:**

<AntennaSubset> AS34|AS12

---

### `[:SOURce<hw>]:BB:EUTRa:TCW:GS:GENSignals` <GeneratedSignal>

Determines the signal is generated by the instrument. The first R&S SMU should generate the "Wanted Signal, Interfer 1 and AWGN" (WSIF1AWGN) signal and the second R&S SMU, the signal of "Interferes 2 and 3" (IF23).

**Parameters:**

<GeneratedSignal> IF23|WSIF1AWGN

---

```
[:SOURce<hw>]:BB:EUTRa:TCW:GS:INSTsetup <InstrumentSetup>
```

Determines whether one or both paths are used.

**Parameters:**

```
<InstrumentSetup> 2PATH|1PATH
```

---

```
[:SOURce<hw>]:BB:EUTRa:TCW:GS:MODE <Mode>
```

**Parameters:**

```
<Mode> DRATe|FDRate|ADRate
```

```
*RST: DRATe
```

**Example:**

```
SOUR:BB:EUTR:TCW:GS:MODE ADRate
```

---

```
[:SOURce<hw>]:BB:EUTRa:TCW:GS:MARKerconfig <MarkerConfig>
```

Selects the marker configuration. The marker can be used to synchronize the measuring equipment to the signal generator.

**Parameters:**

```
<MarkerConfig> UNCHanged|FRAMe
```

**FRAMe**

The marker settings are customized for the selected test case. "Radio Frame Start" markers are output; the marker delays are set equal to zero.

**UNCHanged**

The current marker settings of the signal generator are retained unchanged.

---

```
[:SOURce<hw>]:BB:EUTRa:TCW:GS:RXAntennas <NumOfRXAntennas>
```

For performance requirement tests, determines the number of the Rx antennas.

**Parameters:**

```
<NumOfRXAntennas ANT4|ANT2|ANT1>
```

```
>
```

---

```
[:SOURce<hw>]:BB:EUTRa:TCW:GS:SIGRout <SignalRouting>
```

Selects the signal routing for baseband A signal which in most test cases represents the wanted signal.

**Parameters:**

```
<SignalRouting> PORTB|PORTA
```

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:GS:TRIGgerconfig <TriggerConfig>**

Selects the trigger configuration. The trigger is used to synchronize the signal generator to the other equipment.

**Parameters:**

<TriggerConfig> UNCHanged|AAUTo

**UNCHanged**

The current trigger settings of the signal generator are retained unchanged.

**AAUTo**

The trigger settings are customized for the selected test case. The trigger setting "Armed Auto" with external trigger source "External Trigger 1" is used; the trigger delay is set equal to zero. Thus, the base station frame timing is able to synchronize the signal generator by a periodic trigger.

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?**

Queries the channel bandwidth of the interfering signal.

**Return values:**

<ChanBandwidth> BW20\_00|BW10\_00|BW5\_00|BW3\_00|BW1\_40|BW15\_00

**Usage:** Query only

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:CLID <CellID>**

Sets the Cell ID for the interfering signal.

**Parameters:**

<CellID> integer

Range: 0 to 503

Increment: 1

\*RST: 1

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex <Duplex>**

Selects whether TDD or FDD duplexing mode is used.

**Parameters:**

<Duplex> TDD|FDD

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:FRSHift <FrequencyShift>**

Sets the value of the parameter Frequency Shift m.



**Parameters:**

<FrequencyShift> FS24|FS19|FS14|FS13|FS10|FS9|FS7|FS5|FS4|FS3|FS2|FS1|FS0

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS2:IFTYPE?**

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:IFTYPE** <InterfererType>

Selects the type of the interfering signal:

- For **Blocking** tests, the interfering signal can be an in-band EUTRA/LTE signal (EUTra) or out-of-band CW signal (CW).
- For **Receiver Intermodulation** tests, the first interfering signal can be an EUTRA/LTE signal (EUTra) or narrow-band EUTRA signal (NEUTra). The second interfering signal is always a CW signal (CW).

**Parameters:**

<InterfererType> NEUTra|EUTra|CW

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:NRBlock?**

Queries the number of RBs used by the LTE interfering signal.

**Return values:**

<NumResBlock> integer

Range: 3 to 25  
Increment: 1  
\*RST: 3

**Usage:** Query only

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset** <SigAdvNTAoffset>

Sets the parameter  $N_{TAOffset}$ .

**Parameters:**

<SigAdvNTAoffset> NTA624|NTA0

---

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:OCEdge** <OffsChannelEdge>

Defines the offset of the interfering signal center frequency relative to edge of the wanted channel bandwidth.

**Parameters:**

<OffsChannelEdge> OCE12\_5|OCE7\_5|OCE2\_5

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:OVRB?**

Sets the offset VRB.

**Return values:**

<OffsetVRB>	integer
Range:	0 to 75
Increment:	1
*RST:	0

**Usage:** Query only

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS2:PLLevel?****[[:SOURce<hw>]:BB:EUTRa:TCW:IS3:PLLevel?****[[:SOURce<hw>]:BB:EUTRa:TCW:IS:PLLevel?**

Queries the power level of the interfering signal.

**Return values:**

<PowerLevel>	string
--------------	--------

**Usage:** Query only

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:RBCFrequency <RBlockCentFreq>**

Queries the center frequency of the single resource block interfering signal.

**Parameters:**

<RBlockCentFreq>	float
Range:	100e+03 to 6e+09
Increment:	1
*RST:	1.95e+09

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS2:RFFrequency?****[[:SOURce<hw>]:BB:EUTRa:TCW:IS:RFFrequency <RfFrequency>**

Queries the center frequency of the interfering signal.

**Parameters:**

<RfFrequency>	float
Range:	100e+03 to 6e+09
Increment:	1
*RST:	1.95e+09

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:TDDConfig <TddConfig>**

For TDD mode, selects the UL/DL Configuration number.

**Parameters:**

<TddConfig> integer

Range: 0 to 6  
 Increment: 1  
 \*RST: 0

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:TMODEl?**

Queries the test model. The interfering signal is generated according to E-TM1.1 test model.

**Return values:**

<TestModel> TM1\_1

**Usage:** Query only

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:TREQUIRE <TestRequire>**

Selects whether the standard out-of-band blocking requirements test is performed (BLPE) or the optional blocking scenario, when the BS is co-located with another BS in a different operating band (COBS).

**Parameters:**

<TestRequire> COBS|BLPE

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:UEID <UE\_ID\_nRNTI>**

Sets the UE ID/n\_RNTI for the interfering signal.

**Parameters:**

<UE\_ID\_nRNTI> integer

Range: 0 to 65535  
 Increment: 1  
 \*RST: 1

**[[:SOURce<hw>]:BB:EUTRa:TCW:MUE:TSRS <TransmitSRS>****[[:SOURce<hw>]:BB:EUTRa:TCW:SUE:TSRS <TransmitSRS>**

Enables/disables the transmission of the SRS.

The SRS transmission is optional for this test case.

**Parameters:**

<TransmitSRS> 0|1|OFF|ON

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:ACKDefinition <AckDefinition>**

Determines whether a high or a low binary level on the feedback line connector represents an ACK.

**Parameters:**

<AckDefinition>      LOW|HIGH

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:AUSDelay <AddUserDelay>**

Determines the point in time when the feedback can be sent to the instrument.

**Parameters:**

<AddUserDelay>      float

Range:      -1 to +2.99

Increment:  0.01

\*RST:      0

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSMue <BBSelectMovUE>**

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSSue <BBSelectStatUE>**

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSelector <BBSelector>**

This parameter is required for multiplexing serial commands for different baseband units to one feedback line. If the selector n is configured in the GUI for a specific baseband unit, the baseband unit will listen only to serial commands containing the selector n.

**Parameters:**

<BBSelector>      integer

Range:      0 to 3

Increment:  1

\*RST:      0

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONMue <ConnectorMovUE>**

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONSue <ConnectorStatUE>**

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:CONnector <Connector>**

Determines the feedback line connector (LEVATT or USER1).

**Parameters:**

<Connector>      LEVatt|USER1|NOFB

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:MODE <Mode>**

Determines the feedback mode.

**Parameters:**

&lt;Mode&gt;

SER3X8|SER|BIN

**BIN**

Binary ACK/NACK

The ACK/NACK feedback is implemented as low/high voltage level on the feedback line connector.

**SER**

Serial

ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial protocol.

**SER3X8**

Serial 3x8

ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial commands, consisting of three serial packets.

[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:RTF:SERRate &lt;SerialRate&gt;

Sets the bit rate of the serial transmission. Possible rates are 115.2 kbps, 1.6 Mbps and 1.92 Mbps.

**Parameters:**

&lt;SerialRate&gt;

SR1\_92M|SR1\_6M|SR115\_2K

[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:TC &lt;TestCase&gt;

Selects the test case.

**Parameters:**

&lt;TestCase&gt;

TS36141\_TC67|TS36141\_TC72|TS36141\_TC73|  
 TS36141\_TC74|TS36141\_TC75A|TS36141\_TC75B|  
 TS36141\_TC76|TS36141\_TC78|TS36141\_TC821|  
 TS36141\_TC822|TS36141\_TC823|TS36141\_TC824|  
 TS36141\_TC831|TS36141\_TC832|TS36141\_TC833|  
 TS36141\_TC841

[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:WS:ACPucch &lt;AddConfigPUCCH&gt;

Enables the optional transmission of PUCCH format 2.

**Parameters:**

&lt;AddConfigPUCCH&gt; 0|1|OFF|ON

[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:WS:BFormat &lt;BurstFormat&gt;

Sets the burst format.

**Parameters:**

<BurstFormat> BF4|BF3|BF2|BF1|BF0

---

**[:SOURCE<hw>]:BB:EUTRa:TCW:WS:CHBW <ChanBandwidth>**

Selects the channel bandwidth.

**Parameters:**

<ChanBandwidth> BW20\_00|BW10\_00|BW5\_00|BW3\_00|BW1\_40|BW15\_00

---

**[:SOURCE<hw>]:BB:EUTRa:TCW:WS:CLID <CellID>**

Sets the Cell ID.

**Parameters:**

<CellID> integer

Range: 0 to 503  
 Increment: 1  
 \*RST: 0

---

**[:SOURCE<hw>]:BB:EUTRa:TCW:WS:CYCPrefix <CyclicPrefix>**

Selects normal or extended cyclic prefix.

**Parameters:**

<CyclicPrefix> EXTended|NORMAL

---

**[:SOURCE<hw>]:BB:EUTRa:TCW:WS:DUPLex <Duplex>**

Selects whether TDD or FDD duplexing mode is used.

**Parameters:**

<Duplex> TDD|FDD

---

**[:SOURCE<hw>]:BB:EUTRa:TCW:WS:FMThroughput <FractMaxThrough>**

Selects the fraction of maximum throughput.

**Parameters:**

<FractMaxThrough> FMT70|FMT30

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:FRC <FRC>**

Displays the fixed reference channel used. An overview of the FRCs and the cross-reference between the selected [Channel Bandwidth](#) and the FRC is given in the individual description of the test cases.

**Parameters:**

<FRC>                    A11|A12|A13|A14|A15|A21|A22|A23|A31|A32|A33|A34|A35|A36|  
A37|A41|A42|A43|A44|A45|A46|A47|A48|A51|A52|A53|A54|A55|  
A56|A57|A71|A72|A73|A74|A75|A76|A81|A82|A83|A84|A85|A86

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:FROffset <FreqOffset>**

Sets the frequency offset.

**Parameters:**

<FreqOffset>            FO\_1340|FO\_625|FO\_270|FO\_0

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:HSMODE <HighSpeedMode>**

Enables/disables high speed mode.

**Parameters:**

<HighSpeedMode>    0|1|OFF|ON

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:NTAOffset <SigAdvNTAoffset>**

Sets the parameter  $N_{TAOffset}$ .

**Parameters:**

<SigAdvNTAoffset>    NTA624|NTA0

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS:ORTCover?**

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS2:ORTCover?**

**[[:SOURce<hw>]:BB:EUTRa:TCW:IS3:ORTCover?**

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:ORTCover?**

Queries the used resource index  $n_{PUCCH}$ .

**Return values:**

<OrthoCover>            integer

Range:            2 to 2

Increment:        1

\*RST:             2

**Usage:**             Query only

---

**[ :SOURce<hw>]:BB:EUTRa:TCW:WS:OUPLevel <OutPowerLevel>**

The settings of the selected test case becomes active only after selecting "Apply Settings".

**Parameters:**

<OutPowerLevel>      float

                            Range:      -115 to 0  
                            Increment: 0.01  
                            \*RST:        -30

---

**[ :SOURce<hw>]:BB:EUTRa:TCW:MUE:OVRB <OffsetVRB>**

**[ :SOURce<hw>]:BB:EUTRa:TCW:SUE:OVRB <OffsetVRB>**

**[ :SOURce<hw>]:BB:EUTRa:TCW:WS:OVRB <OffsetVRB>**

Sets the number of RB the allocated RB(s) are shifted with.

**Parameters:**

<OffsetVRB>            integer

                            Range:      0 to 75  
                            Increment: 1  
                            \*RST:        0

---

**[ :SOURce<hw>]:BB:EUTRa:TCW:WS:PLLevel?**

Queries the Power Level.

**Return values:**

<PowerLevel>            string

**Usage:**                Query only

---

**[ :SOURce<hw>]:BB:EUTRa:TCW:WS:PLPC?**

Queries the resulting PUCCH power level by activated optional transmission of PUCCH format 2.

**Return values:**

<PowerLevelPUCCH string  
>

**Usage:**                Query only

---

**[ :SOURce<hw>]:BB:EUTRa:TCW:WS:PLPS?**

Queries the resulting PUSCH power level.



**Return values:**

&lt;PowerLevelPUSCH&gt;string

**Usage:**

Query only

---

**[ :SOURce<hw> ]:BB:EUTRa:TCW:IS:PRCOndition?****[ :SOURce<hw> ]:BB:EUTRa:TCW:IS2:PRCOndition?****[ :SOURce<hw> ]:BB:EUTRa:TCW:IS3:PRCOndition?****[ :SOURce<hw> ]:BB:EUTRa:TCW:WS:PROCondition <PropagationCond>**

Selects a predefined multipath fading propagation conditions. The settings of the fading simulator are adjusted according to the corresponding channel model as defined in 3GPP TS 36.141, Annex B.

**Parameters:**

<PropagationCond> AWGNOnly|HST3|HST1|PDMov|ETU200Mov|ETU300|EVA70|EVA5|EPA5|ETU70

---

**[ :SOURce<hw> ]:BB:EUTRa:TCW:WS:RFFrequency <RfFrequency>**

Sets the RF frequency of the wanted signal.

**Parameters:**

<RfFrequency> float  
Range: 100e+03 to 6e+09  
Increment: 1  
\*RST: 1.95e+09

---

**[ :SOURce<hw> ]:BB:EUTRa:TCW:WS:SPSFrame <SpecSubframe>**

In TDD duplexing mode, sets the Special Subframe Configuration number.

**Parameters:**

<SpecSubframe> integer  
Range: 0 to 8  
Increment: 1  
\*RST: 0

---

**[ :SOURce<hw> ]:BB:EUTRa:TCW:WS:TDDConfig <TddConfig>**

For TDD mode, selects the UL/DL Configuration number.

**Parameters:**

<TddConfig> integer  
 Range: 0 to 6  
 Increment: 1  
 \*RST: 0

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:TIOBase?**

Queires the timing offset base value.

**Return values:**

<TimingOffsBase> float  
 Range: 0 to 250  
 Increment: 0.01  
 \*RST: 0

**Usage:** Query only

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:MUE:UEID <UE\_ID\_nRNTI>**

**[[:SOURce<hw>]:BB:EUTRa:TCW:SUE:UEID <UE\_ID\_nRNTI>**

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:UEID <UE\_ID\_nRNTI>**

Sets the UE ID/n\_RNTI.

**Parameters:**

<UE\_ID\_nRNTI> integer  
 Range: 0 to 65535  
 Increment: 1  
 \*RST: 1

## 10 References

- [1] 3GPP TR 25.913 "Requirements for Evolved UTRA (E-UTRA) and Evolved UTRAN (E-UTRAN)"
- [2] 3GPP TR 25.892 "Feasibility study for Orthogonal Frequency Division Multiplexing (OFDM) for UTRAN enhancement"
- [3] 3GPP TS 36.211 "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation"
- [4] 3GPP TS 36.212 "Evolved Universal Terrestrial Radio Access (E-UTRA); Multiplexing and channel coding"
- [5] 3GPP TS 36.213 "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures"
- [6] 3GPP TS 36.141 "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing"
- [7] 3GPP TS 36.214 "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer; Measurements"
- [8] 3GPP TS 36.101 "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"
- [9] 3GPP TS 36.104 "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception"
- [10] 3GPP TS 36.113 "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)"
- [11] 3GPP TS 36.124 "Evolved Universal Terrestrial Radio Access (E-UTRA); ElectroMagnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment"
- [12] 3GPP TS 36.133 "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management"
- [13] 3GPP TS 36.143 "Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater conformance testing"
- [14] 3GPP TS 36.521 "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1, 2, 3"
- [15] 3GPP TS 36.523 "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Part 1, 2, 3"

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