

# EUTRA/LTE

## Digital Standard for

## R&S<sup>®</sup>Signal Generators

### Operating Manual

EUTRA/LTE, LTE Rel. 9, LTE closed loop BS Test, LTE Logfile Generation, LTE-A Rel.10



1171.5177.12 – 17

This document describes the following software options:

- R&S®AMU-K55/-K255/-K69/-K81/-K84/-K284/-K85  
1402.9405.02, 1402.9457.02, 1403.0501.02, 1403.0553.02, 1403.0818.02, 1403.0853.02,  
1403.0830.02
- R&S®SMATE-K55/-K69/-K81/-K84/-K85  
1404.7851.02, 1403.0501.02, 1404.8612.02, 1404.8829.02, 1404.8841.02
- R&S®SMBV-K55/-K255/-K84/-K284  
1407.9203.xx, 1415.8360.02, 1415.8602.xx, 1415.8625.02
- R&S®SMJ-K55/-K255/-K69/-K81/-K84/-K284/-K85  
1409.2206.02, 1409.2258.02, 1403.0501.02, 1409.3054.02, 1409.3360.02, 1409.3402.02,  
1409.3383.02
- R&S®SMU-K55/-K255/-K69/-K81/-K84/-K284/-K85  
1408.7310.02, 1408.7362.02, 1403.0501.02, 1408.8169.02, 1408.8475.02, 1408.8517.02,  
1408.8498.02
- R&S®AFQ-K255/-K284  
1401.5906.02, 1415.0253.02
- R&S®SFU-K255  
2115.2366.02

© 2012 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>

Printed in Germany – Subject to change – Data without tolerance limits is not binding.

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

Trade names are trademarks of the owners.

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 purpose 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.








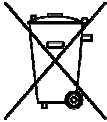

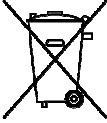

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English. 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. For product-specific information, see the data sheet and the product documentation.

## Symbols and safety labels

Symbol	Meaning	Symbol	Meaning
	Notice, general danger location Observe product documentation	○	ON/OFF supply voltage
	Caution when handling heavy equipment	⏻	Standby indication
	Danger of electric shock	— — —	Direct current (DC)

## Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Warning! Hot surface		Alternating current (AC)
	Protective conductor terminal		Direct/alternating current (DC/AC)
	Ground		Device fully protected by double (reinforced) insulation
	Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

### Signal words and their meaning

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



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a potentially 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 signal words 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 signal words described here are always used only in connection with the related product documentation and the related product. The use of signal words in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

## Basic Safety Instructions

### 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, 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, overvoltage category 2, pollution severity 2.
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 even 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 even death.

### Electrical safety

*If the information on electrical safety is not observed either at all or 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 a protective conductor contact and protective conductor.
3. Intentionally breaking the protective conductor 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 there is no power switch for disconnecting the product from the AC supply network, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the AC supply network. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 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, the disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cables on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

## Basic Safety Instructions

6. The product may be operated only from TN/TT supply networks fuse-protected 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 provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages  $V_{rms} > 30$  V, suitable measures (e.g. appropriate measuring equipment, fuse protection, 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 protective conductor terminal on site and the product's protective 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 fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

## Operation

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

## Basic Safety Instructions

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/Environmental protection", 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. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. 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).
8. EMC classes (in line with CISPR 11)  
Class A: Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings.  
Class B: Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings.

### 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, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

## Basic Safety Instructions

### 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. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
5. 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.
6. 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.
7. 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/Environmental protection

1. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.



## Instrucciones de seguridad elementales

2. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately.  
Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
3. 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.
4. 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.

For additional information about environmental protection, visit the Rohde & Schwarz website.

# Instrucciones de seguridad elementales

### **¡Es imprescindible leer y cumplir 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.














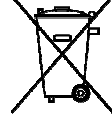
Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa 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.

## Instrucciones de seguridad elementales


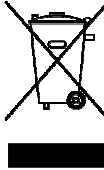

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto 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. Los datos específicos del producto figuran en la hoja de datos y en la documentación del producto.

### Símbolos y definiciones de seguridad

Símbolo	Significado	Símbolo	Significado
	Aviso: punto de peligro general Observar la documentación del producto		Tensión de alimentación de PUESTA EN MARCHA / PARADA
	Atención en el manejo de dispositivos de peso elevado		Indicación de estado de espera (standby)
	Peligro de choque eléctrico		Corriente continua (DC)
	Advertencia: superficie caliente		Corriente alterna (AC)
	Conexión a conductor de protección		Corriente continua / Corriente alterna (DC/AC)
	Conexión a tierra		El aparato está protegido en su totalidad por un aislamiento doble (reforzado)
	Conexión a masa		Distintivo de la UE para baterías y acumuladores Más información en la sección "Eliminación/protección del medio ambiente", punto 1.

## Instrucciones de seguridad elementales

Símbolo	Significado	Símbolo	Significado
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)		Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos  Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser  Más información en la sección "Funcionamiento", punto 7.		

### 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.*

## Instrucciones de seguridad elementales

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, 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. Categoría de sobrecarga eléctrica 2, índice de suciedad 2.
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, se pueden causar lesiones o, en determinadas circunstancias, 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, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión. El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m). Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se integran productos sin interruptor 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.

## Instrucciones de seguridad elementales

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.

## Instrucciones de seguridad elementales

### 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/protección del medio ambiente", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. 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).
8. Clases CEM (según CISPR 11)  
Clase A: dispositivo apropiado para el uso en cualquier zona excepto en áreas residenciales y en aquellas zonas que se encuentran conectadas a una red de suministro de baja tensión que alimenta un edificio de viviendas.  
Clase B: dispositivo apropiado para el uso en áreas residenciales y en aquellas zonas que se encuentran conectadas a una red de suministro de baja tensión que alimenta un edificio de viviendas.

### 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.

## Instrucciones de seguridad elementales

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. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
5. 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.
6. 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).
7. 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.

## Instrucciones de seguridad elementales

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/protección del medio ambiente

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.
2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado.  
Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, diríjase a su servicio de atención al cliente de Rohde & Schwarz.
3. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (povos 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.
4. 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.

Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.



# Qualitätszertifikat

## Certificate of quality

## Certificat de qualité

Certified Quality System  
**ISO 9001**

Certified Environmental System  
**ISO 14001**

### **Sehr geehrter Kunde,**

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

### **Der Umwelt verpflichtet**

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

### **Dear Customer,**

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

### **Environmental commitment**

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

### **Cher client,**

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

### **Engagement écologique**

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

# Customer Support

## Technical support – where and when you need it

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

## Up-to-date information and upgrades

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

### Europe, Africa, Middle East

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

### North America

Phone 1-888-TEST-RSA (1-888-837-8772)  
[customer.support@rsa.rohde-schwarz.com](mailto:customer.support@rsa.rohde-schwarz.com)

### Latin America

Phone +1-410-910-7988  
[customersupport.la@rohde-schwarz.com](mailto:customersupport.la@rohde-schwarz.com)

### Asia/Pacific

Phone +65 65 13 04 88  
[customersupport.asia@rohde-schwarz.com](mailto:customersupport.asia@rohde-schwarz.com)

### China

Phone +86-800-810-8228 /  
+86-400-650-5896  
[customersupport.china@rohde-schwarz.com](mailto:customersupport.china@rohde-schwarz.com)



# Contents

<b>1</b>	<b>Preface</b> .....	<b>11</b>
1.1	Documentation Overview.....	11
1.2	Typographical Conventions.....	12
<b>2</b>	<b>Preamble</b> .....	<b>13</b>
<b>3</b>	<b>Introduction</b> .....	<b>14</b>
3.1	Requirements for UMTS Long-Term Evolution.....	14
3.2	<b>LTE Downlink Transmission Scheme</b> .....	<b>15</b>
3.2.1	OFDMA Parameterization.....	17
3.2.1.1	Frame structure type 1 (FDD).....	17
3.2.1.2	Frame structure type 2 (TDD).....	18
3.2.2	Downlink Resource Grid.....	19
3.2.3	Downlink Data Transmission.....	20
3.2.4	Downlink Control Information Transmission.....	20
3.2.5	Downlink Reference Signal Structure and Cell Search.....	22
3.2.5.1	Cell-specific downlink reference signals.....	22
3.2.5.2	MBSFN reference signals.....	24
3.2.5.3	UE-specific reference signal.....	25
3.2.5.4	Positioning reference signals.....	26
3.2.6	Downlink Physical Layer Procedures.....	27
3.3	<b>LTE Uplink Transmission Scheme</b> .....	<b>27</b>
3.3.1	SC-FDMA Parameterization.....	29
3.3.2	Uplink Data Transmission.....	29
3.3.3	Uplink Control Information Transmission.....	30
3.3.4	Uplink Reference Signal Structure.....	31
3.3.5	Uplink Physical Layer Procedures.....	32
3.4	<b>LTE MIMO Concepts</b> .....	<b>33</b>
3.4.1	Downlink MIMO.....	34
3.4.1.1	Spatial Multiplexing.....	34
3.4.1.2	Transmit Diversity.....	36
3.4.1.3	Beamforming.....	36
3.4.2	Uplink MIMO.....	37

<b>3.5</b>	<b>LTE MBMS Concepts.....</b>	<b>37</b>
<b>3.6</b>	<b>LTE-Advanced Introduction.....</b>	<b>37</b>
3.6.1	Carrier Aggregation.....	38
3.6.2	Enhanced Uplink SC-FDMA.....	39
<b>4</b>	<b>EUTRA/LTE Parameterization.....</b>	<b>41</b>
<b>4.1</b>	<b>OFDMA Parameterization.....</b>	<b>41</b>
<b>4.2</b>	<b>Reference Signals.....</b>	<b>41</b>
<b>4.3</b>	<b>Synchronization Signal (SYNC).....</b>	<b>42</b>
<b>4.4</b>	<b>Physical Broadcast Channel (PBCH).....</b>	<b>42</b>
<b>4.5</b>	<b>Physical Control Format Indicator Channel (PCFICH).....</b>	<b>43</b>
<b>4.6</b>	<b>Physical Hybrid ARQ Indicator Channel (PHICH).....</b>	<b>43</b>
<b>4.7</b>	<b>Physical Downlink Control Channel (PDCCH).....</b>	<b>44</b>
<b>4.8</b>	<b>Physical Multicast Channel (PMCH).....</b>	<b>44</b>
<b>4.9</b>	<b>Data Allocations.....</b>	<b>44</b>
<b>4.10</b>	<b>Modulation Mapping.....</b>	<b>45</b>
<b>4.11</b>	<b>MIMO.....</b>	<b>45</b>
<b>4.12</b>	<b>SC-FDMA Parameterization.....</b>	<b>46</b>
<b>4.13</b>	<b>Demodulation Reference Signal (DRS).....</b>	<b>46</b>
<b>4.14</b>	<b>Sounding Reference Signal (SRS).....</b>	<b>46</b>
<b>4.15</b>	<b>Physical Uplink Control Channel (PUCCH).....</b>	<b>47</b>
<b>4.16</b>	<b>Physical Random Access Channel (PRACH).....</b>	<b>47</b>
<b>4.17</b>	<b>Data Allocation.....</b>	<b>47</b>
<b>4.18</b>	<b>Modulation Mapping.....</b>	<b>48</b>
<b>5</b>	<b>R&amp;S Signal Generator Specific Information.....</b>	<b>49</b>
<b>5.1</b>	<b>Conflict Handling in the R&amp;S Signal Generator.....</b>	<b>49</b>
5.1.1	Downlink.....	49
5.1.2	Uplink.....	50
5.1.3	DCI Conflict Handling.....	51
<b>5.2</b>	<b>Subframes Handling in the R&amp;S Signal Generator.....</b>	<b>53</b>
5.2.1	Copy/Paste Subframe.....	53
5.2.2	Number of Configurable Subframes.....	53
5.2.3	Four Configurable Frames in Uplink and Downlink Direction.....	53
5.2.3.1	Uplink Direction.....	54

5.2.3.2	Downlink Direction.....	56
<b>5.3</b>	<b>Power Setting.....</b>	<b>57</b>
5.3.1	General Power Settings.....	57
5.3.2	Downlink Power Settings.....	58
5.3.3	Uplink Power Settings.....	59
<b>6</b>	<b>Realtime Feedback for Closed Loop BS Tests.....</b>	<b>61</b>
<b>6.1</b>	<b>Exemplary Testing Scenario.....</b>	<b>61</b>
<b>6.2</b>	<b>Feedback Modes.....</b>	<b>62</b>
6.2.1	Binary Mode.....	63
6.2.2	Serial Mode.....	63
6.2.3	Serial 3x8 Mode.....	63
6.2.4	Structure of a serial and 3x8 serial feedback command.....	64
<b>6.3</b>	<b>Timing Aspects.....</b>	<b>66</b>
6.3.1	Parameterization of the feedback timing.....	66
6.3.1.1	Timing for binary mode with 3GPP Distance Mode, serial or serial 3x8 mode.....	66
6.3.1.2	Maximum number of serial feedback commands.....	67
6.3.1.3	Timing for binary mode with Direct Response Distance Mode.....	67
6.3.2	Uplink Timing.....	68
6.3.2.1	General timing rules.....	70
<b>6.4</b>	<b>Avoiding Synchronization Problems.....</b>	<b>70</b>
<b>6.5</b>	<b>Limitation.....</b>	<b>72</b>
<b>7</b>	<b>EUTRA/LTE User Interface.....</b>	<b>73</b>
<b>7.1</b>	<b>Main Dialog for EUTRA/LTE Signals.....</b>	<b>73</b>
<b>7.2</b>	<b>LTE Logfile Generation.....</b>	<b>79</b>
7.2.1	Signal Processing Chains and Logging Points.....	79
7.2.2	Output Files.....	82
7.2.2.1	File Names.....	82
7.2.2.2	Extended Logfiles Contents.....	85
	Extended DCI Logfile.....	85
	Extended UCI Logfile.....	88
7.2.3	Working with the Logfile Generation Functionality.....	88
7.2.4	Logfile Generation Settings.....	89
<b>7.3</b>	<b>Test Setups/Models.....</b>	<b>91</b>

<b>7.4</b>	<b>General DL Settings / General TDD DL Settings</b> .....	<b>93</b>
7.4.1	MBSFN Settings.....	95
7.4.2	DL Carrier Aggregation Configuration.....	108
7.4.3	Physical Settings.....	113
7.4.4	TDD Frame Structure.....	115
7.4.5	K55 Configuration Mode.....	115
7.4.6	MIMO.....	116
7.4.7	Cell Specific Settings.....	118
7.4.8	Downlink Reference Signal Structure.....	121
7.4.9	Synchronization Signal Settings.....	122
7.4.10	Positioning Reference Signal Settings.....	122
<b>7.5</b>	<b>DL Frame Configuration</b> .....	<b>124</b>
7.5.1	General Frame Configuration.....	125
7.5.2	Subframe Configuration.....	126
7.5.3	Resource Allocation Table DL.....	127
<b>7.6</b>	<b>Enhanced PBCH, PDSCH and PMCH Settings</b> .....	<b>134</b>
7.6.1	Allocation Settings.....	135
7.6.2	Precoding Settings.....	135
7.6.3	Scrambling Settings.....	139
7.6.4	Channel Coding Settings.....	139
<b>7.7</b>	<b>Enhanced PCFICH, PHICH and PDCCH Channel Configuration</b> .....	<b>141</b>
7.7.1	Precoding Settings.....	142
7.7.2	PCFICH Settings.....	143
7.7.3	PHICH Settings.....	144
7.7.4	PDCCH Settings.....	146
7.7.5	PDCCH Format Variable.....	149
7.7.6	DCI Format Configuration.....	155
<b>7.8</b>	<b>Configure User</b> .....	<b>166</b>
<b>7.9</b>	<b>Antenna Port Mapping</b> .....	<b>169</b>
<b>7.10</b>	<b>Dummy Data Configuration</b> .....	<b>172</b>
<b>7.11</b>	<b>OFDMA Timeplan</b> .....	<b>173</b>
<b>7.12</b>	<b>General UL Settings</b> .....	<b>174</b>
7.12.1	Physical Settings.....	175

7.12.2	TDD Frame Structure.....	177
7.12.3	Cell Specific Settings.....	178
7.12.4	UL Reference Signals.....	179
7.12.5	PRACH Settings.....	180
7.12.6	PUSCH Structure.....	181
7.12.7	PUCCH Structure.....	182
7.12.8	SRS Structure.....	184
<b>7.13</b>	<b>UL Frame Configuration.....</b>	<b>186</b>
7.13.1	General Scheduling Configuration.....	186
7.13.2	Allocation Table UL.....	189
<b>7.14</b>	<b>User Equipment Configuration.....</b>	<b>193</b>
7.14.1	Common Settings.....	196
7.14.2	FRC Configuration.....	198
7.14.3	Realtime Feedback Configuration.....	200
7.14.4	HARQ Statistics.....	204
7.14.5	Physical Uplink Shared Channel (PUSCH).....	205
7.14.6	Reference Signal Structure.....	208
7.14.7	SRS Structure.....	209
7.14.8	PRACH Power Ramping.....	216
7.14.9	PRACH Configuration.....	216
<b>7.15</b>	<b>Enhanced PUSCH Settings.....</b>	<b>218</b>
7.15.1	General PUSCH Settings.....	219
7.15.2	Frequency Hopping.....	219
7.15.3	Channel Coding / Multiplexing.....	220
<b>7.16</b>	<b>Enhanced PUCCH Settings.....</b>	<b>223</b>
<b>7.17</b>	<b>SC-FDMA Timeplan.....</b>	<b>226</b>
<b>7.18</b>	<b>TDD Timeplan.....</b>	<b>227</b>
<b>7.19</b>	<b>Filter/Clipping/Power Settings.....</b>	<b>229</b>
7.19.1	Time Domain Windowing.....	229
7.19.2	Filter Settings.....	230
7.19.3	Clipping Settings.....	234
7.19.4	Power Settings.....	235
<b>7.20</b>	<b>Trigger/Marker/Clock Settings.....</b>	<b>237</b>

7.20.1	Trigger In.....	238
7.20.2	Timing Configuration.....	243
7.20.3	Marker Mode.....	244
7.20.4	Marker Delay.....	245
7.20.5	Clock Settings.....	246
7.20.6	Global Settings.....	248
<b>8</b>	<b>Test Case Wizard.....</b>	<b>250</b>
<b>8.1</b>	<b>Introduction to Conformance Testing.....</b>	<b>250</b>
8.1.1	UE Conformance Testing.....	250
8.1.2	BS Conformance Testing.....	251
8.1.3	Repeater Conformance Testing.....	252
<b>8.2</b>	<b>Basic Configuration.....</b>	<b>252</b>
<b>8.3</b>	<b>Supported Test Cases.....</b>	<b>252</b>
8.3.1	Generic Structure of the Description of the Implemented Test Cases.....	254
<b>8.4</b>	<b>Standard Test Setups.....</b>	<b>254</b>
8.4.1	Standard Test Setup - One Path.....	254
8.4.2	Standard Test Setup - Two Paths.....	255
8.4.3	Test Setup - Diversity Measurements.....	256
8.4.4	Test Setup - Four Rx Antennas.....	256
<b>8.5</b>	<b>General Considerations.....</b>	<b>257</b>
<b>8.6</b>	<b>User Interface.....</b>	<b>260</b>
8.6.1	General Settings.....	261
8.6.2	Wanted Signal and Cell Specific Settings.....	264
8.6.3	Apply.....	266
<b>8.7</b>	<b>Transmitter Characteristics (TS 36.141, Chapter 6).....</b>	<b>266</b>
8.7.1	Prior Considerations.....	266
8.7.2	Introduction to the Unwanted Emissions Tests.....	267
8.7.3	Test Case 6.7: Transmitter Intermodulation.....	269
<b>8.8</b>	<b>Receiver Characteristics (TS 36.141, Chapter 7).....</b>	<b>275</b>
8.8.1	Prior Considerations.....	275
8.8.2	General Workflow for Carrying Out a Receiver Test.....	276
8.8.3	Interfering Signal Settings.....	277
8.8.4	Test Case 7.2: Reference Sensitivity Level.....	280



8.8.5	Test Case 7.3: Dynamic range.....	282
8.8.6	Test Case 7.4: In-channel selectivity (ICS).....	285
8.8.7	Test Case 7.5A: Adjacent Channel Selectivity (ACS).....	288
8.8.8	Test Case 7.5B: Narrow-band blocking.....	290
8.8.9	Test Case 7.6: Blocking.....	293
8.8.10	Test Case 7.8: Receiver intermodulation .....	297
<b>8.9</b>	<b>Performance Requirements (TS 36.141, Chapter 8).....</b>	<b>301</b>
8.9.1	Prior Considerations.....	301
8.9.2	Realtime Feedback Configuration, AWGN and Propagation Condition Settings.....	303
8.9.3	Test Case 8.2.1: PUSCH in multipath fading propagation conditions.....	305
8.9.4	Test Case 8.2.2: UL timing adjustment.....	308
8.9.5	Test Case 8.2.3: HARQ-ACK multiplexed on PUSCH.....	313
8.9.6	Test Case 8.2.4: High Speed Train conditions.....	315
8.9.7	Test Case 8.3.1: ACK missed detection for single user PUCCH format 1a.....	319
8.9.8	Test Case 8.3.2: CQI performance requirements for PUCCH format 2.....	321
8.9.9	Test Case 8.3.3: ACK missed detection for multi user PUCCH format 1a.....	324
8.9.10	Test Case 8.4.1: PRACH false alarm probability and missed detection.....	329
<b>9</b>	<b>Remote-Control Commands.....</b>	<b>334</b>
<b>9.1</b>	<b>Primary Commands.....</b>	<b>334</b>
<b>9.2</b>	<b>Filter/Clipping/Power Settings.....</b>	<b>339</b>
9.2.1	Filter Settings.....	339
9.2.2	Clipping Settings.....	346
9.2.3	Power Settings.....	347
<b>9.3</b>	<b>Clock Settings.....</b>	<b>350</b>
<b>9.4</b>	<b>Timing Configuration.....</b>	<b>354</b>
<b>9.5</b>	<b>Trigger Settings.....</b>	<b>354</b>
<b>9.6</b>	<b>Marker Settings.....</b>	<b>362</b>
<b>9.7</b>	<b>General EUTRA/LTE Settings.....</b>	<b>367</b>
<b>9.8</b>	<b>General EUTRA/LTE Downlink Settings.....</b>	<b>368</b>
<b>9.9</b>	<b>General EUTRA/LTE Uplink Settings.....</b>	<b>381</b>
<b>9.10</b>	<b>DL Frame Configuration.....</b>	<b>394</b>
<b>9.11</b>	<b>DL MBFSN Settings.....</b>	<b>405</b>
<b>9.12</b>	<b>DL Carrier Aggregation Settings.....</b>	<b>415</b>

9.13	Enhanced PBCH, PDSCH, PMCH Settings.....	418
9.14	Enhanced PCFICH, PHICH and PDCCH Configuration.....	427
9.15	UL Frame Configuration.....	458
9.16	UL Enhanced Settings.....	464
9.17	Configure User.....	473
9.18	Dummy Data Configuration.....	477
9.19	User Equipment.....	479
9.20	Realtime Feedback.....	496
9.21	LTE Logfiles Generation.....	501
9.22	Test Case Wizard Remote-Control Commands.....	504
<b>A</b>	<b>References.....</b>	<b>521</b>
	<b>List of Commands.....</b>	<b>523</b>
	<b>Index.....</b>	<b>535</b>

# 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

The Quick Start Guide 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

The 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 ordered 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 10, i.e. the following official 3GPP specifications are implemented:

- 3GPP TS 36.211, Version 10.2.0
- 3GPP TS 36.212, Version 10.2.0
- 3GPP TS 36.213, Version 10.2.0

## 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.

In the context of the LTE study item, 3GPP work first focused on the definition 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 handover 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 LTE 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.

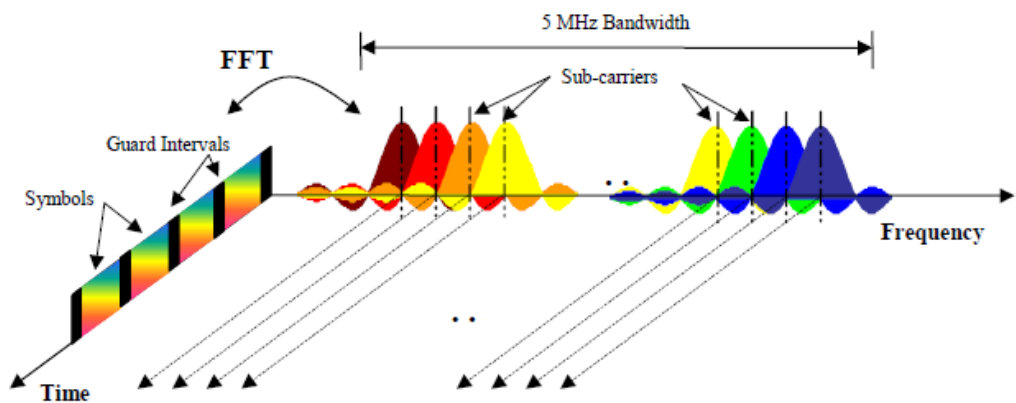


Fig. 3-1: Frequency-Time Representation of an OFDM Signal (3GPP TR 25.892 [2])

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  $mT_u < t \leq (m+1)T_u$ .

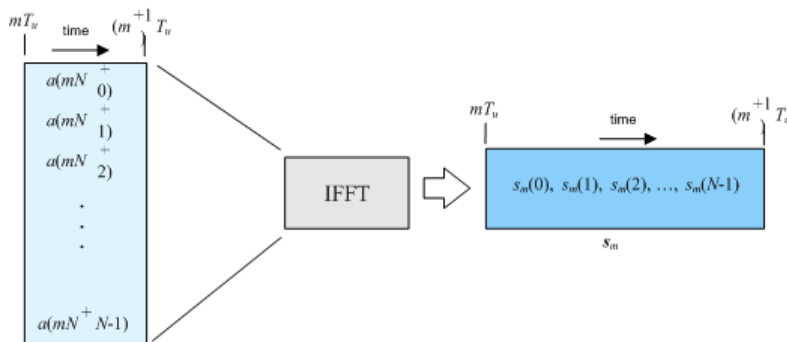


Fig. 3-2: OFDM useful symbol generation using an IFFT (3GPP TR 25.892 [2])

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.

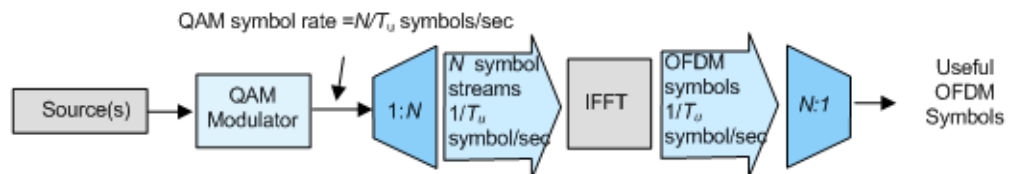


Fig. 3-3: OFDM Signal Generation Chain (3GPP TR 25.892 [2])

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.

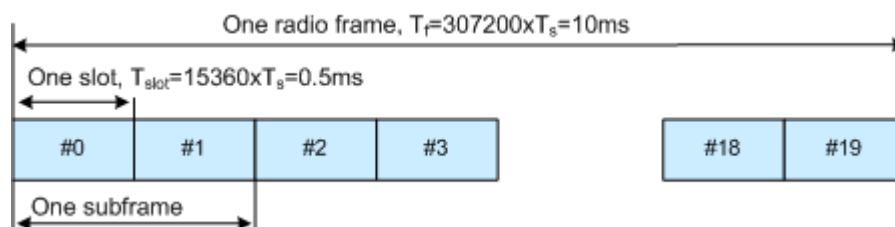


Fig. 3-4: Frame format 1 (FDD mode)

For information on the related settings, refer to "Duplexing" on page 77, chapter 7.5, "DL Frame Configuration", on page 124 and chapter 7.11, "OFDMA Timeplan", on page 173.

### 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).

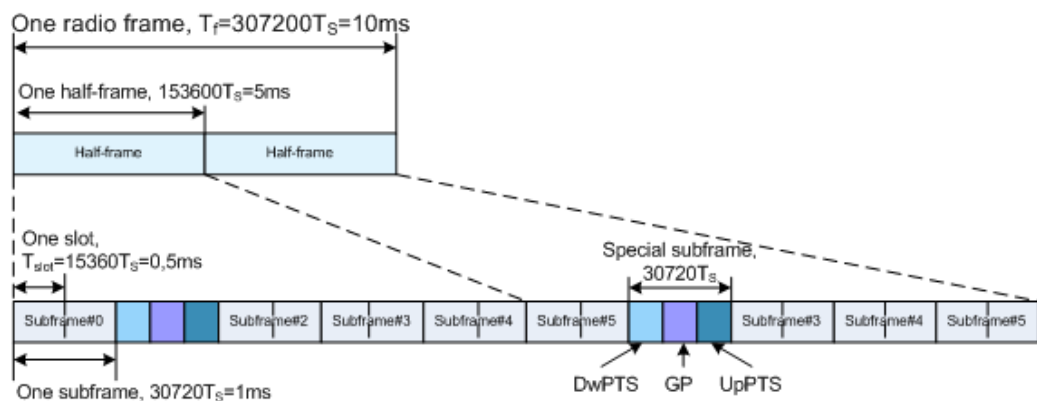


Fig. 3-5: Frame format 2 (TDD mode), 5 ms switching periodicity

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

For information on the related settings, refer to "Duplexing" on page 77, chapter 7.4.4, "TDD Frame Structure", on page 115 and chapter 7.18, "TDD Timeplan", on page 227.

### 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  $N_{BW}^{DL}$  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.  $N_{BW}^{DL}$  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  $N_{BW}^{DL}$  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.

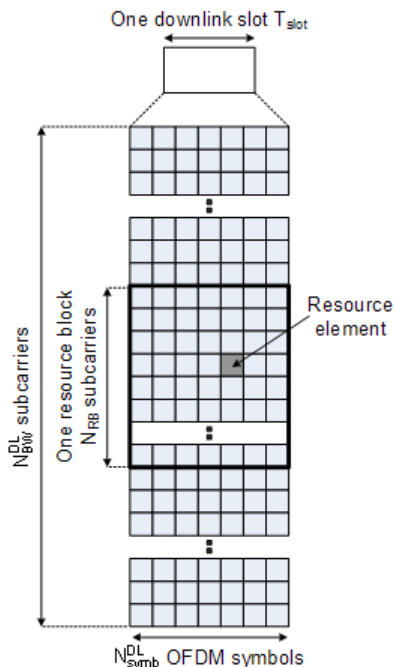


Fig. 3-7: Downlink Resource Grid (3GPP TS 36.211 [3])

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 $N_{\text{symbol}}^{\text{DL}}$	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

For information on the related settings, refer to [chapter 7.11, "OFDMA Timeplan"](#), on page 173 and [chapter 7.18, "TDD Timeplan"](#), on page 227.

### 3.2.3 Downlink Data Transmission

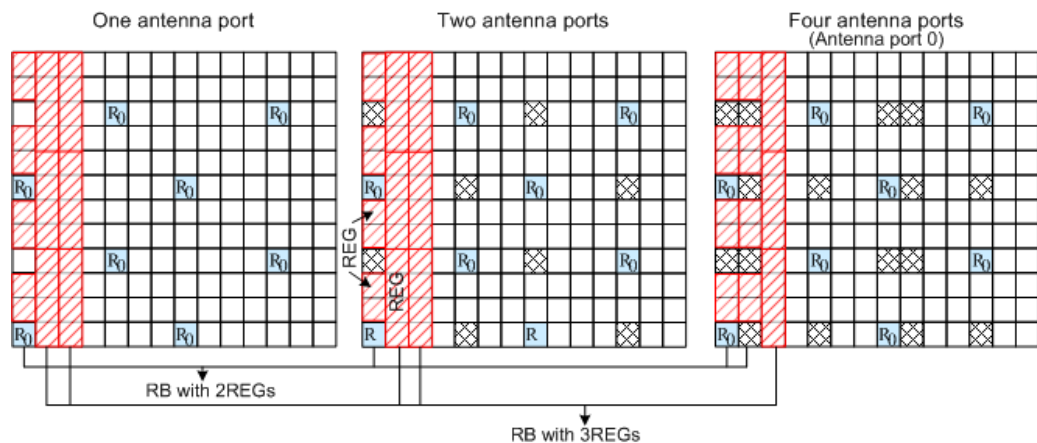
Data is allocated to the UEs in terms of resource blocks. A physical resource block consists of 12 (24) consecutive subcarriers in the frequency domain for the  $\Delta f = 15$  kHz ( $\Delta f = 7.5$  kHz) case. In the time domain, a physical resource block consists of  $N_{\text{symbol}}^{\text{DL}}$  consecutive OFDM symbols, see [figure 3-7](#).  $N_{\text{symbol}}^{\text{DL}}$  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).

For information on the related settings, refer to [chapter 7.6, "Enhanced PBCH, PDSCH and PMCH Settings"](#), on page 134.

### 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.

For information on the related settings, refer to ["PHICH Duration"](#) on page 120 and [chapter 7.7, "Enhanced PCFICH, PHICH and PDCCH Channel Configuration"](#), on page 141.

### 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.

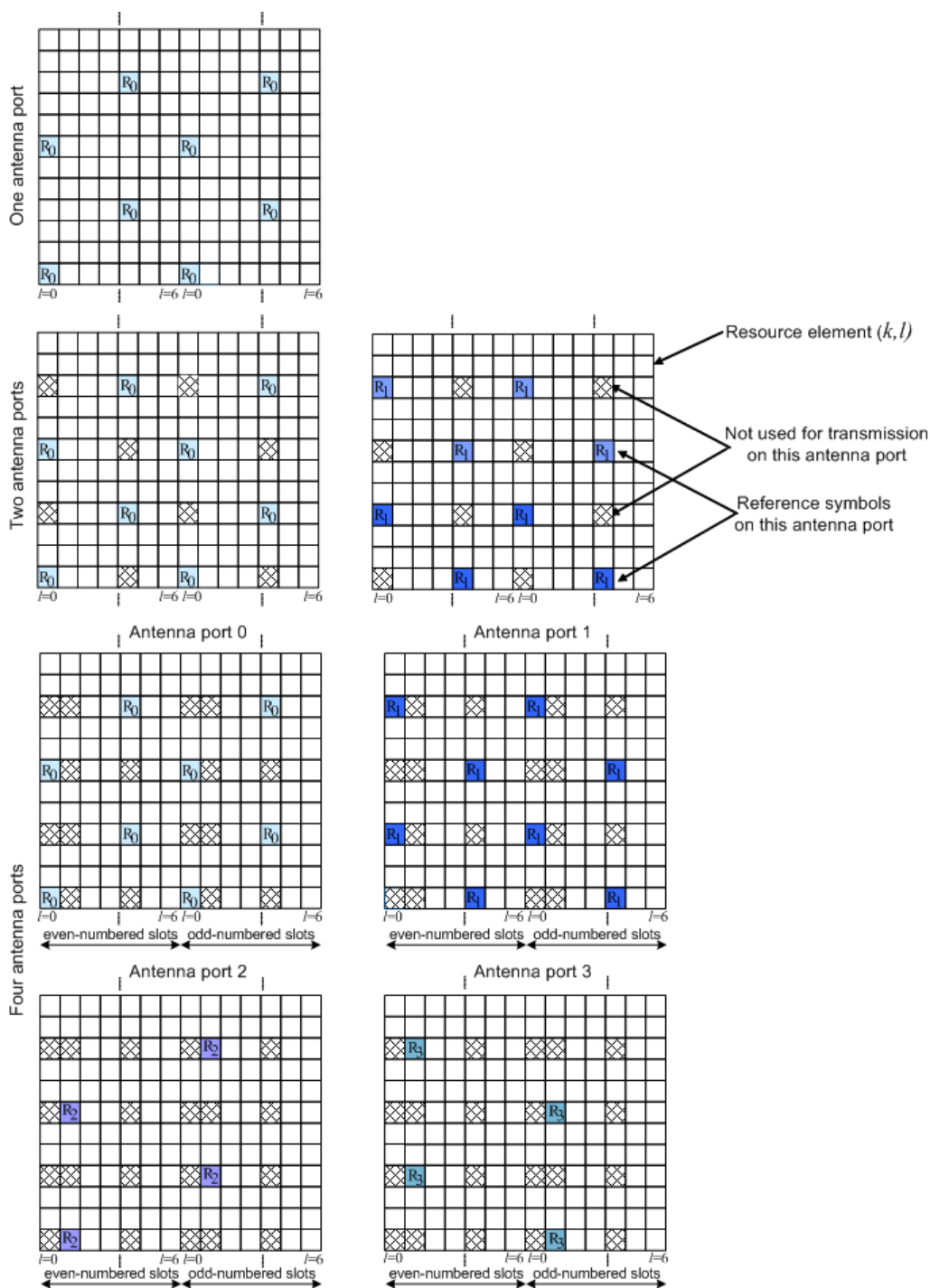
For the LTE downlink, four types of reference signals are defined:

- [Cell-specific downlink reference signals](#)  
The cell-specific reference signals are common signals in a cell, that are intended for all UE within this cell.
- [chapter 3.2.5.2, "MBSFN reference signals"](#), on page 24  
These reference signals are used for channel estimation and demodulation of signals transmitted by means of MBSFN.
- [UE-specific reference signal](#)  
These reference signals are intended for a specific user.
- [chapter 3.2.5.4, "Positioning reference signals"](#), on page 26

For information on the related settings, refer to [chapter 7.4.8, "Downlink Reference Signal Structure"](#), on page 121.

#### 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 (antenna ports 0 .. 3). 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.



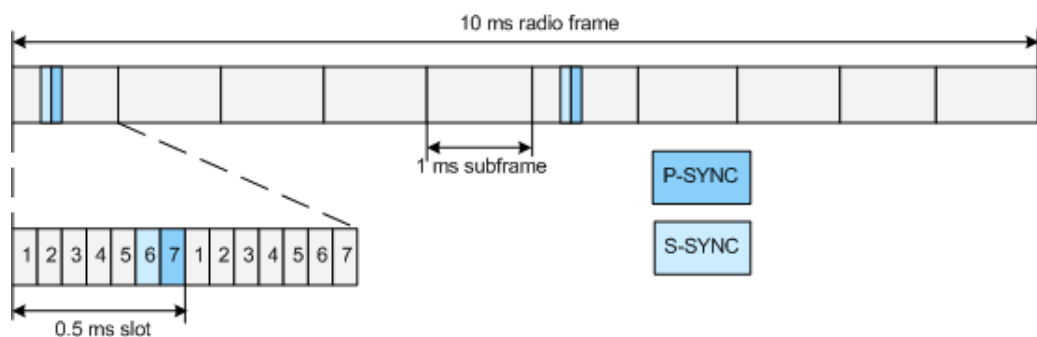
**Fig. 3-9: Downlink Reference Signal Structure (Normal Cyclic Prefix)**

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.

For information on the related settings, refer to [chapter 7.4.9, "Synchronization Signal Settings"](#), on page 122.

### 3.2.5.2 MBSFN reference signals

MBSFN reference signals are defined for extended cyclic prefix only. The MBSFN reference signals are transmitted on antenna port 4 and only when the PMCH is transmitted.

The [figure 3-11](#) shows the resource elements used by the MBSFN reference signal in case of  $\Delta f=15$  kHz.



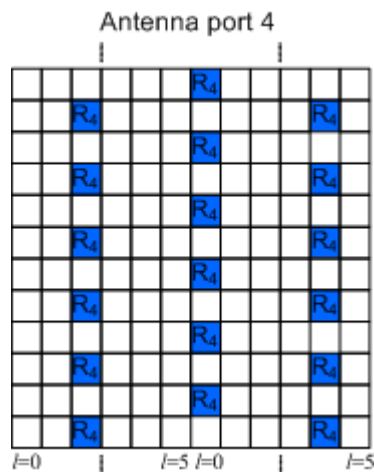


Fig. 3-11: MNSFN reference signal structure (extended cyclic prefix, carrier spacing 15 KHz)

For information on the related settings, refer to [chapter 7.4.1, "MBSFN Settings"](#), on page 95.

### 3.2.5.3 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.

In case of single-antenna transmission, the UE-specific reference signals are transmitted on antenna port 5, 7 or 8. If a spatial multiplexing is applied, the UE-specific reference signals are transmitted on antenna ports 7 and 8.

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.

The following figures show the mapping of the UE-specific reference signals to the resource elements.

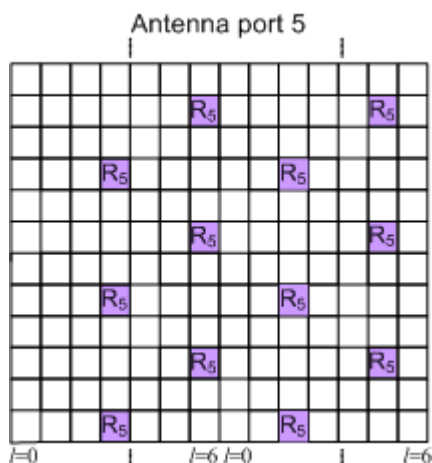


Fig. 3-12: UE-specific reference signals, antenna port 5 (normal cyclic prefix)

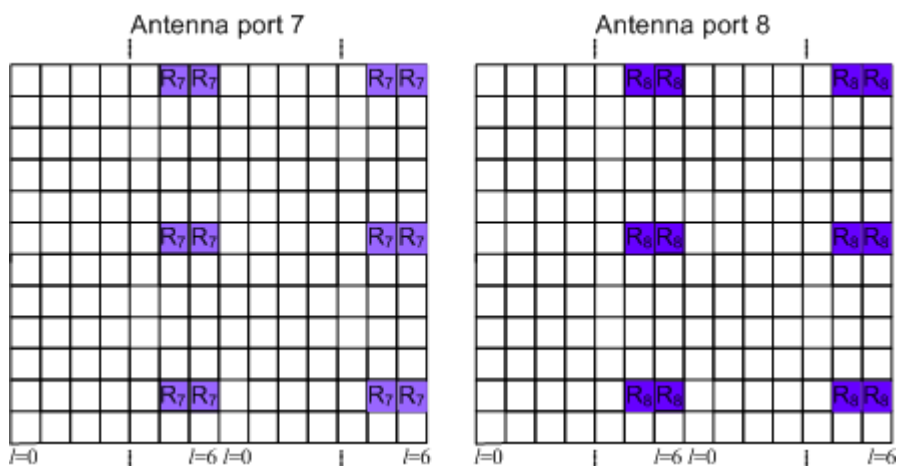


Fig. 3-13: UE-specific reference signals, antenna ports 7 and 8 (normal cyclic prefix, downlink subframe)

### 3.2.5.4 Positioning reference signals

The positioning reference signals are transmitted only in downlink subframes configured for positioning reference signals transmission. Positioning reference signals are transmitted on antenna port 6.

The figure 3-14 shows the mapping of the positioning reference signals for the one and two PBCH antenna ports case (normal cyclic prefix). Refer to the specification for information about the mapping in all other cases.

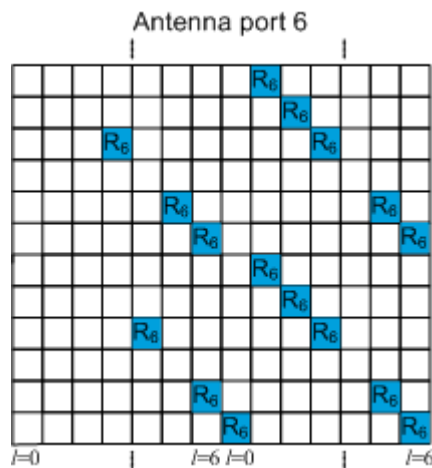


Fig. 3-14: Mapping of PRS (normal cyclic prefix), one and two PBCH antenna ports.

For information on the related settings, refer to [chapter 7.4.10, "Positioning Reference Signal Settings"](#), on page 122.

### 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 LTE Uplink Transmission Scheme

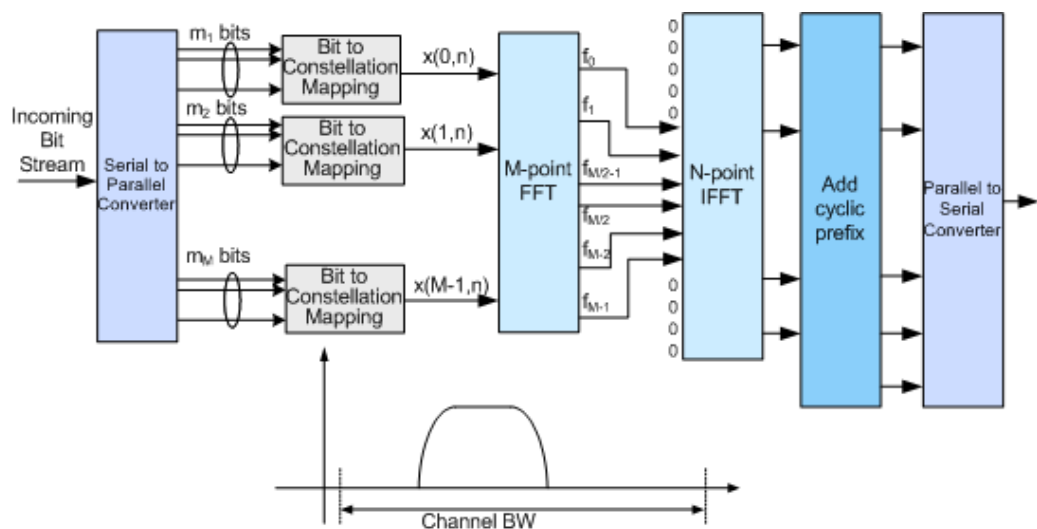
During the study item phase of LTE, alternatives for the optimum uplink transmission scheme were investigated. While OFDMA is seen optimum to fulfill the LTE requirements in downlink, OFDMA properties are less favorable for the uplink. This is mainly due to

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. 3-15: 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  $N_{\text{syimb}}^{\text{UL}}$  SC-FDMA symbols, where  $N_{\text{syimb}}^{\text{UL}} = 7$  for the normal cyclic prefix and  $N_{\text{syimb}}^{\text{UL}} = 6$  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.

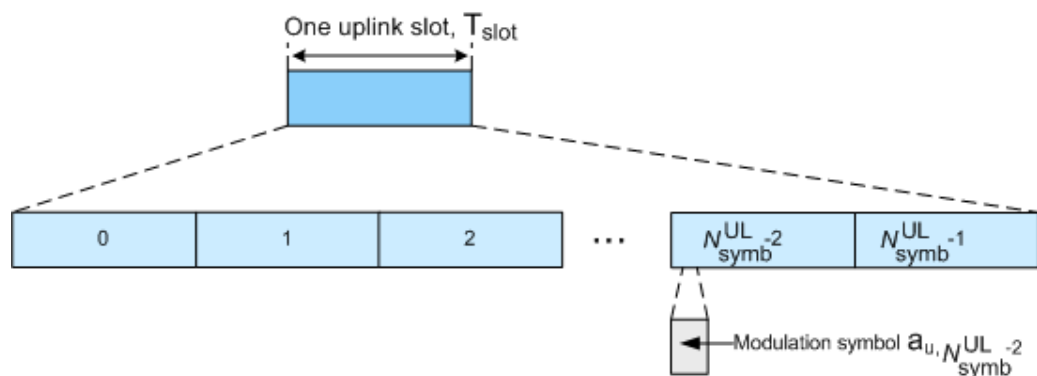


Fig. 3-16: Uplink Slot Structure

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 $N_{\text{syimb}}^{\text{UL}}$	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

For information on the related settings, refer to "Link Direction" on page 77, chapter 7.4.4, "TDD Frame Structure", on page 115, chapter 7.17, "SC-FDMA Timeplan", on page 226 and chapter 7.18, "TDD Timeplan", on page 227.

### 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**).

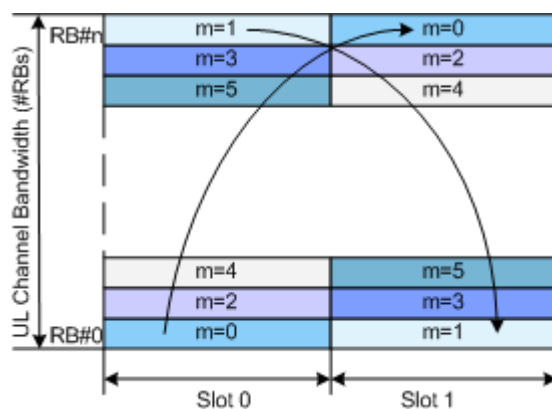
For information on the related settings, refer to [chapter 7.12.6, "PUSCH Structure"](#), on page 181, [chapter 7.14.5, "Physical Uplink Shared Channel \(PUSCH\)"](#), on page 205 and [chapter 7.15, "Enhanced PUSCH Settings"](#), on page 218.

### 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.

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. PUCCH is allocated as shown on the [figure 3-17](#) (taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8)).



**Fig. 3-17: PUCCH Mapping**

According to 3GPP 36.211, seven PUCCH formats are defined (see [table 3-2](#)).

**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

PUCCH format	Description	Physical Bits	Modulation Scheme	ODFM Symbols used for DRS (normal CP)	ODFM Symbols used for DRS (extended CP)
2a	CQI and ACK/NACK	21	QPSK+BPSK	1, 5	-
2b	CQI and ACK/NACK for MIMO	22	QPSK+QPSK	1, 5	-
3	ACK/NACK if DL carrier aggregated with more than 2 cells	48	QPSK	1, 5	3

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. For the different PUCCH formats, different number of PUCCH resource indices are available within a resource block (see table below). The actual number of the used orthogonal sequences is additionally determined by the parameter `delta_shift`, used to support working by different channel conditions.

PUCCH format	PUCCH resource indices	number available within a resource block
1/1a/1b	N(1)_PUCCH	36 for normal CP 24 for extended CP
2/2a/2b	N(2)_PUCCH	12
3	N(3)_PUCCH	5

For information on the related settings, refer to [chapter 7.12.7, "PUCCH Structure"](#), on page 182 and [chapter 7.16, "Enhanced PUCCH Settings"](#), on page 223.

### 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.

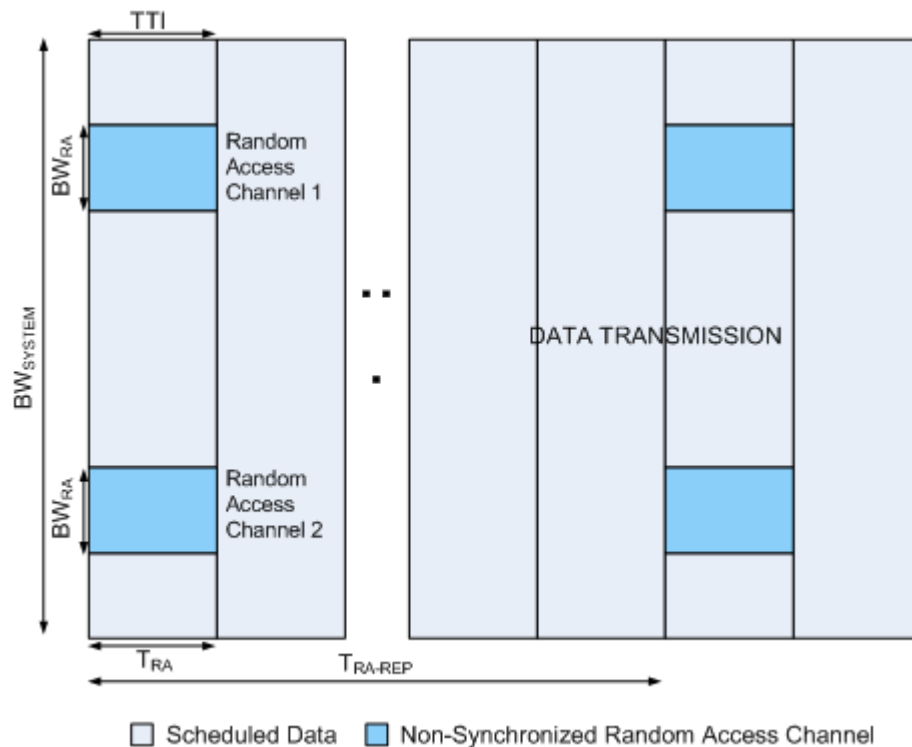
For information on the related settings, refer to [chapter 7.12.4, "UL Reference Signals"](#), on page 179, [chapter 7.12.8, "SRS Structure"](#), on page 184, [chapter 7.14.6, "Reference Signal Structure"](#), on page 208 and [chapter 7.14.7, "SRS Structure"](#), on page 209.

### 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. 3-18: 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.



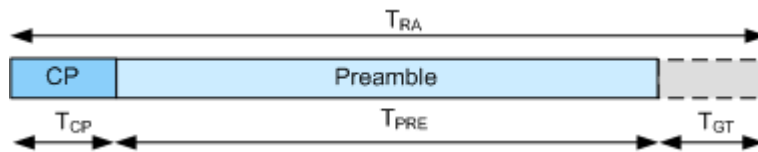


Fig. 3-19: Random Access Preamble

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.

For information on the related settings, refer to [chapter 7.12.5, "PRACH Settings"](#), on page 180, [chapter 7.14.8, "PRACH Power Ramping"](#), on page 216 and [chapter 7.14.9, "PRACH Configuration"](#), on page 216.

### 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 or more 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.

For information on the related settings, refer to [chapter 7.4.6, "MIMO"](#), on page 116, [chapter 7.6.2, "Precoding Settings"](#), on page 135 and [chapter 7.9, "Antenna Port Mapping"](#), on page 169.

#### 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.

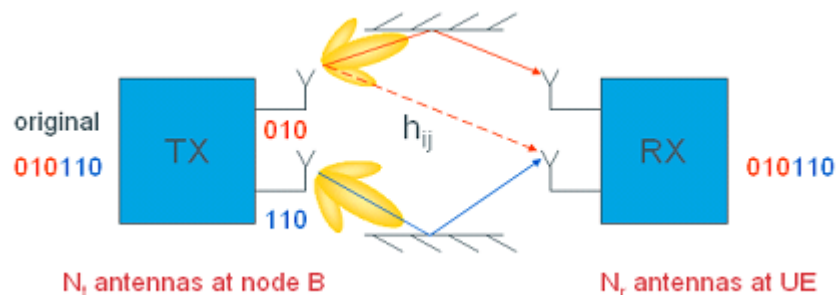


Fig. 3-20: Spatial multiplexing

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  $H$ :

$$H = \begin{matrix} & \begin{matrix} \xrightarrow{N_t} \\ \left[ \begin{array}{cccc} h_{11} & h_{12} & \dots & h_{1N_r} \\ h_{21} & h_{22} & & h_{2N_r} \\ \vdots & & \ddots & \vdots \\ h_{N_t1} & h_{N_t2} & \dots & h_{N_tN_r} \end{array} \right] \\ \downarrow N_r \end{matrix} \end{matrix}$$

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.

### Codewords and spatial layers

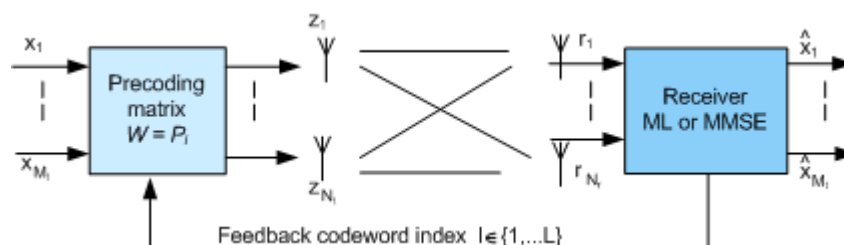
A block of information bits that can be separately processed before it is transmitted in a subframe, is called codeword [17].

A spatial layer indicates the number of spatial streams that can be simultaneously transmitted [17]. The number of layers for transmission is less than or equal to the number of transmit antenna ports and depends on the rank of the matrix  $H$ .

In LTE, up to 2 codewords can be transmitted simultaneously and mapped onto different layers. There is a fixed mapping between codewords to layers.

### Precoding

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 [3] 3GPP TS 36.211, Physical Channels and Modulation (Release 8).



**Fig. 3-21: 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 [3] 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

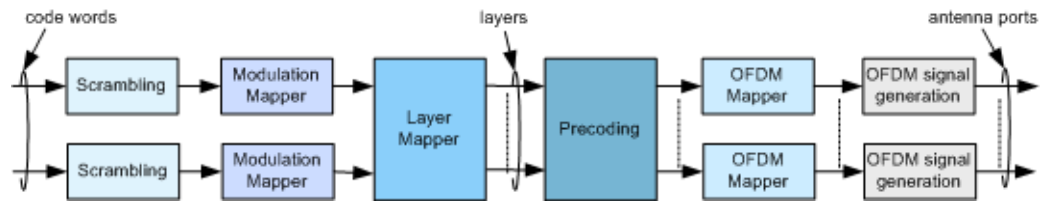


Fig. 3-22: Overview of downlink baseband signal generation

## Transmission modes

LTE defines the following transmission modes for the PDSCH [5].

Table 3-3: Transmission modes overview

Transmission mode	Transmission scheme
Tx Mode 1	Single-antenna transmission (antenna port 0), no MIMO
Tx Mode 2	Transmit diversity
Tx Mode 3	<ul style="list-style-type: none"> <li>• Transmit diversity</li> <li>• Open-loop spatial multiplexing with large delay CDD</li> </ul>
Tx Mode 4	<ul style="list-style-type: none"> <li>• Transmit diversity</li> <li>• Closed-loop spatial multiplexing</li> </ul>
Tx Mode 5	<ul style="list-style-type: none"> <li>• Transmit diversity</li> <li>• Multi-user MIMO</li> </ul>
Tx Mode 6	<ul style="list-style-type: none"> <li>• Transmit diversity</li> <li>• Closed-loop spatial multiplexing using a single transmission layer</li> </ul>
Tx Mode 7 (Beamforming)	Single-antenna port transmission; antenna port 5
Tx Mode 8	<ul style="list-style-type: none"> <li>• Dual layer transmission; antenna port 7 and 8</li> <li>• Single-antenna port; antenna port 7 or 8</li> </ul>

### 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.

### 3.4.1.3 Beamforming

The beamforming is a method to shape the transmitted signal in the receiver's direction. In LTE, the beamforming is defined as transmission mode 7 (Tx Mode 7). Beamforming uses the special virtual antenna port 5 and is also called antenna port 5 transmission.

The channel estimation in a beamforming scenario is based on the [UE-specific reference signal](#).

### 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 (see [chapter 3.2.5.2, "MBSFN reference signals"](#), on page 24).

MBMS data is carried on the MBMS traffic channel (MTCH) as logical channel. The MBMS control information is conveyed by the MBMS control channel MCCH. Both logical channels, the MTCH and the MCCH, are mapped onto the physical multicast channel PMCH in the multi-cell transmission case and on the PDSCH in case a single-cell transmission is used.

For information on the related settings, refer to [chapter 7.4.1, "MBSFN Settings"](#), on page 95.

## 3.6 LTE-Advanced Introduction

In September 2009 the 3GPP Partners made a formal submission to the ITU proposing that LTE Release 10 & beyond (LTE-Advanced) should be evaluated as a candidate for IMT-Advanced.



This description gives a brief description only of the LTE-A features currently covered by the software option R&S SMx/AMU-K85. The full set of LTE-Advanced features is described in [20].

For a complete LTE-Advanced technology introduction and an insight description of the LTE-A features, refer to the following Rohde & Schwarz documents:

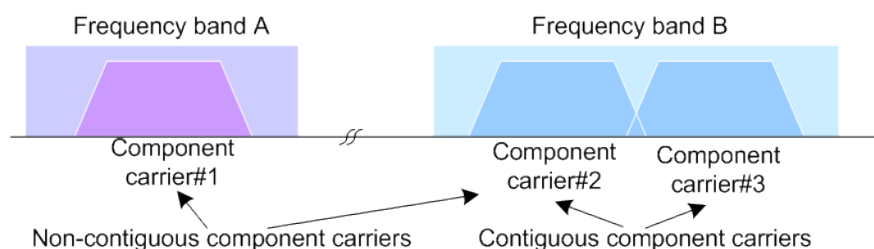
- With Paper 1MA169 "LTE-Advanced Technology Introduction" [18]
- Application Note 1MA166 "LTE-Advanced Signals Generation and –Analysis" [19]

The last two documents can be found in the official Rohde & Schwarz internet site > Download Area > Application Notes: [http://www2.rohde-schwarz.com/en/service\\_and\\_support/Downloads/Application\\_Notes/](http://www2.rohde-schwarz.com/en/service_and_support/Downloads/Application_Notes/)

### 3.6.1 Carrier Aggregation

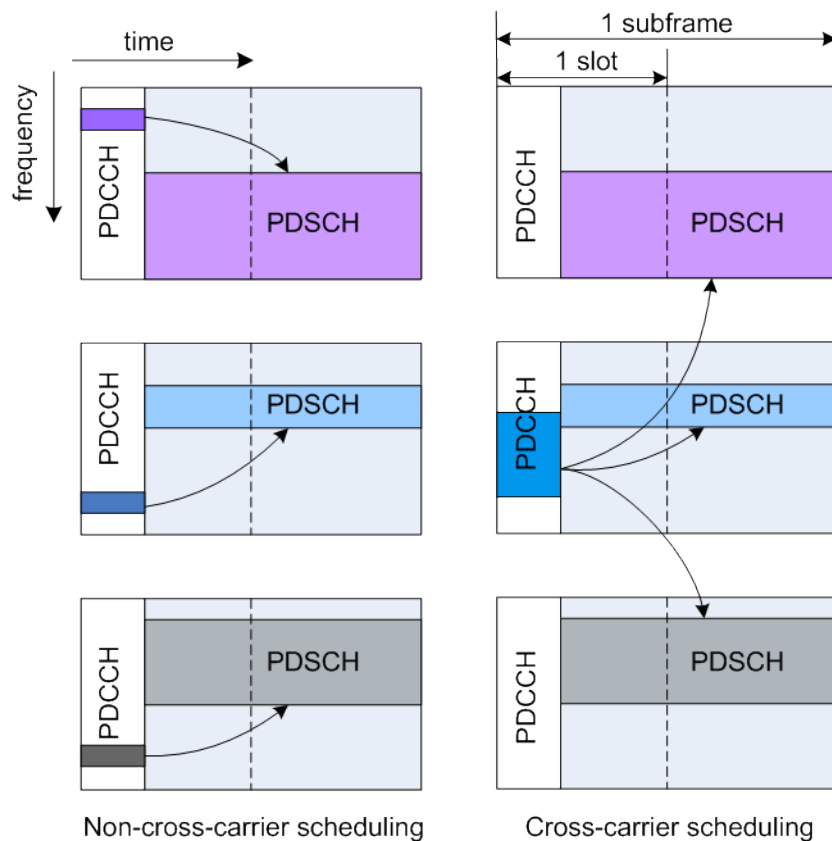
To fulfill the requirements to even higher data rates as in the LTE Rel. 8, the LTE-A Rel. 10 specification uses the aggregation of multiple LTE carrier. Two or more component carrier (CC) are grouped in order to support wider transmission bandwidths up to 100MHz. To an LTE Rel. 8 terminal, each component carrier will appear as an LTE carrier, while an LTE Rel 10 terminal can exploit the total aggregated bandwidth. As backward compatibility is fulfilled, a LTE-advanced cell can serve both LTE Rel 8 and LTE Rel 10 terminals simultaneously.

Spectrum deployment may be either contiguous with adjacent component carriers, or non-contiguous with non-adjacent component carriers (see figure 3-23). The individual component carriers may belong to the same frequency band (intra-band) or even to different frequency bands (inter-band). Component carriers transmitted by the same eNodeB provide the same cell coverage.



**Fig. 3-23: Carrier aggregation [18]**

The LTE-A specification defines two different approaches about informing the UE about the scheduling for each band: a separate PDCCH for each carrier or a common PDCCH for multiple carriers (cross-carrier scheduling).



**Fig. 3-24: LTE-A scheduling approaches**

In the dedicated/non-cross-carrier approach, the PDCCH on a component carrier assigns PDSCH resources on the same component carrier. The used PDCCH structure is identical to the LTE Rel. 8/9 PDCCH structure.

In the cross-carrier approach, the PDCCH on a component carrier assigns resources on one of multiple component carriers. The component carriers are identified by the new introduced DCI field, the CIF (carrier indicator field).

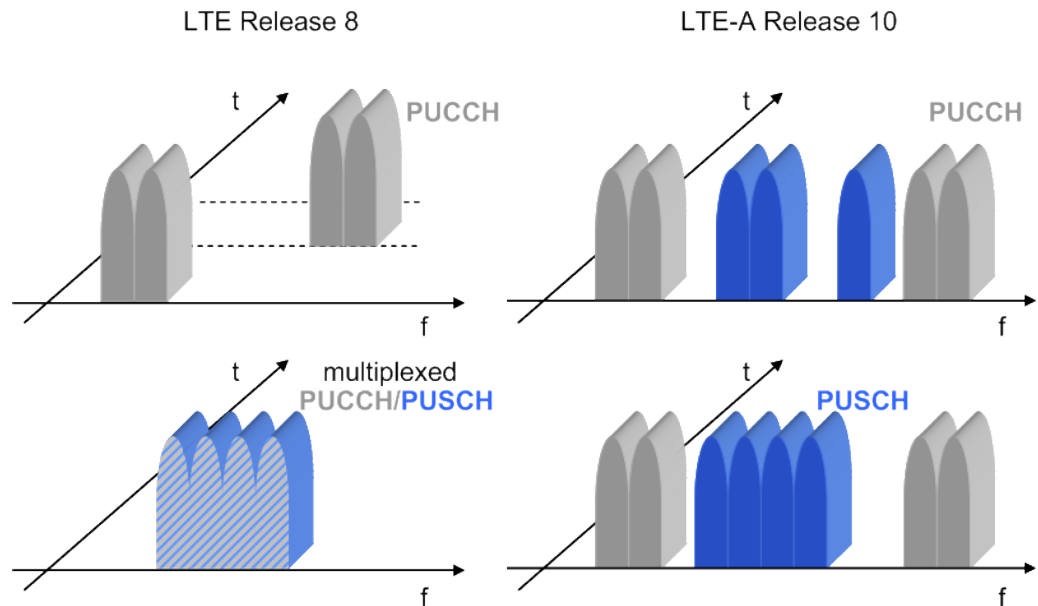
For information on the related settings, refer to [chapter 7.4.2, "DL Carrier Aggregation Configuration"](#), on page 108, [chapter 7.7, "Enhanced PCFICH, PHICH and PDCCH Channel Configuration"](#), on page 141 and [chapter 7.8, "Configure User"](#), on page 166.

### 3.6.2 Enhanced Uplink SC-FDMA

The LTE-A Rel 10 enhances the uplink transmission scheme compared to the LTE Rel. 8 uplink with the following:

- **Control-data decoupling**  
In LTE Rel 8/9 a UE only uses physical uplink control channel (PUCCH) when it does not have any data to transmit on PUSCH. I.e. if a UE has data to transmit on PUSCH, it would multiplex the control information with data on PUSCH. This is no longer valid in LTE-Advanced, which means that simultaneous PUCCH and PUSCH transmission is possible in uplink direction.

- Non-contiguous data transmission  
 LTE-Advanced extends the uplink transmission scheme by allowing clustered PUSCH, i.e. the uplink transmission is not anymore restricted to the use of consecutive subcarriers, but clusters of resource blocks may be allocated (two "Sets" of consecutive PUSCH resource block groups according to resource allocation type 1 as defined in TS 36.213).



**Fig. 3-25: LTE release 8 and LTE-A Release 10 UL transmission schemes [18]**

For information on the related settings, refer to [chapter 7.13, "UL Frame Configuration"](#), on page 186 and [chapter 7.14, "User Equipment Configuration"](#), on page 193.



## 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

- LTE defines one reference signal per downlink antenna port (see table). In the R&S Signal Generator, the mapping of the logical antenna ports 4 to 8 to the physical Tx-antennas is configurable.

Antenna Port	Reference Signal
AP0 - AP3	Cell-specific Reference Signals (CS-RS)
AP4	MBSFN-RS
AP5	UE-specific Reference Signals (DM-RS): single-layer
AP6	Positioning Reference Signals (PRS)
AP7-AP8	UE-specific Reference Signals (DM-RS): up to 2 layers

- There is a direct mapping of the CS-RS, i.e. antenna port 0 is mapped to Tx-antenna 1 solely, antenna port 1 is mapped to Tx-antenna 2 and so on.
- R&S Signal Generator offers to select the physical Tx-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 CS-RS 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.
- Generation of reference signals for antenna port 4-8 depend on the availability of MBSFN, PRS and beamformed PDSCHs.

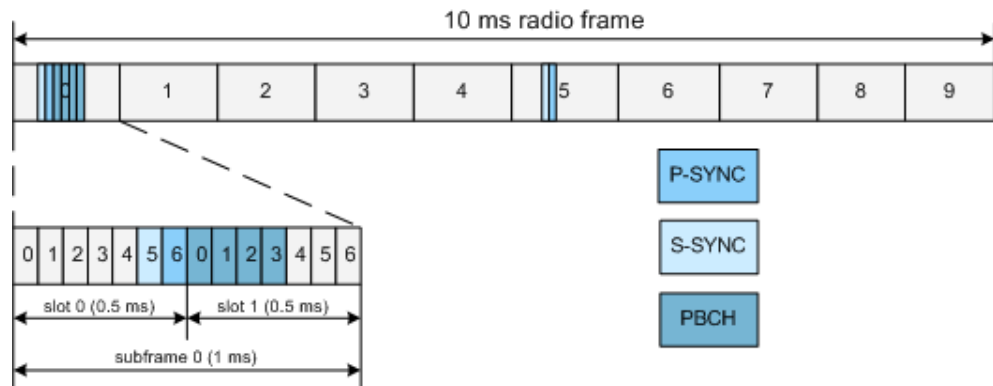
### 4.3 Synchronization Signal (SYNC)

- 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.

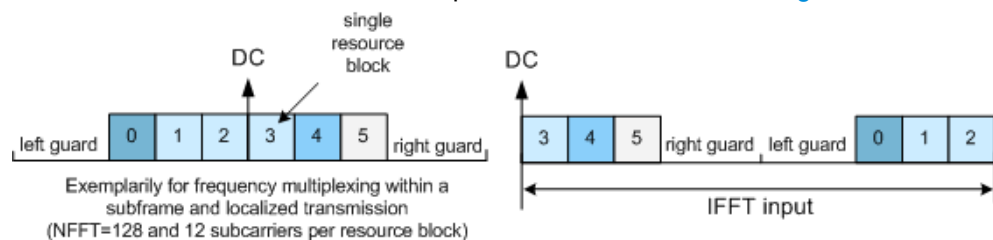
## 4.8 Physical Multicast Channel (PMCH)

In this version of the firmware, the following limitations apply:

- The simulated BS belongs to only one MBSFN areas.  
All radio resources reserved for MBSFN subframes are assigned to one MBSFN area, i.e. the MBSFN Area fills all MBSFN subframes signaled by SIB Type 2.
- Only one *MBSFN-SubframeConfig* is configurable.
- One MCCH per MBSFN is supported. The MCCH is mapped to the first active MBSFN subframe within one MCCH repetition period.
- The parameters "Radio frame allocation offset", "MCCH offset" and "Notification offset" are set to identical values in order to simplify the MBSFN configuration.

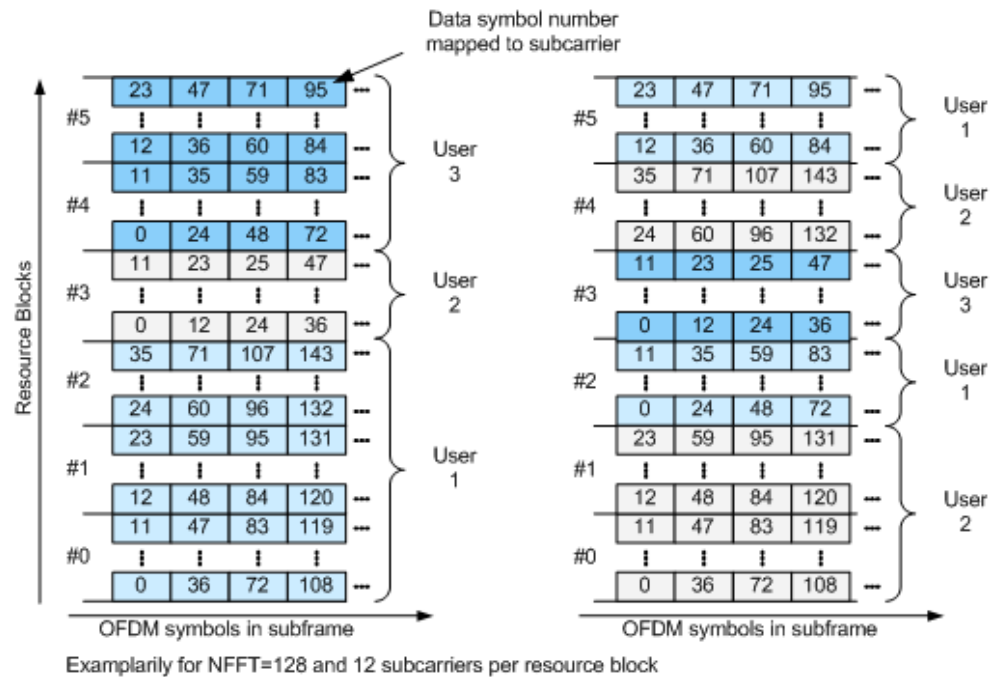
## 4.9 Data Allocations

- 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 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.

## 4.10 Modulation Mapping

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

## 4.11 MIMO

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

## 4.12 SC-FDMA Parameterization

- SC-FDMA physical layer parameterization is based on a bandwidth agnostic layer 1. However, current 3GPP specifications focus on the channel bandwidths 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.

## 4.13 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.

## 4.14 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, 1b or 3 in the same subframe is explicitly enabled for a UE.

## 4.15 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.

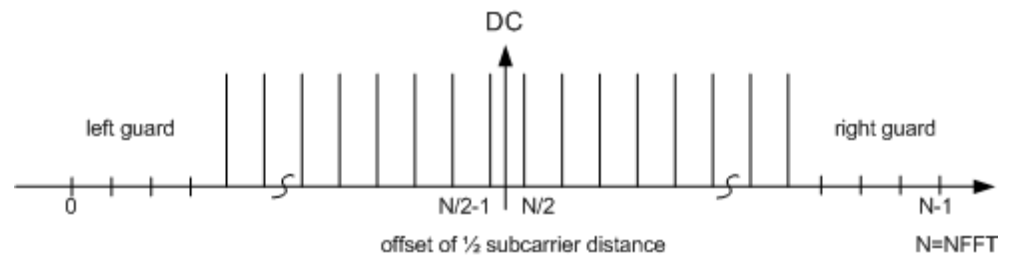
- Position of PUCCH can be configured in terms of PUCCH region.
- The content of PUCCH can be set individually for each TTI.
- All seven PUCCH formats as defined in the 3GPP TS 36.211 are supported.
- One of 12 cyclic shifts (5 for PUCCH format 3) and for PUCCH formats 1/1a/1b one of three orthogonal codes can be selected indirectly by choosing the appropriate PUCCH index.
- For configuration of multi user PUCCH tests according to 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".

## 4.16 Physical Random Access Channel (PRACH)

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

## 4.17 Data Allocation

- Both resource allocation types type 0 and type 1 are supported
- 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.

## 4.18 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 options EUTRA/LTE R&S SMx/AMU-K55/-K255/-K69/-K81/-K84/-K85. 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:

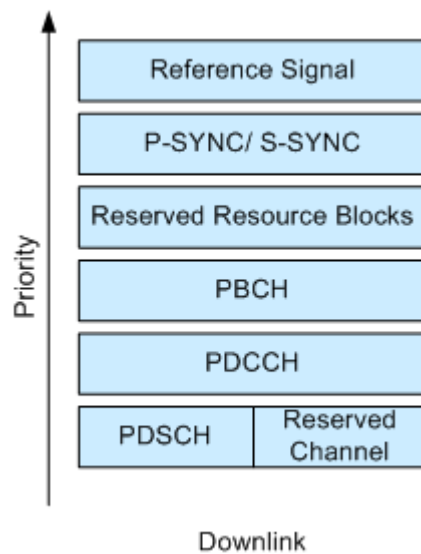
- Reference Signal
- Primary Synchronization Signal (P-SYNC)
- Secondary Synchronization Signal (S-SYNC)
- Physical Broadcast Channel (PBCH)
- Physical Downlink Control Channel (PDCCH), including PCFICH and PHICH
- Physical Downlink Shared Channel (PDSCH)
- Reserved channel

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.



If PRS and MBSFN is configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely.

If a PDSCH is configured to overlap partially with the PRS bandwidth in a PRS subframe, the PRS in these resource blocks are skipped then (see [example "Overlapping PDSCH, PRS and MBSFN"](#) on page 123).

### 5.1.2 Uplink

In the uplink implementation of the R&S Signal Generator it is possible to configure different user equipments (UEs) 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.

Although a conflict is also displayed if the PUSCH and PUCCH allocations of one UE are overlapping, the signals of both allocations are added. 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 PCFICH, PHICH and PDCCH Channel Configuration](#) dialog, the position of the DCI/PDCCH inside the multiplexed bit stream can be freely configured by setting the appropriate CCE index.

Since the number of CCEs for each PDCCH may vary, the 3GPP specification TS 36.211 [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. If this restriction is not fulfilled or two CCEs are overlapping, 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", "Down" and "Resolve Conf." 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 second DCI/PDCCH is that the CCEs allocated for the second DCI/PDCCH are overlapping with the CCEs used by the first one. The second DCI/PDCCH is ignored by the multiplexing.

User	UE_ID n_RNTI	Cell Index	DCI Format	Search Space	Content	PDCCH Format	Number CCEs	CCE Index	No.Dummy CCEs	Conflict
User1	0	0	0	Common	Config...	2	4	0	4	
User1	0	0	1A	UE-Spec	Config...	0	1	1	-	
User2	250	0	0	UE-Spec	Config...	1	2	16	8	
RA_RNTI	1	0	1C	Common	Config...	2	4	8	4	

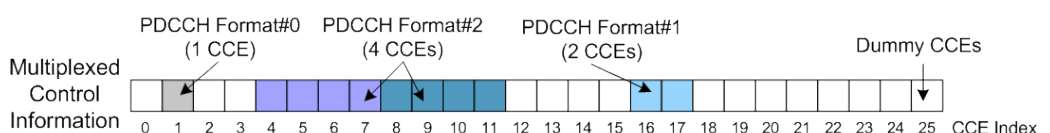
One of the ways to overcome this problem and to resolve the DCI conflict is to use the [Resolve Conflicts](#) function of the software. The built-in algorithm re-assigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values will not be maintained. The calculated signal is suitable for receiver tests that demand conflict free CCEs but have no requirements on explicit CCE values. If the conflict can not be resolved automatically, the values are left unchanged.

If however there is a requirement for CCE Indexes with explicit values, the corrections can be performed manually. In this example for example, set the CCE index of the third DCI/PDCCH to 4.

User	UE_ID n_RNTI	Cell Index	DCI Format	Search Space	Content	PDCCH Format	Number CCEs	CCE Index	No.Dummy CCEs	Conflict
User1	0	0	0	Common	Config...	2	4	4	0	
User1	0	0	1A	UE-Spec	Config...	0	1	1	2	
User2	250	0	0	UE-Spec	Config...	1	2	16	8	
RA_RNTI	1	0	1C	Common	Config...	2	4	8	4	

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.



If "[Activate Carrier Aggregation](#) > ON", the parameter [Cell Index](#) determines the component carrier the corresponding User is mapped to. For this reason, there is no DCI conflict, if in the example above the second DCI belongs to a User enabled on an SCell.

User	UE_ID n_RNTI	Cell Index	DCI Format	Search Space	Content	PDCCH Format	Number CCEs	CCE Index	No.Dummy CCEs	Conflict
User1	0	0	0	Common	Config...	2	4	0	4	
User1	0	1	1A	UE-Spec	Config...	0	1	1	24	
User2	250	0	0	UE-Spec	Config...	1	2	16	8	
RA_RNTI	1	0	1C	Common	Config...	2	4	8	4	

## 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, PRACH 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 therefore 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 and the PRACH are configured 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 49 become effective.

However, 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 remaining signal 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 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, the maximum number of the real configurable uplink subframes depends on the selected [Duplexing](#) mode (TDD or FDD), [TDD Frame Structure](#) and whether [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 40 subframes, where the maximum number of 40 subframes is available for sequence lengths of at least four frames
  - In a TDD frame only the uplink subframes are enabled for configuration. The maximum 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 uplink subframes for the PUSCH channel of the first user equipment (UE 1) 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 current subframe to be configured is selected by means of the parameter [Sub-frame](#).



The configurable range ("Number of configurable uplink subframes") can be configured independently for the individual user equipments. Furthermore, for Release 10 user equipments, the range can be configured independently for the PUCCH and the PUSCH channel.

Subframes behind the configurable range of the corresponding UE or channel are displayed as read-only.

---

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 figure 3-6)	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 Uplink Subframes** set to 13, "Subframes" 0 ... 12 are configurable. Subframes from 13 on are readonly.
- For selected TDD duplexing mode, "UL/DL Configuration = 6" and disabled realtime feedback the "Number of Configurable Uplink Subframes" is in the range 1 .. 20 (see [table 5-1](#)).  
If for instance the "Number of Configurable Uplink Subframes" is set to 10, the following 10 subframes are configurable: 2,3,4,7,8,12,13,14,17,18.  
These are the first 10 uplink subframes. All other subframes (downlink subframes, special subframes and subframes from 19 on) are readonly.
- For selected TDD duplexing mode, "UL/DL Configuration = 6" and enabled realtime feedback, up to 6 HARQ processes can be configured and therefore 1, 2, 3 or 6 configurable uplink subframes are available for the PUSCH channel of the first user equipment.  
If for instance the "Number of Configurable Uplink Subframes" is set to 6, the following 6 subframes are configurable: 2,3,4,7,8,12.  
These are the first 6 uplink subframes. All other subframes (downlink subframes, special subframes and subframes from 13 on) are readonly.

**5.2.3.2 Downlink Direction**

In downlink direction, the maximum number of the real configurable subframes depends on the selected [Duplexing](#) mode (TDD or FDD), [TDD Frame Structure](#), whereas in downlink direction the special subframes are also configurable (in addition to the downlink subframes).

Since the realtime feedback 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 possibilities 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 TS 36.141.

### 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 235).

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 \(PDSCH Ratio  \$\rho\_B/\rho\_A\$ \)](#) and [PDCCH Ratio  \$\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.

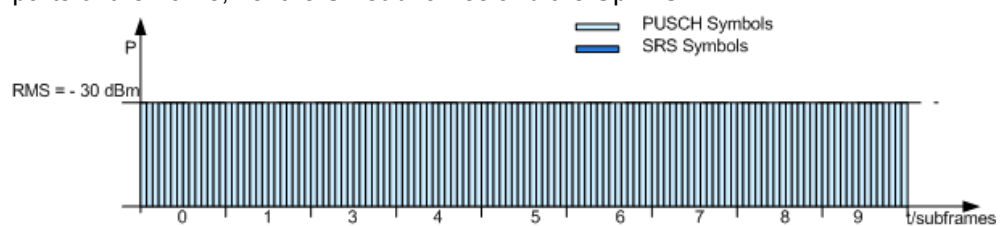
### 5.3.3 Uplink Power Settings

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

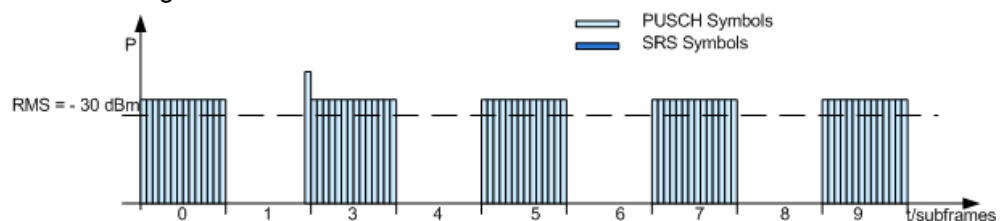
- Level Reference
- Power factors for PUSCH/PUCCH/PRACH/SRS
- DRMS Power Offset (available for PUSCH and PUCCH)
- UE Power

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 UpPTS.

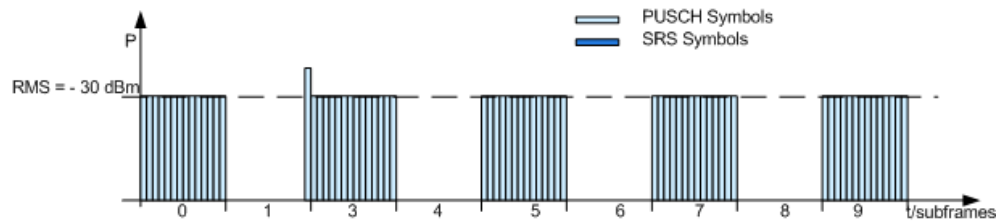


**Note:** The absolute power of a single subframe depends also on the signal within of the remaining subframes.



- "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 TS 36.141, 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.

---

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.

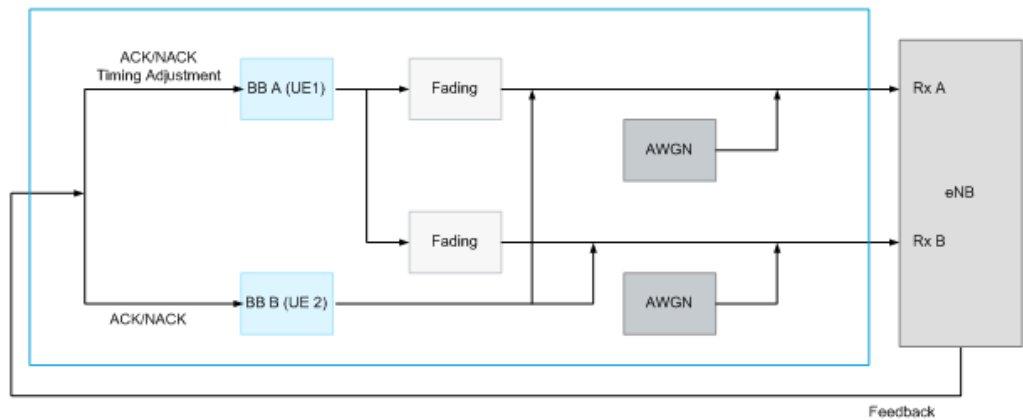
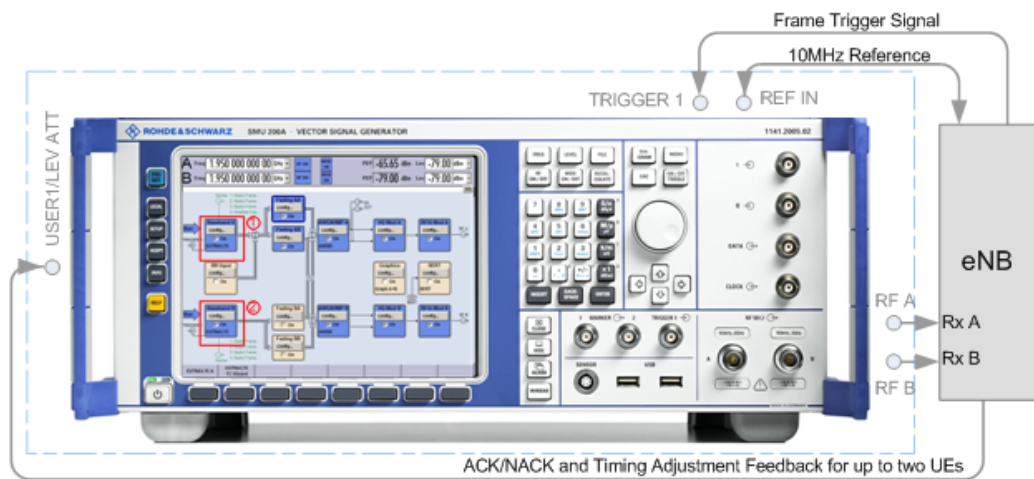


Fig. 6-1: Exemplary test scenario

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 = Baseband A generates the signal of the moving UE
- 2 = Baseband B generates the signal of the stationary 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 202), the input level is interpreted as ACK or NACK.

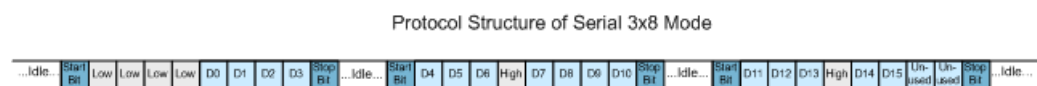
### 6.2.2 Serial Mode

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, 1.6 Mbps 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, 1.6 Mbps 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							- 1: adjust subframe "n+7" - 2: adjust subframe "n+k" - 0 or 3: adjust both subframes "n+k" and "n+7"				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. - $T_A = 31$ means no adjustment - $T_A > 31$ means an increasing advance of the uplink signal - $T_A < 31$ means the advance of the uplink signal is decreased by delaying the signal 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. - $T_A = 31$ means no adjustment - $T_A > 31$ means an increasing advance of the uplink signal - $T_A < 31$ means the advance of the uplink signal is decreased by delaying the signal 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:			0: NACK 1: ACK	reserved	
							- 1: adjust subframe "n+7" - 2: adjust subframe "n+k" - 0 or 3: adjust both subframes "n+k" and "n+7"					

Fig. 6-3: Message bits

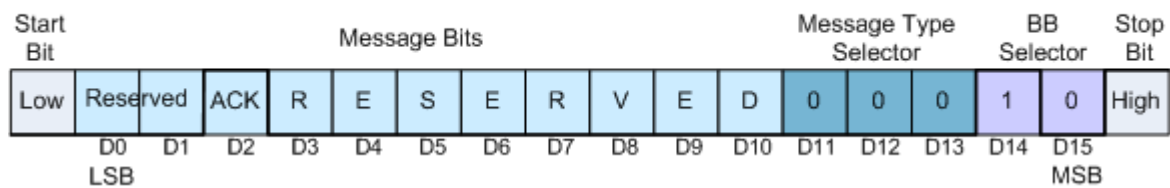
**Example:**

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.

One serial feedback command



*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.

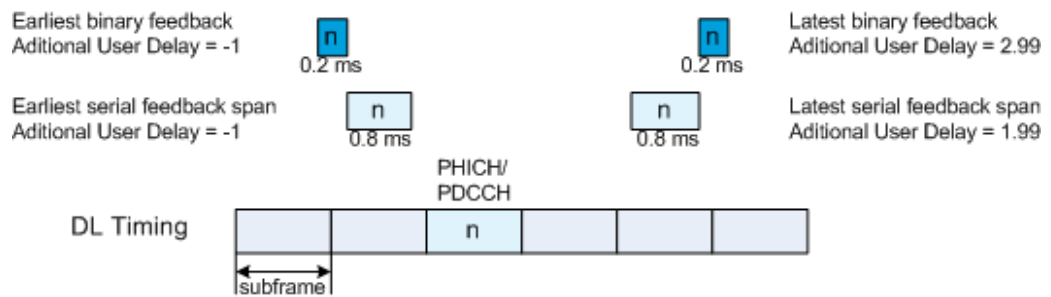


Fig. 6-5: Parameterization of the feedback timing

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 Direct Response Distance Mode

In **binary mode**, there is also another possibility for 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.

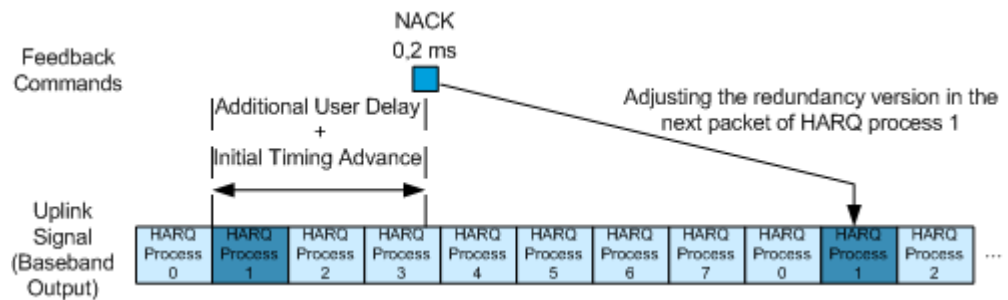
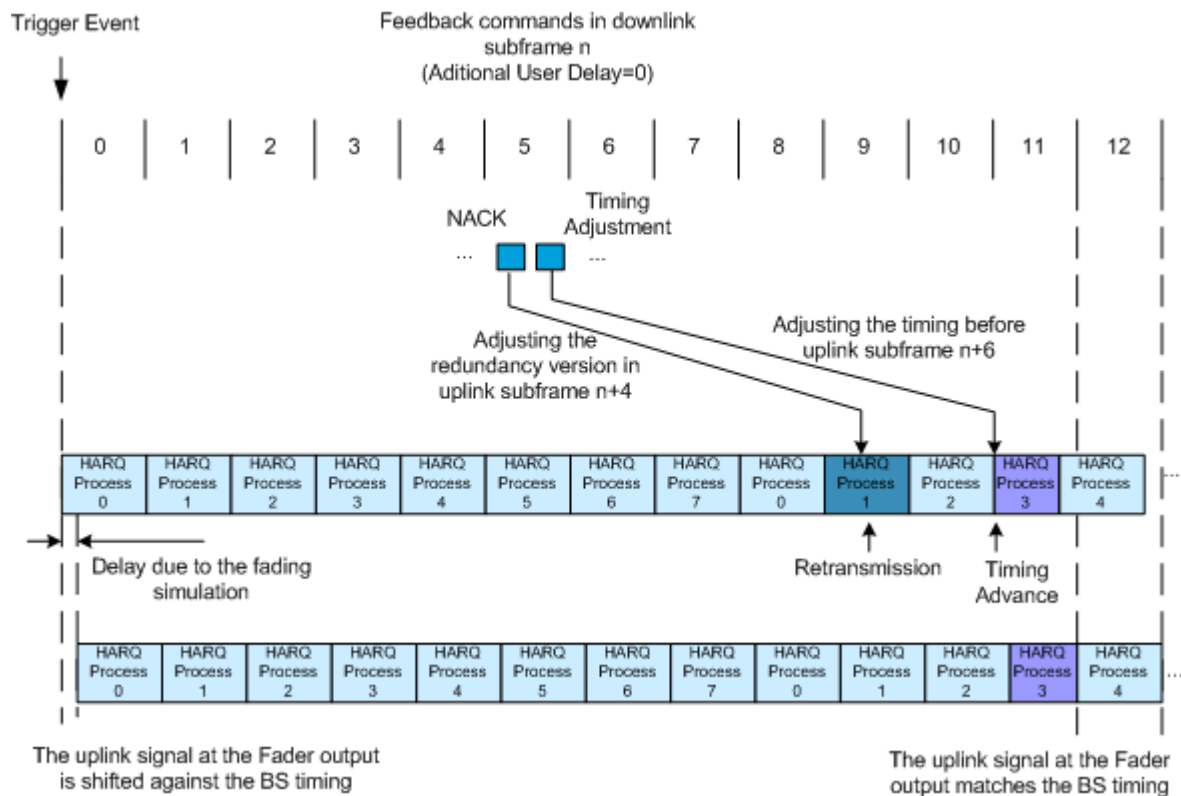


Fig. 6-6: Timing of feedback commands in Direct Response Distance Mode (Example for FDD).

### 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). This does not apply if binary mode with direct response distance mode is used.

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 for serial or serial 3x8 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, in case of TDD transmission with UL/DL configuration 0.

### 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 Avoiding Synchronization Problems

In order to be able to successfully decode the transmitted uplink packets, both the signal generator and the device under test have to keep track of the redundancy versions used in the HARQ processes, because the device under test has to know which redundancy version to expect at a certain point in time (subframe). Using the [Assume ACK until first received ACK command](#) functionality may be necessary especially if the generator is triggered by a normal frame marker of the device under test (DUT) and if the device under test already is expecting uplink transmissions before the generator is triggered.

### Examples

Consider the following examples:

- "Redundancy Version Sequence" = 0,2,3,1
- "Maximum Number of Transmissions" = 4
- One HARQ process is shown

The device under test already is expecting uplink transmissions before the generator is triggered. But as no uplink transmissions take place before the generator starts its signal output, the device under test will not be able to successfully decode packets and therefore will expect retransmissions with different redundancy versions. After triggering the generator by a frame marker, the following situation occurs, if - for example - the DUT expects RV 3 after the generator was triggered.

**Example: Disabled parameter "Assume ACK until first received ACK command"**

The following table shows the situation after triggering the generator if the parameter "Assume ACK until first received ACK command" is disabled.

The generator schedules a new transmission with RV 0.	The DUT expects a retransmission with RV 3.	The DUT sends a NACK to the generator.
The generator received NACK and schedules a retransmission with RV 2.	The DUT expects a retransmission with RV 1.	The DUT sends a NACK to the generator.
The generator received NACK and schedules a retransmission with RV 3.	The DUT reached the maximum number of transmissions and expects a new transmission with RV 0.	The DUT sends a NACK to the generator.
The generator received NACK and schedules a retransmission with RV 1.	The DUT expects a retransmission with RV 2.	The DUT sends a NACK to the generator.
The generator reached the maximum number of transmissions and schedules a new transmission with RV 0.	The DUT expects a retransmission with RV 3.	The DUT sends a NACK to the generator.

The generator and the DUT would keep on being out of synchronization.

**Example: Enabled parameter "Assume ACK until first received ACK command"**

This situation described in the first example does not occur if the generator is triggered by the device under test at a point in time when the DUT expects new transmissions (e.g. by a special marker indicating this). However, if only a frame marker is available from the DUT, the "Assume ACK until first received ACK command" functionality can be enabled, and the above example changes.

The generator schedules a new transmission with RV 0.	The DUT expects a retransmission with RV 3.	The DUT sends a NACK to the generator.
The generator ignores the NACK and schedules a new transmission with RV 0.	The DUT expects a retransmission with RV 1.	The DUT sends a NACK to the generator.
The generator ignores the NACK and schedules a new transmission with RV 0.	The DUT reached the maximum number of transmissions and expects a new transmission with RV 0.	The DUT sends an ACK to the generator.
The generator received ACK and schedules a new transmission with RV 0.	The DUT expects a new transmission with RV 0.	The DUT sends an ACK to the generator.
The generator received ACK and schedules a new transmission with RV 0.	The DUT expects a new transmission with RV 0.	The DUT sends an ACK to the generator.

Now the generator and the DUT are synchronized.

## 6.5 Limitation

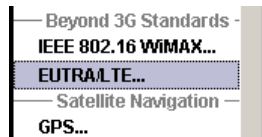
Although an arbitrary data source can be selected, the used user data before the channel coding is the same in all subframes for all HARQ processes and for all transmissions.

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.



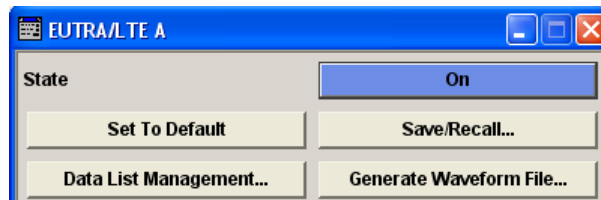
## 7 EUTRA/LTE User Interface

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

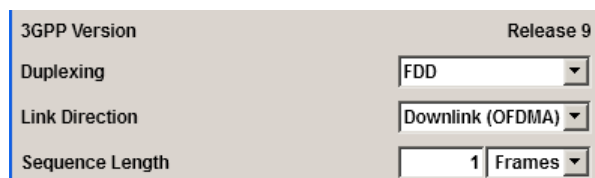


### 7.1 Main Dialog for EUTRA/LTE Signals

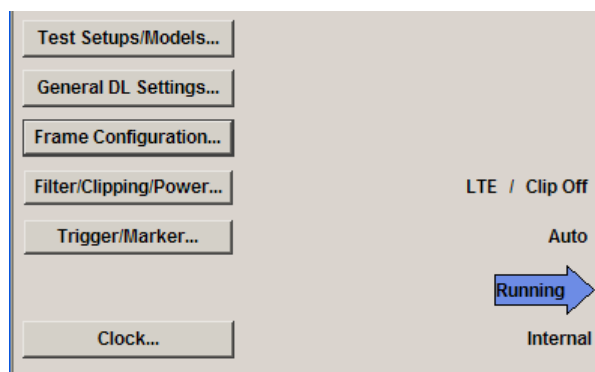
The dialog is split into several sections for configuring the standard. The upper menu section is where the EUTRA/LTE digital standard is enabled and reset, the default settings are called, and where the generated waveform file can be selected.



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 in path A 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 335

### 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

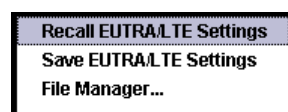
SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:PRESet on page 336

### 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/LTE Setting"	Opens the "File Select" window for loading a saved EUTRA/LTE configuration. The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.
"Save EUTRA/LTE Setting"	Opens the "File Select" window for saving the current EUTRA/LTE signal 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 336

`[ :SOURce<hw> ] :BB:EUTRa:SETTing:LOAD` on page 337

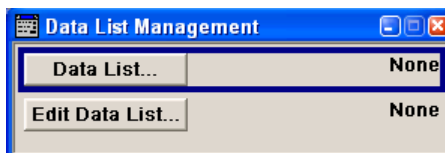
`[ :SOURce<hw> ] :BB:EUTRa:SETTing:STORe` on page 337

`[ :SOURce<hw> ] :BB:EUTRa:SETTing:STORe:FAST` on page 337

`[ :SOURce<hw> ] :BB:EUTRa:SETTing:DEL` on page 337

### 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 402

[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :DSElect on page 402

[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:DATA on page 476

[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:DSElect on page 476

**Generate Waveform File...**

Calls the "Generate Waveform" dialog used to store the current EUTRA/LTE signal as ARB signal in a waveform file.

This file can be loaded in the "ARB" dialog and processed as multi carrier or multi segment signal.

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 7.14.3, "Realtime Feedback Configuration"](#), on page 200), the waveform file is generated as if this functionality is disabled.

**Note:** The [Sequence Length](#) of the generated ARB file is determined by the parameter [SFN Restart Period](#)

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:WAVEform:CREate on page 338

**Test Case Wizard**

Opens the Test Case Wizard dialog (see [chapter 8, "Test Case Wizard"](#), on page 250).

**Logfile Generation**

Opens the dialog for configuring the settings for generation of logfiles (see [chapter 7.2, "LTE Logfile Generation"](#), on page 79).

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

**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 339

**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 335

**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 336

**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 338

**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 91.

SCPI command:

n.a.

**General DL Settings.../ General UL Settings...**

The name of the button depends on the chosen link direction.

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

The dialogs are described respectively in [chapter 7.4, "General DL Settings / General TDD DL Settings"](#), on page 93 and [chapter 7.12, "General UL Settings"](#), on page 174.

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 124 and [chapter 7.13, "UL Frame Configuration"](#), on page 186 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 7.19, "Filter/Clipping/Power Settings"](#), on page 229.

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 7.20, "Trigger/Marker/Clock Settings"](#), on page 237.

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 356

#### **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 355

**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 7.20.5, "Clock Settings"](#), on page 246.

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

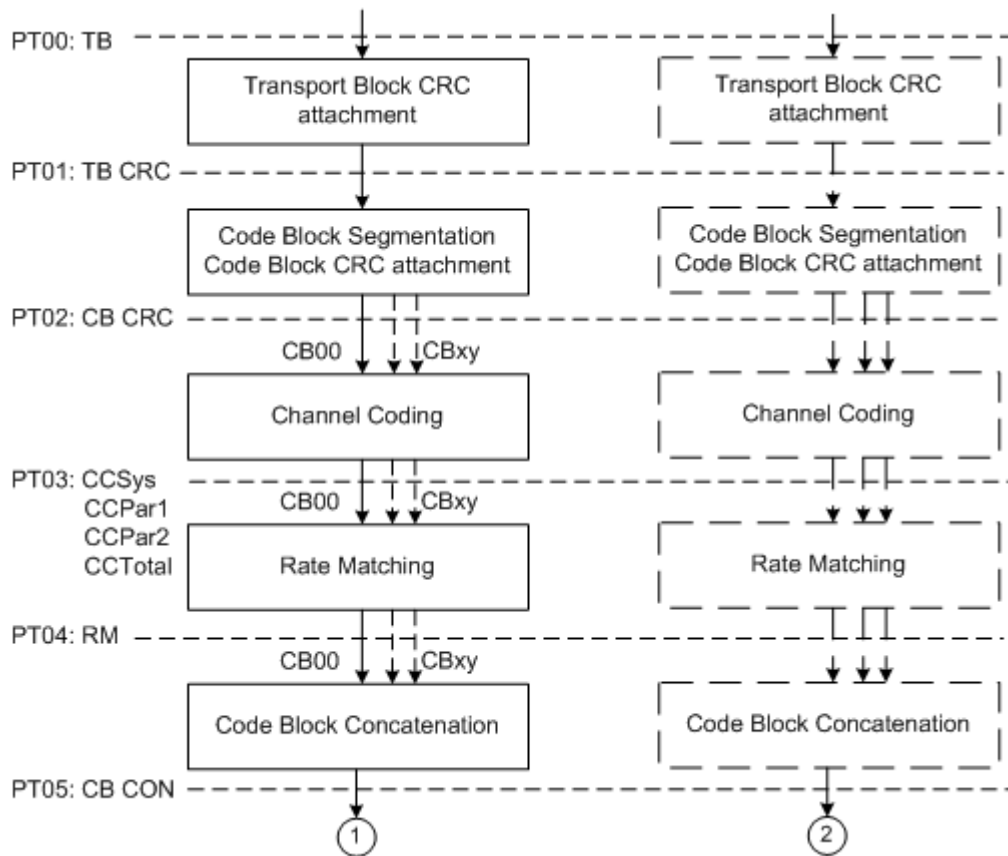
Logfile generation can be enabled after a completed processing step of the selected channel, at the so called logging point. Logging points (PTxx) are available after each completed processing stage up to the "Precoding", as shown on the figures bellow.

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

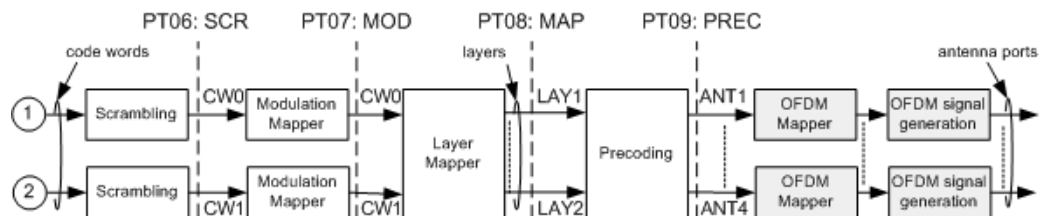


For detailed information about the signal processing of all channels, refer to the corresponding 3GPP specification.

**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>



Point/ Channel	PT00 TB	PT01 TBCRC	PT02 CBCRC	PT03 CC	PT04 RM	PT05 CBCON	PT06 SCR	PT07 MOD	PT08 MAP	PT09 PREC
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
PMCH <sup>1)</sup>	X	X		X	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**

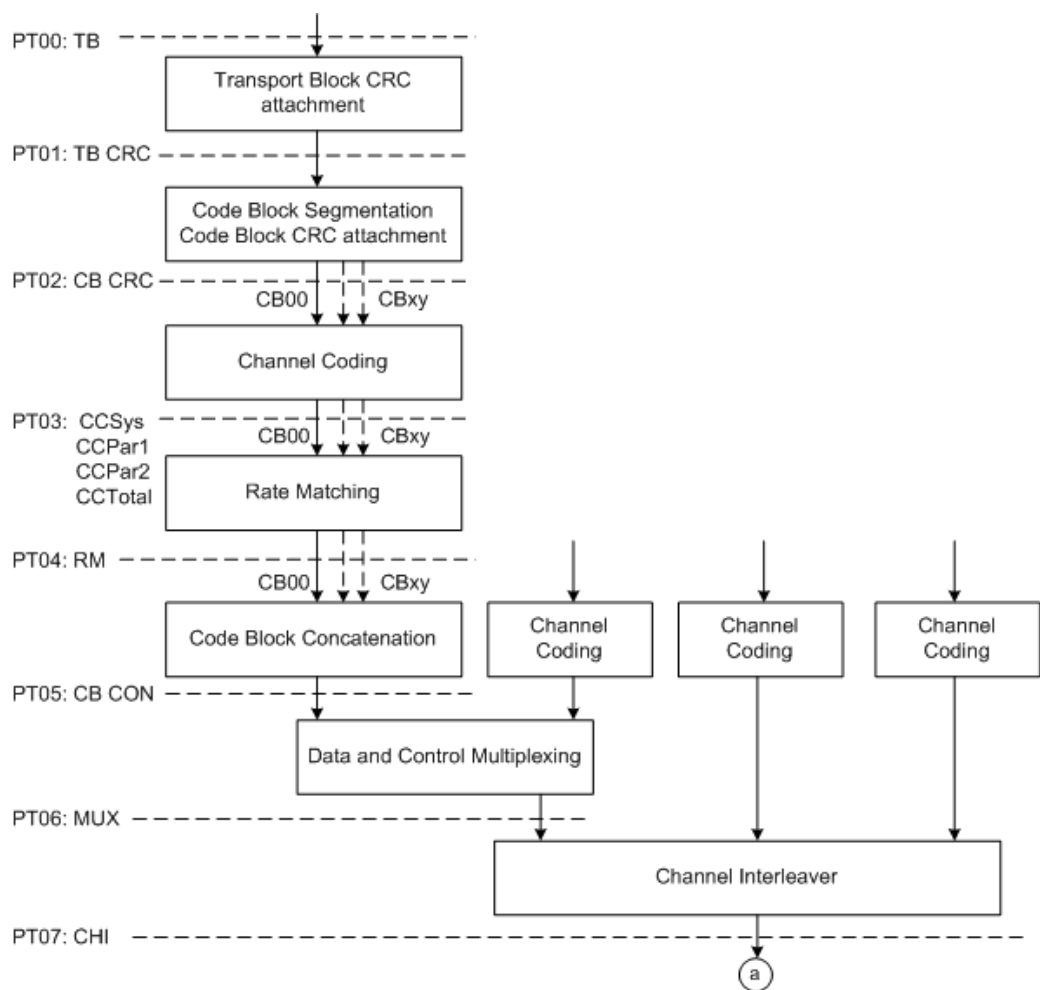


Fig. 7-3: Transport channel processing for UL-SCH (according to 3GPP TS 36.212)

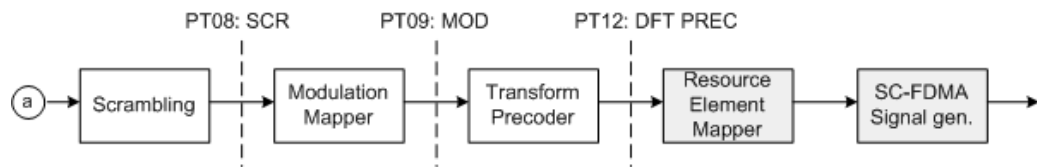


Fig. 7-4: Overview of uplink physical channel processing (according to 3GPP TS 36.211)

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 82. 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 85 and ["Extended UCI Logfile"](#) on page 88).

### 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#>]_<PointName>[_<
```

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   PMCH 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

<Point#>	<PointName>	Description
	CCPar2	Parity 2 Bits
	CCTotal	PDSCH and PUSCH allocation only Complete bit-stream after channel coding, incl. systematic, parity 1 and parity 2 bits
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#>]_<PointName>[_<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#>,
- 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#>
  - PDCCH number of useful REGs  
<Frame#>, <Subframe#>, PDCCH: Columns:<Columns#>, Rows:<Rows#>, Useful REGs  
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#>  
The additional information DTX REG is assigned to all Dummy PDCCH REGs (see ["Number of Dummy REGs"](#) on page 148).



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
```

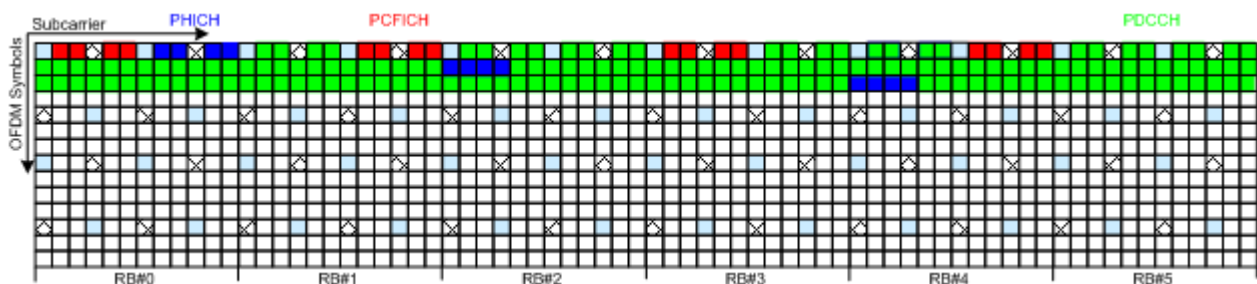
```

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 contain 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 Bit
```

#### 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
```

### 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 88.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:STATe` on page 502

**Output Path**

Selects the network directory the logged files are stored in.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:OUTPut` on page 502

**Logging Files Preamble**

An optional preamble may be added to the file name. Refer to [chapter 7.2.2.1, "File Names"](#), on page 82 for a description of the file naming convention used.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:LFP` on page 502

**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 85 and respectively ["Extended UCI Logfile"](#) on page 88.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:EDLogging` on page 503

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:EULogging` on page 503

**Physical Channels**

Selects the channel for which logfiles are generated.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:ENCC` on page 503

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:PBCH` on page 503

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:PDSCh` on page 503

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:PMCH` on page 504

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:PUSCh` on page 504

**Enable/Disable All**

Enables/disables all logging points.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:EALL` on page 503

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:DALL` on page 503

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:EALL` on page 503

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:DALL` on page 503

**Logging Point**

Enables/disables one particular logging point.

Refer to [chapter 7.2.1, "Signal Processing Chains and Logging Points"](#), on page 79 for description on the available logging points.

SCPI command:

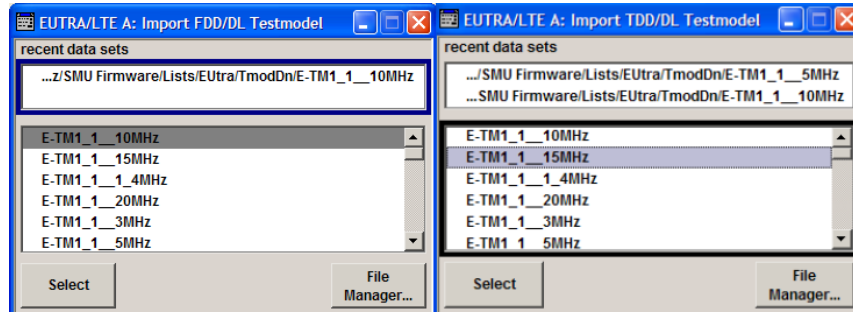
`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:DL:LOGPoint<ch0>` on page 503

`[ :SOURce<hw> ] :BB:EUTRa:LOGGen:UL:LOGPoint<ch0>` on page 503

## 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:

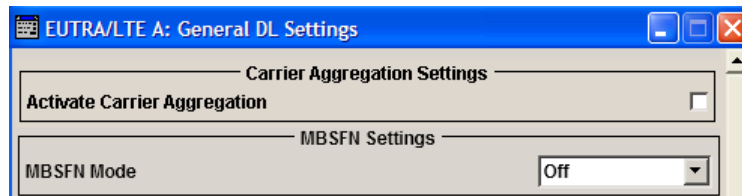
`[ :SOURce<hw> ] :BB:EUTRa:SETTing:TMOD:DL` on page 338

`[ :SOURce<hw> ] :BB:EUTRa:SETTing:TMOD:TDD` on page 338

## 7.4 General DL Settings / General TDD DL Settings

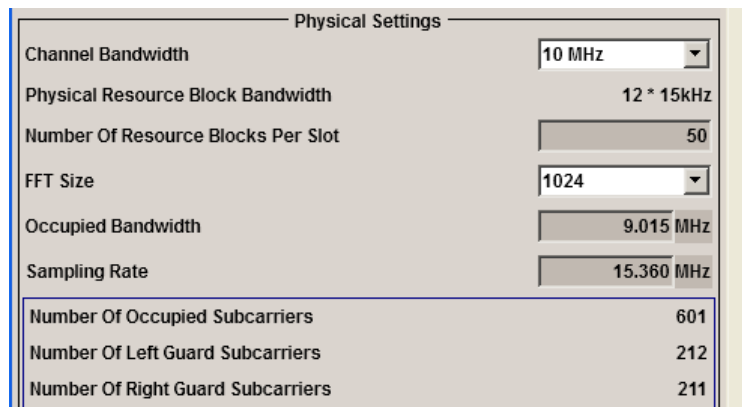
The "General DL Settings" dialog allows configuring the EUTRA/LTE system for transmission direction downlink, i.e. the signal of one BS or one cell.

The dialog consists of the sections [DL Carrier Aggregation Configuration](#), [MBSFN Settings](#), [Physical Settings](#), [K55 Configuration Mode](#), [MIMO](#), [Cell Specific Settings](#), [Downlink Reference Signal Structure](#), [Synchronization Signal Settings](#) and [Positioning Reference Signal Settings](#).



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 DL Settings" dialog comes with the same parameters as the "General DL Settings" dialog 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.

TDD Frame Structure	
UL/DL Configuration	0
Configuration of Special Subframe	0

In the "K55 Configuration" 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 1
Simulated Antenna Path B	Antenna 3
Antenna Port Mapping	

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	1
PDSCH Ratio $\rho_B/\rho_A$	0.000 dB
PDCCH Ratio $\rho_B/\rho_A$	0.000 dB
PBCH Ratio $\rho_B/\rho_A$	0.000 dB
PHICH Duration	Normal
PHICH N_g	1/6
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	0.000 dB
RS Power per RE relative to Level Display	-

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

The "Positioning Reference Signal Settings" section comprises the related settings.

Positioning Reference Signal Settings	
PRS State	<input checked="" type="checkbox"/>
PRS Configuration Index	0
PRS Periodicity T_PRS	160
PRS Subframe Offset Delta_PRS	0
Number of PRS DL Subframes(N_PRS)	1
PRS Bandwidth	1.40 MHz
PRS Power	0.000 dB

### 7.4.1 MBSFN Settings



Configuration of the "MBSFN Settings" requires the additional software option R&S SMx/AMU-K84.

The "MBSFN Settings" section comprises the parameters necessary to configure a MBSFN transmission. Refer to [chapter 3.5, "LTE MBMS Concepts"](#), on page 37 for background information.



According to the MBMS LTE concept, one eNodeB may serve more than one MBSFN areas. In this implementation, the simulated cell belongs to only one MBSFN areas. Hence, all radio resources reserved for MBSFN subframes are assigned to one MBSFN area.

In a LTE network, the MBSFN information is transmitted only during the specially reserved MBSFN subframes. Almost all MBMS control information is carried by a special control channel, the MCCH. There is one MCCH per MBSFN area. In this implementation, the MCCH is always mapped to the first active MBSFN subframe within one MCCH repetition period (see figure in [example "MBSFN Resource Allocation"](#) on page 98).

A configurable "MCCH repetition period" determines how frequent the control information is transmitted within a defined "MCCH modification period" (see figure below).

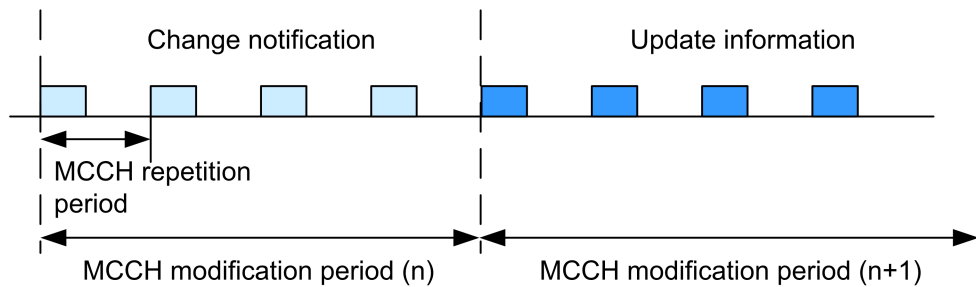


Fig. 7-6: Change of MCCH information

The MCCH carries a single message, the *MBSFNAreaConfiguration* message, which provides information on the ongoing MBMS sessions and the corresponding radio resources, i.e. the mapping of the PMCHs. The BCCH also carries some of the MBMS control information by means of the special System Information Blocks SIB Type 13 and SIB Type 2.



For exact definition of control elements and messages such as *MBSFNAreaConfiguration*, please refer to 3GPP TS 36.311, v9.6.0. [16].

The following table provides an overview of the steps an UE performs to acquire the information about the resource configuration of reserved MBSFN subframes, the position of the MCCH within the MBSFN subframes as well as information necessary to demodulate the MCCH and to retrieve the information about the PMCH scheduling.

Table 7-6: Acquiring MBSFN information

Step	Information provided by	Description	User Interface
1	BCCH > SIB#2 <ul style="list-style-type: none"> <li><i>MBSFN-SubframeConfiguration</i></li> </ul>	The SIB#2 contains common radio configuration information and among other things a list ( <i>mbsfn_SubframeConfigList</i> ) with scheduling information for up to 8 MBSFN allocations ( <i>MBSFN-SubframeConfiguration</i> ).  Hence, after receiving the SIB#2 each UE, also the MBSFN incapable UEs, are informed about the subframes that are reserved for MBSFN in the downlink.	<a href="#">Subframe Config (SIB Type 2)</a>
2	BCCH > SIB#13 <ul style="list-style-type: none"> <li><i>MBSFN-AreaInfoList</i></li> <li><i>MBMS-NotificationConfiguration</i></li> </ul>	The SIB#13 carries the information necessary to acquire the MBMS control information for up to 8 MBSFN areas ( <i>MBSFN-AreaInfoList</i> ), as well as the common MBMS notification scheduling information ( <i>MBMS-NotificationConfiguration</i> ).  After receiving the SIB#13 the MBSFN capable UE is able to find the MBSFN reference signals ( <i>mbsfn-AreaID</i> ) and to detect and demodulate the MCCH ( <i>mcch-Config</i> and <i>MBMS-Notification-Configuration</i> ).	<a href="#">MBSFN-AreaInfoList Parameters</a> <a href="#">MBSFN-Notification-Config Parameters</a>



Step	Information provided by	Description	User Interface
3	MCCH > <i>MBSFNAreaConfiguration</i> <ul style="list-style-type: none"> <li>• <i>PMCH-InfoList</i></li> <li>• <i>CommonSF-Allocation- PatternList</i></li> </ul>	The MCCH carries the single message <i>MBSFNAreaConfiguration</i> that determines which of the reserved MBSFN subframes (compare SIB#2) belong to which MBSFN area and provides a list with configuration information for up to 15 PMCHs ( <i>PMCH-InfoList</i> ) per an MBSFN area.  <b>Note:</b> The <i>MBSFN-SubframeConfiguration</i> is equivalent to the summary of all <i>CommonSF-AllocationPatternList</i> . In this implementation, all MBSFN subframes are assigned to one MBSFN area. Hence, <i>MBSFN-SubframeConfiguration</i> equates the <i>CommonSF-AllocationPatternList</i> and configuration of the later one is done with the parameters of SIB#2.  The <i>PMCH-InfoList</i> specifies the individual PMCHs, including MBMS sessions, used MCS, allocated subframes ( <i>sf-AllocEnd</i> ) and the periodicity for providing MCH scheduling information on MAC layer ( <i>mch-SchedulingPeriod</i> ).	<a href="#">Common Subframe Allocation Period</a> <a href="#">PMCH-InfoList Parameters</a>
4	PMCH	The UE receives the PMCHs.	

The following figures show the signaling of MBSFN information during the acquisition steps.

Step

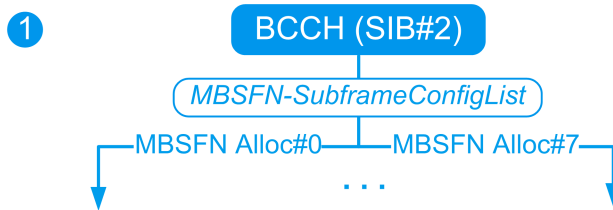


Fig. 7-7: MBSFN Signaling (step 1)

Step

2

3

4

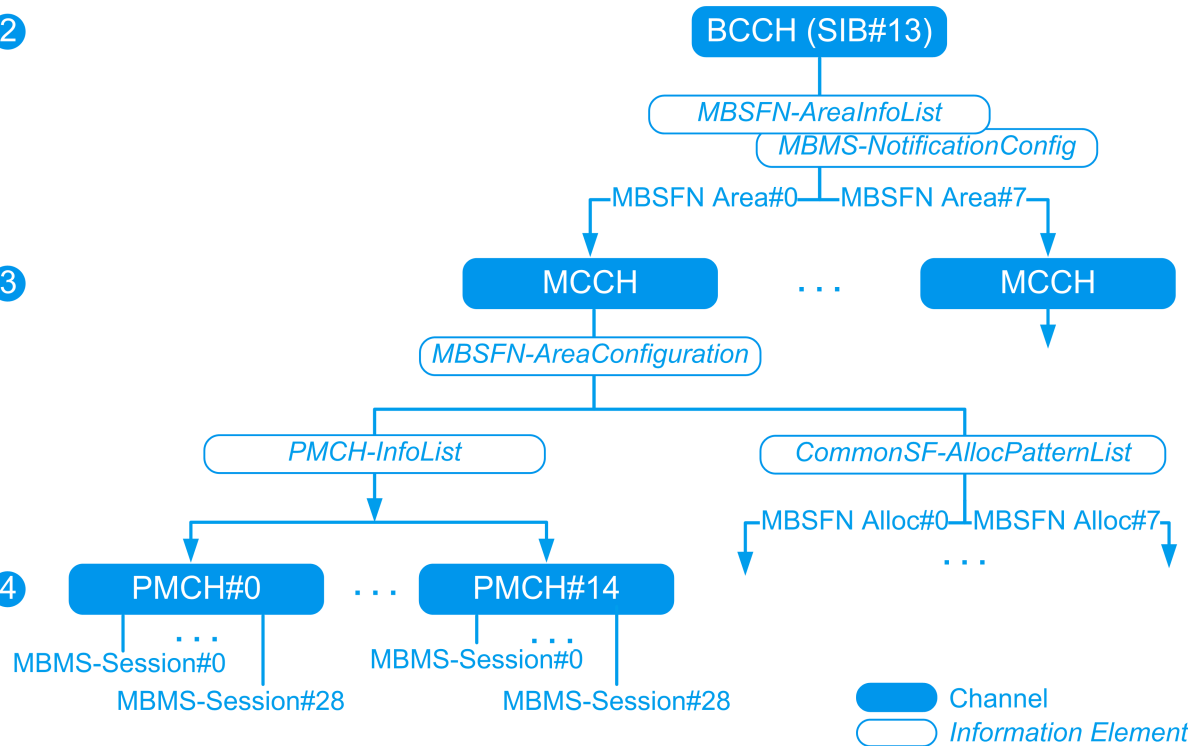


Fig. 7-8: MBSFN Signaling (steps 2 to 4)

**Example: MBSFN Resource Allocation**

This example shows the MBSFN resource allocation for the settings listed in the following table. Use the default values for the other parameters.



**ARB Sequence Length**

The generation of a signal with cyclically repeating MBSFN pattern requires an "ARB sequence length" equal to the "MCCH repetition period" or to the "MCCH modification period".

The maximum value of the ARB sequence length depends on the selected channel bandwidth and on the memory size option of the generator.

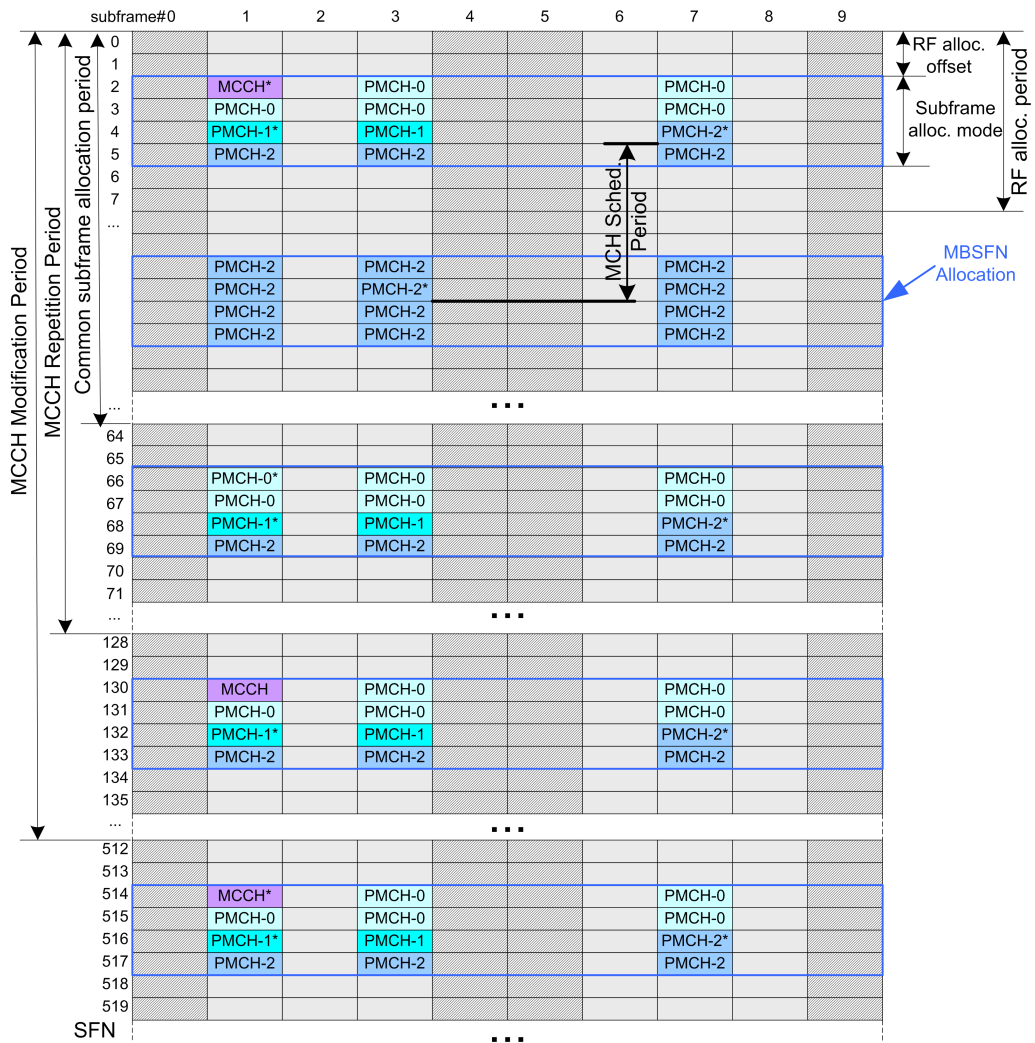
Parameter	Value
EUTRA/LTE main dialog > Duplexing	FDD
EUTRA/LTE main dialog > Sequence Length	512 Frames
General DL Settings > Channel Bandwidth	1.4 MHz
General DL Settings > MBSFN Mode	Mixed
Radio Frame Allocation Period	8 Frames
Radio Frame Allocation Offset	2 Frames

Parameter	Value
Subframe Allocation Mode	4 Frames
Allocation value (HEX)	AAAAAA
MCCH State	On
MCCH Repetition Period	128 Frames
MCCH Modification Period	512 frames
Notification Repetition Coefficient	2 Frames
Notification Subframe Index	4, i.e. the MCCH change notification on PDCCH is transmitted on subframe#6
Common Subframe Allocation Period	64 Frames, i.e. the PMCH scheduling is repeated after 64 frames
Number of PMCHs	3
PMCH#0: SF Alloc Start/SF Alloc EndSF Alloc End	5
PMCH#0: MCH Scheduling Period	8
PMCH#1: SF Alloc End	7
PMCH#1: MCH Sched. Period	8
PMCH#2: SF Alloc End	95 (automatically calculated)
PMCH#2: MCH Sched. Period	8

The following figure shows the resource allocation.



SFN is the System Frame Number. By default, the SFN starts with 0 by the start value can be adjusted with the parameter [SFN Offset](#).

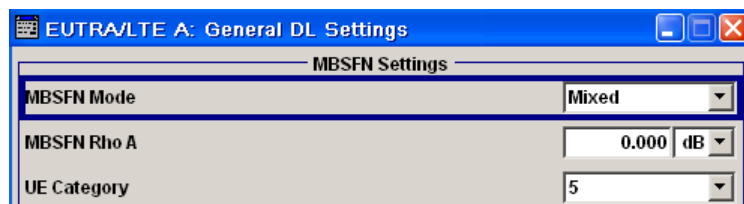


**Fig. 7-9: Example of MBSFN resource allocation**

- Pattern subframes = Subframes not allowed to be scheduled as MBSFN subframes
- Grey subframes = MBSFN subframes not used for MBMS transmission, i.e. regular LTE subframes that can be used for allocation of DL signal
- MCCH\* = First MCCH in a new MCCH modification period
- PMCH-0\*/PMCH-1\*/PMCH-2\* = First PMCH of one MCH scheduling period.



If PRS and MBSFN is configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely (see [example "Overlapping PDSCH, PRS and MBSFN"](#) on page 123).



**MBSFN Mode**

Enables the MBSFN transmission and selects a mixed MBSFN Mode, i.e. the available subframes are shared between MBSFN and regular LTE operation.

**Note:** Dedicated MBSFN Mode (i.e. all subframes are used for MBSFN solely) will be supported in a later version.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:MODE on page 411

**MBSFN Rho A**

Defines the power of the MBSFN channels relative to the common Reference Signals.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:RHOA on page 413

**UE Category**

Defines the UE category as defined in 3GPP TS 36.306.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:UEC on page 414

**Subframe Config (SIB Type 2)**

This section comprises settings for configuration of the general MBSFN structure, i.e. it defines which subframes are used for MBSFN transmission. In the “real” system, these values are transmitted via the System Information Block (SIB) Type 2.

The parameters in this section correspond to the MBMS information element *MBSFN-SubframeConfig*, as defined in [16].

The graph in this section displays the currently reserved MBSFN subframes. To select a subframe as MBSFN subframe, click on this subframe.

**Note:** The here described parameters are for configuration of the MBSFN structure only, the coding of the SIB#2 and the SIB#13 is not done automatically.

Also, the content of the MCCH is not generated automatically, but has to be set manually by means of an according data source.

**Radio Frame Allocation Period ← Subframe Config (SIB Type 2)**

Radio-frames that contain MBSFN subframes occur when the following equation is satisfied:

$SFN \bmod \text{radioFrameAllocationPeriod} = \text{radioFrameAllocationOffset}$

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:SC:APER on page 414

### Radio Frame Allocation Offset ← Subframe Config (SIB Type 2)

Radio-frames that contain MBSFN subframes occur when the following equation is satisfied:

$SFN \bmod \text{radioFrameAllocationPeriod} = \text{radioFrameAllocationOffset}$

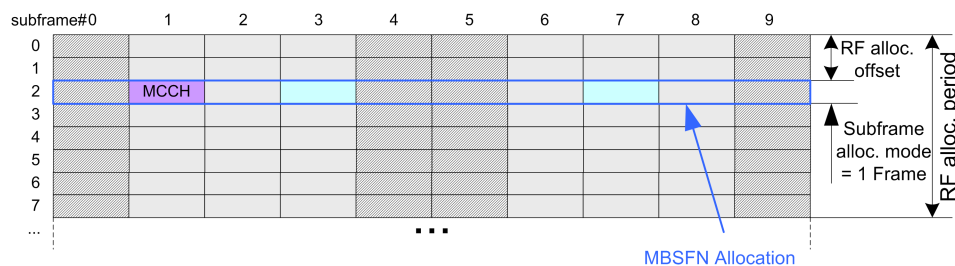
SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:SC:AOFFSET on page 414

### Subframe Allocation Mode ← Subframe Config (SIB Type 2)

Defines whether MBSFN periodic scheduling is 1 or 4 frames.

The figure in [example "MBSFN Resource Allocation"](#) on page 98 shows a MBSFN allocation composed of 4 frames. The following figure displays a MBSFN allocation with "Subframe allocation mode" set to 1 frame.



SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:SC:AMODE on page 413

### Allocation value (HEX) ← Subframe Config (SIB Type 2)

Defines which MBSFN subframes are allocated.

This parameter is identical to the bitmap defined by the field *subframeAllocation* of the MBMS information element *MBSFN-SubframeConfig*.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:SC:AVAL on page 414

### Area Info (SIB Type 13)

This section comprises settings for configuration of the general MBSFN area info, i.e. it defines where to find the MCCH. In the "real" system, these values are transmitted via the System Information Block (SIB) Type 13.

The parameters in this section correspond to the MBMS information elements *MBSFN-AreaInfoList* and *MBSFN-NotificationConfig*, as defined in [16].

**Note:** The here described parameters are for configuration of the MBSFN structure only, the coding of the SIB#2 and the SIB#13 is not done automatically.

Also the content of the MCCH is not generated automatically, but has to be set manually by means of an according data source.

Area Info (SIB Type 13)	
Area ID (N_ID_MBSFN)	<input type="text" value="0"/>
Non-MBSFN Region Length	<input type="text" value="2"/> OFDMA Sym. ▾
Notification Indicator	<input type="text" value="0"/>
MCCH State	<input checked="" type="checkbox"/>
MCCH Repetition Period	32 Frames ▾
MCCH Offset	<input type="text" value="0"/>
MCCH Modification Period	512 Frames ▾
Allocation Value (HEX)	<input type="text" value="1"/>
MCCH MCS	2 ▾
MCCH Modulation	QPSK
MCCH Transport Block Size	<input type="text" value="1"/>
MCCH Data Source	PN9 ▾
Notification Repetition Coefficient	2 ▾
Notification Offset	<input type="text" value="0"/>
Notification Subframe Index	<input type="text" value="1"/>
Notification Pattern	<input type="text" value="0..."/>

#### MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)

This section comprises the parameters of the MBMS information element *MBSFN-Area-InfoList*.

#### Area ID (N\_ID\_MBSFN) ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)

Defines the MBSFN area ID, parameter  $N_{id}^{MBSFN}$ .

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:ID on page 406

#### Non-MBSFN Region Length ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)

Defines how many symbols from the beginning of the subframe constitute the non-MBSFN region.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:NMRL on page 410

#### Notification Indicator ← MBSFN-AreaInfoList Parameters ← Area Info (SIB Type 13)

Defines which PDCCH bit is used to notify the UE about change of the MCCH applicable for this MBSFN area. Value 0 corresponds to the least significant bit as defined for the [DCI Format 1C](#).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:NIND on page 410

**MCCH State** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Enables/disables the MCCH.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:STATe on page 410

**MCCH Repetition Period** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Defines the interval between transmissions of MCCH information in radio frames.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:RPER on page 409

**MCCH Offset** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Indicates, together with the "MCCH repetition period", the radio frames in which MCCH is scheduled. MCCH is scheduled in radio frames for which:

$SFN \bmod \text{"MCCH repetition period"} = \text{"MCCH offset"}$

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS on page 409

**MCCH Modification Period** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Defines periodically appearing boundaries, i.e. radio frames for which the following equation is fulfilled:

$SFN \bmod \text{"MCCH modification period"} = 0$

The contents of different transmissions of MCCH information can only be different if there is at least one such boundary in-between them.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:MPER on page 408

**Allocation Value (HEX)** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Indicates the subframes of the radio frames indicated by the "MCCH repetition period" and the "MCCH offset", that may carry MCCH.

**Note:** In the current implementation, the MCCH is always mapped to the first active MBSFN subframe.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL? on page 406

**MCCH MCS** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Defines the Modulation and Coding Scheme (MCS) applicable for the subframes indicated by the "MCCH Allocation value" and for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by MAC).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:MCS on page 407



**MCCH Modulation** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Displays the values as determined by the "MCCH MCS".

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation? on page 407

**MCCH Transport Block Size** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Displays the values as determined by the "MCCH MCS".

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize? on page 410

**MCCH Data Source** ← **MBSFN-AreaInfoList Parameters** ← **Area Info (SIB Type 13)**

Sets the data source used for the MCCH.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:DATA on page 407

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt on page 407

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:PATtern on page 409

**MBSFN-NotificationConfig Parameters** ← **Area Info (SIB Type 13)**

This section comprises the parameters of the MBMS information element *MBSFN-NotificationConfig*.

**Notification Repetition Coefficient** ← **MBSFN-NotificationConfig Parameters** ← **Area Info (SIB Type 13)**

Selects the current change notification repetition period common for all MCCHs that are configured. The notification repetition period is calculated as follow:

*change notification repetition period = shortest modification period / "Notification repetition coefficient"*

Where the *shortest modification period* corresponds with the value of the selected "MCCH modification period".

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:NRC on page 408

**Notification Offset** ← **MBSFN-NotificationConfig Parameters** ← **Area Info (SIB Type 13)**

Defines, together with the "Notification Repetition Coefficient", the radio frames in which the MCCH information change notification is scheduled, i.e. the MCCH information change notification is scheduled in radio frames for which:

*SFN mod notification repetition period = "Notification offset"*

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset on page 408

**Notification Subframe Index** ← **MBSFN-NotificationConfig Parameters** ← **Area Info (SIB Type 13)**

Defines the subframe used to transmit MCCH change notifications on PDCCH.

In FDD: Value 1, 2, 3, 4, 5 and 6 correspond with subframe #1, #2, #3, #6, #7 and #8 respectively

In TDD: Value 1, 2, 3, 4 and 5 correspond with subframe #3, #4, #7, #8 and #9 respectively

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:NSI on page 409

### Notification Pattern ← MBSFN-NotificationConfig Parameters ← Area Info (SIB Type 13)

Sets the pattern for the notification bits sent on PDCCH DCI format 1c.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern on page 408

### PMCH Structure

This section comprises settings for configuration of the PMCH structure, i.e. where to find a PMCH carrying a certain MTCH. In the “real” system, these values are transmitted via the MCCH (*MBSFNAreaConfiguration*).

The parameters in this section correspond to the MBMS information elements *MBSFNAreaConfiguration* and *PMCH-InfoList*, as defined in [16].

SF Alloc Start	SF Alloc End	MCS	Scheduling Period	Data Source	DList Pattern
0	0	0	-	PN9	-

### Common Subframe Allocation Period ← PMCH Structure

Defines the period during which resources corresponding with field *commonSF-Alloc* are divided between the (P)MCH that are configured for this MBSFN area.

The subframe allocation patterns, as defined by *commonSF-Alloc*, repeat continuously during this period.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:MTCH:CSAP on page 411

### PMCH-InfoList Parameters ← PMCH Structure

Comprises the parameters of the *PMCH-InfoList*.

### Number of PMCHs ← PMCH-InfoList Parameters ← PMCH Structure

Defines the number of PMCHs in this MBSFN area.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:MTCH:NPMChs on page 411

**SF Alloc Start/SF Alloc End ← PMCH-InfoList Parameters ← PMCH Structure**

Defines the first/last subframe allocated to this (P)MCH within a period identified by field *commonSF-Alloc*.

The subframes allocated to (P)MCH corresponding with the  $n^{\text{th}}$  entry in *pmch-InfoList* are the subsequent subframes starting from either the subframe identified by "SF Alloc End" of the  $(-1)^{\text{th}}$  listed (P)MCH or, for  $n=1$ , the first subframe, through the subframe identified by "SF Alloc End" of the  $n^{\text{th}}$  listed (P)MCH. Value 0 corresponds with the first subframe defined by field *commonSF-Alloc*.

**Note:** Configuring the MCHs ("SF Alloc Start" values) from bottom to top. Although the 3GPP specification defines the "SF Alloc End" parameter as the only one required, in this implementation it is mandatory to define the "SF Alloc Start" instead.

The implemented algorithm uses the selected "SF Alloc Start" and calculates automatically the "SF Alloc End" of the corresponding MCH. The algorithm applies the internal rule, that there will be no gap between two consequent MCHs.

It is therefore recommended to configure the MCHs, i.e. define the "SF Alloc Start" values, from bottom to the top. This workaround prevents the configuration of overlapping MCHs.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASStart on page 413

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAEnd on page 413

**MCS ← PMCH-InfoList Parameters ← PMCH Structure**

Defines the value for parameter according to [5] Table 7.1.7.1-1, which defines the Modulation and Coding Scheme (MCS) applicable for the subframes of this (P)MCH as indicated by the field *commonSF-Alloc*. The MCS does however neither apply to the subframes that may carry MCCH, i.e. the subframes indicated by the field *sf-AllocInfo* within System Information Block Type 13, nor for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by MAC).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS on page 412

**MCH Scheduling Period ← PMCH-InfoList Parameters ← PMCH Structure**

Defines the MCH scheduling period, i.e. the periodicity used for providing MCH scheduling information at lower layers (MAC) applicable for an MCH.

**Note:** The first subframe of the scheduling period may contain the MAC control element and therefore uses MCS of MCCH (however, the data source from PMCH is still used).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod on page 413

**Data Source ← PMCH-InfoList Parameters ← PMCH Structure**

Sets the data source for this PMCH/MTCH.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA on page 412

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt on page 412

[ :SOURCE<hw> ] :BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATTErn on page 412

## 7.4.2 DL Carrier Aggregation Configuration



Carrier Aggregation is an LTE-A (LTE Rel 10) feature enabled for instruments equipped with software option R&S SMx/AMU-K85.

The "DL Carrier Aggregation Configuration" dialog provides the settings for the configuration of one primary cell (PCell) and up to four secondary cells (SCell). In real system, the RRC messages signal all the relevant system information for a certain SCell. In this implementation, all relevant and configurable SCell settings are grouped in the "DL Carrier Aggregation Configuration" dialog. The remaining cell-specific settings are identical for all component carriers.

### SCell Settings Derivation

The settings of each SCell are calculated automatically from the configured PCell settings and depending on the parameters in the "DL Carrier Aggregation Configuration" dialog. The following list provides an overview of the restrictions and interdependencies between related parameters if DL Carrier Aggregation is enabled:

- Combination of FDD and TDD is not possible.
- Simultaneous support of LTE and LTE-A users is provided (see [Configure User > Activate CA](#)).
- The following settings in the PCell are not allowed:
  - "Channel Bandwidth = User"
  - "PDSCH Scheduling = Auto/DCI"
- To enable cross-carrier scheduling, the DCI formats are extended to support the CIF field. The DCIs have to be configured individually per component carrier. In this firmware version, the "Auto/DCI" mode is always disabled and the component carriers of the SCells use the same frame configuration as the PCell. Support of cross-carrier scheduling in "Auto/DCI" mode will be available in future version.
- The "Control Region for PDCCH" of all component carrier/SCells is set to the same value, unless the 3GPP standard specifies a specific value, e.g. in special subframes in TDD mode.
 

The [PHICH Duration](#) of the SCells is adjusted automatically if required, i.e. if this parameter is set to "Extended" in the PCell, the SCell are generated with extended PHICH duration even if the "PDCCH Start" is not set properly for the SCell. However, the PHICH Duration in a SCell will be adjusted if the selected narrow channel bandwidth in this SCell leads to not sufficient amount of PDCCH symbols. Consequently, different channel bandwidth results in different [Number of available CCEs \(PDCCH\)](#).
- The parameter [Number of PHICH Groups](#) may have different values in the SCells, because it is calculated based on the parameter "N<sub>g</sub>".
- If a SCell spans channel bandwidth with less RBs than the PCell, the instrument ignores the allocations or part of the them that is outside the channel bandwidth.

### Limitation in the maximum LTE-A bandwidth

The LTE specification defines a maximum **Channel Bandwidth** of 20MHz and aggregation of up to five component carriers to achieve 100MHz bandwidth.

R&S Signal Generator configured to generate more than one component carrier per baseband automatically applies the multi carrier function. In this case, the maximum bandwidth of the generated LTE-A signal is restricted by the instrument's hardware. In R&S SMU, the RF bandwidth of multi carrier signal is limited to 80MHz. Using the maximum sampling rate, the R&S SMBV equipped with one of the hardware options R&S SMBV-B10/B50 can internally generate multi carrier signals with up to 120 MHz RF bandwidth.



In this description, the terms cell and component carrier (CC) are used interchangeably.

### Example: Enabling Carrier Aggregation and Cross-Carrier Scheduling

**Tip:** In the following, a general example is provided. Only the related settings are discussed.

1. In the first instrument, select "Baseband Block A > EUTRA/LTE" and configure the settings of the PCell as required, e.g. select one of the predefined "Test Setups/ Models".
2. To enable carrier aggregation:
  - a) select "General DL Settings > DL Carrier Aggregation Configuration > Activate Carrier Aggregation > ON"
  - b) select "DL Frame Configuration > Configure User" and enable/disable "Activate CA" per user as required.
3. In the "General DL Settings > DL Carrier Aggregation Configuration > Component Carrier Table" configure the settings of the SCells (see example on the following figure).

Cell Index	Phys. Cell ID	Bandwidth	Baseband	delta f/ MHz	CIF Present	schedCell Index	PDSCH Start	Power/ dB	Delay/ ns	State
0	0	10 MHz	Path A	0.0	On	0	2	0.00	0	On
1	1	30 MHz	Path A	20.0	On	0	2	0.00	0	On
2	3	500 MHz	Path A	35.0	On	0	2	0.00	100	On
3	7	5 MHz	Path B	0.0	On	7	1	0.00	0	On
4	5	1.40 MHz	Path A	0.0	Off	0	2	0.00	0	Off

4. To enable cross-carrier scheduling for a certain component carrier/SCell:
  - a) set the "DL Carrier Aggregation Configuration > schedCell Index" of this component carrier/cell to 0  
In the example, the component carriers SCell#1, SCell#2 and SCell#4 can be cross-scheduled over the PCell

- b) enable the "DL Carrier Aggregation Configuration > CIF Present" parameter.  
In this example, the component carriers SCell#1 and SCell#2 will be cross-scheduled over the PCell.
  - c) To enable a component carrier/SCell, set "DL Carrier Aggregation Configuration > State > ON".
5. Enable LTE signal generation "EUTRA/LTE State > ON".
  6. If required, use the Fading simulator to configure the propagation conditions.
  7. If required, adjust the RF frequency of path A to the middle frequency of the resulting total signal bandwidth.
  8. Activate the RF output.

The instrument will generate the signal in the path A as multi carrier signal, composed of three carrier, the PCell, the SCell#1 and SCell#2. Each of these component carrier spans "Channel Bandwidth" = 10MHz and the SCells use carrier frequency offset with 20MHz and 35MHz respectively.

In two path instrument, the SCell#3 will be generated by the path B. The instrument uses the internal coupled mode, 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; the component carrier specific parameters, e.g. "Channel Bandwidth" are set accordingly.

The SCell#4 is disabled.



If independent fading is required for each of the component carriers, configure one component carrier/cell per path, use the "Save/Recall" function to transfer the settings file to further instruments and adjust the component carrier settings as required.

### Activate Carrier Aggregation

Enables/disables the generation of several component carriers.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:CA:STATE on page 415

### Component Carrier Table

The table provides the settings of the component carriers. The first row displays the settings of the PCell as configured in the "General DL Settings" dialog. The following four rows provide the configurable settings of the up to four SCells.

### Cell Index ← Component Carrier Table

Sets the cell index of the corresponding SCell, as specified in 36.331 [16]. The SCell Index is required for signaling on the DCI [Carrier Indicator Field \(CIF\)](#) field.

The cell index of the PCell is always 0.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:INDEX on page 417

**Physical Cell ID ← Component Carrier Table**

Sets the physical Cell ID of the corresponding SCell. The physical Cell ID of the PCell is set by the parameter "General DL Settings > [Cell ID](#)".

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:ID on page 416

**Bandwidth ← Component Carrier Table**

Sets the bandwidth of the corresponding component carrier/SCell.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:BW on page 415

**Baseband ← Component Carrier Table**

Determines the baseband block that generates the selected component carrier.

**Note:** For two path instruments, setting this parameter to "Path B", enables LTE signal simulation in the second path and will disable all other digital standards and digital modulation modes in this path.

Enabling path B to simulate a component carrier 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; the component carrier specific parameters, e.g. "Channel Bandwidth" are set accordingly.

If more than one component carriers are configured per baseband, the multi carrier function of the R&S Signal Generator is automatically enabled. In this case, the maximum frequency offset "[delta f](#)" between the central frequencies of the cells is limited by the instrument's hardware.

**Note:** The LTE-A signal is generated as multi carrier waveform by one baseband and hence all the component carriers/cells can only be faded jointly.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:BB on page 415

**delta f / MHz ← Component Carrier Table**

Sets the frequency offset between the central frequency of corresponding SCell and the frequency of the PCell.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:DFReq on page 416

**CIF Present ← Component Carrier Table**

Defines whether the [Carrier Indicator Field \(CIF\)](#) is included in the PDCCH DCI formats transmitted from the corresponding SCell.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:CIF on page 416

**schedCell Index ← Component Carrier Table**

Defines the component carrier/cell that signals the UL and DL grants for the selected SCell. The signaling cell is determined by its [Cell Index](#).

According to the LTE-A specification, cross-carrier scheduling has to be enabled per user and per component carrier.

To enable signaling for one particular SCell on the PCell, i.e. cross-carrier scheduling, set the "schedCell Index" to 0.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:SCINdex on page 417

#### **PDSCH Start ← Component Carrier Table**

Sets the starting symbol of the PDSCH for the corresponding SCell, i.e. determines the "Control Region for PDCCH".

**Note:** All subframes use the same "Control region for PDCCH" as set here, regardless of the settings of the PCell.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:PStart on page 417

#### **Power / dB ← Component Carrier Table**

Sets the RS EPRE (Reference Signal Energy per Resource Element) of the according SCell relative to the RS EPRE of the PCell.

The absolute power of the RS of a cell is calculated according to the following formula:

$$\text{Absolute\_RS\_EPRE}_{\text{Cell}_X} = \text{RS Power per RE relative to Level Display} + \text{"Level Display"} + \text{CA\_Power}_{\text{Cell}_X}$$

#### **Example:**

Set "EUTRA/LTE > Set to Default"

Set [Activate Carrier Aggregation](#) > ON

For the SCell1, set  $\text{CA\_Power}_{\text{Cell}_1} = \text{Power / dB} = -5\text{dB}$

Enable SCell1, i.e. set [State](#) > ON

The value of the parameter "General DL Settings > [RS Power per RE relative to Level Display](#)" is -30.736 dB

The power displayed in the header of the instrument is "Level = -30 dBm"

$$\text{Absolute\_RS\_EPRE}_{\text{Cell}_1} = (-30.736\text{dB}) + (-30.00\text{dBm}) + (-5\text{dB}) = -65.736\text{dBm}$$

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:POFFset on page 417

#### **Delay / ns ← Component Carrier Table**

Sets the time delay of the SCell relative to the PCell.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:TDElay on page 418

#### **State ← Component Carrier Table**

Activates/deactivates the component carrier/SCell.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:CA:CELL<ch0>:State on page 418



### 7.4.3 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 372

#### 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 373

**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 373

**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 374

**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 373

**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 374

**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 374

**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 375

#### 7.4.4 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 367

##### 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.

The UpPTS length selected with this parameter determines the maximum number of the SC-FDMA symbols available for SRS in the special subframe.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TDD:SPSConf on page 367

#### 7.4.5 K55 Configuration Mode

In the "K55 Configuration Mode" section a selection is made, whether the PDSCH Scheduling is performed manually 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 manually 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 [Rho A](#) 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 7-7](#) shows this dependency.

**Table 7-7: 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	

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:CONF:MODE on page 369

## 7.4.6 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" This mode combines a 1 Tx-antenna 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 this mode, 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 can be 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 "Beamforming (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 369

### 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 369

### 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 370

### 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 370

### Antenna Port Mapping

(enabled for instruments equipped with R&S SMx/AMU-K84/-K284)

Opens the [Antenna Port Mapping \(General DL Settings\)](#) dialog for defining the mapping of the logical antenna ports to the available physical Tx antennas.

## 7.4.7 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 375

### 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 376

**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 376

**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 377

**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 378

**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 378

**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 377

**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 377

**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 378

**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:

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

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 379

#### 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 376

### 7.4.8 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 57.

**Reference Signal Power**

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

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:REFSig:POWer](#) on page 371

**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 371

## 7.4.9 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 372

**P-SYNC Power**

Sets the power of the P-SYNC allocations.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:SYNC:PPOWer](#) on page 372

**S-SYNC Power**

Sets the power of the S-SYNC allocations.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:SYNC:SPOWer](#) on page 372

## 7.4.10 Positioning Reference Signal Settings

This section comprises the setting necessary to configure the positioning reference signals (PRS). See also [chapter 3.2.5.4, "Positioning reference signals"](#), on page 26.



Configuration of the PRSs requires additional SW option R&S SMx/AMU-K84.



If PRS and MBSFN is configured to be in the same subframe, MBSFN is skipped and PRS is transmitted solely.

If a PDSCH is configured to overlap partially with the PRS bandwidth in a PRS subframe, the PRS in these resource blocks are skipped then.

**Example: Overlapping PDSCH, PRS and MBSFN**

PRS State = ON

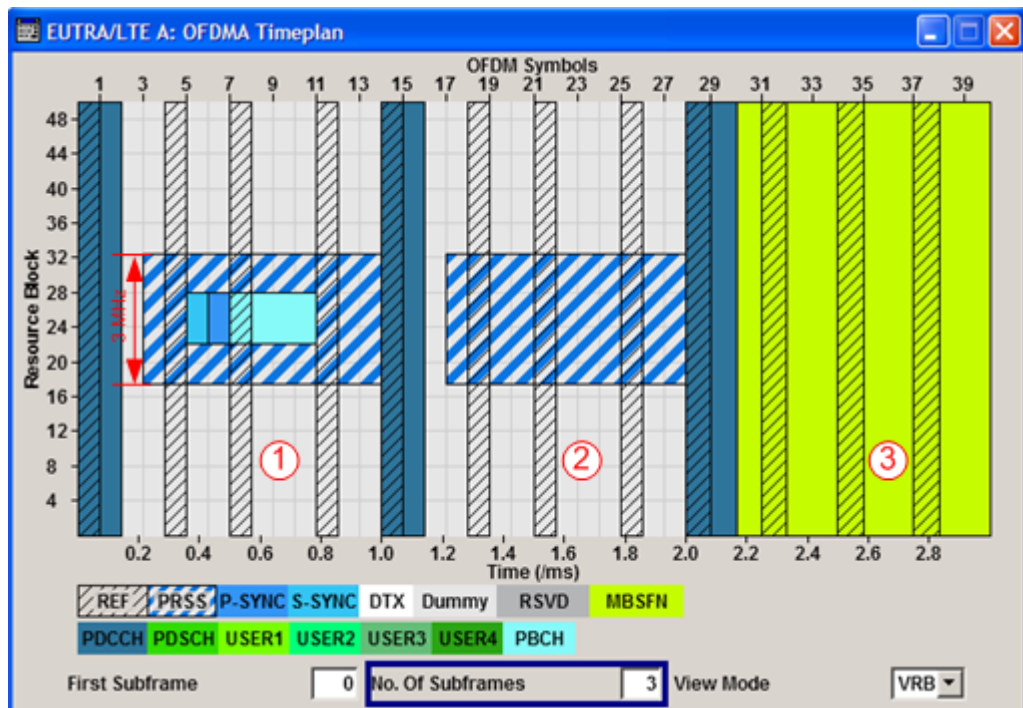
PRS Configuration Index = 0

Number of PRS DL Subframes (N\_PRS) = 2

PRS Bandwidth = 3 MHz

MBSFN Mode = Mixed

Use the OFDMA Timeplan to show the allocation of the PRSs.



- 1 = PDSCH and PRS are overlapping in the subframe#0
- 2 = MBSFN is ignored in subframe#1
- 1+2 = two consequent PRS subframes with 3 MHz Bandwidth
- 3 = first MBSFN subframe

**PRS State**

Enables the generation of the PRS.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:PRSS:STATe on page 380

**PRS Configuration Index**

Sets the PRS Configuration Index  $I_{PRS}$  as defined in 3GPP TS 36.211, table 6.10.4.3-1.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:PRSS:CI on page 379

**PRS Periodicity T\_PRS**

Displays the periodicity of the PRS generation ( $T_{PRS}$ ) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:PRSS:TPRS? on page 381

**PRS Subframe offset Delta\_PRS**

Displays the subframe offset of the PRS generation ( $\Delta_{PRS}$ ) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:PRSS:DPRS? on page 380

**Number of PRS DL Subframes (N\_PRS)**

Defines the number of consecutive DL subframes in that PRS are transmitted.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:PRSS:NPRS on page 380

**PRS Bandwidth**

Defines the RBs in which the PRS is transmitted.

**Note:** The PRS Bandwidth must not be bigger than channel bandwidth.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:PRSS:BW on page 379

**PRS Power**

Sets the power of a PRS resource element relative to the power of a common reference signal resource element.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL:PRSS:POW on page 380

## 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, "Four Configurable Frames in Uplink and Downlink Direction"](#), on page 53.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:DL:CONSubframes` on page 396

### 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 396

### 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 166.

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 395

**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 7.10, "Dummy Data Configuration"](#), on page 172.

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 396

**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 396

**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 397

**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 53.

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 53.

SCPI command:

n.a.

#### **Show Time Plan**

Calls the time plan for the OFDMA resource allocation.

The menu is described in detail in [chapter 7.11, "OFDMA Timeplan"](#), on page 173.

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 PCFICH, PHICH and PDCCH Channel Configuration"](#), on page 141.

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.

#### **Codeword**

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 397

**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 398
```

**Enhanced Settings DL**

Calls the "Enhanced Settings" dialog for configuration of precoding and channel coding (see [chapter 7.6, "Enhanced PBCH, PDSCH and PMCH Settings"](#), on page 134).

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.

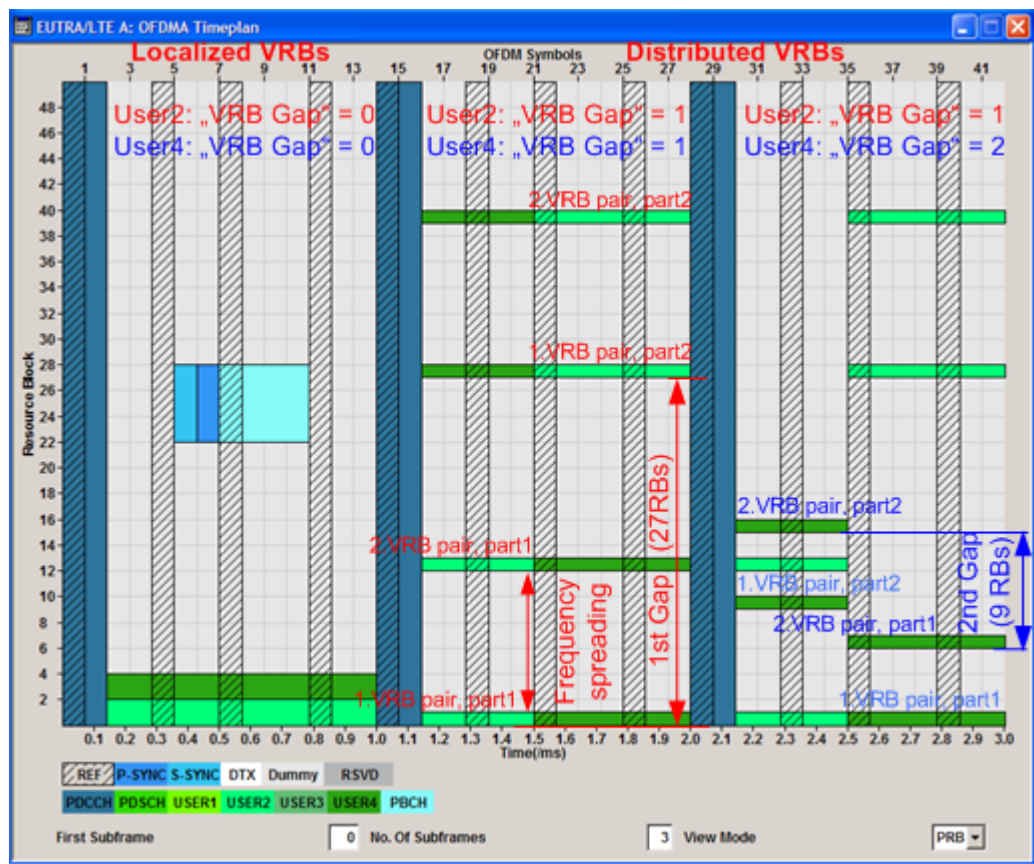


Fig. 7-10: DL Time Plan

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 398

**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 determined by the selected bandwidth of the first one.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :`  
**RBCount** on page 399

**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 [TDD Frame Structure](#) 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 399
```

**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 400
```

**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 400
```

**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 401
```

**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 49 ).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PHYSbits? on page 401
```

**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 automatical set to "MIB".

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :DATA
on page 402
```

### **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 402
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PATtern on page 402
```

### **Rho A**

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 403
```

### **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 403
```

### **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 404
```

### **Conflict**

Indicates a conflict between allocations.

For more information, see [chapter 5.1, "Conflict Handling in the R&S Signal Generator"](#), on page 49.

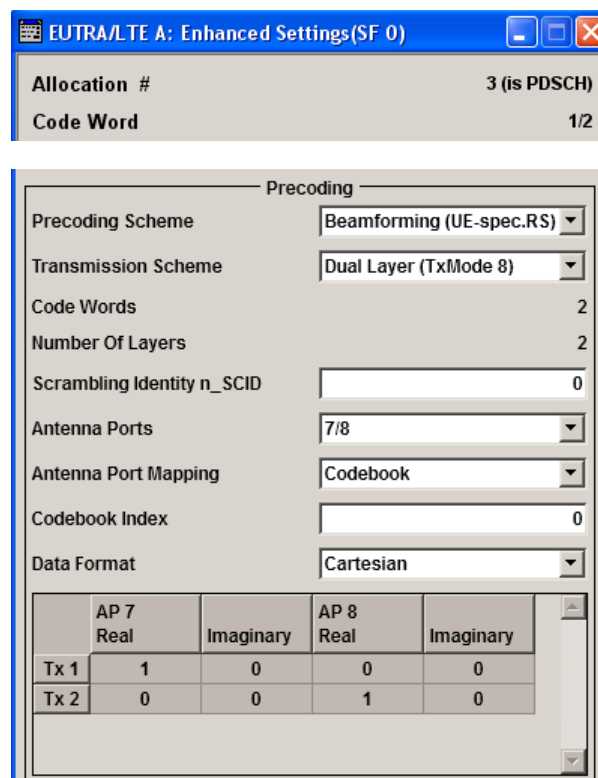
SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
CONFLict? on page 404
```

## 7.6 Enhanced PBCH, PDSCH and PMCH 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.

Scrambling	
State	<input checked="" type="checkbox"/>
UE ID/n_RNTI	<input type="text" value="1 135"/>

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 397

## 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.
- "Beamforming (UE-spec.RS)" Sets the PDSCH to transmission mode selected with the parameter [Transmission Scheme](#).
- "Antenna Port 4" (for instruments equipped with R&S SMx/AMU-K84)  
Default precoding scheme for the PMCH transmitted in MBFSN sub-frames.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PRECoding:SCHeM on page 425
```

### Transmission Scheme

(for instruments equipped with R&S SMx/AMU-K84)

Determines the transmission scheme (see also [table 3-3](#)).

"Transmission Scheme"	Available for <a href="#">Global MIMO Configuration</a>	Description
"Single Layer (TxM 7)"	SISO+BF 2Tx/4Tx-Antennas	<p>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.</p> <p>This special mode is defined for transmission using antenna port 5. In the R&amp;S Signal Generator, antenna port 5 is simulated by all enabled antennas, depending on the selected <a href="#">Global MIMO Configuration</a>. Note that for "SISO + BF" configuration mode, antenna port 5 is simulated by maximum two antennas.</p> <p><b>Tip:</b> To enable the instrument to generate a <b>transmission using antenna port 5</b> 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".</p>
"Dual layer (TxM 8)"	SISO+BF 2Tx/4Tx-Antennas	<p>Sets the PDSCH to transmission mode 8, as described in 3GPP TS 36.213, i.e. UE-specific RS will be added to the PDSCH.</p> <p>In this mode antenna ports 7 and 8 are used. In the R&amp;S Signal Generator, antenna ports 7 and 8 are simulated by all enabled antennas, depending on the selected "Global MIMO Configuration".</p> <p><b>Tip:</b> To enable the instrument to generate a transmission using antenna port 7 and 8, set the parameter "Global MIMO Configuration" to "SISO + BF", "2 Tx-antennas" or "4 Tx-antennas".</p>

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PRECoding:TRSCHeM on page 426
```



**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 397

**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 424

**Scrambling Identity n\_SCID**

Sets the scrambling identity according to 36.211, sec. 6.10.3.1.

This value is used for initialization of the sequence used for generation of the UE-specific reference signals.

SCPI command:

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

PRECoding:SCID on page 425

**Antenna Ports**

(for instruments equipped with R&S SMx/AMU-K84)

Displays and configures the antenna port(s) for the selected [Transmission Scheme](#).

In case only one code word and therefore only one layer is configured in the "Dual Layer (TxMode 8)", the mapping of the layer to antenna port 7 or antenna port 8 is configurable.

**Tip:** Use this configuration possibility to configure a dual-layer multi-user MIMO (MU-MIMO) scenario.

SCPI command:

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

PRECoding:AP on page 422

**Antenna Port Mapping**

(for instruments equipped with R&S SMx/AMU-K84)

Sets the way that the logical antenna ports are mapped to the physical Tx antennas, see [Mapping Methods](#).

SCPI command:

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

PRECoding:APM on page 423

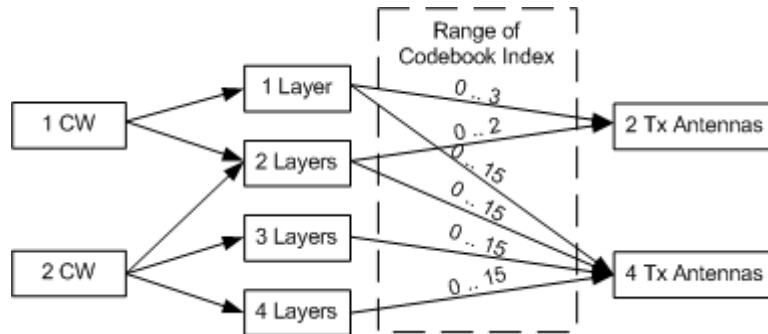
**Codebook Index**

(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 423
```

### 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 423
```

### Mapping Coordinates

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ALLoc<ch0> [ :CW<user> ] :
PRECoding:DAFormat on page 424
```

### Mapping Table

(for instruments equipped with R&S SMx/AMU-K84)

Defines the mapping of the antenna ports (AP) to the physical antennas, see [Mapping Table](#).

### 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 426
```

#### 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 426
```

### 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 421
```

#### 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 422
```

### 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 49).

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 "Physical Bits" 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 401
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :USER<ch> :PHYSbits?
on page 405
```

### 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 419
```

### SFN Offset

(for PBCH only)

By default, the counting of the SFN (System Frame Number) starts with 0. Use this parameter to set a different start SFN value.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL:PBCH:SOFFset on page 420
```

### SFN Restart Period

(for instruments equipped with R&S SMx/AMU-K84)

not available for R&S SMBV and R&S WinIQSIM2

Determines the time span after which the SFN (System Frame Number) restarts.

By default, the SFN restart period is equal to the ARB sequence length. Selecting a SFN restart period of "1024 Frames", enables the instrument to calculate the PBCH including SFN independently from the other channels. With this setting, the SFN restarts after 1024 frames and the generation process is fully 3GPP compliant, but the calculation may take very long time.

**Tip:** Use the "3GPP (1024 Frames)" mode only if 3GPP compliant SFN period is required!

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL:PBCH:SRPeriod` on page 420

### 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 421

### 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 421

### 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 420

## 7.7 Enhanced PCFICH, PHICH and PDCCH Channel Configuration

The "Enhanced Channel Configuration" dialog 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](#).

The screenshot displays the configuration interface for EUTRA/LTE A: Enhanced Channel Configuration(F0/SF0). It is divided into four main sections: Precoding, PCFICH, PHICH, and PDCCH.

**Precoding Section:**

- State:
- Precoding Scheme: Tx Diversity (dropdown)
- Number Of Layers: 2

**PCFICH Section:**

- Power: 0.000 dB
- Scrambling State(PCFICH):
- Control Region for PDCCH: 2 OFDMA Sym. (dropdown)

**PHICH Section:**

- Number of PHICH Groups: 2
- Power Mode: Individual (dropdown)

	ACK/NACK Pattern Group	Power Info	Power Settings
0	0--- 0---	-3.010  -   -   -3.010  -   -	Config...
1	0--- 0---	0.000  -   -   -3.010  -   -	Config...

**PDCCH Section:**

- Power: 0.000 dB
- Scrambling State (PDCCH):
- Number of Bits: 1 920
- Number of available REGs: 240
- Number of available CCEs: 26
- PDCCH Format: 2 (dropdown)
- Number of PDCCHs: 0
- Number of REGs allocated to PDCCH: 0
- Number of Dummy REGs: 20
- Data Source: PN9 (dropdown)

## 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 429

### 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 429

### 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 430

## 7.7.2 PCFICH Settings

### PCFICH Power

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

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PCFich:POWER`  
on page 430

### 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 431

### Control Region for PDCCH

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

Channel Bandwidth	PHICH Duration	Duplex. Mode	OFDM Symbols in the control region	
			Normal Subframe	Special Subframe
	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 372

`[ :SOURCE<hw> ] :BB:EUTRa:DL:PHICH:DURation` on page 378

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PCFich:CREGion`  
on page 431

### 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 one 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 433

#### Power Mode

Determines whether all PHICH in a PHICH group are sent 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 432



**PHICH 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 within this group.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PHICH:POWer` on page 432

**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 433

**Power Info**

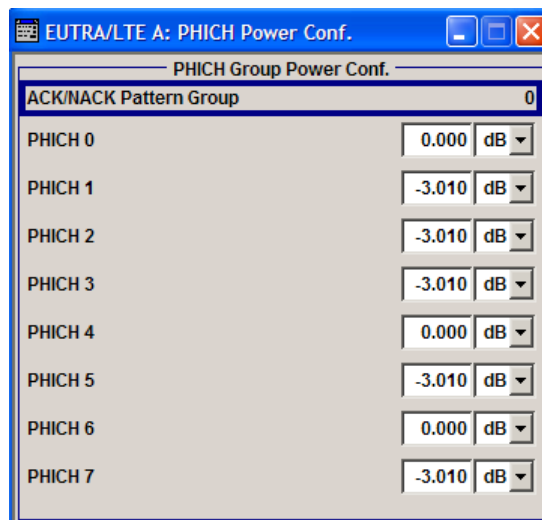
Displays the power values of the configured PHICHs.

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 432
```

## 7.7.4 PDCCH Settings

### PDCCH 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 433
```

### 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 434
```

### Number of Bits (PDCCH)

Defines 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 434
```

### Number of available REGs (PDCCH)

Defines 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 434
```

### Number of available CCEs (PDCCH)

Defines 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:

$\#CCEs\ available_{PDCCH} = \#REGs\ available\ PDCCH / 9$

**Note:** If "Activate Carrier Aggregation > ON", the parameter "Number of available CCEs (PDCCH)" displays information about the PCell.

Information related to the SCells is displayed by the corresponding parameter [Number of Dummy CCEs](#).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:AVCCes  
on page 435

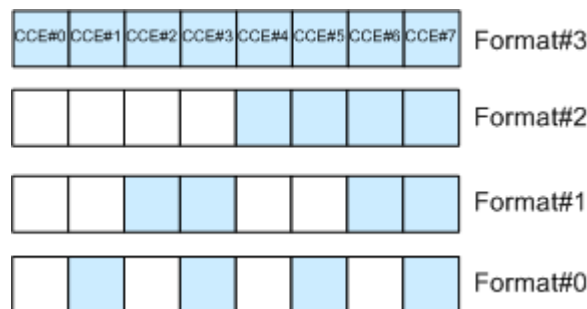
### PDCCH Format

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 downlink control information (DCI) format and content (see [chapter 7.7.5, "PDCCH Format Variable"](#), on page 149).

"-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.

- [REGs available PDCCH = #REGs allocated PDCCH](#),
- [#PDCCH = 1](#),
- [#DummyREGs = 0](#).

"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:FORMAT  
on page 435

**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 (#REG) reserved for the transmission of one PDCCH, i.e. depends on the selected **PDCCH Format** and is calculated as follow:

$$\#PDCCH = \text{REGs available PDCCH} / \#REG.$$

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:NOPDchs
```

on page 436

**Number of REGs allocated to PDCCH**

(for "PDCCH Format" different than "Variable")

Defines the number of REGs that are actually allocated for PDCCH transmission (#REGs allocated<sub>PDCCH</sub>) and is calculated as follow:

$$\#REGs\ allocated_{PDCCH} = \#PDCCH * \#REG$$

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:ALRegs
```

on page 437

**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:

$$\#DummyREGs = \text{REGs available PDCCH} - \#REGs\ allocated\ PDCCH.$$

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:DREGs on page 437
```

**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 438
```

**DList/Pattern (PDCCH)**

(for "PDCCH Format" different than "Variable")

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

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:PATtern`  
on page 438

`[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:PATtern`  
on page 438

## 7.7.5 PDCCH Format Variable

- ▶ To enable the settings described in this section, select "PDCCH Format > Variable".

PDCCH Format										Variable	
Dummy CCE REGs										Data	
Dummy CCE Data Source										PN9	
Append		Insert		Delete		Down		Up		Reset	Resolve Conf.
User	UE_ID n_RNTI	Cell Index	DCI Format	Search Space	Content	PDCCH Format	Number CCEs	CCE Index	No.Dummy CCEs	Conflict	
User1	0	0	0	Auto	Config...	0	1	1	-		
User1	0	0	2B	Auto	Config...	2	4	4	18		
RA_RNTI	1	0	1A	Auto	Config...	2	4	0	0		

Use these parameters and the DCI table to configure the multiple scheduling messages (DCIs) with the corresponding PDCCHs.

### 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 439

### 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 439

**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 440

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:DCRegs:DSElect
```

on page 439

**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 441

**Insert**

Insert a new row before the current one.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:SITem
```

on page 440

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:INSert
```

on page 441

**Delete**

Deletes the selected row.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:SITem
```

on page 440

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:DELete
```

on page 441

**Down/Up**

Moves the selected row down or up.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:SITem
```

on page 440

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:DOWN
```

on page 442

**Reset**

Resets the table.

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:RESet
```

on page 442

**Resolve Conflicts**

The "Resolve Conf." is a built-in algorithm that re-assigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values will not be maintained. If the conflict can not be resolved automatically, the values are left unchanged.

For more information on how to solve DCI conflicts, see [chapter 5.1.3, "DCI Conflict Handling"](#), on page 51.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:SOLVE
on page 442
```

**DCI Table**

Comprises the settings concerning the PDCCH content.

**User ← DCI Table**

Selects the User the DCI is dedicated to. The available [DCI Format](#) depend on the value of this parameter.

**Note:** If "[Activate Carrier Aggregation](#) > ON", the [Cell Index](#) determines the component carrier the corresponding User is mapped to. To enable one particular User in more than one component carrier, append several table rows and enable the same User in the different component carriers.

"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 445
```

**UE\_ID/n\_RNTI ← DCI Table**

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 443
```

**Cell Index ← DCI Table**

Determines the component carrier the corresponding DCI is transmitted on.

This parameter refers to the "DL Carrier Aggregation Configuration > [Cell Index](#)". The "Cell Index" of the PCell (Primary Cell) is always set to 0.

**Example:**

If the following settings are enabled in the "DL Carrier Aggregation Configuration" dialog, the value range of the parameter "Cell Index" is 0, 1, 3, 5 and 7.

Component Carrier	Cell Index
PCell	0
SCell#1	1
SCell#2	3
SCell#3	7
SCell#4	5

SCPI command:

```
[ :SOURce<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
CELL on page 443
```

**DCI Format ← DCI Table**

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 7-8](#)).

**Table 7-8: 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/2B</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, 2B
None	All formats

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :  
DCIFmt on page 442

### Search Space ← DCI Table

Defines the search space for the selected DCI, i.e determines the valid CCE indexes.

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.

**Note:** The 3GPP specification defines two kinds of search spaces, the common and the UE-specific search space.

Avoid the use of the "Auto" and "Off" values; this values are provided for backwards compatibility reasons only.

"Off"	No search space is determined, i.e. all CCEs have to be monitored.
"Auto"	Provided for backward compatibility only. An internal mapping to the common and UE-specific search space is applied depending on the selected user: for "User 1..4", "Auto" corresponds to "UE-spec"; in all other cases, "Auto" corresponds to "Common".
"Common"	The DCI is mapped to the common search space. A common search space is used when all or a group of UEs are addressed. The combination User 1 and common search space is enabled in PCell only.
"UE-spec"	Non-common DCIs are mapped to the UE-specific search space. 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 <a href="#">User</a> set to "User 1..4".

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :  
SESpace on page 445

### Content Config ← DCI Table

Opens a dialog box to configure the DCI fields of the selected [DCI Format](#).

SCPI command:

n.a.

### PDCCH Format (Variable) ← DCI Table

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 443
```

#### Number CCEs ← DCI Table

Defines 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 444
```

#### CCE Index ← DCI Table

Sets the CCE start index.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
CINDEX on page 444
```

#### Number of Dummy CCEs ← DCI Table

Defines the number of dummy CCEs that are appended to the corresponding PDCCH.

**Note:** If "**Activate Carrier Aggregation** > ON", the "Number of Dummy CCEs" is calculated per component carrier and depends on the selected **Bandwidth**.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
NDCCes on page 444
```

#### Conflict (DCI) ← DCI Table

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 51.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
CONFLICT? on page 445
```

## 7.7.6 DCI Format Configuration

### Carrier Indicator Field (CIF)

(Requires option R&S SMx/AMU-K85 LTE-A Rel. 10)

This field is enabled if the "[Activate Carrier Aggregation](#) > ON" and for User with enabled "Configure User > [Activate CA](#)".

The CIF is present in **each** DCI Format and identifies the component carrier that carries the PDSCH or PUSCH for the particular PDCCH in the cross-carrier approach (see [figure 3-24](#)).

According to the LTE specification, cross-carrier scheduling is enabled by higher-level signaling. To enable cross-carrier scheduling in this implementation, enable the "[DL Carrier Aggregation Configuration](#)>CIF Present" for component carrier/cell.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL [ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0> :
DCIConf:CIField on page 446
```

### 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 446
```

### DCI Format 0

The DCI format 0 is used for scheduling uplink transmission on PUSCH and transmits the information listed in the table below.

## Enhanced PCFICH, PHICH and PDCCH Channel Configuration

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
"Carrier Indicator Field (CIF)"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:CIField</code> on page 446	see " <a href="#">Carrier Indicator Field (CIF)</a> " on page 155
"PUSCH Frequency Hopping"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:PFHopping</code> on page 451	
"Resource Block Assignment and Hopping Resource Allocation"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:RAHR</code> on page 453	
"Modulation and Coding Scheme and Redundancy Version"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:MCSR</code> on page 450	
"New Data Indicator"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:NDI</code> on page 451	
"TPC Command for PUSCH"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:TPCC</code> on page 456	
"Cyclic Shift for DMRS"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:CSDMrs</code> on page 448	
"UL Index"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:ULIndex</code> on page 458	Enabled for TDD mode and <a href="#">TDD Frame Structure 0</a>
"Downlink Assignment Index"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:DLAindex</code> on page 449	Enabled for TDD mode and UL/DL Configuration 1 - 6

## Enhanced PCFICH, PHICH and PDCCH Channel Configuration

Control Information Field	SCPI command	Dependencies
"CSI/CQI Request"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:CSIRequest on page 448	
"Resource Allocation Type"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:RAType on page 453	

**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.

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
"Carrier Indicator Field (CIF)"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:CIField on page 446	see "Carrier Indicator Field (CIF)" on page 155
"Resource Allocation Header"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:RAH on page 452	Enabled for Channel Bandwidth > 10RBs
"Resource Block Assignment"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:RBA on page 453	
"Modulation and Coding Scheme"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:MCSR on page 450	
"HARQ Process Number"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:HPN on page 450	
"New Data Indicator"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:NDI on page 451	

## Enhanced PCFICH, PHICH and PDCCH Channel Configuration

Control Information Field	SCPI command	Dependencies
"Redundancy Version"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 454	
"TPC Command for PUCCH"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 456	
"Downlink Assignment Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 449	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 screenshot shows the 'DCI Format 1A' configuration window. The fields and their values are as follows:

- Carrier Indicator Field: 0
- Mode: PDSCH
- Localized/Distributed VRB Assignment:  On
- Gap Value:  On
- Resource Block Assignment: 1
- Modulation and Coding Scheme: 0
- HARQ Process Number: 0
- New Data Indicator:  On
- Redundancy Version: 1
- TPC Command: 0
- SRS Request: 1

At the bottom, the 'Data' section shows the resulting Bit Data: 00 0111 0000 0000 0100 0000 0010 1000.

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
"Carrier Indicator Field (CIF)"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField on page 446	see "Carrier Indicator Field (CIF)" on page 155
"Mode"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:F1AMode on page 446	
"Localized/Distributed VRB Assignment"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA on page 458	

## Enhanced PCFICH, PHICH and PDCCH Channel Configuration

Control Information Field	SCPI command	Dependencies
"GAP Value"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:GAP on page 449	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 453	
"Modulation and Coding Scheme"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:MCSR on page 450	PDSCH Mode
"HARQ Process Number"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:HPN on page 450	PDSCH Mode
"New Data Indicator"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:NDI on page 451	PDSCH Mode
"Redundancy Version"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:RV on page 454	PDSCH Mode
"TPC Command"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:TPCC on page 456	PDSCH Mode
"Downlink Assignment Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:DLAindex on page 449	PDSCH Mode Enabled for "TDD" mode
"Preamble Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:PRACH:PRINDEX on page 447	PRACH Mode
"PRACH Mask Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0> :DCIConf:PRACH:MINDEX on page 447	PRACH Mode

**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.

## Enhanced PCFICH, PHICH and PDCCH Channel Configuration

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
"Carrier Indicator Field (CIF)"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField on page 446	see "Carrier Indicator Field (CIF)" on page 155
"Localized/Distributed VRB Assignment"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA on page 458	
"GAP Value"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP on page 449	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 453	
"Modulation and Coding Scheme"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 450	
"HARQ Process Number"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN on page 450	
"New Data Indicator"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI on page 451	
"Redundancy Version"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RV on page 454	

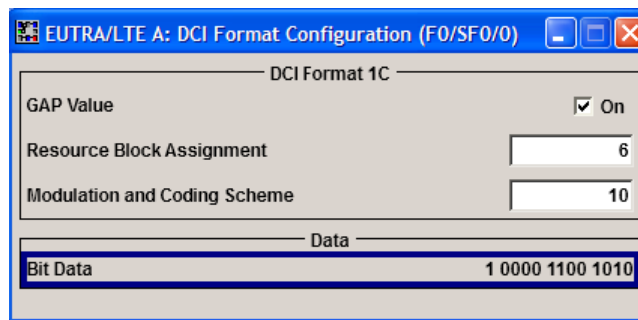


## Enhanced PCFICH, PHICH and PDCCH Channel Configuration

Control Information Field	SCPI command	Dependencies
"TPC Command"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 456	
"Downlink Assignment Index"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 449	Enabled for TDD mode
"TPMI Information for Precoding"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI on page 457	
"PMI Confirmation for Precoding"	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:PMI on page 451	

**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 449	Enabled for Channel Bandwidth >= 50RBs
Resource Block Assignment	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA on page 453	
Modulation and Coding Scheme	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC: PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR on page 450	

**DCI Format 1D**

DCI format 1D is used for the compact scheduling of one PDSCH code word with precoding and power offset information.

**EUTRA/LTE A: DCI Format Configuration (F0/SF0/1)**

DCI Format 1D

Carrier Indicator Field: 0

Localized/Distributed VRB Assignment:  On

Gap Value:  On

Resource Block Assignment: 1

Modulation and Coding Scheme: 0

HARQ Process Number: 0

New Data Indicator:  On

Redundancy Version: 0

TPC Command for PUCCH: 0

TPMI Information for Precoding: 0

Downlink Power Offset:  On

Data

Bit Data: 0 0011 0000 0000 0100 0000 0010 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 1D transmits the information listed in the table below.

Control Information Field	SCPI command	Dependencies
"Carrier Indicator Field (CIF)"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:CIField</code> on page 446	see "Carrier Indicator Field (CIF)" on page 155
Localized/Distrib	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:VRBA</code> on page 458	
Resource Block Assignment	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:RBA</code> on page 453	
GAP Value	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:GAP</code> on page 449	Enabled for Channel Bandwidth >= 50RBs, Distributed VBR Assignment and User = User 1..4
Modulation and Coding Scheme	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:MCSR</code> on page 450	
HARQ Process Number	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:HPN</code> on page 450	
New Data Indicator	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:NDI</code> on page 451	
Redundancy Version	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:RV</code> on page 454	

Control Information Field	SCPI command	Dependencies
TPC Command for PUCCH	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC on page 456	
Downlink Assignment Index	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex on page 449	Enabled for TDD mode
TPMI Information for Precoding	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI on page 457	
Downlink Power Offset	[ :SOURCE<hw> ] :BB:EUTRa:DL[ :SUBF<st0> ] :ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DPOffset on page 449	

### DCI Format 2/2A/2B

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. The DCI Format 2B is enabled for 2-, 4-Tx-Antennas.

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.

## Enhanced PCFICH, PHICH and PDCCH Channel Configuration

**EUTRA/LTE A: DCI Format Configuration(F0/SF0/2)**

**DCI Format 2**

Carrier Indicator Field: 0

Resource Allocation Header:  On

Resource Block Assignment: 3

TPC Command: 2

HARQ Process Number: 3

Transport Block to Codeword Swap Flag:  On

**Transport Block 1**

Modulation and Coding Scheme: 3

New Data Indicator:  On

Redundancy Version: 0

**Transport Block 2**

Modulation and Coding Scheme: 1

New Data Indicator:  On

Redundancy Version: 0

Precoding Information: 1

**Data**

Bit Data: 0 0010 0000 0000 0000 0011 1001 1100 0111 0000 0010 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.

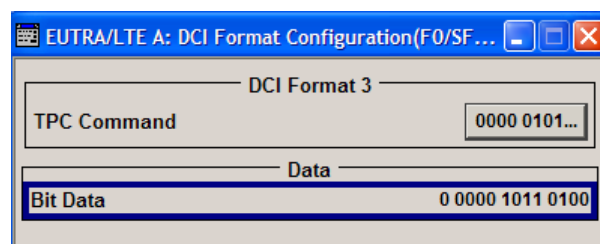
The DCI Format 2/2A/2B transmits the information listed in the table below.

Control Information Field	SCPI command	Dependencies
"Carrier Indicator Field (CIF)"	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:CIField</code> on page 446	see "Carrier Indicator Field (CIF)" on page 155
Resource Allocation Header	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:RAH</code> on page 452	Enabled for Channel Bandwidth > 10RBs
Resource Block Assignment	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:RBA</code> on page 453	
TPC Command for PUCCH	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:TPCC</code> on page 456	
Downlink Assignment Index	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:DLAindex</code> on page 449	Enabled for TDD mode
HARQ Process Number	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:HPN</code> on page 450	
Transport Block to Codeword Swap Flag	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt; :DCIConf:SWAPflag</code> on page 454	DCI Format 2/2A only

Control Information Field	SCPI command	Dependencies
Scrambling Identity	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt;:DCIConf:SID</code> on page 456	DCI Format 2B only
Precoding Information	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt;:DCIConf:PRECinfo</code> on page 452	DCI Format 2/2A only
"Transport Block 1"		
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</code> on page 455	
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</code> on page 455	
Redundancy Version	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt;:DCIConf:TB1:RV</code> on page 455	
"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</code> on page 455	
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</code> on page 455	
Redundancy Version	<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL[ :SUBF&lt;st0&gt; ] :ENCC: PDCCh:EXTC:ITEM&lt;ch0&gt;:DCIConf:TB2:RV</code> on page 455	

### 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 457

## 7.8 Configure User

The "Configure User" dialog 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.

- **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.

	User 1	User 2	User 3	User 4
Tx Mode	User	Mode 1	User	User
UE Category	2	5	User	User
Antenna Mapping	Config...	Config...	Config...	Config...
Scrambling	On	On	On	On
Channel Coding	On	On	Off	Off
UE ID	0	0	0	0
Data Source	PN9	PN9	PN9	PN9
DList/Pattern	-	-	-	-
P_A	0 dB	0 dB	0 dB	0 dB
Activate CA	On	Off	On	On

For more details, see [chapter 4.9, "Data Allocations"](#), on page 44.

### User (Configure User)

Displays the consecutive number of the users.

SCPI command:

n.a.

### Tx Mode

(enabled for "Auto/DCI" scheduling mode)

Sets the transmission mode of the according user as defined in 3GPP TS 36.213, section 7.1.

Tx Mode 8 requires the additional SW option R&S SMx/AMU-K84.

Depending on the selection here, only valid DCI formats can be set for this user. According to the selected "Tx mode" and the selected "DCI format", the "Precoding" for the according PDSCH allocation is set automatically. If no Tx mode is selected, i.e. "-" is set, the range for valid DCI formats is not affected

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:USER<ch>:TXM](#) on page 404

### UE Category

Sets the UE Category.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:DL:USER<ch>:UEC](#) on page 405

### Configure Ant. Mapping

For "Tx Mode 7" and "Tx Mode 8", the [Antenna Port Mapping](#) dialog opens to define the mapping of the logical antenna ports to the available physical Tx antennas.

### 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 475

**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 475

**UE ID (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 476

**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 476

**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 476

[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:PATtern on page 477

**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 477

**Activate CA**

Requires software option R&S SMx/AMU-K85 (LTE-A Rel. 10)

Enables/disables carrier aggregation for the selected user.



If [Activate Carrier Aggregation](#) is enabled, carrier aggregation is activated automatically for all users, but can be deactivated afterwards.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:CA:STATe on page 477

## 7.9 Antenna Port Mapping

Antenna Port Mapping settings are provided in the "Antenna Port Mapping (User)" dialog, the "General DL Settings > Antenna Port Mapping" dialog and in the "Enhanced PDSCH Settings > Precoding" section.

This dialogs comprise the settings necessary to configure the mapping of the logical antenna ports to the physical Tx antennas. The number of physical antennas is set with the parameter "General DL Settings > [Global MIMO Configuration](#)".

The dialog consists of two parts, a mapping table and a selection about the way the antenna mapping is performed.

### Mapping Methods

The antenna mapping can be performed according to one of the following three methods:

- "Codebook"  
The used precoding weights are according to the 3GPP TS 36.211, table 6.3.4.2.3-1 resp. 6.3.4.2.3-2. The selected element is defined by the selected codebook index and the number of layers.
- "Random codebook"  
The precoding weights are selected randomly from the tables defined for the codebook method.
- "Fixed weight"  
A fixed precoding weight can be defined which will be used for all allocations of the according "User" throughout the frame.

Depending on the selected mapping method, the mapping table is invisible ("Random codebook"), read-only ("Codebook") or full configurable ("Fixed weight").

### Mapping Table

The mapping table is a matrix with number of rows equal to the number of physical Tx antennas and number of columns equal to the number of antenna ports (AP). The allowed values are listed in the following tables.

"Global MIMO Configuration"	Number of rows
"1 TxAntenna"	1 row
"2 TxAntenna"	2 rows
"4 TxAntenna"	4 rows
"SISO + BF"	2 rows

"Tx Mode"	Number of columns	Antenna Port (AP)
Tx Mode 7	1	AP 5
Tx Mode 8	2	AP 7 AP 8

Antenna Ports AP0, AP1, AP2 and AP3 are always mapped to the four Tx antennas Tx1, Tx2, Tx3 and Tx4.

Per default, the AP4 and AP6 are mapped to Tx1.

### Antenna Port Mapping (General DL Settings)

Comprises the settings for defining the mapping of the logical APs to the available physical Tx antennas.

#### Mapping Coordinates ← Antenna Port Mapping (General DL Settings)

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL:MIMO:APM:MAPCoordinates on page 371
```

#### Mapping table ← Antenna Port Mapping (General DL Settings)

Defines the mapping of the antenna ports (AP) to the physical antennas, see [Mapping Table](#).

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:DL:MIMO:APM:AP4:TX<ch>:IMAGinary
```

on page 370

```
[ :SOURCE<hw> ] :BB:EUTRa:DL:MIMO:APM:AP4:TX<ch>:REAL on page 370
```

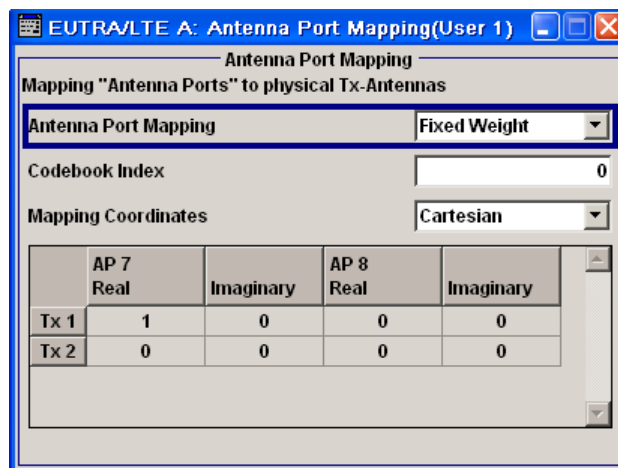
```
[ :SOURCE<hw> ] :BB:EUTRa:DL:MIMO:APM:AP6:TX<ch>:IMAGinary
```

on page 371

```
[ :SOURCE<hw> ] :BB:EUTRa:DL:MIMO:APM:AP6:TX<ch>:REAL on page 371
```

### Antenna Port Mapping (User)

Comprises the settings for defining the mapping of the logical APs to the available physical Tx antennas.



### Antenna Port Mapping ← Antenna Port Mapping (User)

Defines the antenna port mapping method, see [Mapping Methods](#).

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:MODE` on page 475

### Codebook Index ← Antenna Port Mapping (User)

Sets the codebook index for mapping mode Codebook.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:CBINdex` on page 474

### Mapping Coordinates ← Antenna Port Mapping (User)

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates` on page 474

### Mapping table ← Antenna Port Mapping (User)

Defines the mapping of the antenna ports (AP) to the physical antennas, see also [Mapping Table](#).

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:AP5:TX<st>:IMAGinary`

on page 474

`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:AP5:TX<st>:REAL` on page 474

`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:AP7:TX<st>:IMAGinary`

on page 474

`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:AP7:TX<st>:REAL` on page 474

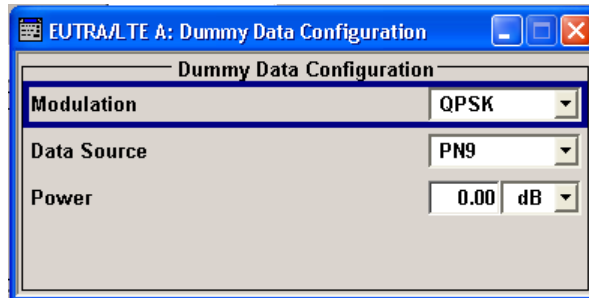
`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:AP8:TX<st>:IMAGinary`

on page 474

`[ :SOURce<hw> ] :BB:EUTRa:DL:USER<ch>:APM:AP8:TX<st>:REAL` on page 474

## 7.10 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 477

### 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 478

### 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 479

### 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 478

**Power (Dummy Data)**

Sets the power of the subcarriers allocated with dummy data.

SCPI command:

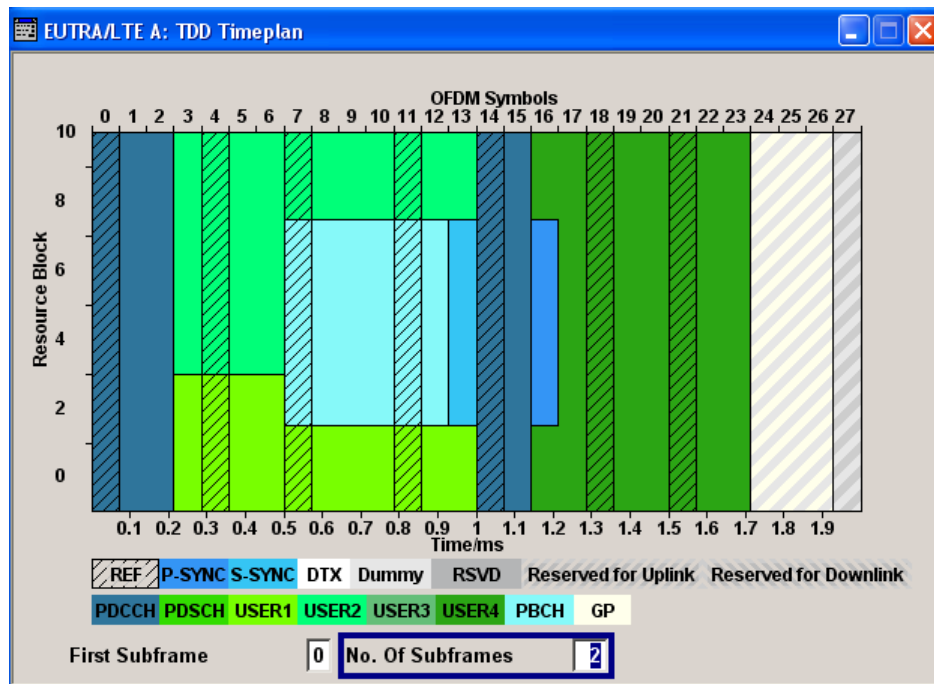
[ :SOURce<hw> ] :BB:EUTRa:DL:DUMD:POWer on page 478

## 7.11 OFDMA Timeplan

The "OFDMA Timeplan" dialog is called in the "Frame Configuration" dialog 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).

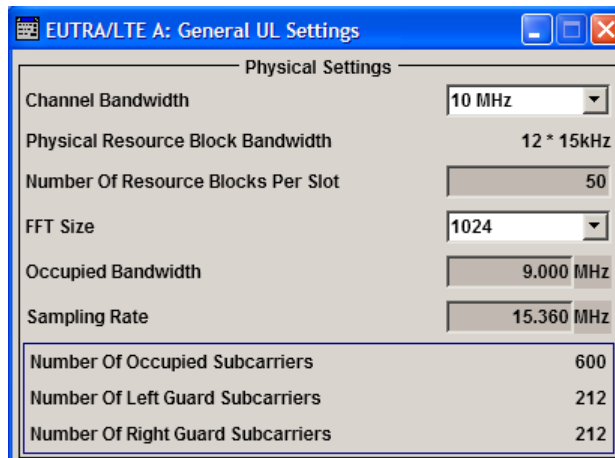
SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:DL:VIEW:MODE on page 395

## 7.12 General UL Settings

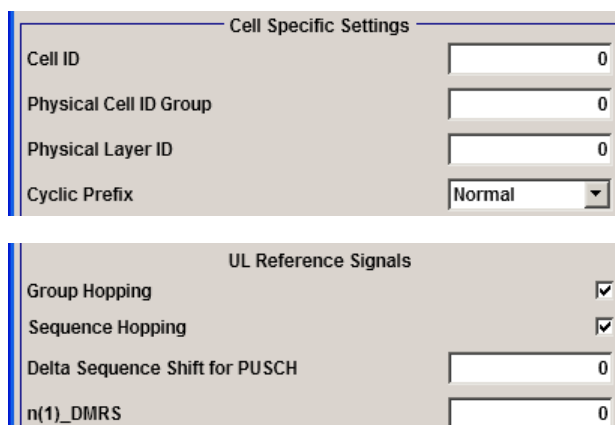
The General UL Settings menu allows configuring the EUTRA/LTE system for transmission direction uplink.

In the "Physical Settings" section, the channel bandwidth respectively the number of resource blocks per slot is selected.



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.



PRACH	
PRACH Frequency Offset	<input type="text" value="0"/>
PRACH Configuration	<input type="text" value="0"/>
Restricted Set (High Speed Mode)	<input checked="" type="checkbox"/>

PUSCH Structure	
Frequency Hopping Mode	<input type="text" value="Intra-subframe"/>
PUSCH Hopping Offset	<input type="text" value="0"/>
Number of Sub-bands	<input type="text" value="4"/>

PUCCH Structure	
Number of RBs used for PUCCH	<input type="text" value="4"/>
Delta Shift	<input type="text" value="2"/>
Delta Offset	<input type="text" value="0"/>
N(1)_cs	<input type="text" value="6"/>
N(2)_RB	<input type="text" value="1"/>
Range n(1)_PUCCH (Normal CP)	0...44
Range n(1)_PUCCH (Extended CP)	0...29
Range n(2)_PUCCH	0...15
Range n(3)_PUCCH	0...19

SRS Structure	
SRS Subframe Configuration	<input type="text" value="15"/>
Configuration Period T_SFC	Reserved
Transmission Offset Delta_SFC	Reserved
SRS Bandwidth Configuration C_SRS	<input type="text" value="0"/>
A/N+SRS simultaneous Tx	<input type="checkbox"/>

## 7.12.1 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 six bandwidths (1.4, 3, 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 382

#### 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 382

#### 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 383

#### 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 382

#### 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 383

#### **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 383

#### **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 384

#### **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 384

## **7.12.2 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 367

#### **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.

The UpPTS length selected with this parameter determines the maximum number of the SC-FDMA symbols available for SRS in the special subframe.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:TDD:SPSConf on page 367

### 7.12.3 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, as well as cell-specific SRS parameters.

#### 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:

$$\text{Cell ID} = 3 * \text{Physical Cell ID Group} + \text{Physical Layer ID}$$

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 and scrambling sequences for all PUCCH formats
- 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 384

#### 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 385

#### 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 385

#### 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 385

## 7.12.4 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 386

### 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 386

### 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 386

### 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 387

### 7.12.5 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 389

#### PRACH Configuration

Sets the PRACH configuration index as defined in the 3GPP TS 36.211, i.e. defines the time and frequency resources 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.

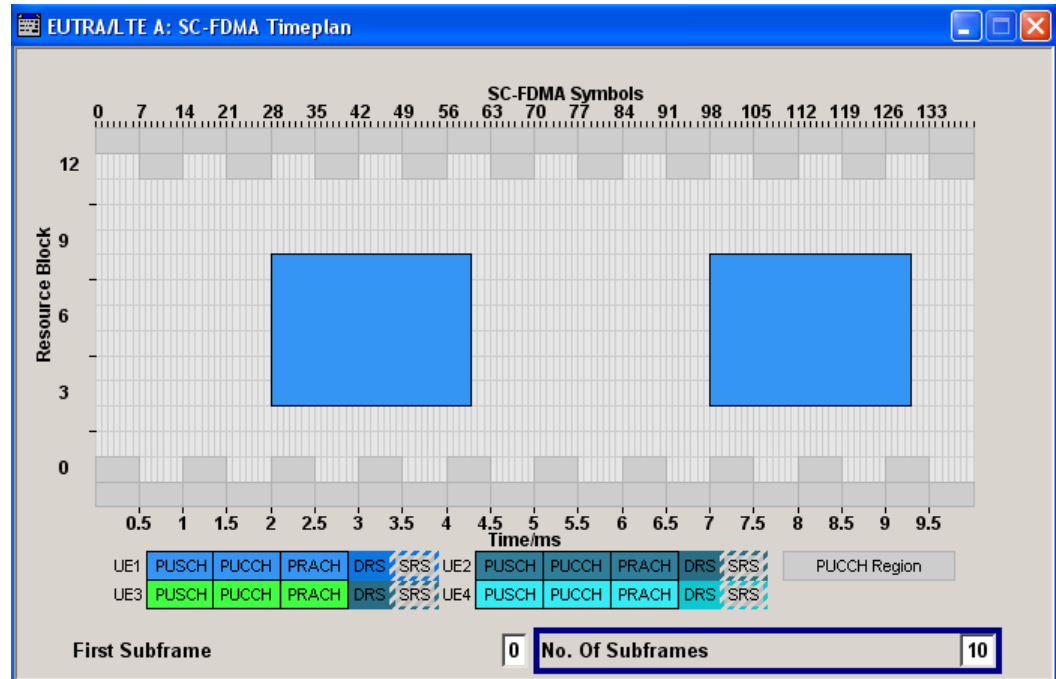
Duplexing Mode	Configuration of Special Subframes	(Global) Cyclic Prefix	PRACH Configuration
FDD	-	Normal/Extended	0 .. 63
TDD	0 .. 3	Normal/Extended	0 .. 47
	4	Normal	0 .. 47
	4	Extended	0 .. 57
	5 .. 8	Normal/Extended	0 .. 57

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 389

**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 390

**7.12.6 PUSCH Structure****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 390

#### **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 390

#### **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 391

### **7.12.7 PUCCH Structure**

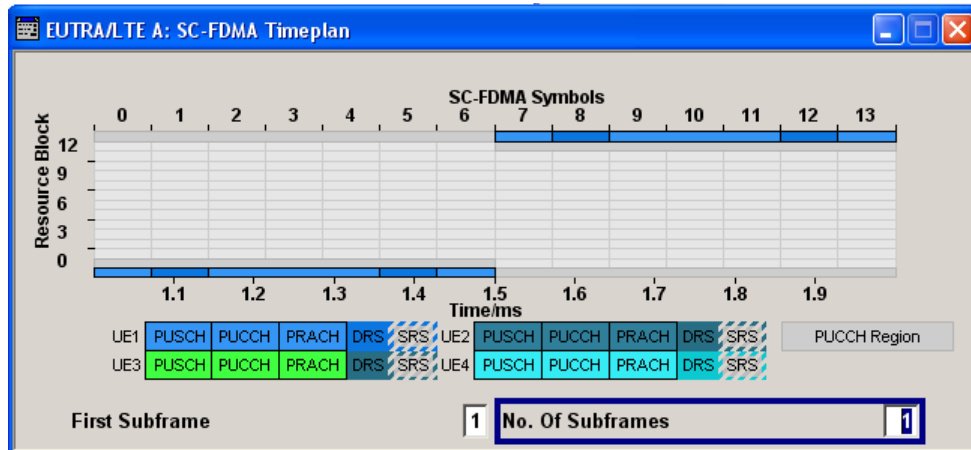
#### **Number of RBs used for PUCCH**

Sets the PUCCH region in terms of reserved resource blocks, located at the edges of the channel bandwidth (see [figure 3-17](#)).

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 391

**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 30).

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:PUCCh:DESHift` on page 391

**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 392

**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 392

**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 392

**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 393

**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 393

**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 393

**Range n(3)\_PUCCH**

Displays the range of possible number of PUCCH format 3 transmissions from different users in one subframe.

Insufficient ranges are displayed as '-'.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:PUCCh:N3Max on page 394

**7.12.8 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.

This parameter can also influence the shortening of PUCCH/PUSCH transmissions, 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 388

### 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 389

### 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 388

### 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 388

### A/N + SRS simultaneous Tx

Enables/disables simultaneous transmission of SRS (sounding reference signal) and ACK/NACK messages, i.e. transmission of SRS and PUCCH in the same subframe.

Simultaneous transmission of SRS and PUCCH is allowed only for PUCCH formats 11, 1a, 1b and 3, 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 387

### 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 387

## 7.13 UL Frame Configuration

The "UL Frame Configuration" dialog for uplink allows configuring the subframes and the SC-FDMA resource allocations. The "UL Frame Configuration" dialog consists of two sections, "General Scheduling Configuration" and the "UL Allocation Table".

**General Scheduling Configuration**

Select User Equipment

UE	Rel.	On/Off
UE1	Rel. 10	<input checked="" type="checkbox"/> On
UE2	Rel. 8/9	<input checked="" type="checkbox"/> On
UE3	Rel. 8/9	<input checked="" type="checkbox"/> On
UE4	Rel. 8/9	<input type="checkbox"/> On

Number of Configurable Uplink Subframes

	UE 1	UE 2	UE 3	UE 4
PUCCH	10	10	8	1
PUSCH	8	10	8	1

**Subframe Configuration**

Cell Index: 0 Subframe: 0 Copy Subframe Paste Subframe

Cyclic Prefix: Normal Uplink Subframe: 0 Show Time Plan... Reset All Subframes

**UL Allocation Table**

	Content	CW	Modulation / Format	Enhanced Settings	Set 1 No.RB	Set 1 Offs.VRB	Set 2 No.RB	Set 2 Offs.VRB	Offs. PRB Slot (n/n+1)	Phys. Bits	Power /dB	State	Conf.
UE1	PUCCH	-	F1b	Config...	1	-	-	-	(0/49)	2	0.000	On	
	PUSCH	1/1	QPSK	Config...	10	2	14	-	(2/2)+(15/15)	6336	0.000	On	
UE2	PUCCH	-	F2	Config...	1	-	-	-	-	-	0.000	Off	
UE3	PUSCH	1/1	64-QAM	Config...	6	30	-	-	(30/30)	4752	0.000	On	
UE4	PUSCH	1/1	QPSK	Config...	6	0	-	-	-	-	0.000	Off	

### 7.13.1 General Scheduling Configuration

This section provides an access to the user equipment settings as well as settings concerning the UL scheduling, like configuring the subframes and adjusting the PUCCH/ PUSCH scheduling.

#### Select User Equipment (UE1...UE4)

Calls the [User Equipment Configuration](#) dialog for configuring the different users.

The check box activates or deactivates the selected UE. The 3GPP release the UE is compliant to is displayed.

**Note:** Disabling the UE deactivates the corresponding allocations. Neither reference signal, nor PUSCH/PUCCH allocations, nor PRACH will be transmitted if an UE is deactivated.

SCPI command:

n.a.

### Number Of Configurable Uplink Subframes

Sets the number of configurable subframes in the up to four configurable frames, i.e. determines the scheduling cycle per UE.

All uplink subframes are filled periodically with the configured subframes with the exception of the Sounding Reference Signal. SRS is set individually for each UE in the [User Equipment Configuration](#) dialog.

The maximum number of configurable subframes depends on the selected [Duplexing mode](#) (TDD or FDD), [TDD Frame Structure](#) 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, "Four Configurable Frames in Uplink and Downlink Direction"](#), on page 53.

For "Rel 8/9" UEs, the "No Of Configurable Uplink Subframes" is the same for PUCCH and PUSCH.

In instruments equipped with R&S SMx/AMU-K85, for the LTE Rel 10 UEs, the scheduling cycles are additionally independent per PUSCH and PUCCH, i.e. the number of configurable subframes can be defined individually per PUCCH and per PUSCH. This enables the configuration of PUCCH and PUSCH with different repetition patterns.

### Example: Independent cycles for PUSCH and PUCCH of the same LTE Rel. 10 UE

As described in the test case 8.2.4, TS 36.141 [6], the PUCCH of the UE has to be transmitted once a frame and the PUSCH - once each eight subframes.

- Set "UE1 > [User Equipment Configuration](#) > "3GPP Release" on page 197" = Release 10.
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE1 > PUCCH" = 10
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE1 > PUSCH" = 8
- Configure the PUCCH and PUSCH allocations of UE1 as required.

**Example: Independent cycles for PUSCH and PUCCH of the same LTE Rel. 8/9 UE**

General Scheduling Configuration				
Select User Equipment				Number of Configurable Uplink Subframes
UE1	UE2	UE3	UE4	
Rel 10	Rel. 8/9	Rel. 8/9	Rel. 8/9	
<input checked="" type="checkbox"/> On	<input checked="" type="checkbox"/> On	<input checked="" type="checkbox"/> On	<input type="checkbox"/> On	
PUCCH	10	10	8	1
PUSCH	8	10	8	1

- Select "UE2 > [User Equipment Configuration > UE ID/n\\_RNTI \(User Equipment\)](#)" = UE ID<sub>UE2</sub>.
- Set "UE3 > [User Equipment Configuration > UE ID/n\\_RNTI \(User Equipment\)](#)" = UE ID<sub>UE2</sub>
- Configure the allocations of as required.
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE2 > PUCCH/PUSCH" = 10
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE3 > PUCCH/PUSCH" = 8

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh` on page 459

`[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh` on page 459

**Cell Index**

Displays the cell index.

SCPI command:

n.a.

**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 460

**Subframe**

Sets the subframe to be configured/displayed in the frame configuration table. All uplink subframes are filled periodically with the configured subframes with the exception of the Sounding Reference Signal. SRS is set individually for each UE in the [User Equipment Configuration](#) dialog.

Subframes behind the configurable range of the corresponding UE or channel ([Number Of Configurable Uplink Subframes](#)) are displayed as read-only.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:SFSelection` on page 460

**Subframe Information**

Displays the kind of the selected subframe, i.e. "Special Subframe", "Uplink Subframe", "Downlink Subframe".

For "Uplink Subframe", it is also shown the uplink subframe number, which is especially useful for TDD duplexing mode.

SCPI command:  
n.a.

#### **Copy/Paste Subframe Settings**

Copies/pastes 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 53.

SCPI command:  
n.a.

#### **Show Time Plan**

Calls the time plan for the SC-FDMA resource allocation.

The dialog is described in detail in section [chapter 7.17, "SC-FDMA Timeplan"](#), on page 226.

SCPI command:  
n.a.

#### **Reset All Subframes**

Resets settings of all subframes including cyclic prefix to the default values.

SCPI command:  
[\[:SOURCE<hw>\]:BB:EUTRa:UL:RSTFrame](#) on page 460

### **7.13.2 Allocation Table UL**

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

#### **Content (UL)**

Selects the content type of the selected allocation.

Data source settings for PUSCH is configurable in dialog [chapter 7.14, "User Equipment Configuration"](#), on page 193.

SCPI command:  
[\[:SOURCE<hw>\]:BB:EUTRa:UL\[:SUBF<st0>\]:ALLoc<ch0>:CONType](#)  
on page 461

#### **Codeword (UL)**

Determines whether one or two codewords use the same physical resource, and whether CW#1 or CW#2 is configured with the selected PUSCH allocation.

SCPI command:  
n.a.

**Modulation/Format**

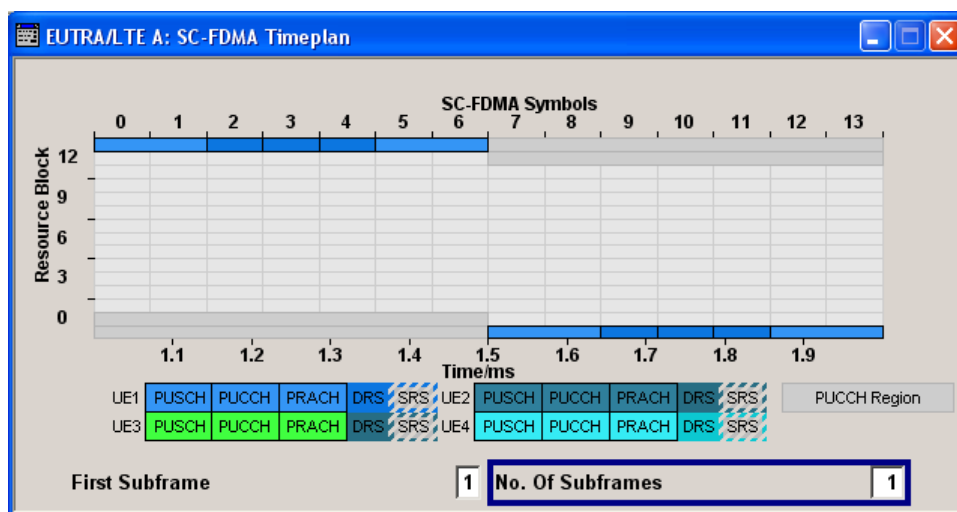
For PUSCH allocation, this parameter sets the modulation scheme (QPSK, 16QAM or 64QAM) for the allocation.

This parameter is read-only, if a predefined **FRC** is selected.

For PUCCH allocation, this parameter sets the PUCCH Format (1/1a/1b/2a/2b/3). See [chapter 3.3.3, "Uplink Control Information Transmission"](#), on page 30 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 224 1/1a/1b.



SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :MODulation
on page 461
```

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :FORMat
on page 461
```

**Enhanced Settings UL**

Calls dialog for configuration of PUSCH/PUCCH depending on the selected allocation (see [chapter 7.15, "Enhanced PUSCH Settings"](#), on page 218 and [chapter 7.16, "Enhanced PUCCH Settings"](#), on page 223).

SCPI command:

n.a.

**Set 1/Set 2 No. RB**

Requires option R&S SMx/AMU-K85 LTE-A (Rel. 10)

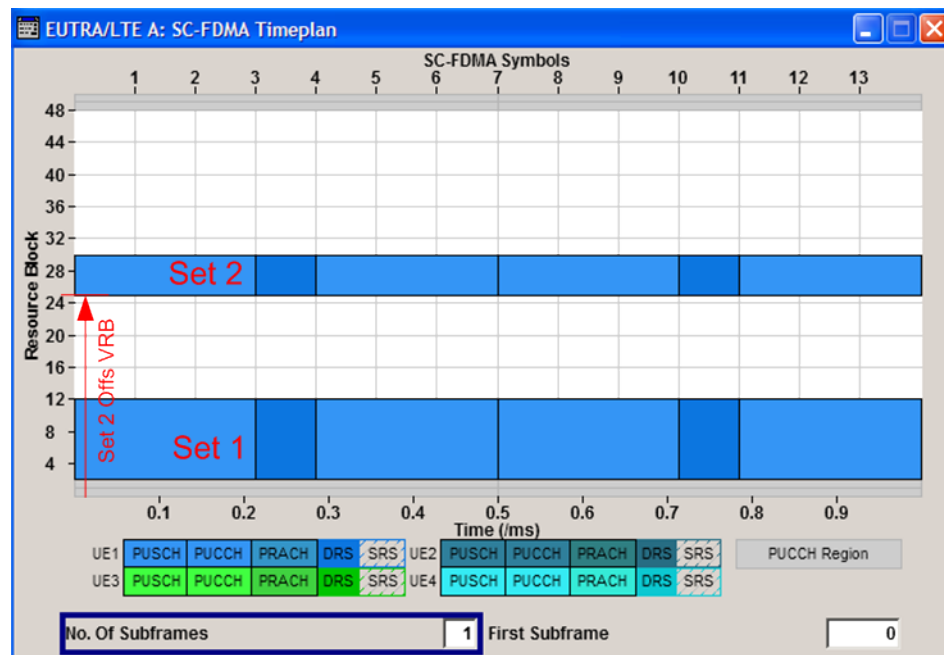
The LTE Rel. 10 specification defines PUSCH transmission not only in a continuous frequency region but also in two "sets" or "clusters" of resource blocks (see [figure 3-25](#)).

This parameters defines the size of the selected allocation in resource blocks of the corresponding set.

This parameter is read-only, if a predefined [FRC](#) is selected.

#### Example: Clustered PUSCH Transmission

- Select "User Equipment Configuration (UE1) > 3GPP Release > Rel.10".
- In the "UL Frame Configuration > Allocation Table", configure the PUSCH allocation of UE1 as follow:
  - "Set 1 No. RB" = 10, "Set 1 Offs. VRB" = 2
  - "Set 2 No. RB" = 5, "Set 2 Offs. VRB" = 25
  - "State" = ON
- Select "Show Time Plan" to visualize the configured allocations



SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:RBCount
on page 461
```

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:RBCount?
on page 461
```

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:
SET<user>:RBCount on page 461
```

#### Set 1/Set 2 Offset VRB

Requires option R&S SMx/AMU-K85 LTE-A (Rel. 10)

For the corresponding set, sets the virtual resource block offset of the selected subframe (see also [example "Clustered PUSCH Transmission"](#) on page 191).

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 462

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:`  
`SET<user>:VRBoffset` on page 462

### Offs PRB Slot (n/n+1)

Displays the start resource block of the selected allocation in the first and the second slot of the subframe.

The start physical resource block in slot n and slot n+1 are set automatically and can deviate from the [Set 1/Set 2 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 462

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :SLOT<user0>:ALLoc<ch0>:`  
`PUCCh:RBOffset?` on page 462

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :SLOT<user0>:ALLoc<ch0>:`  
`PUSCh:SET<s2us>:RBOffset?` on page 462

### 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 463

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:PHYSbits?`  
on page 463

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:PHYSbits?`  
on page 463

### 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 463

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUCCh:POWer`  
on page 463

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUSCh:POWer`  
on page 463

### 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 464

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUCCh:STATe`  
on page 464

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUSCh:STATe`  
on page 464

### 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 49.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :CONFLict?`

on page 464

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUCCh:CONFLict?`

on page 464

`[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUSCh:CONFLict?`

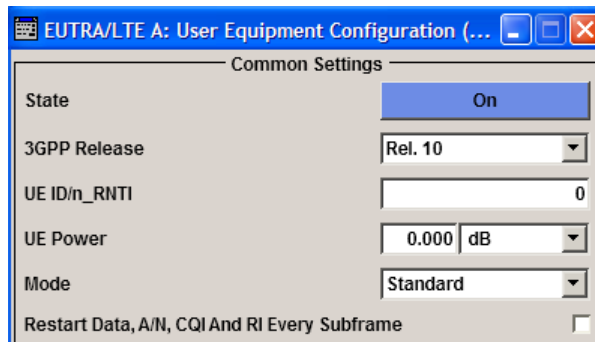
on page 464

## 7.14 User Equipment Configuration

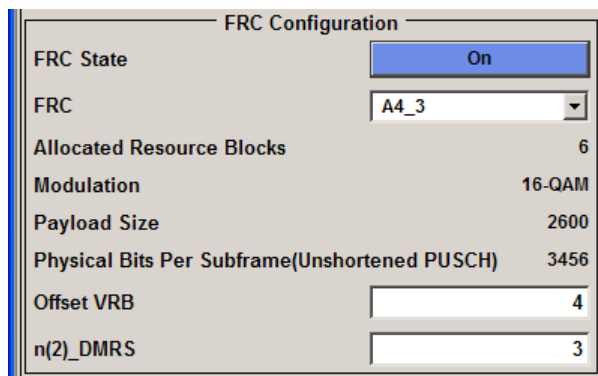
The "User Equipment 1 - 4" menus for users 1 to 4 allows to define and configure up to four scheduled user equipments that can be freely distributed over the time. For each user equipment, the structure of the demodulation reference signal and the sounding reference signal can be configured individually.

The "User Equipment 1 – 4" menu consists of four to five 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", state of the user equipment, the UE's release, 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.



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 Mode	Serial 3x8
Redundancy Version Sequence	0,2,3,1
Max. Number Of Transmissions	4
Assume ACK until first received ACK command	<input type="checkbox"/>
Initial Timing Advance	0 16 T <sub>S</sub>
Connector	User 1
Additional User Delay	0.00 Subframes
Baseband Selector	0
Serial Rate	115.2 kbps
Block Error Insertion	Off
Block Error Rate	0.000 1
HARQ Statistics	

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	PN9
Scrambling	
State	<input checked="" type="checkbox"/>
Channel Coding and Multiplexing	
State	<input checked="" type="checkbox"/>
Mode	UCI+UL-SCH
I_HARQ_offset	0
I_RI_offset	0
I_CQI_offset	0
Channel Coding Configuration	
Channel Interleaver	<input checked="" type="checkbox"/>

Section "Reference Signal Structure" is where reference signal structure can be configured individually for demodulation and sounding purposes.

**Reference Signal Structure**

DRS Power Offset: 0.000 dB

SRS State:  On

SRS Power Offset: 0.000 dB

SRS Cyclic Shift n\_cs: 0

<<< Hide Signal Structure Configuration Details

---

**SRS Structure**

Configuration Index l\_SRS: 0

Periodicity T\_SRS: 2 ms

Subframe Offset T\_offset: 0

SRS Bandwidth B\_SRS: 0

Transmission Comb k\_TC: 0

Hopping Bandwidth b\_hop: 0

Freq. Domain Position n\_RRC: 0

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: 20.0 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

### 7.14.1 Common Settings

In section "Common Settings", the state of the user equipment, the UE's release, 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, nor PRACH will be transmitted if an UE is deactivated.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:STATE on page 481

### 3GPP Release

requires option R&S SMx/AMU-K85 (LTE-A Rel. 10)

Determines whether the selected UE is a LTE Release 8/9 or LTE Release 10 UE. Several further settings are enabled only for Rel. 10 UEs (e.g. see [chapter 7.13, "UL Frame Configuration"](#), on page 186).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:RELease on page 480

### 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 481

### 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 ( $P_{PUSCH}$ ) and PUCCH ( $P_{PUCCH}$ )).

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](#) ( $P_{DRS\_offset}$ ) and [SRS Power Offset](#) ( $P_{SRS\_offset}$ ) respectively.

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:POWER on page 481

### Mode

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 7.14.9, "PRACH Configuration"](#), on page 216).

SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:MODE on page 481

### 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 480

### 7.14.2 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", respectively 3GPP TS 36.521-1, Annex A.

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

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
"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 483

## FRC

Selects a predefined fixed reference channel according to 3GPP TS 36.141, Annex A respectively 3GPP TS 36.521-1, 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 7-9: Supported FRCs from 3GPP TS 36.141**

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).

**Table 7-10: Supported FRCs from 3GPP TS 36.521-1**

FRC	Description
A.2.2.1.1	Reference Channels for QPSK with full RB allocation.
A.2.2.1.2	Reference Channels for 16-QAM with full RB allocation.
A.2.2.2.1	Reference Channels for QPSK with partial RB allocation.
A.2.2.2.2	Reference Channels for 16-QAM with partial RB allocation.
A.2.2.3	Uplink Reference Channels for sustained data-rate test.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:FRC:TYPE](#) on page 484

**Allocated Resource Blocks**

Displays the number of the allocated resource blocks for the selected FRC. For FRCs "A.2.2.2.1" and "A.2.2.2.2" this parameter can also be set to different values according to 3GPP TS 36.521-1.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:FRC:ALRB` on page 482

**Modulation (FRC)**

Displays the modulation for the selected FRC.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:FRC:ALRB` on page 482

**Payload Size (FRC)**

Displays the payload size for the selected FRC.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:FRC:PASize?` on page 483

**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 484

**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 485

**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 482

### 7.14.3 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 61.

### Realtime Feedback Mode

Enables realtime feedback and determines the mode (binary or serial).

- |                       |  |
|-----------------------|--|
| "Off"                 | Realtime feedback is disabled.   |
| "Binary ACK/<br>NACK" | The ACK/NACK feedback is implemented as low/high voltage level on the feedback line connector.<br>Use the parameter <a href="#">ACK Definition</a> to determine whether a high or a low voltage level represents an ACK.<br>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 <a href="#">chapter 6.2.2, "Serial Mode"</a> , on page 63).   |
| "Serial 3x8"          | ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of a serial commands, consisting of three serial packets (see <a href="#">chapter 6.2.3, "Serial 3x8 Mode"</a> , on page 63).   |

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:UL:RTFB:ITADvance` on page 500

### 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 500
```

### 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 500
```

### Assume ACK until first received ACK command

("Serial/Serial 3x8" mode only)

If this parameter is enabled, the signal generator will not use any external HARQ feedback from the device under test for its HARQ processes until an ACK command is received the first time. Until that, the generator will behave as if ACK was received for all transmissions - no matter if actually a NACK was received or if no HARQ feedback was received at all. It therefore will not schedule any retransmissions until ACK is received the first time. This functionality can be useful for synchronization purposes (see [chapter 6.4, "Avoiding Synchronization Problems"](#), on page 70).

**Note:** This functionality applies independently for every HARQ process, i.e. if this parameter is enabled, an ACK has to be received in every HARQ process first, before the generator stops ignoring any NACKs.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL:RTFB:AACK on page 497
```

### 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 500
```

### 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 497

### Connector

Determines the feedback line connector (LEVATT or USER1).

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:RTFB:CONNECTor](#) on page 499

### 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 66.

"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 499

### 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 66.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:RTFB:ADUDelay](#) on page 497

### 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 498

### 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 501

**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.

If the block error insertion functionality is used, no further impairments should be activated (like "Fading" or "AWGN"), as this would cause the measured block error rate to deviate from the configured block error rate.

If block error insertion is enabled, the generator ignores any externally received HARQ ACK/NACK feedback. Instead, it behaves as if ACK was received for a HARQ process if no block error was generated for the previous transmission of that process and it behaves as if NACK was received for a HARQ process if a block error was generated for the previous transmission of that process.

If a block error is generated in a new transmission, block errors will also be generated in all retransmissions, until the maximum number of transmissions is reached. The reason for this is that otherwise the measured block error rate could deviate from the configured one if for example a non-erroneous retransmission can not be decoded by the device under test if the first transmission (which was erroneous) was impaired too much.

If the block error insertion functionality is used together with the [Assume ACK until first received ACK command](#) functionality, no block errors will be inserted before the first received ACK, in order to speed up the synchronization process in this case. This is the only situation where an external HARQ feedback is needed if block error insertion is activated.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:UL:RTFB:BEINsertion](#) on page 498

**Block Error Rate**

Block error rate for the statistical insertion of block errors.

The block error rate is defined as the ratio from the number of NACKs to the sum of the number of NACKs plus the number of ACKs.

As no external HARQ feedback is taken into account if [Block Error Insertion](#) is used, it is expected that the device under test does not send false ACK (ACK after erroneous packet) or false NACK (NACK after non-erroneous packet). Also it is expected that no further impairments like fading or AWGN are applied to the generated uplink signal.

SCPI command:

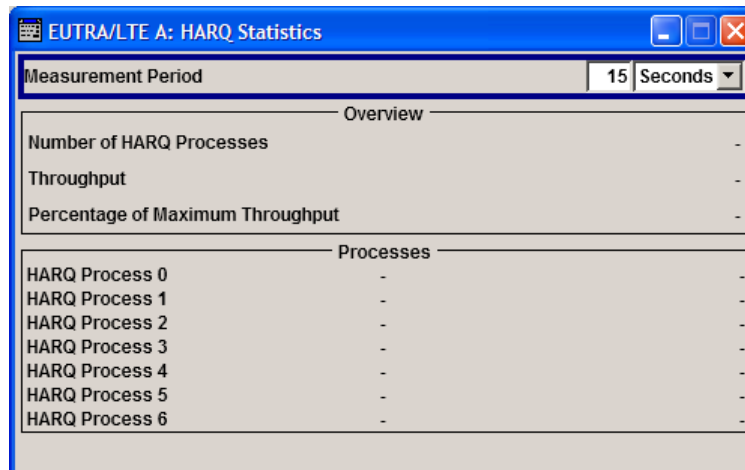
[\[:SOURCE<hw>\]:BB:EUTRa:UL:RTFB:BERate](#) on page 499

**HARQ Statistics**

Opens the [chapter 7.14.4, "HARQ Statistics"](#), on page 204 dialog.

## 7.14.4 HARQ Statistics

This dialog is provided for measuring the HARQ statistics, i.e. the throughput of the uplink transmission. The values of the measured parameters is retrieved from the externally received HARQ feedback commands. The functionality is available in all "Realtime Feedback Modes".



Parameter	Description	SCPI Command
"Measurement Period"	Sets the update period of the HARQ statistics measurement.	
"Number Of HARQ Processes"	Displays the number of HARQ processes. The value is defined in TS 36.213 and depends on the "Duplexing mode" and on the "UL/DL Configuration".	
"Throughput"	Displays the overall absolute throughput of all uplink transmissions that took place during the last measurement period. A "-" represents, that there were no PUSCH transmissions at all (because all subframes are disabled or a PUCCH is transmitted) or if the signal output is not running.	
"Percentage Of Maximum Throughput"	Displays the overall relative throughput, for example as required in the TS 36.141 tests. The value "100%" means there were no retransmissions needed at all during the measurement period. The value "0%" means every PUSCH transmission was acknowledged with a NACK during the measurement period. A "-" represents, that there were no PUSCH transmissions at all (because all subframes are disabled or a PUCCH is transmitted) or if the signal output is not running.	
"Individual Processes"	Displays the absolute and relative throughputs per individual HARQ process. The number of processes corresponds to the value displayed by the parameter "Number Of HARQ Processes".	

### 7.14.5 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 489
```

### 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 489
```

### 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 489
```

### 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 490

### 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 490

### 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 490

### 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 492

### 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 492

### 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 491

**Channel Interleaver (PUSCH)**

Enables/disables channel interleaving.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PUSCh:CCODing:INTerleaver`

on page 491

**7.14.6 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](#) ( $P_{UE}$ ).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:DRS:POWoffset` on page 492

### 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 493

### 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:

$$P_{SRS} = P_{UE} + P_{SRS\_Offset}$$

For global adjustment of the transmit power of the corresponding UE, use the parameter [UE Power](#) ( $P_{UE}$ ).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:POWoffset` on page 493

### SRS Cyclic Shift n\_CS

Sets the cyclic shift  $n_{CS}$  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 493

### Show Signal Structure Configuration Details>>>

Opens the menu for configuring the sounding reference signal structure.

SCPI command:

n.a.

## 7.14.7 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:

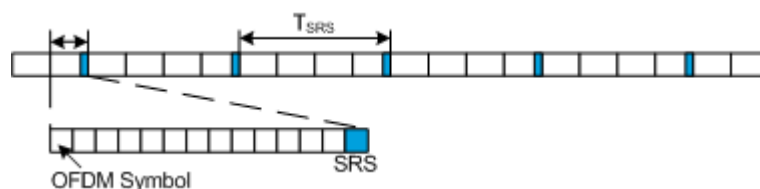
[\[:SOURCE<hw>\]:BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS](#) on page 494

### 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:**

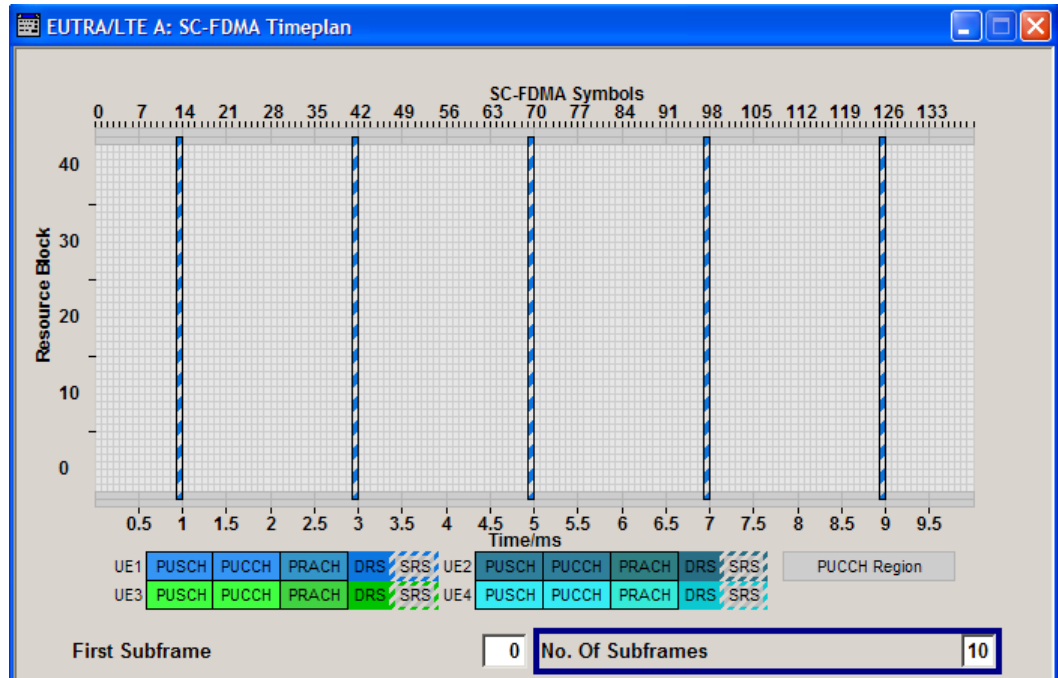
"Configuration Index" = 0, i.e. "Periodicity  $T_{SRS}$ " = 2 ms and "Subframe Offset  $T_{offset}$ " = 0

"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.



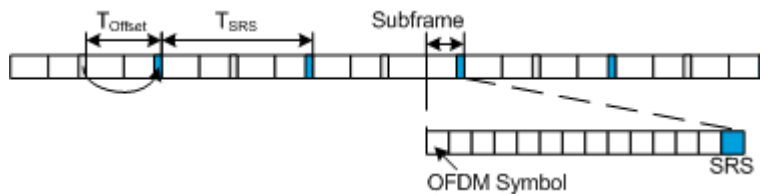
SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:UL:UE<st>:REFSig:SRS:TSRS? on page 495

**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:**

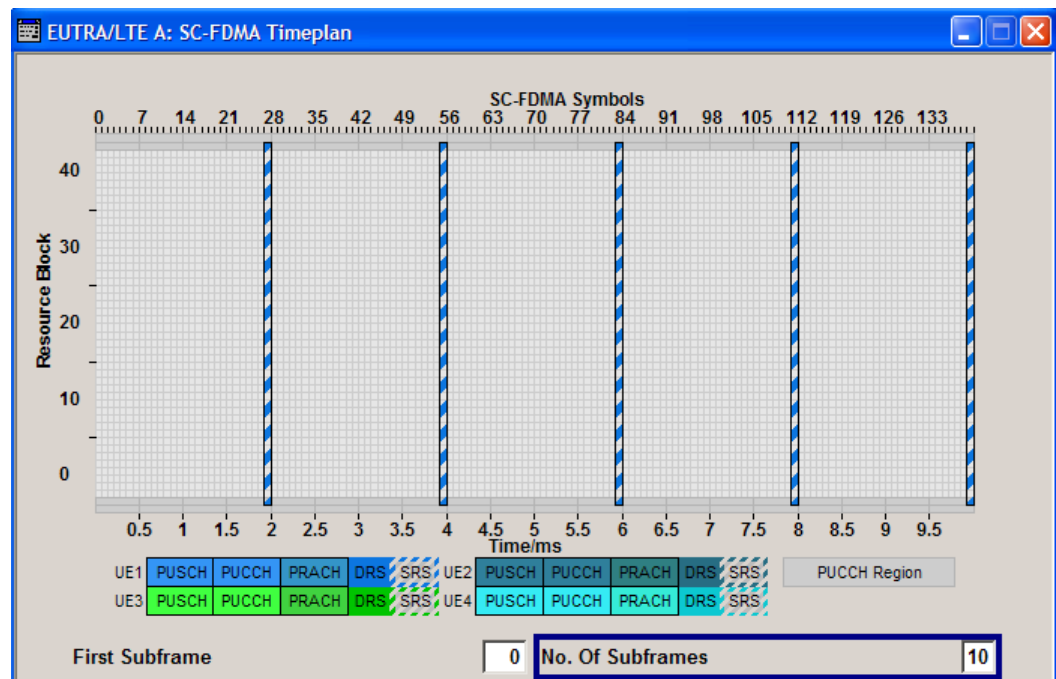
"Configuration Index" = 1, i.e. "Periodicity  $T_{SRS}$ " = 2 ms and "Subframe Offset  $T_{offset}$ " = 1

"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 these 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 495

**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.

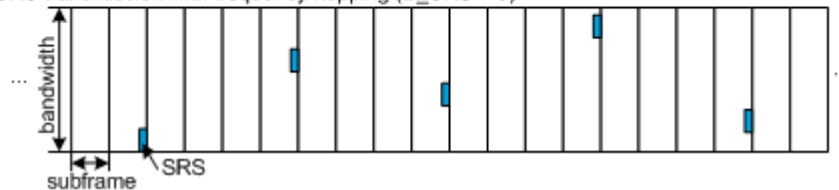
The SRS can span the entire frequency bandwidth or can employ frequency hopping where several narrowband SRSs cover the same total bandwidth.

There are up to four SRS bandwidths defined in the standard. The most narrow SRS bandwidth ( $B_{\text{SRS}} = 3$ ) spans four resource blocks and is available for all channel bandwidths; the other three values of the parameter  $B_{\text{SRS}}$  define more wideband SRS bandwidths, available depending on the channel bandwidth.

SRS transmission without frequency hopping ( $B_{\text{SRS}} = 0$ )



SRS transmission with frequency hopping ( $B_{\text{SRS}} \neq 0$ )



The SRS transmission bandwidth is determined additionally by the "SRS Bandwidth Configuration  $C_{\text{SRS}}$ ".

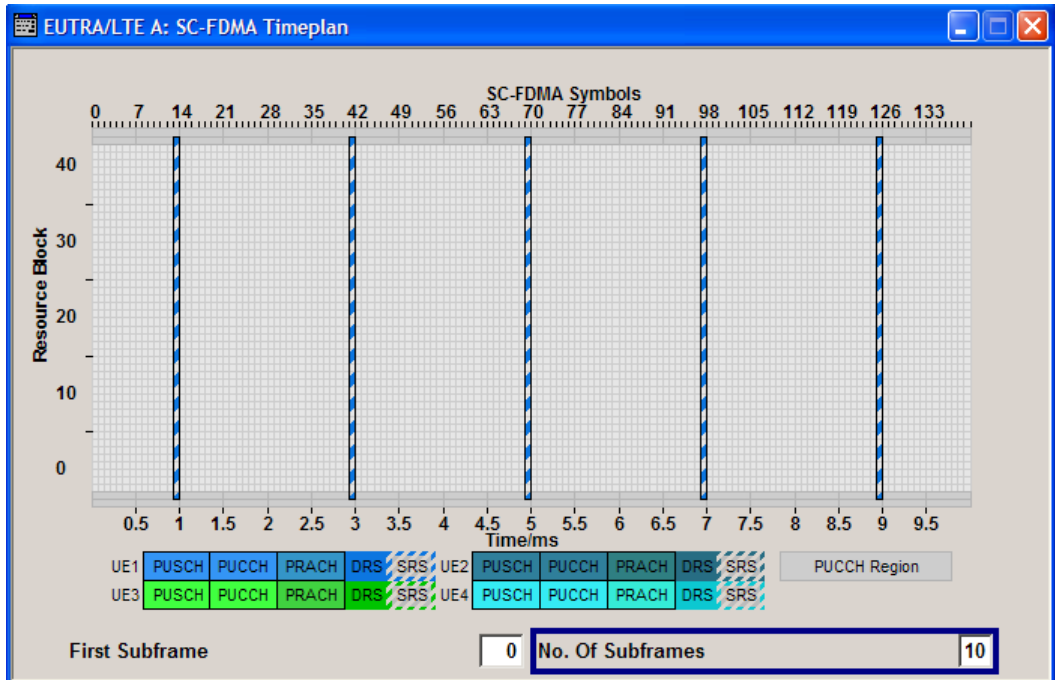
**Example:**

"SRS State" = *On*

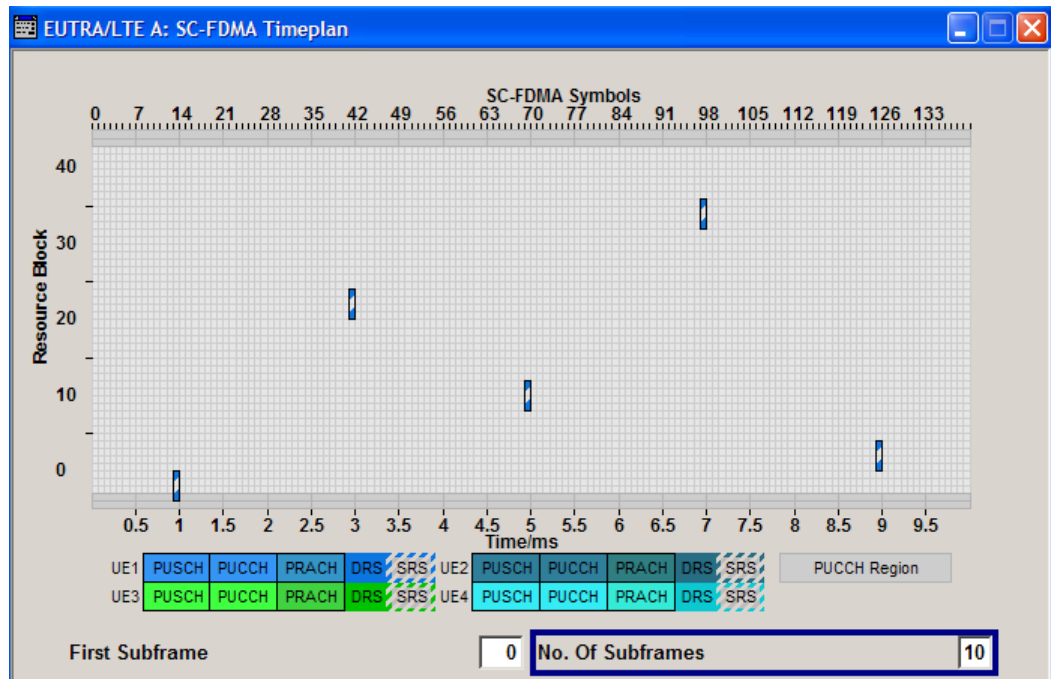
"Duplexing" = *FDD*

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 494

#### 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 496

#### 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 493

#### 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 496

### 7.14.8 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 485

#### 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 485

### 7.14.9 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 486

#### 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 486

#### 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 486

**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 486

**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 487

**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 487

**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 488

**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 488

**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 487

**State (PRACH)**

Enables/disables the PRACH for the selected subframe.

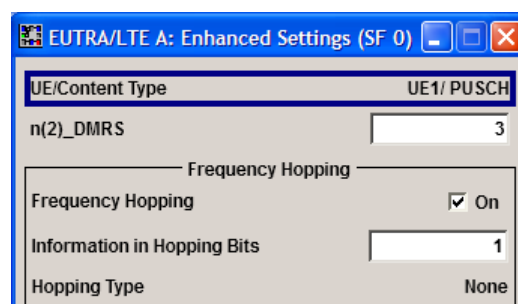
The subframes available for configuration depend on the selected PRACH configuration.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:STATE` on page 488

## 7.15 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	0 0010 11...
Number of Coded A/N Bits	0
Rank Indication (RI)	
Number of RI Bits	2
RI Pattern	00 1110...
Number of Coded RI Bits	0
Channel Quality Indication (CQI)	
Number of CQI Bits	15
CQI Pattern	1 1011 10...
Number of Coded CQI Bits	20
UL-SCH	
Total Number Of Physical Bits	0
Number Of Coded UL-SCH Bits	0
Transport Block Size/Payload	1 500
Redundancy Version Index	2

### 7.15.1 General PUSCH Settings

#### 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 461

#### 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 465

### 7.15.2 Frequency Hopping

#### Frequency Hopping

Enables/disables frequency hopping for PUSCH.

Frequency hopping is applied according to 3GPP TS 36.213.

Based on the [Information in Hopping Bits](#), 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 465
```

#### 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 466
```

#### 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 466
```

### 7.15.3 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 466
```

**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 467
```

**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 467
```

**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 468
```

**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 467
```

**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 469
```

**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 470
```

**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 469
```

**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 468
```

**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 468
```

**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 468
```

**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 463
```

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:PHYSbits?
on page 463
```

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUSCh:PHYSbits?
on page 463
```

**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 follow:

"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 470

#### 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 470

#### Redundancy Version Index (PUSCH)

Sets the redundancy version index.

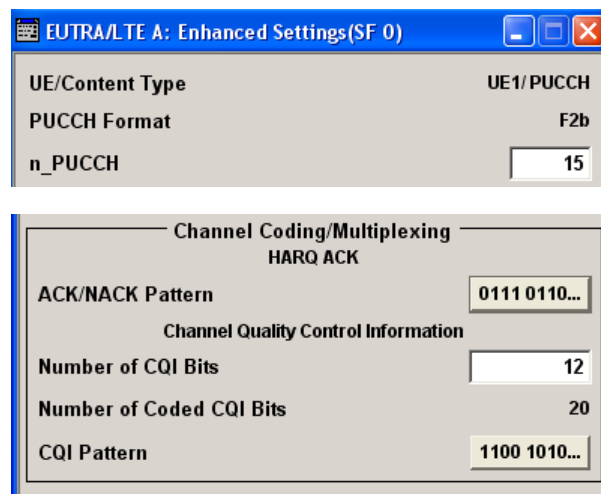
SCPI command:

[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0> :PUSCh:CCODing:RVIndex on page 471

## 7.16 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 allocation.



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 461

**PUCCH Format**

Displays the selected PUCCH Format.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:FORMat
```

on page 461

**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 471

**ACK/NACK Pattern / ACK/NACK+SR Pattern**

("ACK/NACK Pattern" is enabled for PUCCH formats 1a/1b, 2a/2b; "ACK/NACK+SR Pattern" for PUCCH format 3)

Use this parameter to set the ACK/NACK pattern for the PUCCH for the selected subframe. A "1" indicates an ACK, a "0" - a NACK

In PUCCH format 3, the bits given by the ACK/NACK+SR PATTERN represent the  $o^{\text{ACK}}$  bits according to 3GPP TS 36.212, i.e. the up to 21 bits that contain ACK/NACK information for up to two codewords and optionally SR. The number of bits used per subframe is determinate by the value of the parameter [Number of ACK/NACK+SR Bits](#).

To enable the generation of signals with ACK/NACK respectively ACK/NACK+SR information that varies not only per subframe but also differs over the frames, set a pattern with

- more than 1 bit for the PUCCH formats 1a/2a
- more than 2 bits for the PUCCH formats 1b/2b
- more than [Number of ACK/NACK+SR Bits](#) for PUCCH format 3

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 472

**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 473

**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 472

**CQI Pattern (PUCCH)**

Sets the CQI pattern for the PUCCH.

The length of the pattern is determinate 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 473
```

**PUCCH Format 3 Settings**

The PUCCH format 3 is required for sending of the ACK/NACK messages in case DL carrier aggregation with more than two component carriers is used.

See also [chapter 3.6, "LTE-Advanced Introduction"](#), on page 37 and [chapter 7.4.2, "DL Carrier Aggregation Configuration"](#), on page 108.

**Number of ACK/NACK+SR Bits ← PUCCH Format 3 Settings**

(enabled for PUCCH format 3 only)

Sets the number of ACK/NACK+SR bits before channel coding.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:HARQ:BITS
on page 471
```

**Number of Coded ACK/NACK+SR Bits ← PUCCH Format 3 Settings**

(enabled for PUCCH format 3 only)

Displays the number of coded ACK/NACK+SR bits.

SCPI command:

```
[ :SOURCE<hw> ] :BB:EUTRa:UL [ :SUBF<st0> ] :ALLoc<ch0>:PUCCh:HARQ:
CBITs? on page 471
```

**ACK/NACK+SR Pattern ← PUCCH Format 3 Settings**

(enabled for PUCCH format 3 only)

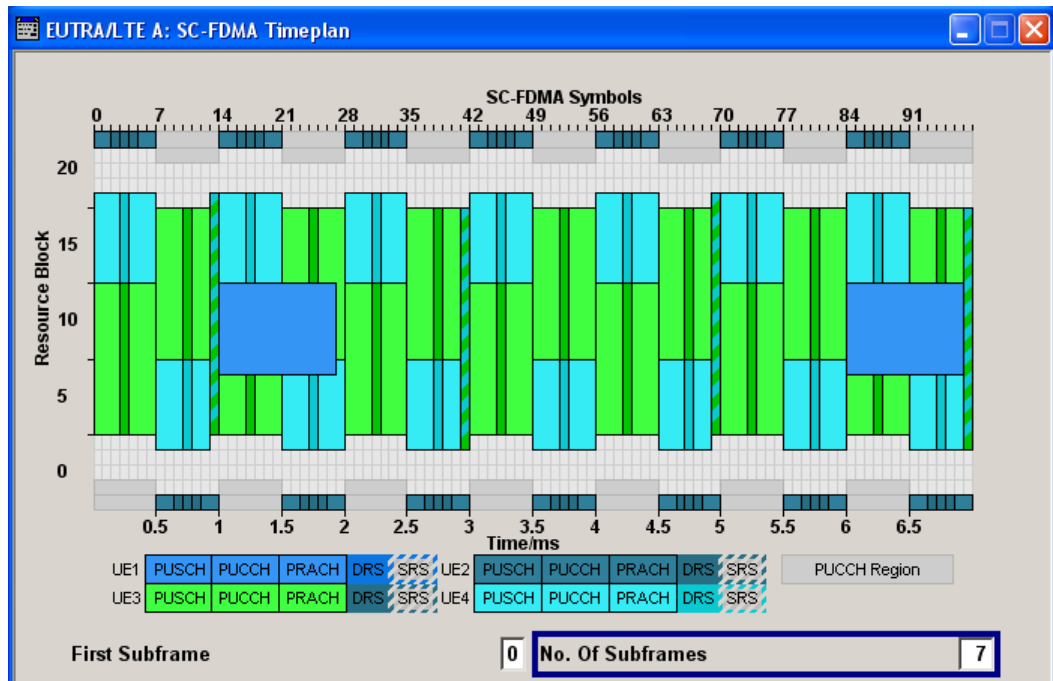
See "[ACK/NACK Pattern / ACK/NACK+SR Pattern](#)" on page 224.

## 7.17 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:

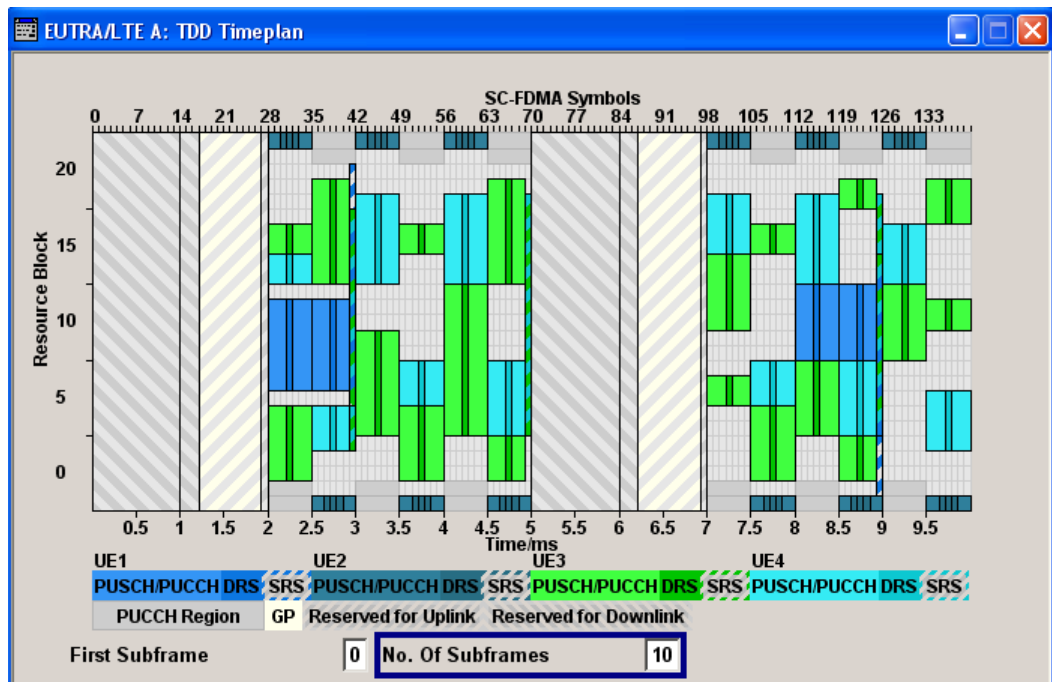
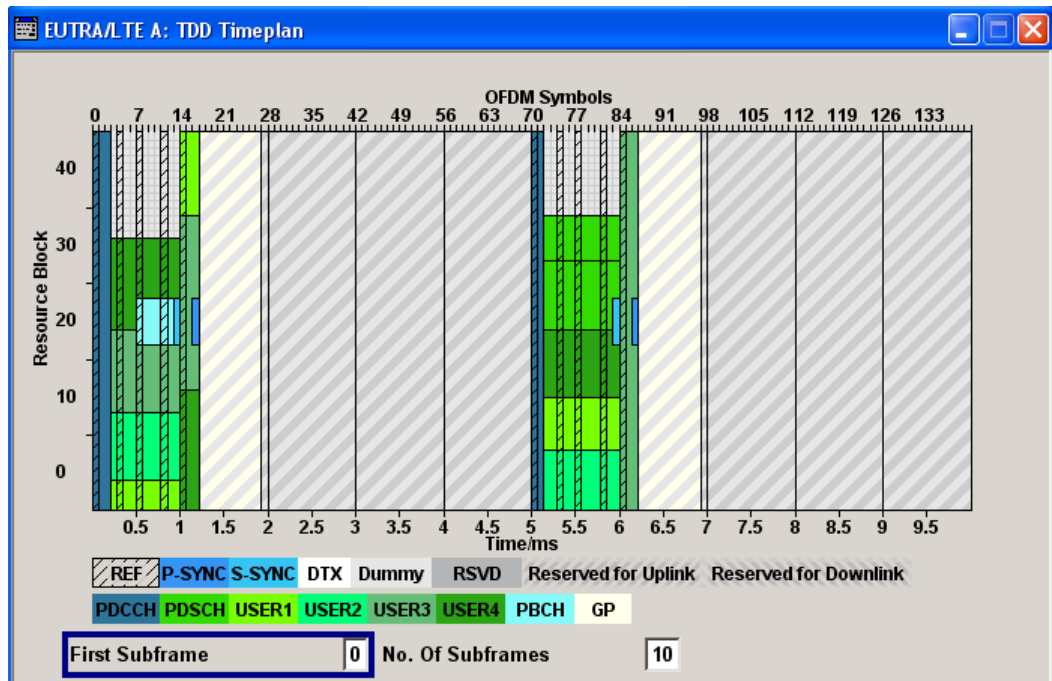
n.a.

## 7.18 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.

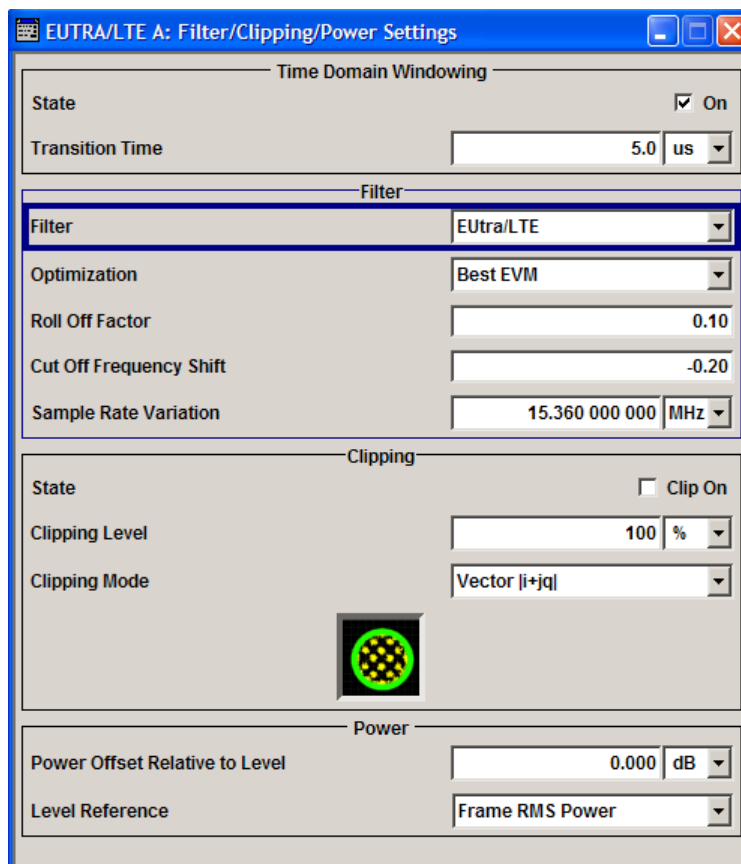
SCPI command:

n.a.

## 7.19 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.



### 7.19.1 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 348

### 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 us and if sample rate = 15.36 MHz, 15 samples overlap.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TDW:TRTime` on page 348

## 7.19.2 Filter Settings

### Filter

Sets the baseband filter.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:FILTer:TYPE` on page 340

### Optimization

Selects one of the provided EUTRA/LTE filters.

Each filter is designed for different application field and optimized for a particular performance. Depending on the filter implementation, these filters require different calculation time. The applied upsampling factor also influences the size of the calculated output waveform file. An output waveform is calculated with the "Generate Waveform File" function or by generating of an LTE waveform with R&S WinIQSIM2.

The [table 7-11](#) outlines the difference between the provided EUTRA/LTE filters by comparing their major specifications.

**Table 7-11: Overview of the EUTRA/LTE filters**

Characteristic	"Best EVM"	"Best APC" "Best ACP (Narrow)"	"Balanced EVM and ACP"	"Best EVM (no upsampling)"
<b>Design goal</b>	An excellent EVM performance while ignoring the effects on ACP	A combination of an excellent ACP performance and a good EVM performance "Best ACP (Narrow)" features additionally a smoother shape in frequency domain	A trade-off between EVM and ACP performance	A combination of an excellent ACP performance and a good EVM performance small output waveform file size
<b>Calculation time</b> (in real-time processing)	By real-time processing, short calculation time	Long calculation time: the filtered signal is precalculated because of the filter complexity	By real-time processing, short calculation time	Long calculation time: the filtered signal is precalculated because of the filter complexity

Characteristic	"Best EVM"	"Best APC" "Best ACP (Narrow)"	"Balanced EVM and ACP"	"Best EVM (no upsampling)"
<b>Upsampling</b>	Upsampling with factor 2 The sample rate of the output waveform is twice the LTE sample rate	Upsampling with factor 2 The sample rate of the output waveform is twice the LTE sample rate The signal processing requires twice as much internal memory and the available memory on the instrument is sufficient for the simulation of half as much frames compared to filter "Best EVM"	Upsampling with factor 2 The sample rate of the output waveform is twice the LTE sample rate	Upsampling is not applied The sample rate of the output waveform is not changed
<b>Output waveform file size</b>	Increased file size	Increased file size	Increased file size	File size is maintained The resulting file size is smaller than in the other cases
<b>Recommended application field</b>	Receiver and performance tests with internal real-time generation, where BLER is analyzed	Transmitter and components tests where excellent ACP is required		Receiver and performance tests with pre-generated waveform files, where BLER is analyzed

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:FiLTer:PARAmeter:LTE:OPTimization`  
on page 344

#### 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 345

#### Roll Off Factor or BxT

Sets the filter parameter.

The Roll Off Factor affects the steepness of the filter flanks. A "Roll Off Factor" = 0 results in the steepest flanks; values near to 1 make the flanks more flat.

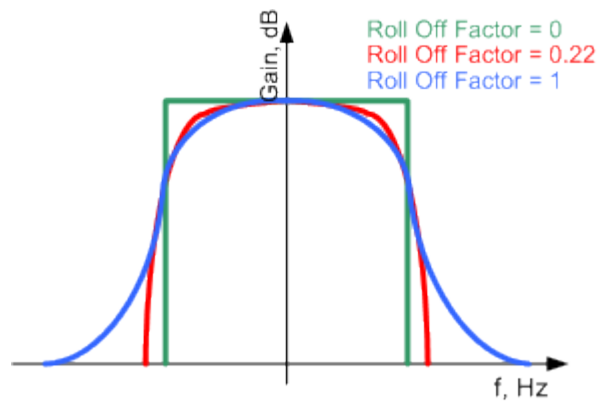


Fig. 7-11: Example of the frequency response of a filter with different Roll Off Factors

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 342
[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:RCOSSine on page 345
[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:PGAuss on page 344
[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:GAUSSs on page 342
[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:SPHase on page 345
[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:APCO25 on page 341
[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:LTE:ROFactor on page 344
```

### Cut Off Frequency Shift

(available for filter parameter Cosine and EUTRA/LTE with EVM Optimization only)

The cut off frequency is a filter characteristic that defines the frequency at the 3 dB down point. The "Cut Off Frequency Shift" affects this frequency in the way that the filter flanks are "moved" and the transition band increases by "Cut Off Frequency Shift" \* "Sample Rate".

- A "Cut Off Frequency Shift" = -1 results in a very narrow-band filter
- Increasing the value up to 1 makes the filter more broad-band
- By "Cut Off Frequency Shift" = 0, the -3 dB point is at the frequency determined by the half of the selected "Sample Rate".

**Tip:** Use this parameter to adjust the cut off frequency and reach spectrum mask requirements.



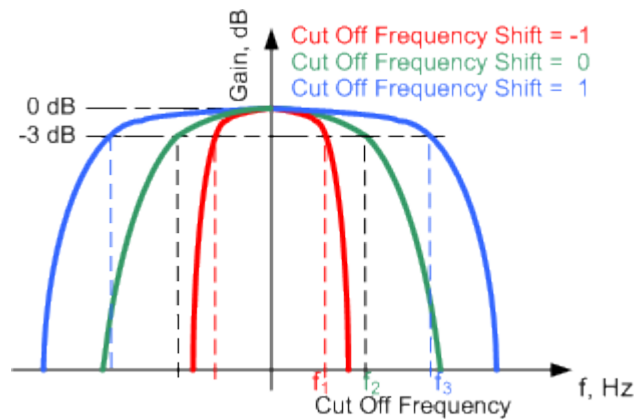


Fig. 7-12: Example of the frequency response of a filter with different Cut Off Frequency Shift

#### Example:

"Channel Bandwidth" = 10 MHz

"Sample Rate" = 15.36 MHz

"Cut Off Frequency Shift" = 0

Frequency at 3 dB down point = +/- 7.68 MHz

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:COsine:COFS` on page 342

`[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:LTE:OPTimization`  
on page 344

`[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:LTE:COFS` on page 344

#### 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 343

`[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:LTE:OPTimization`  
on page 344

`[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:LTE:COFFactor` on page 343

`[ :SOURce<hw> ] :BB:EUTRa:FiLTer:PARAmeter:LPASSEVM` on page 343

#### Filter Mode

Selects an offline or realtime filter mode.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:FiLTer:MODE` on page 340

#### 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.

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 346

### 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 341

[\[:SOURCE<hw>\]:BB:EUTRa:FiLTer:ILENgtH](#) on page 340

### 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 341

[\[:SOURCE<hw>\]:BB:EUTRa:FiLTer:OSAMpling](#) on page 341

## 7.19.3 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 347

### 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 346

**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 234).



"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 347

**7.19.4 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 57.

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 349

**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: <ul style="list-style-type: none"> <li>• PUSCH (without DRS)</li> <li>• PUCCH (without DRS)</li> <li>• PUCCH and PUSCH (both without DRS)</li> <li>• PRACH or</li> <li>• SRS.</li> </ul> <p>The subframe, channel and reference used are displayed by means of the parameters <a href="#">Reference Subframe</a>, <a href="#">Reference Channel</a> and <a href="#">Reference UE</a>.</p> <p>The suitable reference is selected automatically according the following algorithm:</p> <ul style="list-style-type: none"> <li>• The first active UE is used</li> <li>• The data part of the first PUSCH/PUCCH is used</li> <li>• In PRACH mode, the first PRACH preamble is used</li> <li>• If there is no active subframe, the SRS is used.</li> </ul> <p>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.</p>

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:POWC:LEVReference on page 348

### 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 350

### 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 350

### 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 349

## 7.20 Trigger/Marker/Clock Settings



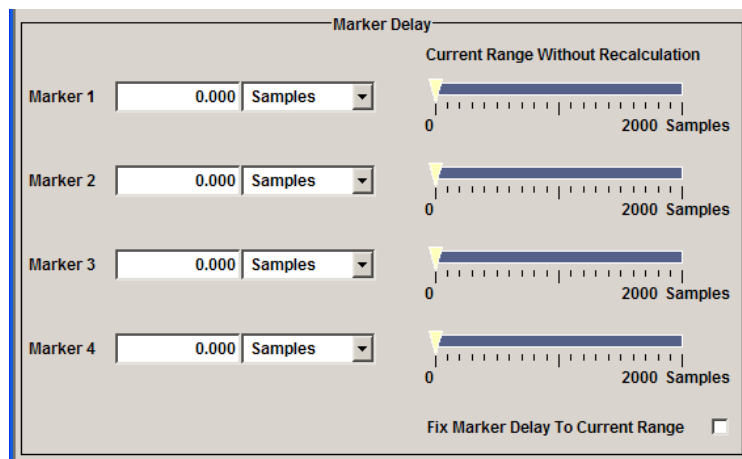
The trigger, clock, and marker delay functions are available for R&S SMx and R&S AMU instruments only.

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

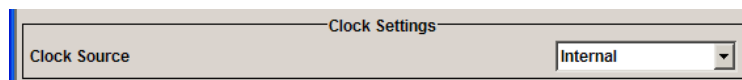
The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.

The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.

The "Marker Delay" section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.



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



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



## 7.20.1 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 after "Arm" (internal with "Execute Trigger" or external) causes a restart.  
**Tip:** This mode is used for example for Base Station Tests if a frame marker from the device under test starts the signal output. Subsequent frame markers will not cause a restart of the signal.
- "Armed\_Ret-rigger" 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 355

#### 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 360

#### 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 360

#### 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 359

**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 355

**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 356

**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 (Baseband A/ B)"	(two-path instruments only) The trigger event is executed by the trigger signal from the second path
"External (TRIGGER 1 / 2)"	The trigger event is executed with the aid of the active edge of an external trigger signal. 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 361

**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 one 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.



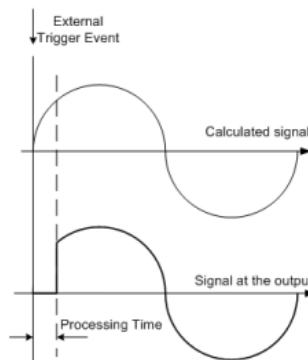
Table 7-12: Typical Applications

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

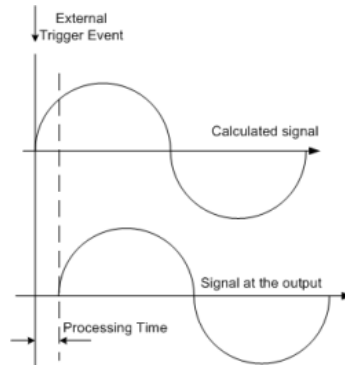
"On"

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 357

#### Trigger Delay Unit

Selects the unit ("Samples" or "Time") of the external and other baseband trigger delay.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TRIGger:DELAy:UNIT` on page 356

#### Trigger Delay

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

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 362

`[ :SOURCE<hw> ] :BB:EUTRa:TRIGger:EXTeRnal<ch>:TDELAy` on page 357

`[ :SOURCE<hw> ] :BB:EUTRa:TRIGger:OBASeband:DELAy` on page 358

`[ :SOURCE<hw> ] :BB:EUTRa:TRIGger:OBASeband:TDELAy` on page 359

#### Actual External Delay

Indicates the resulting external trigger delay in "Time" unit.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TRIGger:EXTeRnal<ch>:RDELAy?` on page 356

`[ :SOURCE<hw> ] :BB:EUTRa:TRIGger:OBASeband:RDELAy?` on page 358

#### 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 362

[\[:SOURce<hw>\]:BB:EUTRa:TRIGger:OBASeband:INHibit](#) on page 358

## 7.20.2 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 and enabled "TDD" mode.

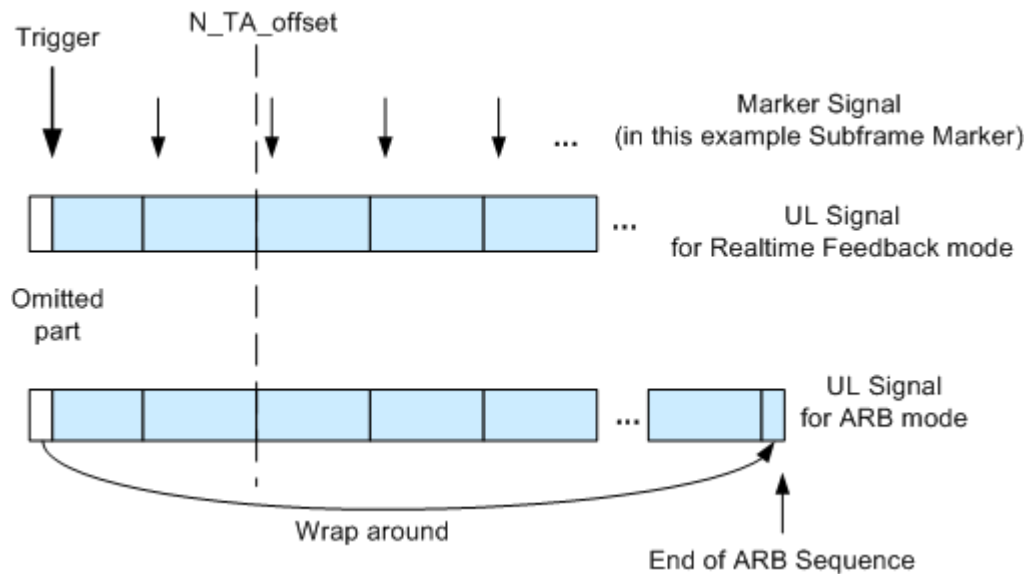
The 3GPP TS 36.211 defines the signal advance parameter depending on the duplexing mode and specifies the following values:

- 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 differently, depending whether the "Realtime Feedback" mode is activated or not (see [figure 7-13](#)).



**Fig. 7-13: 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 354

### 7.20.3 Marker Mode

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

#### 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.

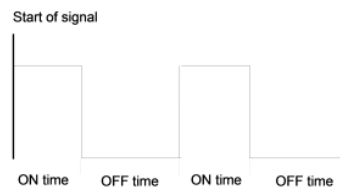
"Radio Frame Start" A marker signal is generated at the start of each radio frame.

- "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 366

- "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 366

[\[:SOURCE<hw>\]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime](#) on page 366

- "Internally Used" Special marker signal for the realtime feedback mode ([chapter 6, "Real-time Feedback for Closed Loop BS Tests"](#), on page 61) or for the "SFN Restart Period 3GPP (1024 Frames)".

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE](#) on page 364

### 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 366

[\[:SOURCE<hw>\]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset](#) on page 366

## 7.20.4 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 363

#### 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 364

`[ :SOURce<hw> ] :BB:EUTRa:TRIGger:OUTPut<ch>:DELay:MINimum?`  
on page 364

#### 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 363

## 7.20.5 Clock Settings

The "Clock Settings" are 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)

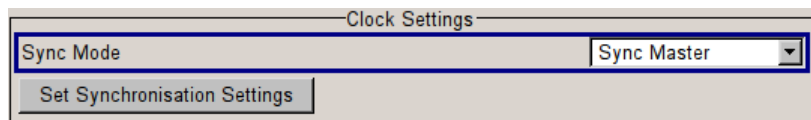
Selects the synchronization mode.

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 353

### Set Synchronization Settings

(for R&S SMBV only)

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

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:CLOCK:SYNChronization:MODE](#) on page 353

### 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 352

### 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 351

#### **Clock Multiplier**

Enters the multiplication factor for clock type "Multiple".

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:CLOCK:MULTIPLIER](#) on page 352

#### **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 351

#### **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:

`CLOCK:INPut:FREQuency?`

## **7.20.6 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 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 252.

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 252.

### 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 269</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 280</a>
7.3	Dynamic range	<a href="#">chap. 8.8.5, on page 282</a>
7.4	In-channel selectivity	<a href="#">chap. 8.8.6, on page 285</a>
7.5	Adjacent Channel Selectivity (ACS)	<a href="#">chap. 8.8.7, on page 288</a>
	Narrow-band blocking	<a href="#">chap. 8.8.8, on page 290</a>
7.6	Blocking	<a href="#">chap. 8.8.9, on page 293</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 297</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 305</a>
8.2.2	Performance requirements for UL timing adjustment	<a href="#">chap. 8.9.4, on page 308</a>
8.2.3	Performance requirements for HARQ-ACK multiplexed on PUSCH	<a href="#">chap. 8.9.5, on page 313</a>

Chapter in TS 36.141	Test Case	Section in this document with further information
8.2.4	Performance requirements for High Speed Train conditions	<a href="#">chap. 8.9.6, on page 315</a>
<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 319</a>
8.3.2	CQI performance requirements for PUCCH format 2	<a href="#">chap. 8.9.8, on page 321</a>
8.3.3	ACK missed detection for multi user PUCCH format 1a	<a href="#">chap. 8.9.9, on page 324</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 329</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.

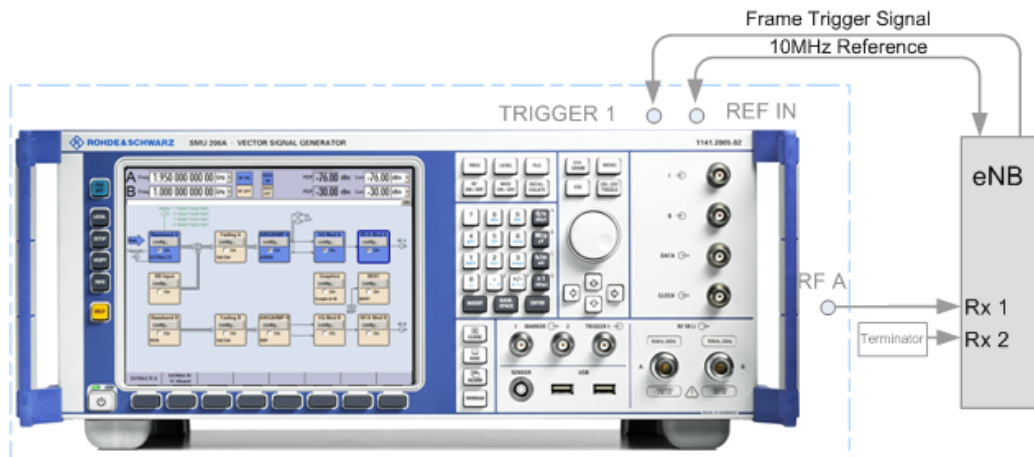


Fig. 8-1: One Path Standard Test Setup (Example of R&S SMU simulating the test case 7.3 "Dynamic Range")

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.

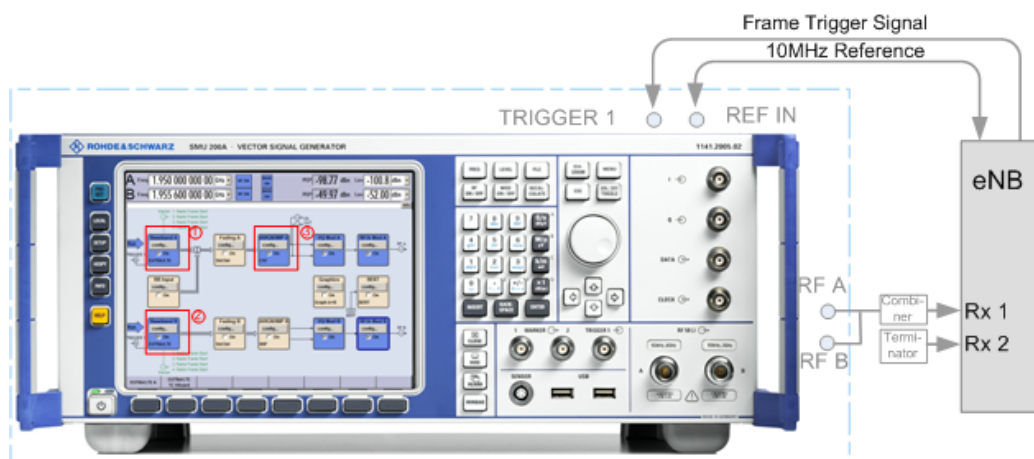


Fig. 8-2: Two Paths Standard Test Setup (Example of R&S SMU simulating test case 7.8 "Receiver Intermodulation")

- 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".

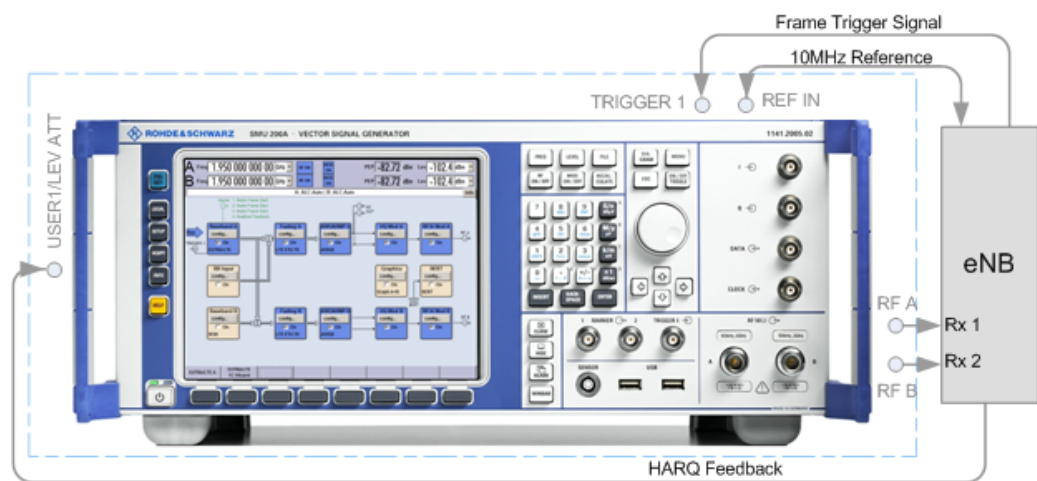


Fig. 8-3: Test Setup for Diversity Measurements (Example of R&S SMU simulating test case 8.2.1 "PUSCH in Multipath Fading Propagation Conditions")



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".



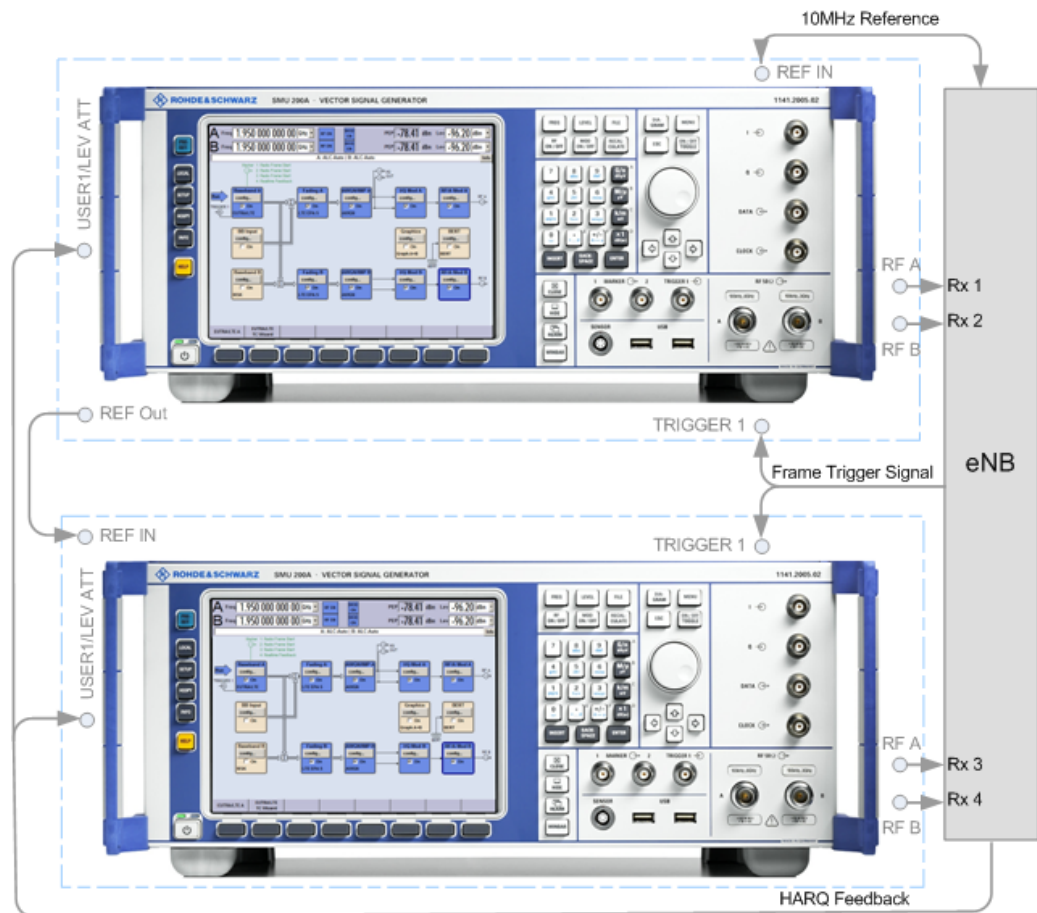


Fig. 8-4: Test Setup for tests with for Rx antennas (Example of 2xR&S SMU simulating test case 8.2.1 "PUSCH in Multipath Fading Propagation Conditions")



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	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	699 MHz to 716 MHz	729 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
...			
17	704 MHz to 716 MHz	734 MHz to 746 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

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 (3 dB 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 .

User Correction Settings	
State	On
User Correction	0.00 dBm
User Cor. Data...	ucor1
Edit User Cor. Data...	

- In order to compensate cable loss and additionally inserted attenuators, the RF level can directly be adjusted in the "Level" input field.

PEP A  dBm Lev A  dBm

- Additional settings in the impairments section of the AWGN block

Optimize Internal I/Q Impairments For RF Output

### 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.

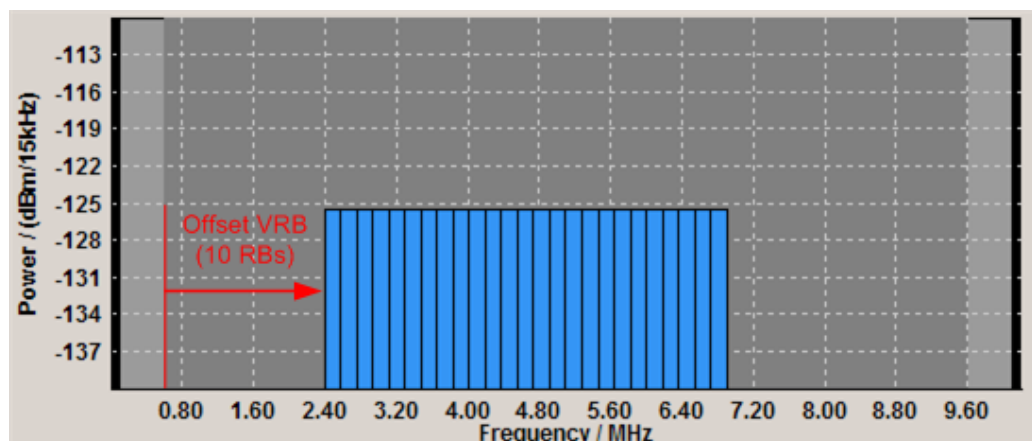
#### Example: Offset VRB

"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

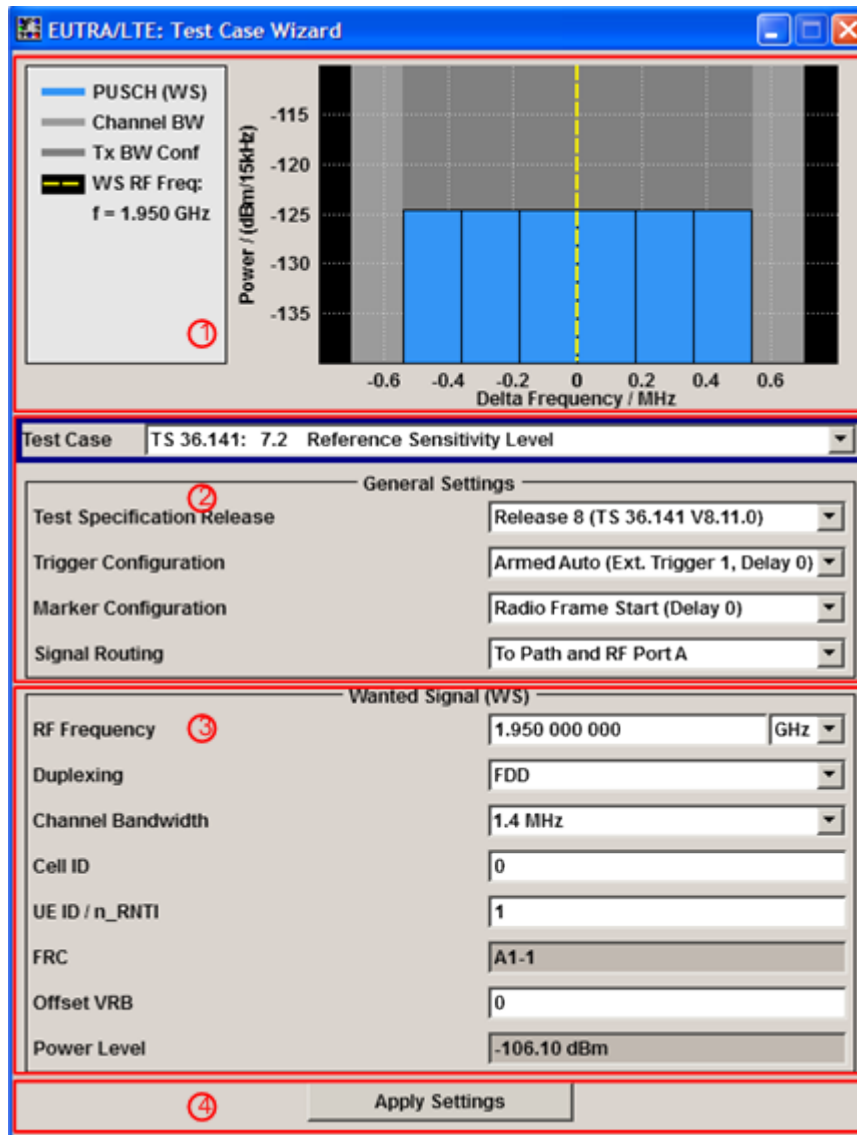
To access the "Test Case Wizard" dialog, select "Baseband Block > EUTRA/LTE > Test Case Wizard".



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 252 for an overview of the available test cases.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:TC](#) on page 514

**Test Specification Release**

Displays the 3GPP test specification used as a guide line for the test cases.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:GS:RELease](#) on page 506

**Trigger Configuration**

Selects the trigger configuration. The trigger is used to synchronize the signal generator to the other equipment.

"Armed Auto (Ext. Trigger 1, Delay 0)"      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.

"Unchanged"      The current trigger settings of the signal generator are retained unchanged.

SCPI command:

[\[:SOURce<hw>\]:BB:EUTRa:TCW:GS:TRIGgerconfig](#) on page 508

**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 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 508

**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 507

### Signal Routing

Selects the signal routing for baseband A signal which in most test cases represents the wanted signal.

"To Path and RF Port A" The baseband signal A is routed to RF output A.

"To Path and RF Port B" (two-path instruments only)  
The baseband signal A is routed to RF output B.

**Tip:** Some transmitter tests like test case 7.2 require separate measurements on both Rx port. Use this feature to route the same baseband signal to the second RF output and perform the measurements.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:GS:SIGRout` on page 508

### Number of Rx Antennas

For performance requirement tests, determines the number of the Rx antennas.

**Note:** Test cases with four antennas require two R&S SMUs.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:GS:RXAntennas` on page 508

### Antenna Subset

Enabled for test setups with four Rx antennas

Determines the signal of which antenna couple, "Antenna 1 and 2" or "Antenna 3 and 4", is generated by the instrument.

SCPI command:

`[ :SOURce<hw> ] :BB:EUTRa:TCW:GS:ANTSubset` on page 507

### Frequency Allocation

Determines the frequency position of the wanted and interfering signal.

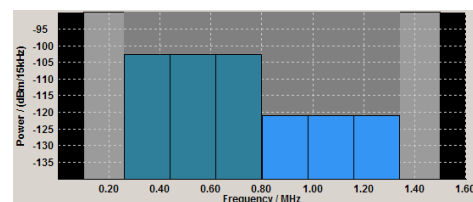
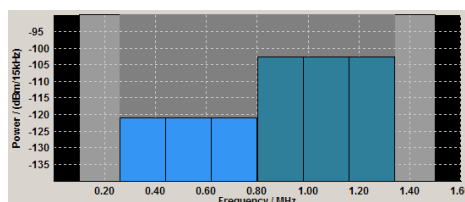
#### Example: Wanted and interfering signal within the same channel

"Test Case" = 7.4 "In Channel Selectivity"

"Channel Bandwidth" = 1.4 MHz

The parameter "Frequency Allocation" determines the position of the allocated RBs within the channel. Allocation in the lower or higher frequencies is possible.

"Frequency Allocation of the Interfering signal" = "Frequency Allocation of the Interfering signal" =  
At Higher Resource Blocks At Lower Resource Blocks



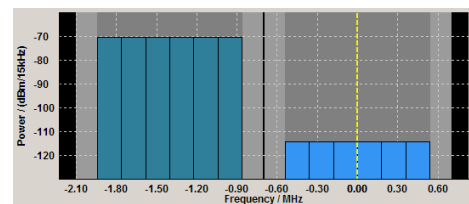
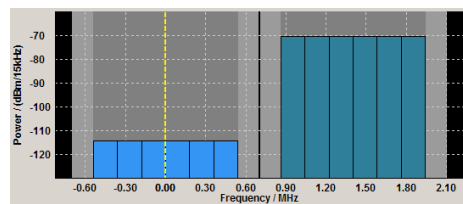
**Example: Interfering signal in the adjacent channel**

"Test Case" = 7.5A "Adjacent Channel Selectivity"

"Channel Bandwidth" = 1.4 MHz

The parameter "Frequency Allocation" determines the position of the wanted signal compared to the interfering signal. Allocation in the lower or higher frequencies is possible, i.e. the position of the allocated bandwidth of the wanted and the interfering signal can be mirrored.

"Frequency Allocation of the Interfering signal" = "Frequency Allocation of the Interfering signal" =  
At Higher Resource Blocks                      At Lower Resource Blocks



SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:FA:FRALlocation](#) on page 506

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:FA:RBALlocation](#) on page 506

## 8.6.2 Wanted Signal and Cell Specific Settings

The following settings are available for almost all transmitter and receiver characteristics and performance requirements tests. Specific parameters are listed together with the description of the corresponding test case.

For the in-channel test cases 7.4, 8.2.2 and 8.3.3, the cell specific settings apply also for the interfering signal, respectively for the signal the stationary UE.

### RF Frequency

Sets the RF frequency of the wanted signal.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:WS:RFFrequency](#) on page 518

### Duplexing

Selects whether TDD or FDD duplexing mode is used (see also "[Duplexing](#)" on page 77).

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:WS:DUPLex](#) on page 515

### TDD UL/DL Configuration

For TDD mode, selects the UL/DL Configuration number (see also "[UL/DL Configuration](#)" on page 115).

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:WS:TDDConfig](#) on page 519



**Signal Advance N\_TA\_offset**

Sets the parameter  $N_{TAOffset}$  (see also "[Signal Advance N\\_TA\\_offset](#)" on page 243).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:NTAOffset on page 516

**Channel Bandwidth**

Selects the channel bandwidth (see also "[Channel Bandwidth \(UL\)](#)" on page 175).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:CHBW on page 515

**Cell ID**

Sets the Cell ID (see also "[Cell ID \(UL\)](#)" on page 178).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:CLID on page 515

**Cyclic Prefix**

Selects normal or extended cyclic prefix.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:CYCPrefix on page 515

**UE ID/n\_RNTI**

Sets the UE ID/n\_RNTI.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:UEID on page 519

**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 516

**Offset VRB**

Sets the number of RB the allocated RB(s) are shifted with (see also [example "Offset VRB"](#) on page 260).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:OVRB on page 517

**Power Level**

Displays the Power Level, depending on the selected test case.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:PLevel? on page 517

### 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 506

## 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 267).

### 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 92.

### 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 288.

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](#)).

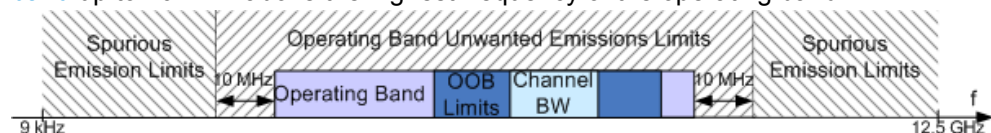
**Table 8-5: Base Station ACLR in paired spectrum**

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 252.

#### 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.

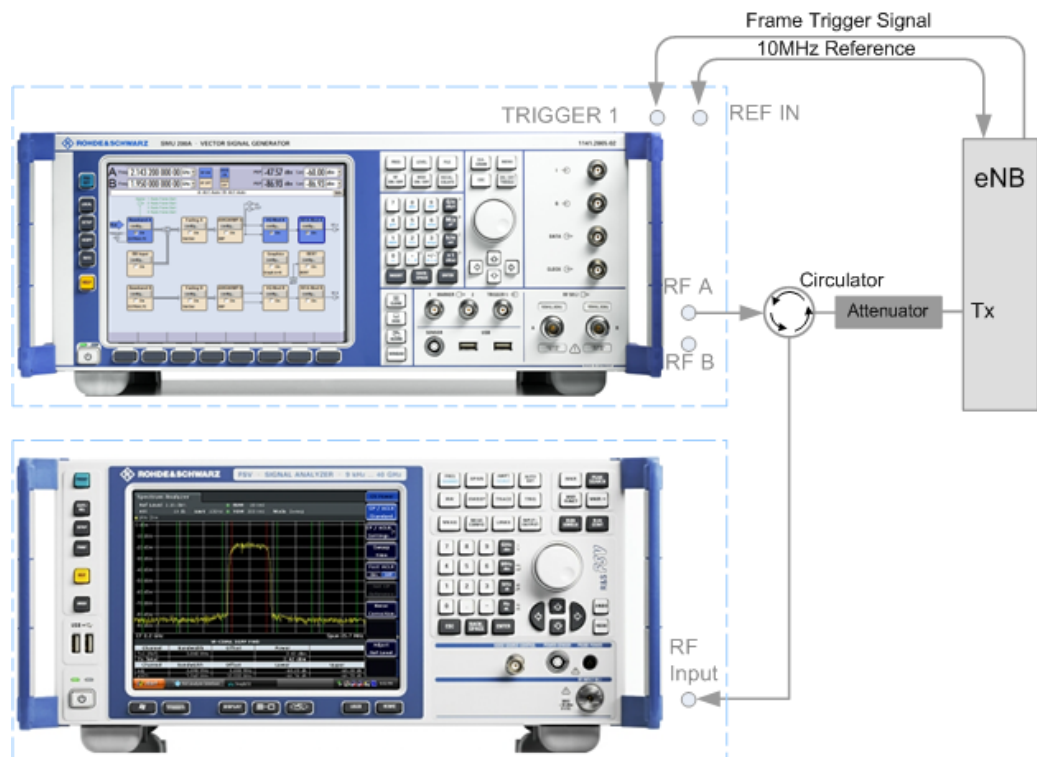


Fig. 8-6: Test setup for Test case 6.7: Transmitter Intermodulation

### 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

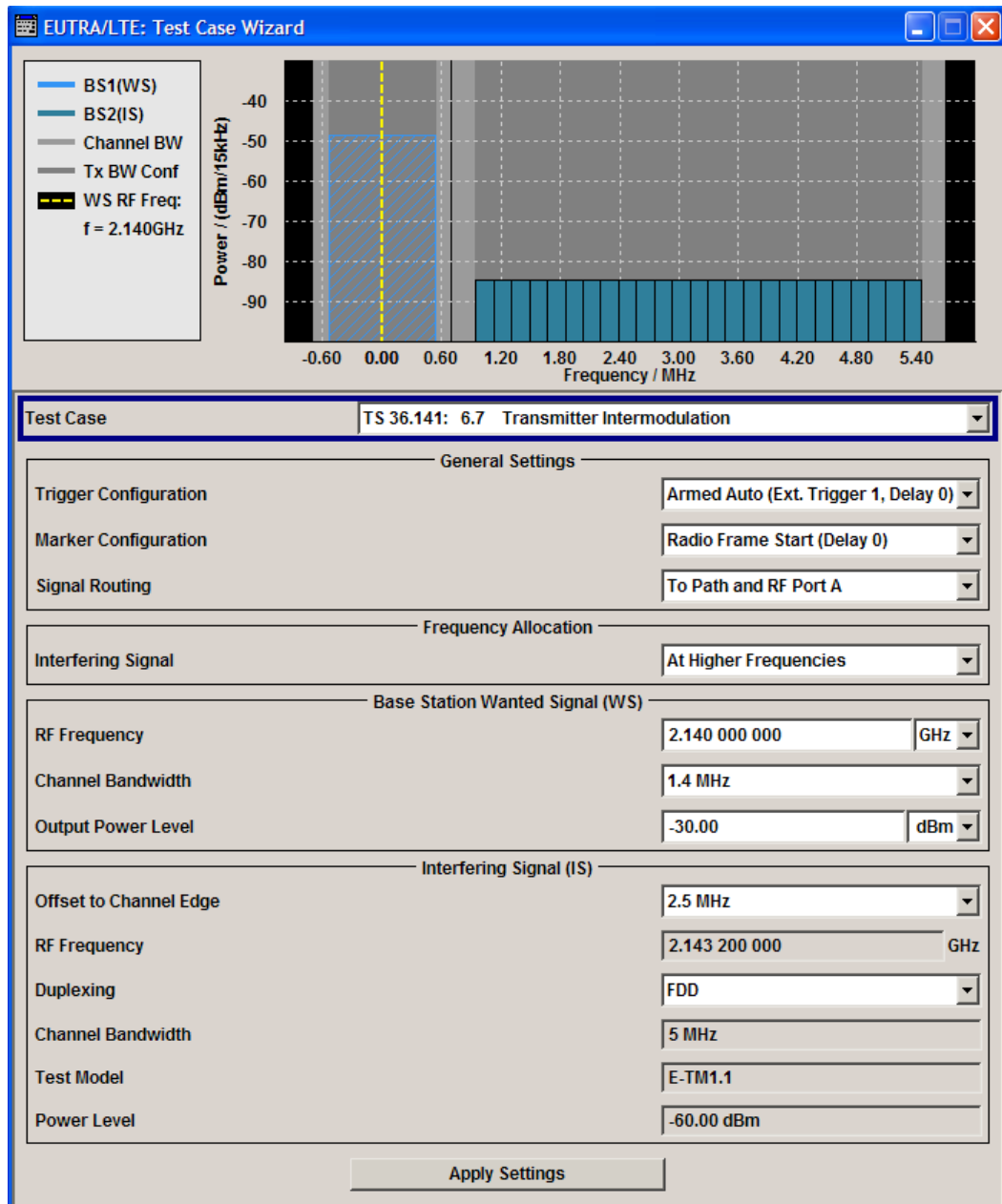


The following describes the general workflow, only the basic steps are listed.

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 264.

**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:OUPLevel1 on page 517



**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 510

**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

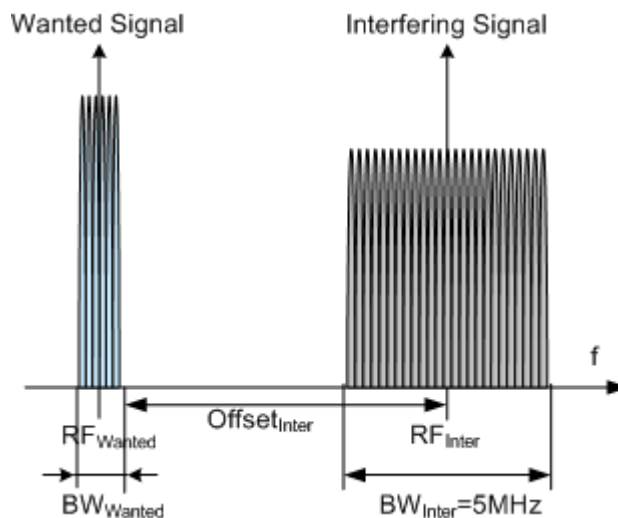


Fig. 8-7: Example: Offset to Channel Edge (Channel Bandwidth = 1.4 MHz)

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS:RFFrequency](#) on page 511

**Duplexing ← Interfering Signal**

Selects whether TDD or FDD duplexing mode is used.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS:DUPLex](#) on page 509

**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 509

**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 512

**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:PLLevel? on page 511

## 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 280
  - [chapter 8.8.5, "Test Case 7.3: Dynamic range"](#), on page 282
- 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 285
  - [chapter 8.8.7, "Test Case 7.5A: Adjacent Channel Selectivity \(ACS\)"](#), on page 288
  - [chapter 8.8.8, "Test Case 7.5B: Narrow-band blocking"](#), on page 290
  - [chapter 8.8.9, "Test Case 7.6: Blocking"](#), on page 293
  - [chapter 8.8.10, "Test Case 7.8: Receiver intermodulation"](#), on page 297

The several test cases shall 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 7-9](#) 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 254.
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 510

### 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

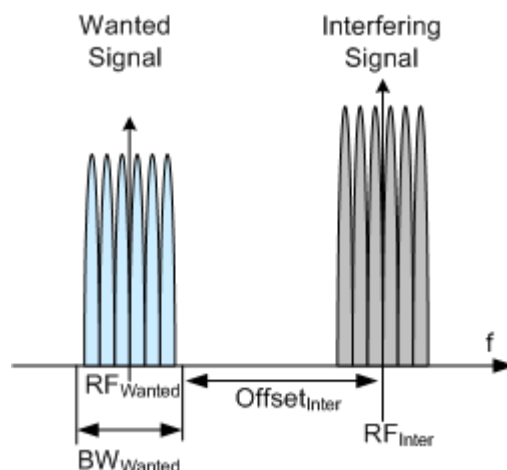


Fig. 8-8: Example: Adjacent Channel Selectivity (ACS), Channel BW = 1.4 MHz

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:RFFrequency on page 511

**Duplexing**

Selects whether TDD or FDD duplexing mode is used.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:DUPLex on page 509

**TDD UL/DL Configuration**

For TDD mode, selects the UL/DL Configuration number.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:TDDConfig on page 512

**Signal Advance N\_TA\_offset**

Sets the parameter  $N_{TAOffset}$  (see also "Signal Advance N\_TA\_offset" on page 243).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:NTAOffset on page 510

**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 509

**Cell ID**

Sets the Cell ID for the interfering signal.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:IS:CLID on page 509

**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 512

**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 510

**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 511

### 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 509

### 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 511

### 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 511

## 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 252.

**Test Setup**

See [chapter 8.4.1, "Standard Test Setup - One Path"](#), on page 254

**Short Description**

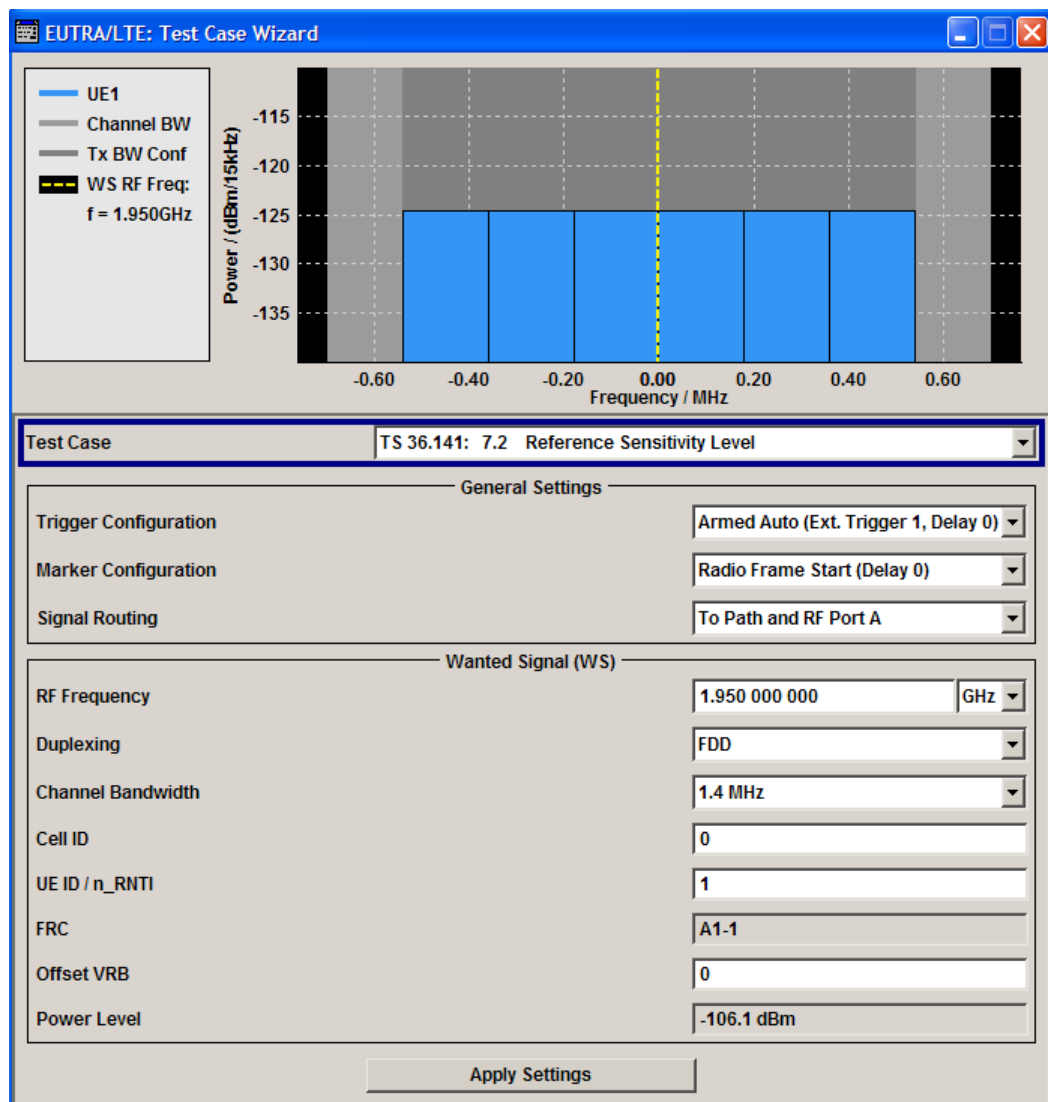
The reference sensitivity level measurement is a test case that aims to verify the Noise Figure of the receivers. The test case uses FRCs with QPSK modulation.

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 264.

### 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 252.
- Option Additive White Gaussian Noise AWGN (R&S SMx-K62)

### Test Setup

See [chapter 8.4.1, "Standard Test Setup - One Path"](#), on page 254

### Short Description

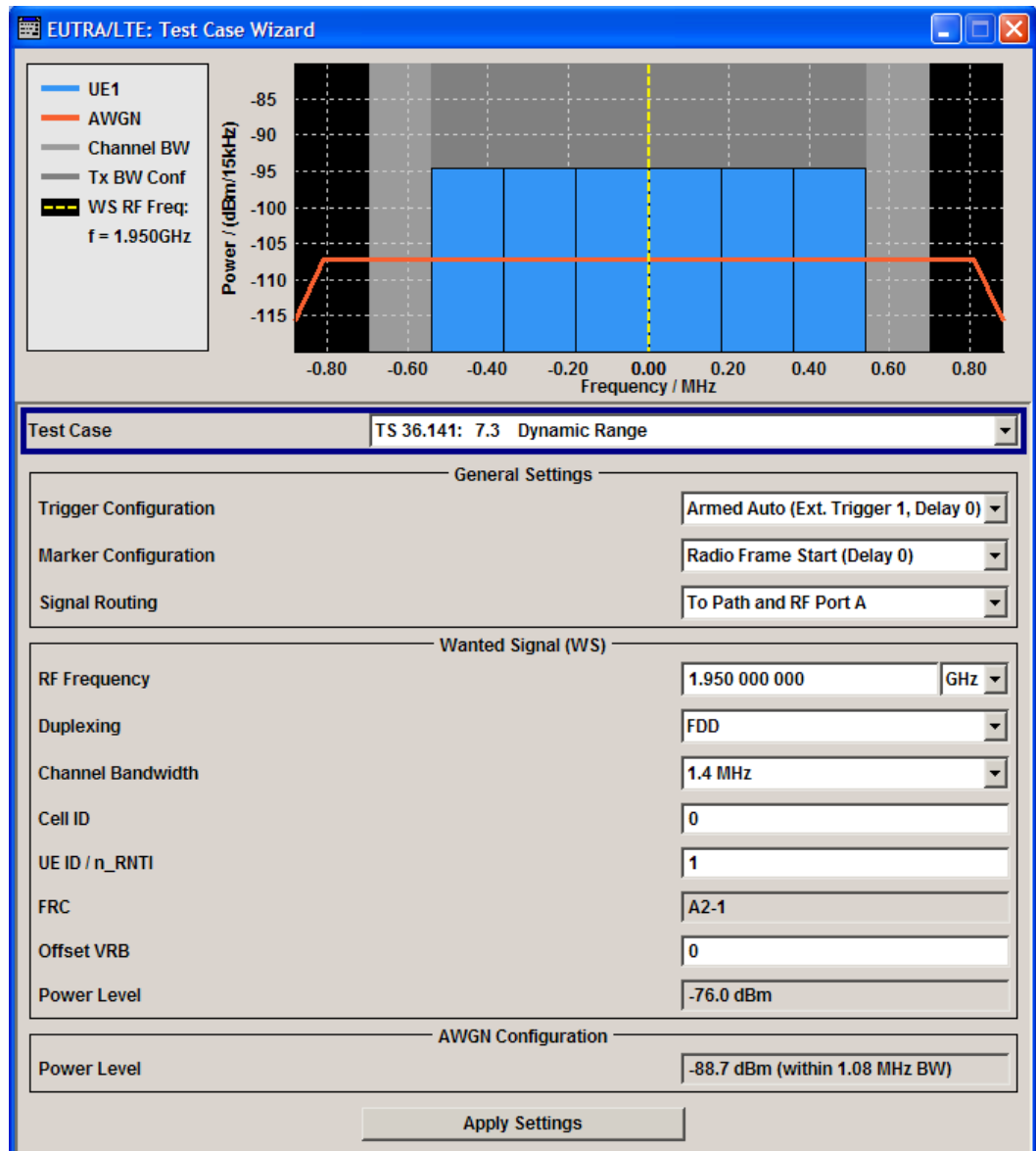
The dynamic range test case aims to stress the receiver and measure its capability to demodulate the useful signal even in the presence of a heavy interfering signal inside the received channel bandwidth. The test case uses FRCs with 16QAM modulation. The throughput measurements are performed for different 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 264.

### 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 506

## 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.

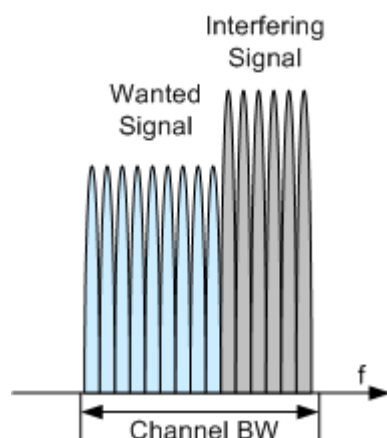
- Instrument equipped with one path, e.g. R&S SMU/SMJ/SMATE/SMBV:  
See [chapter 8.2, "Basic Configuration"](#), on page 252.
- Instrument equipped with two paths, e.g. R&S SMU/SMATE:
  - See [chapter 8.2, "Basic Configuration"](#), on page 252.
  - Option Second RF path (R&S SMx-B20x)
  - Second Option 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 254 or [chapter 8.4.2, "Standard Test Setup - Two Paths"](#), on page 255

### 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**

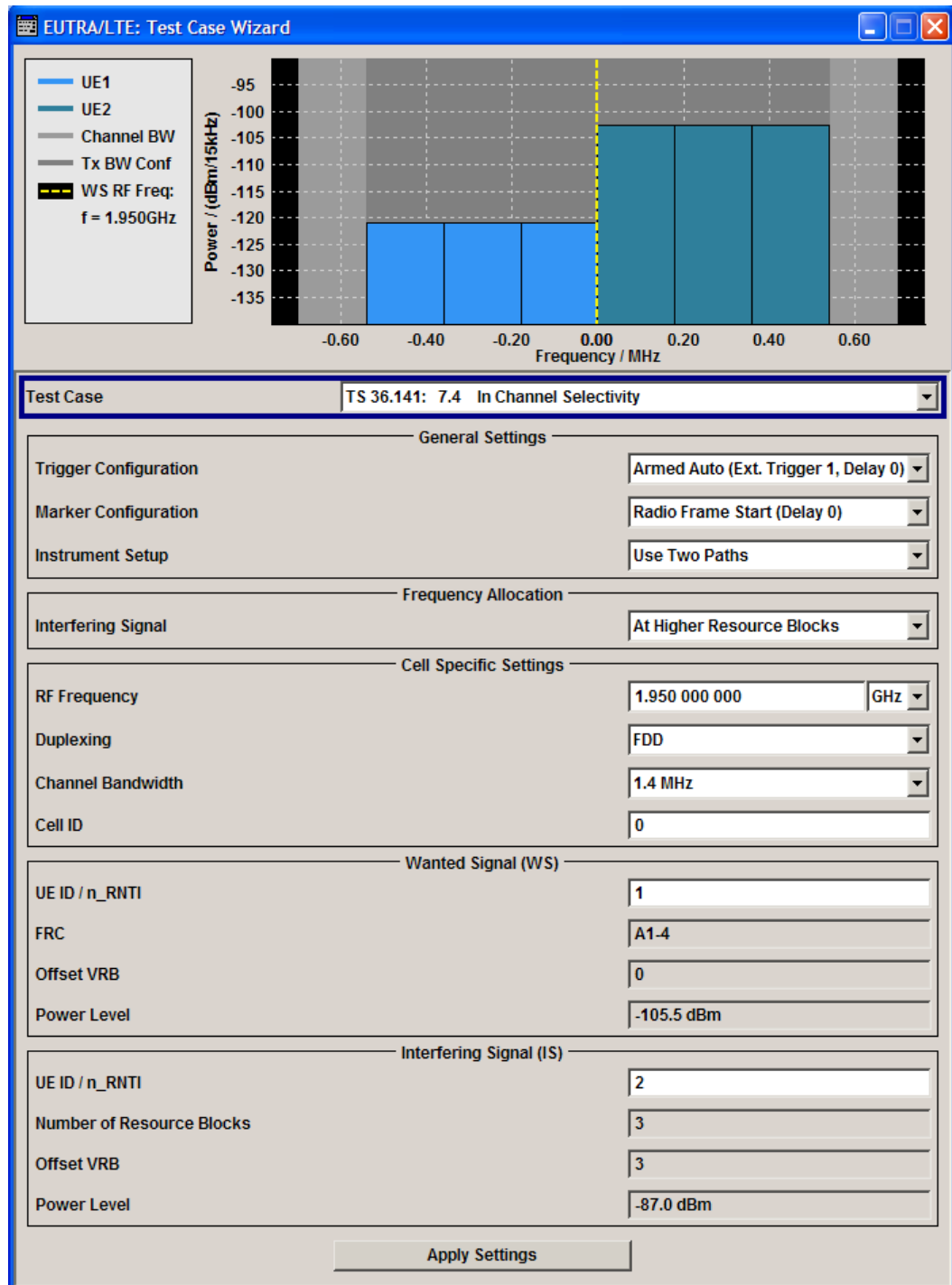
The test shall be done on three channels (B, M and T). The selected "Channel Bandwidth" determines the used FRC and the "Wanted Signal Power Level". For channels larger than 5 MHz not all RBs are allocated.

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 264.

Refer to [chapter 8.8.3, "Interfering Signal Settings"](#), on page 277 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 252.
- 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 255

### 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).

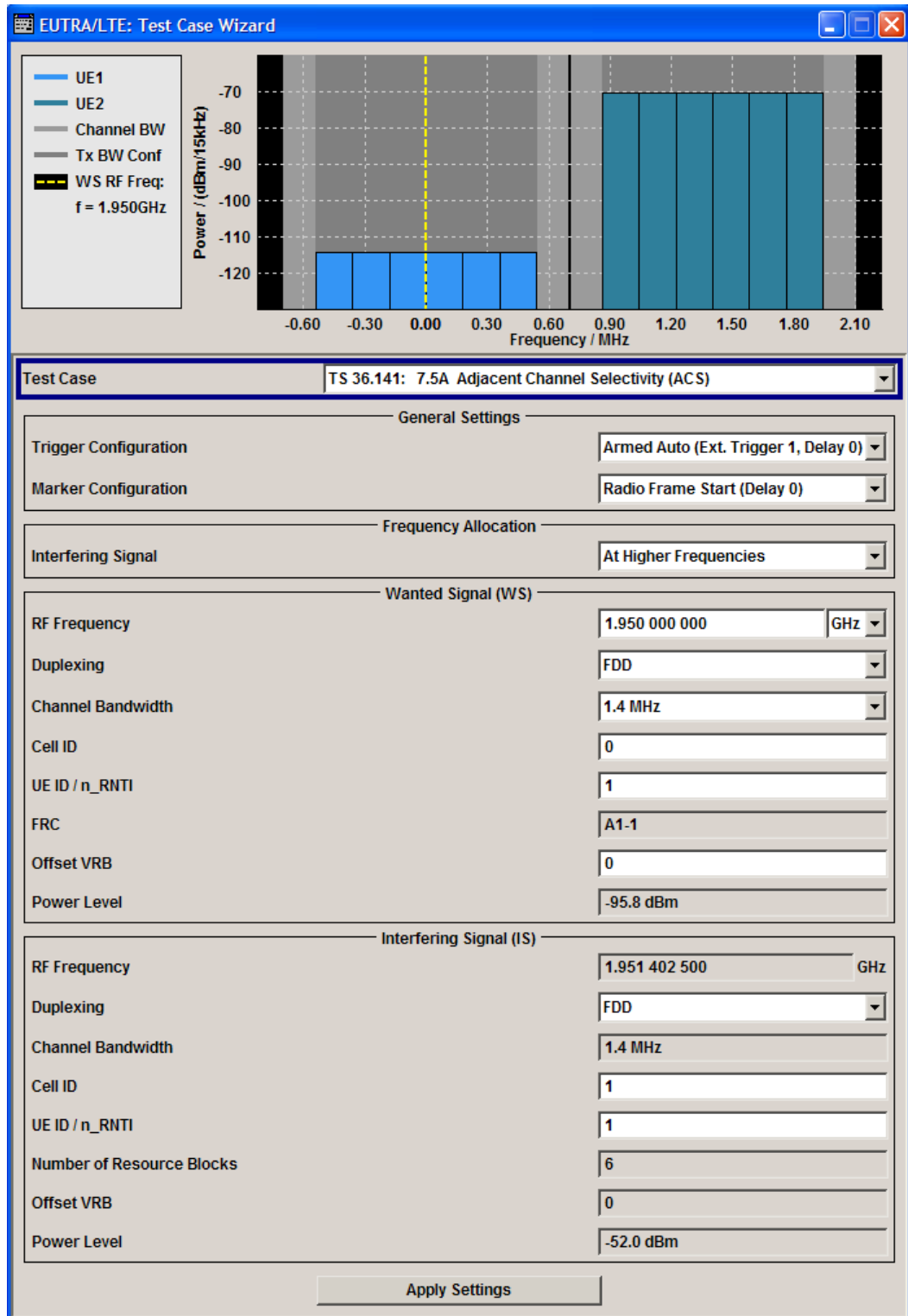
For the parameter in the [table 8-12](#) the throughput shall be equal or greater than 95%.

**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 264.

Refer to [chapter 8.8.3, "Interfering Signal Settings"](#), on page 277 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 252.
- 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 255

#### 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](#)).

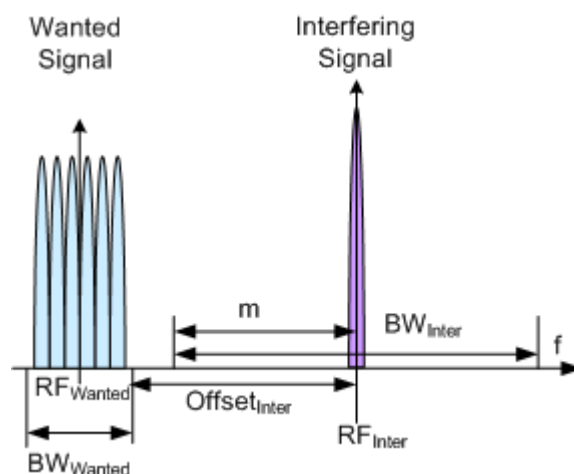


Fig. 8-10: Example: Narrow-band Blocking

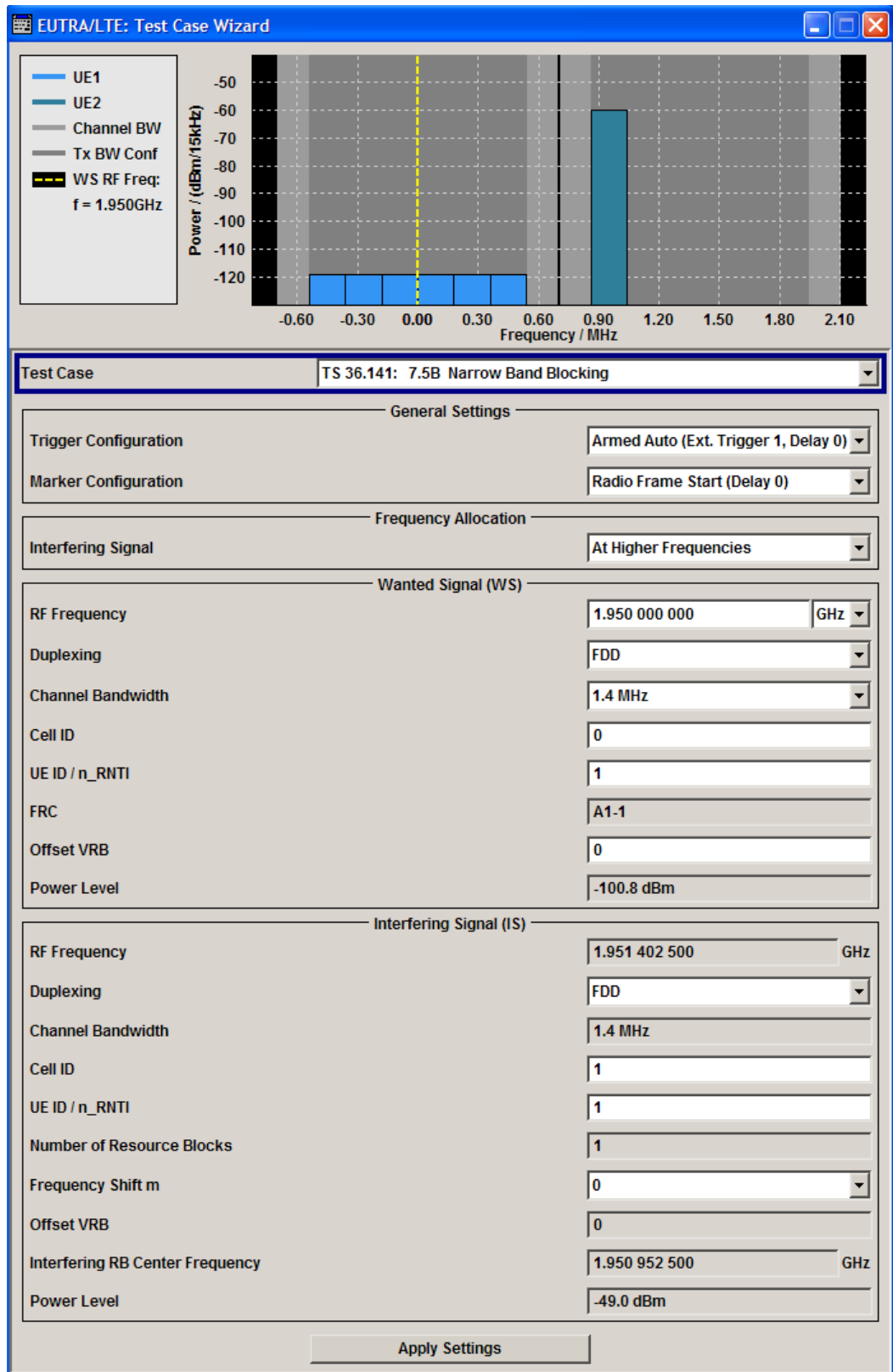
The test shall be done on three channels (B, M and T).

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 264.

Refer to [chapter 8.8.3, "Interfering Signal Settings"](#), on page 277 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 252.
- 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 255. 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.

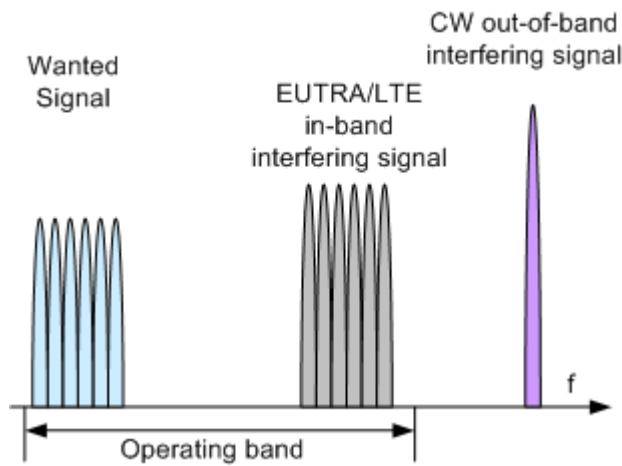


Fig. 8-11: Example: Blocking

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	$P_{REFSENS} + 6\text{dB}$	EUTRA/LTE*
	1 to $(F_{UL\_low} - 20)$ $(F_{UL\_high} + 20)$ to 12750	-15	$P_{REFSENS} + 6\text{dB}$	CW
8	$(F_{UL\_low} - 20)$ to $(F_{UL\_high} + 10)$	-43	$P_{REFSENS} + 6\text{dB}$	EUTRA/LTE*
	1 to $(F_{UL\_low} - 20)$ $(F_{UL\_high} + 10)$ to 12750	-15	$P_{REFSENS} + 6\text{dB}$	CW
12	$(F_{UL\_low} - 20)$ to $(F_{UL\_high} + 12)$	-43	$P_{REFSENS} + 6\text{dB}$	EUTRA/LTE*
	1 to $(F_{UL\_low} - 20)$ $(F_{UL\_high} + 12)$ to 12750	-15	$P_{REFSENS} + 6\text{dB}$	CW
17	$(F_{UL\_low} - 20)$ to $(F_{UL\_high} + 18)$	-43	$P_{REFSENS} + 6\text{dB}$	EUTRA/LTE*
	1 to $(F_{UL\_low} - 20)$ $(F_{UL\_high} + 18)$ to 12750	-15	$P_{REFSENS} + 6\text{dB}$	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 264.

### Interfering Signal

The common settings of the interfering signal are described in [chapter 8.8.3, "Interfering Signal Settings"](#), on page 277.

### 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 512

## 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 252.
- 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 255.

### 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](#)).

Receiver Characteristics (TS 36.141, Chapter 7)

EUTRA/LTE: Test Case Wizard

- UE1
- UE2
- CW Interferer
- Channel BW
- Tx BW Conf
- WS RF Freq:  
f = 1.950GHz

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:  GHz

Duplexing:

Channel Bandwidth:

Cell ID:

UE ID / n\_RNTI:

FRC:

Offset VRB:

Power Level:

Interfering Signal 1

Interferer Type:

RF Frequency:  GHz

Duplexing:

Channel Bandwidth:

Cell ID:

UE ID / n\_RNTI:

Number of Resource Blocks:

Power Level:

Interfering Signal 2

Interferer Type:

RF Frequency:  GHz

Power Level:

The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 264.

Refer to [chapter 8.8.3, "Interfering Signal Settings"](#), on page 277 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 305
  - [chapter 8.9.4, "Test Case 8.2.2: UL timing adjustment"](#), on page 308
  - [chapter 8.9.5, "Test Case 8.2.3: HARQ-ACK multiplexed on PUSCH"](#), on page 313
  - [chapter 8.9.6, "Test Case 8.2.4: High Speed Train conditions"](#), on page 315
- Performance requirements for PUCCH
  - [chapter 8.9.7, "Test Case 8.3.1: ACK missed detection for single user PUCCH format 1a"](#), on page 319
  - [chapter 8.9.8, "Test Case 8.3.2: CQI performance requirements for PUCCH format 2"](#), on page 321
  - [chapter 8.9.9, "Test Case 8.3.3: ACK missed detection for multi user PUCCH format 1a"](#), on page 324
- Performance requirements for PRACH
  - [chapter 8.9.10, "Test Case 8.4.1: PRACH false alarm probability and missed detection"](#), on page 329

### 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 7-9](#) 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:

$$\text{SNR}_{\text{CorrectionFactor}} = 10 * \log_{10}(\# \text{Allocated RBs} / \# \text{Possible RBs}), \text{ dB}$$

*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

$$\text{Power Level}_{\text{WantedSignal}} = \text{Power Level}_{\text{AWGN}} + \text{SNR} + \text{SNR}_{\text{CorrectionFactor}} = -92.7 - 2.1 - 7.78 = -102.6 \text{ dB}$$

#### 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 61 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 <a href="#">chapter 6.2.2, "Serial Mode"</a> , on page 63).
"Serial 3x8"	ACK/NACK Feedback and Timing Adjustments Feedback are implemented by means of serial commands, consisting of three serial packets (see <a href="#">chapter 6.2.3, "Serial 3x8 Mode"</a> , on page 63).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:MODE` on page 514

#### **Connector ← Realtime Feedback Configuration**

Determines the feedback line connector (LEVATT or USER1).

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:CONNector` on page 513

#### **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 66.

SCPI command:

`[ :SOURCE<hw> ] :BB:EUTRa:TCW:RTF:AUSDelay` on page 513

#### **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 513

#### **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 514

#### **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 513



**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:PLevel?` on page 506

**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 518

### 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 252.
- 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 256.

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 256.

**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 are assumed.

The characteristics of the wanted signal are adjusted 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	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
Extended	ETU 70Hz	A4-2	30	5.4	2.2
			70	14.1	10.5

The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 264.

**Fraction of Max. Throughput**

Selects the fraction of maximum throughput.

SCPI command:

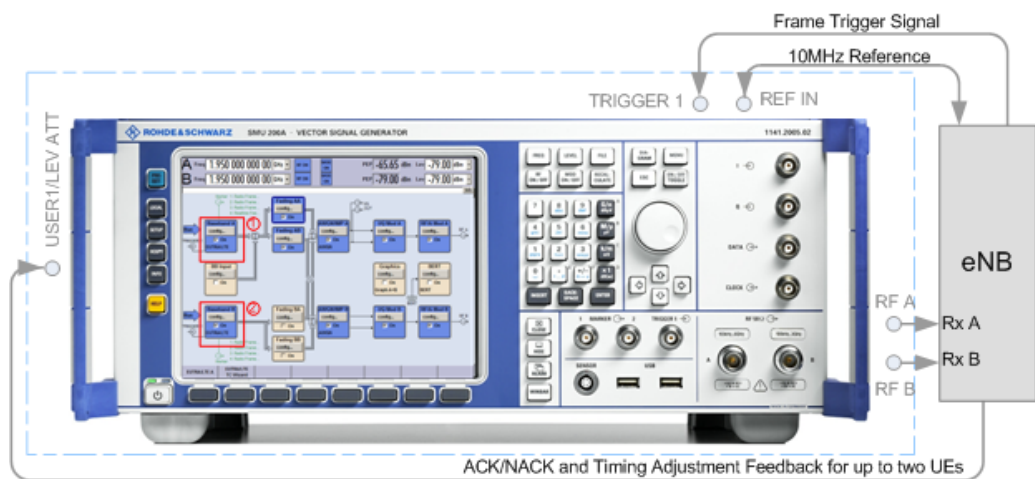
[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:FMThroughput on page 516

**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 252.
- 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 moving UE  
 2 = Baseband B generates the signal of the stationary 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 312).

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 adjusted 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**

Legend:

- UE1 (Blue)
- UE2 (Teal)
- AWGN (Orange)
- Channel BW (Grey)
- Tx BW Conf (Dark Grey)
- WS RF Freq: f = 1.950GHz (Dashed Yellow)

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:
- Offset VRB: 0
- Power Level: -82.01 dBm

**Stationary UE**

- UE ID / n\_RNTI: 2
- FRC: A7-1
- Transmit SRS:
- 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 264.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 305 and ["AWGN Configuration"](#) on page 305.

#### UE ID/n\_RNTI

Sets the UE ID/n\_RNTI.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:MUE:UEID on page 519

[ :SOURce<hw> ] :BB:EUTRa:TCW:SUE:UEID on page 519

#### 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 512

[ :SOURce<hw> ] :BB:EUTRa:TCW:SUE:TSRS on page 512

#### 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 517

[ :SOURce<hw> ] :BB:EUTRa:TCW:SUE:OVRB on page 517

#### Connector Moving UE/Stationary UE

Determines the feedback line connector (LEVATT or USER1).

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:RTF:CONMue on page 513

[ :SOURce<hw> ] :BB:EUTRa:TCW:RTF:CONSue on page 513

#### 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 513

[ :SOURce<hw> ] :BB:EUTRa:TCW:RTF:BBSSue on page 513

### 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 252.
- 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 256 (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**

**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 264.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 305 and ["AWGN Configuration"](#) on page 305.

## 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 252.
- 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 Antenna, 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 256 and [chapter 8.4.1, "Standard Test Setup - One Path"](#), on page 254 (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](#).

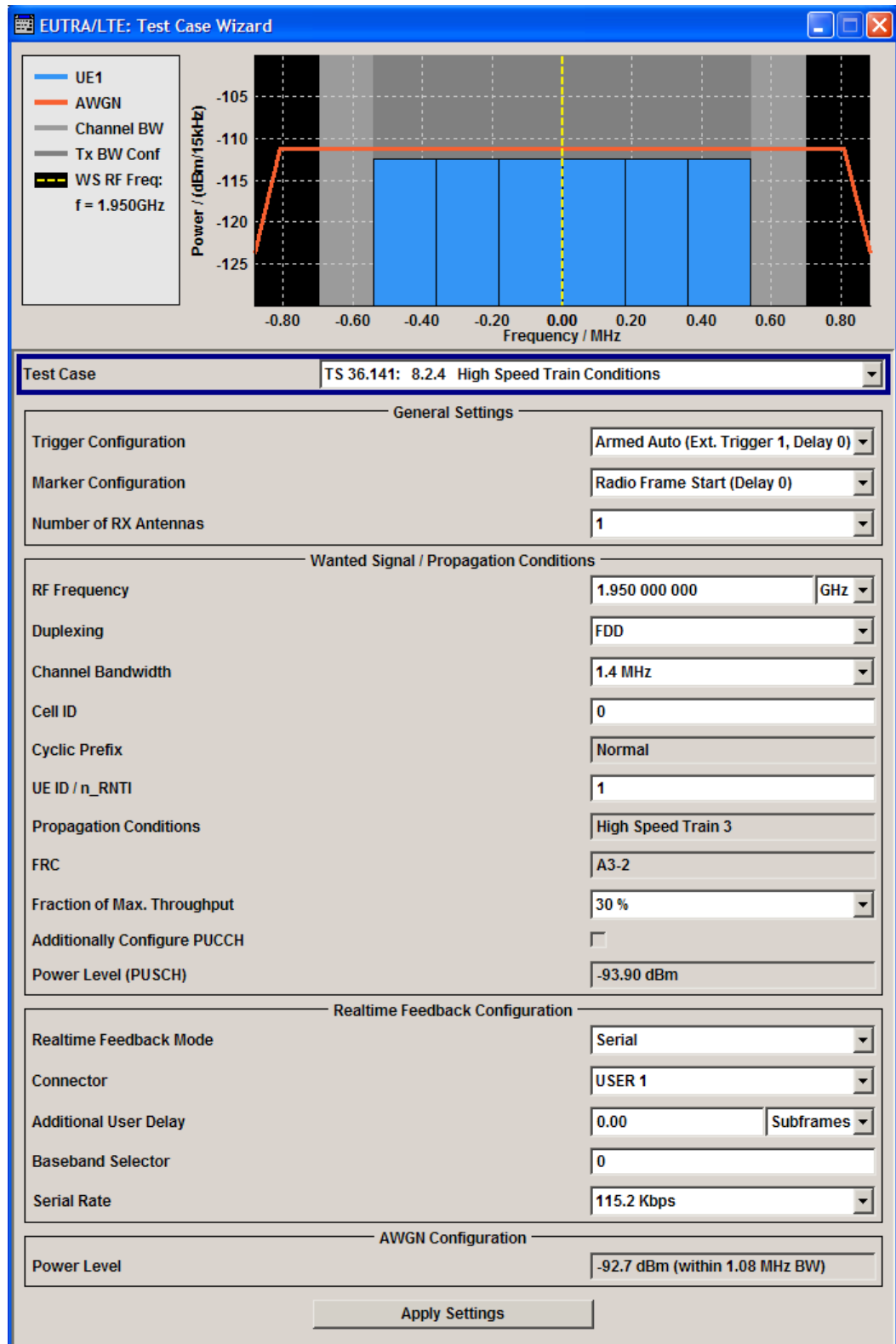
**Table 8-25: Test parameters for High Speed Train conditions**

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



The settings of the wanted signal are described in [chapter 8.6.2, "Wanted Signal and Cell Specific Settings"](#), on page 264.

For description of the propagation conditions settings and the AWGN configuration, refer to "[Propagation Conditions](#)" on page 305 and "[AWGN Configuration](#)" on page 305.

The realtime feedback settings are described in "[Realtime Feedback Configuration](#)" on page 303.

#### **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 515

#### **Power Level (PUSCH)**

Displays the resulting PUSCH power level.

SCPI command:

[ :SOURce<hw> ] :BB:EUTRa:TCW:WS:PLPS? on page 518

#### **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 518

### **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 252.
- 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 256 (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 256 (HARQ feedback line is not required).

### Short Description

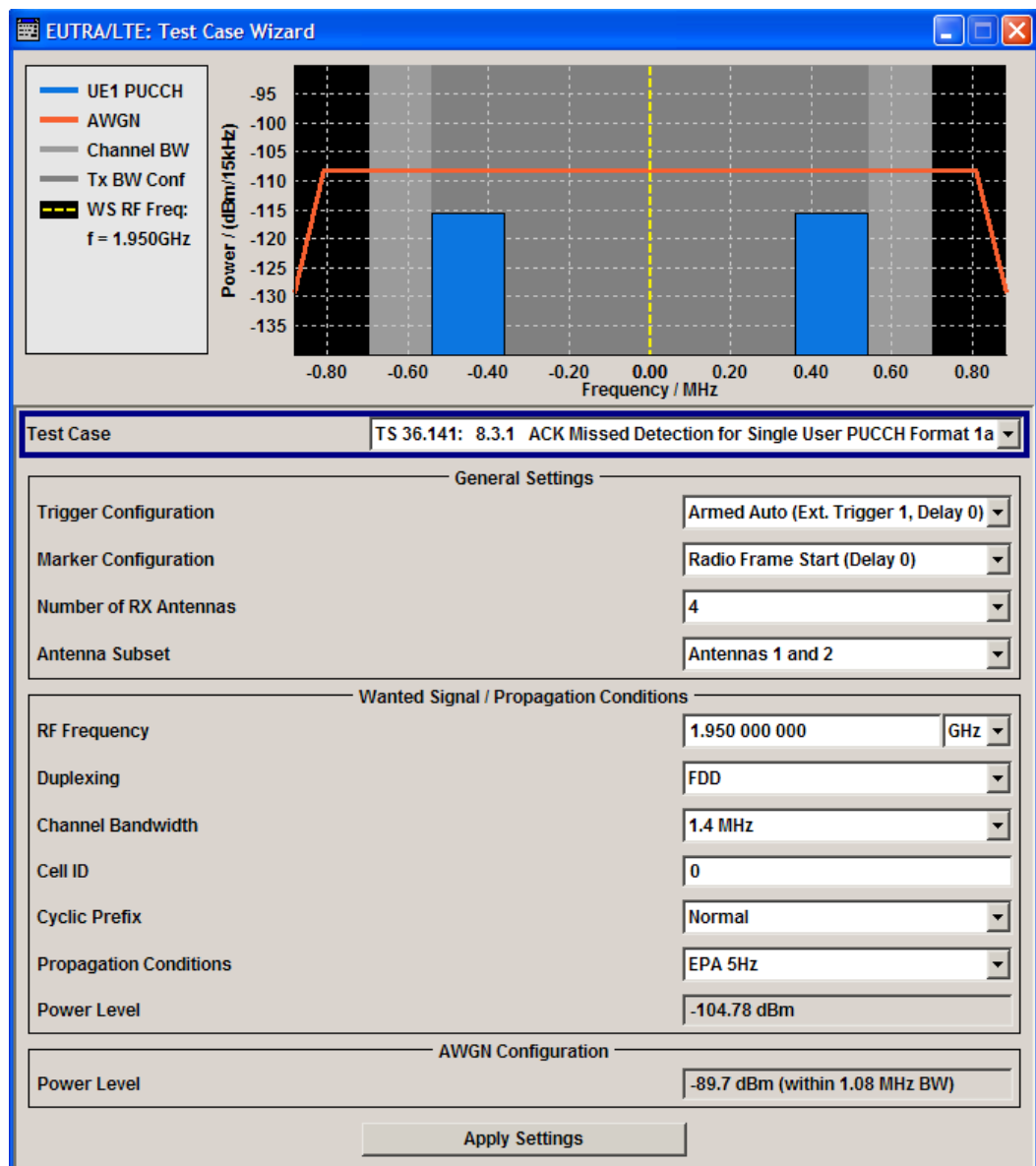
The performance requirement of single user PUCCH for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability 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=10MHz	BW=15MHz	BW=20MHz
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 264.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 305 and ["AWGN Configuration"](#) on page 305.

### 8.9.8 Test Case 8.3.2: CQI performance requirements for PUCCH format 2



#### Renamed Test Case

In 3GPP TS 36.141 versions prior to version 8.9.0 this test case was called "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 252.
- 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

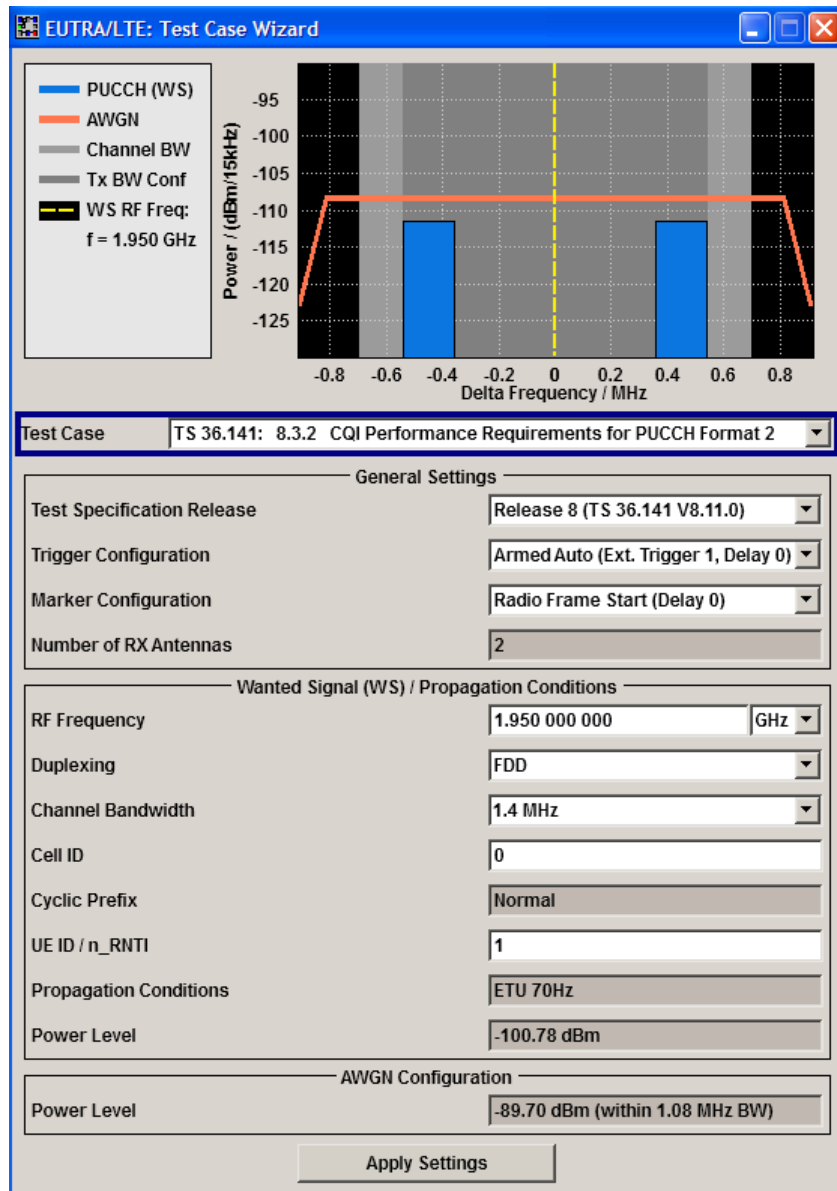
See [chapter 8.4.3, "Test Setup - Diversity Measurements"](#), on page 256 (HARQ feedback line is not required).

### Short Description

The performance requirement of PUCCH for CQI is determined by the BLER probability of detection of CQI. The performance is measured by the required SNR at BLER equal to 1%.

**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	BW=5MHz	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 264.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 305 and ["AWGN Configuration"](#) on page 305.

### 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 252.
- 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).

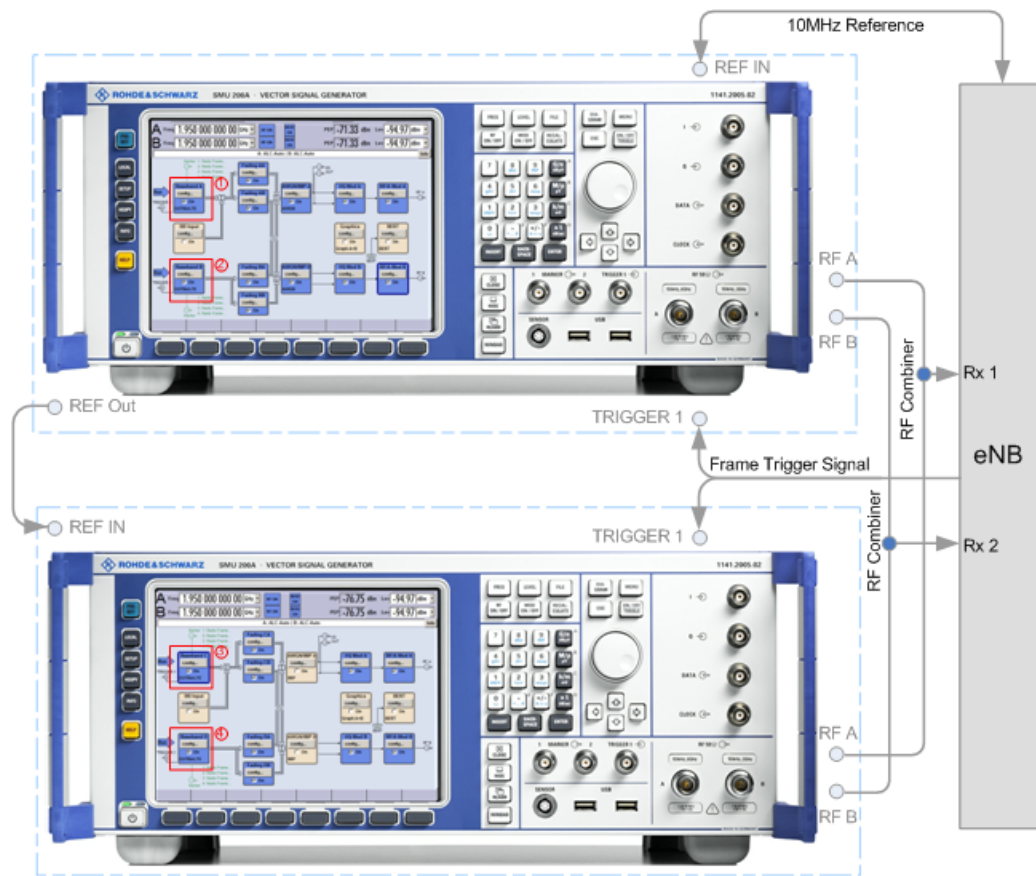


Fig. 8-13: Test Setup for test case 8.3.3 "ACK missed detection for multi user PUCCH format 1a"

- 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	Propagati-on Con- ditions	Chan. BW	Chan. BW	Chan. BW	Chan. BW	Chan. BW	Chan. BW
			1.4MHz	3MHz	5MHz	10MHz	15MHz	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](#).



In the multi user PUCCH test, the Test Case Wizard also sets the "Number of Cyclic Shifts" for the mixed format resource block ( $N_{cs}^{(1)}$ ) to 0 and the cyclic shift increment ( $\Delta_{shift}^{PUCCH}$ ) to 2, as specified in TS 36.141.

**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 264.

For description of the propagation conditions settings and the AWGN configuration, refer to ["Propagation Conditions"](#) on page 305 and ["AWGN Configuration"](#) on page 305.

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 which signals are 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 "Interferers 2 and 3".

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:GS:GENSignals](#) on page 507

### Propagation Conditions

Displays the propagation conditions of the interfering signal.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS:PRCondition?](#) on page 518

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS2:PRCondition?](#) on page 518

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS3:PRCondition?](#) on page 518

### 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 517

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS:ORTCover?](#) on page 517

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS2:ORTCover?](#) on page 517

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS3:ORTCover?](#) on page 517

### Interferer Type

Displays the type of the interfering signal.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS2:IFTYpe?](#) on page 510

### RF Frequency

Displays the center frequency of interfering signal.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS2:RFFrequency?](#) on page 511

### Power Level

Displays the power level of the interfering signals.

SCPI command:

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS2:PLevel?](#) on page 511

[\[:SOURCE<hw>\]:BB:EUTRa:TCW:IS3:PLevel?](#) on page 511



### 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 252.
- 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 256 (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 256 (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.

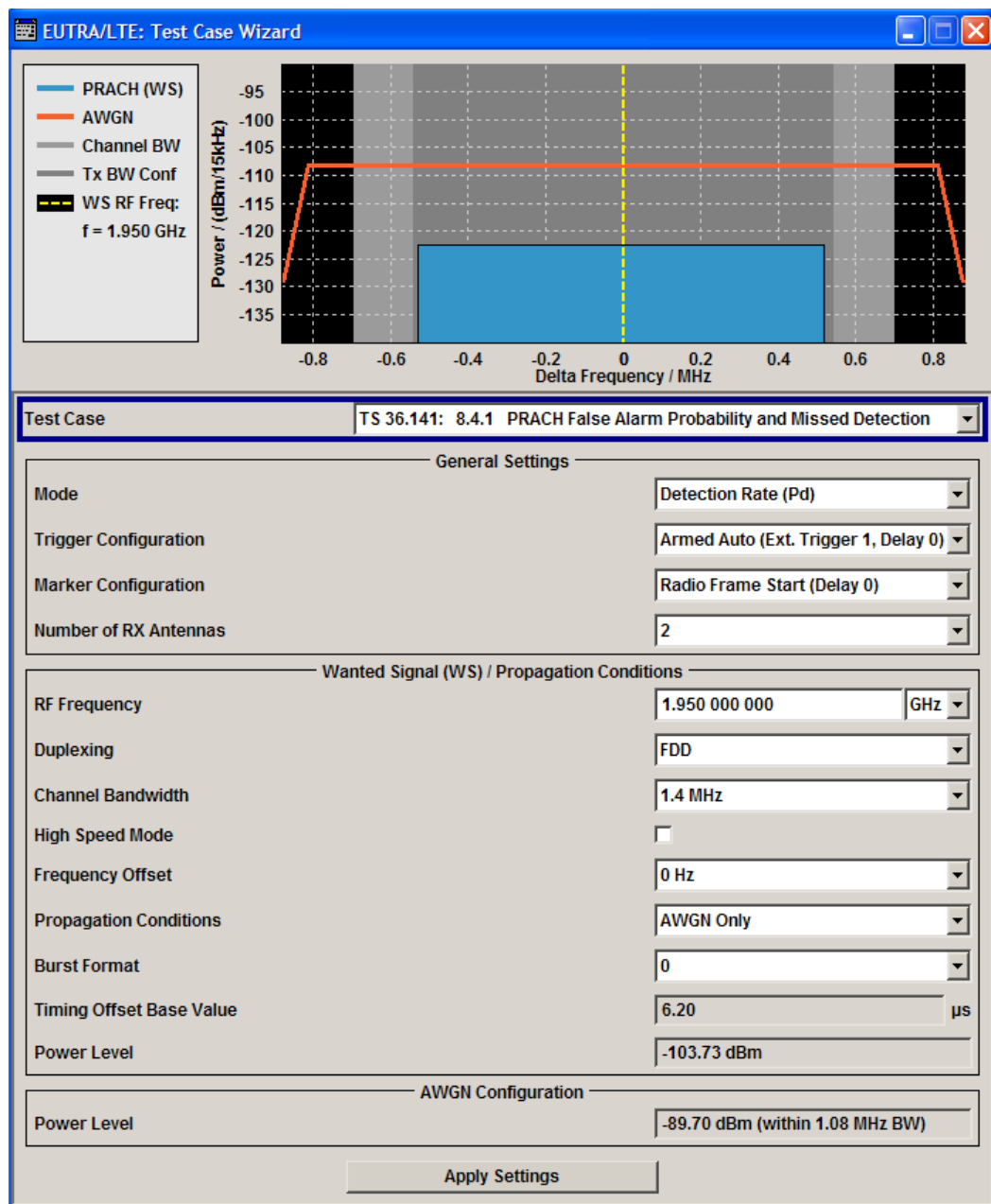
The normal mode test is applicable to all BS. The high speed mode test is applicable to high speed BS.

**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 264.

For detailed description of all available PRACH settings and the cross-reference between them, refer to [chapter 7.14.9, "PRACH Configuration"](#), on page 216.

### 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 507

### 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 519

### 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 516

### 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 516

### Burst Format

Sets the burst format (see also "[Preamble Format \(Burst Format\)](#)" on page 216).

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 515

**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 519

## 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 configuration 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

<code>[SOURce&lt;hw&gt;]:BB:EUTRa:STATE</code> .....	335
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DUPLexing</code> .....	335
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:LINK</code> .....	336
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:PRESet</code> .....	336

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SETTing:CATalog</code> .....	336
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SETTing:DEL</code> .....	337
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SETTing:LOAD</code> .....	337
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SETTing:STORE</code> .....	337
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SETTing:STORE:FAST</code> .....	337
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SETTing:TMOD:TDD</code> .....	338
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SETTing:TMOD:DL</code> .....	338
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SLENgth</code> .....	338
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:WAVeform:CREate</code> .....	338
<code>[:SOURce]:BB:EUTRa:VERSion?</code> .....	339

---

### **`[: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 for path B from inside path A, enabling the LTE signal simulation will disable all other digital standards and digital modulation modes even in the path B.

`BB:EUTR:STAT ON` deactivates the other standards and digital modulation.

#### **Parameters:**

`<State>` ON | OFF  
`*RST:` OFF

#### **Example:**

`BB:EUTR:STAT ON`  
 activates modulation in accordance with the EUTRA/LTE standard.

**Manual control:** See "[State](#)" on page 73

---

### **`[: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 signals can be generated.

**FDD**  
 Different frequencies are used for downlink and uplink directions.

`*RST:` FDD

#### **Example:**

`BB:EUTR:DUPL FDD`  
 selects frequency division duplexing.

**Manual control:** See "[Duplexing](#)" on page 77

**[[: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.

**Manual control:**    See "[Link Direction](#)" on page 77

**[[: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:PRES  
resets all the EUTRA/LTE settings to default values.

**Usage:**                Event

**Manual control:**    See "[Set to Default](#)" on page 74

**[[: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 '<root>\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.

**Manual control:**    See "[Save/Recall...](#)" on page 74



**[: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

**Manual control:** See "[Save/Recall...](#)" on page 74

**[: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`.

**Manual control:** See "[Save/Recall...](#)" on page 74

**[: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`.

**Manual control:** See "[Save/Recall...](#)" on page 74

**[:SOURce<hw>]:BB:EUTRa:SETTing:STORe:FAST <Fast>**

Determines whether the instrument performs an absolute or a differential storing of the settings.

Enable this function to accelerate the saving process by saving only the settings with values different to the default ones.

**Note:** This function is not affected by the "Preset" function.

**Parameters:**

<Fast>                    0 | 1 | OFF | ON  
                               \*RST:            ON

**Manual control:**      See "[Save/Recall...](#)" on page 74

**[ :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.

**Manual control:**      See "[EUTRA Test Models \(E-TM\) Downlink](#)" on page 92

**[ :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>                integer  
                               Range:            1 to Max. No. of Frames  
                               Increment:       1  
                               \*RST:            1

**Example:**                BB:EUTR:SLen 4  
                               selects the generation of 4 frames.

**Manual control:**      See "[Sequence Length](#)" on page 77

**[ :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.

**Note:** The sequence length of the generated ARB file is determined by the selected SFN restart period (`[ :SOURce<hw> ] :BB:EUTRa:DL:PBCH:SRPeriod`).

**Setting parameters:**

<Create> string

**Example:**

`M MEM: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

**Manual control:** See ["Generate Waveform File..."](#) on page 76

**[ :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

**Manual control:** See ["3GPP Version"](#) on page 76

## 9.2 Filter/Clipping/Power Settings

### 9.2.1 Filter Settings

<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:TYPE</code> .....	340
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:MODE</code> .....	340
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:ILENght</code> .....	340
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:ILENght:AUTO</code> .....	341
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:OSAMpling</code> .....	341
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:OSAMpling:AUTO</code> .....	341
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:APCO25</code> .....	341
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:COSSine</code> .....	342
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:COSSine:COFS</code> .....	342
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:GAUSS</code> .....	342
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:LPASS</code> .....	343
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:LPASSEVM</code> .....	343
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:LTE:COFFactor</code> .....	343
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:LTE:COFS</code> .....	344
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:LTE:OPTimization</code> .....	344
<code>[ :SOURce&lt;hw&gt; ] :BB:EUTRa:FILTer:PARAmeter:LTE:ROFactor</code> .....	344

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:FILTer:PARAmeter:PGAuss</code> .....	344
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:FILTer:PARAmeter:RCOSine</code> .....	345
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:FILTer:PARAmeter:SPHase</code> .....	345
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:FILTer:PARAmeter:USER</code> .....	345
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:SRATe:VARiation</code> .....	346

---

### `[:SOURce<hw>]:BB:EUTRa:FILTer:TYPE <Type>`

Selects the baseband filter type.

#### Parameters:

<Type>                   RCOSine | COSine | GAUSSs | LGAuss | CONE | COF705 |  
 COEqualizer | COFequalizer | C2K3x | RECTangle | PGAuss |  
 LPASs | DIRac | ENPShape | EWPSshape | LTEFilter |  
 LPASSEVM | SPHase | APCO25 | USER  
 \*RST:            COSine

**Example:**            `BB:EUTR:FILT:TYPE COS`  
 sets the baseband filter type.

**Manual control:**    See "[Filter](#)" on page 230

---

### `[: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.

**Manual control:**    See "[Filter Mode](#)" on page 233

---

### `[: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>               integer  
 Range:            1 to 128  
 Increment:       1  
 \*RST:            10

**Example:**            `BB:EUTR:FILT:ILEN 10`  
 sets the number of filter tabs to 10.

**Manual control:**    See "[Impulse Length](#)" on page 234

---

**[[:SOURce<hw>]:BB:EUTRa:FILTer:ILENth: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.

**Manual control:** See "[Impulse Length](#)" on page 234

---

**[[:SOURce<hw>]:BB:EUTRa:FILTer:OSAMpling <Osampling>**

**Note:** This command is available for WinIQSIM2 only.

Sets the upsampling factor.

**Parameters:**

<Osampling> integer  
Range: 1 to 32  
Increment: 1  
\*RST: 32

**Example:** BB:EUTR:FILT:OSAM 32  
sets the upsampling factor to 32.

**Manual control:** See "[Oversampling](#)" on page 234

---

**[[: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.

**Manual control:** See "[Oversampling](#)" on page 234

---

**[[: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  
 Increment: 0.01  
 \*RST: 0.20

**Example:**

BB:EUTR:FILT:PAR:APCO25 0.06  
 the roll-off factor is set to 0.06.

**Manual control:** See ["Roll Off Factor or BxT"](#) on page 231

**[:SOURCE<hw>]:BB:EUTRa:FILTer:PARAmeter:COsine <Cosine>**

Sets the roll-off factor for the Cosine filter type.

**Parameters:**

<Cosine> float  
 Range: 0.00 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.

**Manual control:** See ["Roll Off Factor or BxT"](#) on page 231

**[: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: -0.20

**Example:**

BB:EUTR:FILT:PAR:COS:COFS 0.04  
 the "cut of frequency shift" value is set to 0.04.

**Manual control:** See ["Cut Off Frequency Shift"](#) on page 232

**[: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  
 Increment: 0.01  
 \*RST: 0.50

**Example:** BB:EUTR:FILT:PAR:GAUS 0.5  
the BxT is set to 0.5.

**Manual control:** See ["Roll Off Factor or BxT"](#) on page 231

**[[:SOURce<hw>]:BB:EUTRa:FILT:PAR: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.

**Manual control:** See ["Cut Off Frequency Factor"](#) on page 233

**[[:SOURce<hw>]:BB:EUTRa:FILT:PAR: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.

**Manual control:** See ["Cut Off Frequency Factor"](#) on page 233

**[[:SOURce<hw>]:BB:EUTRa:FILT:PAR: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.

**Manual control:** See ["Cut Off Frequency Factor"](#) on page 233

---

**[: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.

**Manual control:** See ["Cut Off Frequency Shift"](#) on page 232

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:OPTimization <Optimization>**

Defines the applied EUTRA/LTE filter. Available are EVM, ACP, ACPN (ACP Narrow), STD (a trade-off between ACP and EVM) and BENU (Best EVM, no upsampling).

**Parameters:**

<Optimization> STD | EVM | ACP | ACPN | BENU  
 \*RST: EVM

**Example:** BB:EUTR:FILT:PAR:LTE:OPT ACPN  
 selects ACP (Narrow) optimization.

**Manual control:** See ["Optimization"](#) on page 230

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:ROFactor <Rofactor>**

Sets the roll-off factor for the LTE filter type.

**Parameters:**

<Rofactor> float  
 Range: 0.00 to 1.0  
 Increment: 0.01  
 \*RST: 0.1

**Example:** BB:EUTR:FILT:PAR:LTE:ROF 0.2  
 the roll-off factor is set to 0.2.

**Manual control:** See ["Roll Off Factor or BxT"](#) on page 231

---

**[:SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:PGAuss <Pgauss>**

Sets the BxT for the Gauss filter type (pure).



**Parameters:**

<Pgauss> float  
 Range: 0.15 to 2.50  
 Increment: 0.01  
 \*RST: 0.50

**Example:**

BB:EUTR:FILT:PAR:PGA 0.5  
 the BxT is set to 0.5.

**Manual control:** See ["Roll Off Factor or BxT"](#) on page 231

**[:SOURCE<hw>]:BB:EUTRa:FILT:PAR:RCOSine <Rcosine>**

Sets the roll-off factor for the Root Cosine filter type.

**Parameters:**

<Rcosine> float  
 Range: 0.0 to 1.0  
 Increment: 0.01  
 \*RST: 0.22

**Example:**

BB:EUTR:FILT:PAR:RCOS 0.4  
 the roll-off factor is set to 0.4.

**Manual control:** See ["Roll Off Factor or BxT"](#) on page 231

**[: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  
 Increment: 0.01  
 \*RST: 2.00

**Example:**

BB:EUTR:FILT:PAR:SPH 2  
 the BxT is set to 2.0

**Manual control:** See ["Roll Off Factor or BxT"](#) on page 231

**[:SOURCE<hw>]:BB:EUTRa:FILT:PAR:USER <User>**

The command selects the user-defined filter (\* .vaf).

The directory applicable to the following command is defined with the command `MMEemory: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 eutra_user_filter`  
selects the user-defined filter.

**Manual control:** See "[Load User Filter](#)" on page 231

**[: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.

**Manual control:** See "[Sample Rate Variation](#)" on page 233

## 9.2.2 Clipping Settings

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:CLIPping:LEVel</a> .....	346
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:CLIPping:MODE</a> .....	347
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:CLIPping:STATE</a> .....	347

**[: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> integer  
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.

**Manual control:** See "[Clipping Level](#)" on page 234

**[ :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.

**Manual control:** See "[Clipping Mode](#)" on page 235

**[ :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.

**Manual control:** See "[Clipping State](#)" on page 234

### 9.2.3 Power Settings

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TDW:STATe.....</a>	348
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TDW:TRTime.....</a>	348
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:POWC:LEVReference.....</a>	348
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:POWC:ORTLevel.....</a>	349

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:POWC:REFChannel.....</a>	<a href="#">349</a>
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:POWC:REFSubframe?.....</a>	<a href="#">350</a>
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:POWC:RUE?.....</a>	<a href="#">350</a>

---

### **[:SOURce<hw>]:BB:EUTRa:TDW:STATe <State>**

Activates/deactivates the time domain windowing.

#### **Parameters:**

<State>                    ON | OFF  
 \*RST:                    OFF

**Example:**                BB:EUTRa:TDW:STAT ON  
 activates time domain windowing.

**Manual control:**        See "[State \(Time Domain Windowing\)](#)" on page 229

---

### **[: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:EUTRa:TDW:TDT 2us  
 sets the transition time to 2us.

**Manual control:**        See "[Transition Time](#)" on page 230

---

### **[: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 sub-frame of a certain UE.

\*RST: FRMS

**Example:**

BB:EUTR:POWC:LEVR UEB

sets level reference to UE Burst RMS Power

**Manual control:**

See "[Level Reference](#)" on page 235

**[ :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: 0.001dB  
 \*RST: 0dB

**Example:**

BB:EUTR:POWC:ORTL -1.0 dB

sets the power offset of the baseband part

**Manual control:**

See "[Power Offset relative to Level Display](#)" on page 235

**[ :SOURce<hw>]:BB:EUTRa:POWC:REFChannel <Refchannel>**

Queries the channel type the measured RMS and PEP is referring to, if the Level Reference is set to "UE Burst RMS Power"

**Parameters:**

<Refchannel> NF | PUSCH | PUCCH | PRACH | SRS | PUCPUS  
 \*RST: NF

**Example:** `BB:EUTR:POWC:LEVR UEB`  
sets level reference to UE Burst RMS Power  
`BB:EUTR:POWC:RUE?`  
queries the channel type

**Manual control:** See ["Reference Channel"](#) on page 236

#### **[:SOURCE<hw>]:BB:EUTRa:POWC:REFSubframe?**

Queries the subframe the measured RMS and PEP is referring to, if the Level Reference is set to "UE Burst RMS Power"

**Return values:**  
<Refsubframe> integer  
Range: 0 to 39  
Increment: 1  
\*RST: 0

**Example:** `BB:EUTR:POWC:LEVR UEB`  
sets level reference to UE Burst RMS Power  
`BB:EUTR:POWC:REFS?`  
queries the reference subframe

**Usage:** Query only

**Manual control:** See ["Reference Subframe"](#) on page 236

#### **[:SOURCE<hw>]:BB:EUTRa:POWC:RUE?**

Queries the UE the measured RMS and PEP is referring to, if the Level Reference is set to "UE Burst RMS Power".

**Return values:**  
<Rue> UE1 | UE2 | UE3 | UE4  
\*RST: UE1

**Example:** `BB:EUTR:POWC:LEVR UEB`  
sets level reference to UE Burst RMS Power  
`BB:EUTR:POWC:RUE?`  
queries the reference UE

**Usage:** Query only

**Manual control:** See ["Reference UE"](#) on page 236

## 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.

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:MODE</code> .....	351
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:CUSTom</code> .....	351
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:SOURce</code> .....	352
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:MULTiplier</code> .....	352
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:SYNChronization:EXECute</code> .....	353
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:CLOCK:SYNChronization:MODE</code> .....	353

**`[: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.

**Manual control:** See "Clock Mode" on page 247

**`[: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  
 Increment: 0.000001  
 \*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.

**Manual control:** See "[Custom External Clock](#)" on page 248

**[: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:EURa: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:

**Manual control:** See "[Clock Source](#)" on page 247

**[: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> integer  
 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.
- Manual control:** See "[Clock Multiplier](#)" on page 248

### `[:SOURce<hw>]:BB:EUTRa:CLOCK:SYNChronization:EXECute`

For R&S SMBV only

Performs automatic 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

**NONE**

The instrument is working in stand-alone mode.

**MASTer**

The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.

**SLAVE**

The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

\*RST: NONE

- Example:** `BB:EUTR:CLOC:SYNC:MODE MAST`  
the instrument is configured to work as a master one.
- Manual control:** See "[Sync. Mode](#)" on page 246

## 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>            NTA0 | NTA624 | 0  
\*RST:                NTA0

**Example:** `BB:EUTR:TIMC:NTA NTA0`  
sets parameter  $N_{TA\ offset}$

**Manual control:** See "[Signal Advance N\\_TA\\_offset](#)" on page 243

## 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.

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa[:TRIGger]:SEQUence</code>	355
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:ARM:EXECute</code>	355
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:DElay:UNIT</code>	356
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:EXECute</code>	356
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:EXternal&lt;ch&gt;:RDElay?</code>	356
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:EXternal&lt;ch&gt;:TDElay</code>	357
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:EXternal:SYNChronize:OUTPut</code>	357
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OBASeband:DElay</code>	358
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OBASeband:INHibit</code>	358
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OBASeband:RDElay?</code>	358
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OBASeband:TDElay</code>	359
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:RMODE?</code>	359
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:SLENgth</code>	360
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:SLUNit</code>	360

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:SOURce</code> .....	361
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger[:EXTErnal&lt;ch&gt;]:DELay</code> .....	362
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger[:EXTErnal&lt;ch&gt;]:INHibit</code> .....	362

---

### `[:SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence <Sequence>`

Selects the trigger mode.

#### Parameters:

<Sequence>

AUTO | RETRigger | AAUTo | ARETrigger | SINGle

#### **AUTO**

The modulation signal is generated continuously.

#### **RETRigger**

The modulation signal is generated continuously. A trigger event (internal or external) causes a restart.

#### **AAUTo**

The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command

`BB:EUTR:TRIG:ARM:EXEC` and started again when a trigger event occurs.

This mode is used for example for Base Station Tests if a frame marker from the device under test starts the signal output. Subsequent frame markers will not cause a restart of the signal.

#### **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.

#### Manual control:

See "[Trigger Mode](#)" on page 238

---

### `[: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

**Manual control:** See ["Arm"](#) on page 78

**[:SOURce<hw>]:BB:EUTRa:TRIGger:DELay:UNIT <DelUnit>**

Defines the unit of the external and other baseband trigger delay.

**Parameters:**

<DelUnit> SAMPLE | TIME  
\*RST: SAMPLE

**Example:**

```
BB:EUTR:TRIG:DEL:UNIT SAMP
sets the external trigger delay to samples.
```

**Manual control:** See ["Trigger Delay Unit"](#) on page 242

**[: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

**Manual control:** See ["Execute Trigger"](#) on page 78

**[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:RDELay?**

Queries the actual external trigger delay (expressed in time unit).

**Return values:**

<ExtRDelay> float  
 Range: 0 to 688  
 Increment: 250E-12  
 \*RST: 0

**Example:**

BB:EUTR:TRIG:EXT:RDEL?  
 Response: 5.12E-6 the resulting delay of the external trigger signal is 5.12 micro seconds.

**Usage:**

Query only

**Manual control:**

See "[Actual External Delay](#)" on page 242

**[[:SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:TDELay <ExtTDelay>**

Defines the trigger delay (expressed in time units) for external triggering.

**Parameters:**

<ExtTDelay> float  
 Range: 0 to 688  
 Increment: 250E-12  
 \*RST: 0

**Example:**

BB:EUTR:TRIG:EXT:TDEL 5E-6  
 sets a delay of 5 micro seconds for the trigger.

**Manual control:**

See "[Trigger Delay](#)" on page 242

**[[: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 240 for a detailed description of the applications of this setting.

**Parameters:**

<Output> 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

**Manual control:** See "[Sync. Output to External Trigger](#)" on page 240

**[: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:**

<Delay> integer  
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.

**Manual control:** See "[Trigger Delay](#)" on page 242

**[: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:**

<Inhibit> integer  
Range: 0 to  $2^{26}-1$   
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.

**Manual control:** See "[Trigger Inhibit](#)" on page 242

**[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:RDELay?**

Queries the actual trigger delay (expressed in time units) of the trigger signal from the second path (two-path instruments only).

**Return values:**

<IntOthRDelay> float  
 Range: 0 to 688  
 Increment: 250E-12  
 \*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:RDEL?  
 Response: 3.2E-6 the resulting delay of the internal trigger signal is 3.2 micro seconds.

**Usage:** Query only

**Manual control:** See "[Actual External Delay](#)" on page 242

**[[:SOURce<hw>]:BB:EUTRa:TRIGger:OBASband:TDElay <IntOthTDelay>**

Specifies the trigger delay (expressed in time units) for triggering by the trigger signal from the second path (two-path instruments only).

**Parameters:**

<IntOthTDelay> float  
 Range: 0 to 688  
 Increment: 250E-12  
 \*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:TDEL 1.5E-6  
 sets a delay of 1.5 micro seconds for the trigger.

**Manual control:** See "[Trigger Delay](#)" on page 242

**[[: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:RMOD?`  
queries the current status of signal generation.  
Response: RUN  
the signal is generated, an external trigger was executed.

**Usage:** Query only

**Manual control:** See ["Running/Stopped"](#) on page 239

---

**[: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> integer  
Range: 1 to 4294967295  
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

**Manual control:** See ["Signal Duration"](#) on page 239

---

**[: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:**

&lt;Slunit&gt;

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.

**Manual control:**See "[Signal Duration Unit](#)" on page 239

---

**[[:SOURce<hw>]:BB:EUTRa:TRIGger:SOURce <Source>**

Selects the trigger source.

**Parameters:**

&lt;Source&gt;

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.

**Manual control:** See "[Trigger Source](#)" on page 240

**[:SOURce<hw>]:BB:EUTRa:TRIGger[:EXTernal<ch>]:DELay <Delay>**

Specifies the trigger delay (expressed as a number of samples) for external triggering.

**Parameters:**

<Delay> integer  
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.

**Manual control:** See "[Trigger Delay](#)" on page 242

**[: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> integer  
Range: 0 to  $2^{26}-1$   
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.

**Manual control:** See "[Trigger Inhibit](#)" on page 242

## 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.

<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut:DELay:FIXed</code> .....	363
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:DELay</code> .....	363
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:DELay:MAXimum?</code> .....	364
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:DELay:MINimum?</code> .....	364
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:MODE</code> .....	364
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:FOFFset</code> .....	366
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:ROFFset</code> .....	366
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:OFFTime</code> .....	366
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:ONTime</code> .....	366
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:TRIGger:OUTPut&lt;ch&gt;:PERiod</code> .....	366

---

### **`[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:EUTRa:TRIG:OUTP:DEL:FIX ON`  
 restricts the marker signal delay setting range to the dynamic range.

**Manual control:**        See "[Fix marker delay to current range](#)" on page 246

---

### **`[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>                    integer  
 Range:                    0 samples to 2<sup>24</sup>-1 samples  
 Increment:                1 sample  
 \*RST:                    0 samples

#### **Example:**

`BB:EUTRa:TRIG:OUTP2:DEL 1600`  
 sets a delay of 1600 samples for the signal on connector MARKER 2.

**Manual control:**        See "[Marker x Delay](#)" on page 246

**[[: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> integer  
Range: 0 to max

**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

**Manual control:** See "[Current Range without Recalculation](#)" on page 246

**[[: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> integer  
Range: 0 to max

**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

**Manual control:** See "[Current Range without Recalculation](#)" on page 246

**[[:SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE <Mode>**

Defines the signal for the selected marker output.

**Parameters:**

&lt;Mode&gt;

SUBFram | FRAM | REStart | PERiod | RATio | FAP | INTernal

**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`.

**FAP**

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.

**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 366.

**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.

**INTernal**

Special marker signal for the real time feedback mode ([chapter 6, "Realtime Feedback for Closed Loop BS Tests"](#), on page 61) or for SFN Restart Period "3GPP (1024 Frames)".

\*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.

**Manual control:** See "[Marker Mode](#)" on page 244

**[: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> integer  
 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.

**Manual control:** See "[Rise/Fall Offset](#)" on page 245

**[: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> integer  
 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.

**Manual control:** See "[Marker Mode](#)" on page 244

**[: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> unsigned integer  
 Range: 1 sample 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.
```

**Manual control:** See "[Marker Mode](#)" on page 244

## 9.7 General EUTRA/LTE Settings

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TDD:SPSConf</a> .....	367
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TDD:UDConf</a> .....	367

---

**[\[:SOURce<hw>\]: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> integer  
 Range: 0 to 8  
 Increment: 1  
 \*RST: 0

**Example:**

```
BB:EUTR:TDD:SPSC 2
sets the special subframe configuration
```

**Manual control:** See "[Configuration of Special Subframes](#)" on page 115

---

**[\[:SOURce<hw>\]: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> integer  
 Range: 0 to 6  
 Increment: 1  
 \*RST: 0

**Example:** BB:EUTR:TDD:UDC 2  
sets the UL/DL configuration

**Manual control:** See "[UL/DL Configuration](#)" on page 115

## 9.8 General EUTRA/LTE Downlink Settings

[SOURce<hw>]:BB:EUTRa:DL:CONF:MODE.....	369
[SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFIguration.....	369
[SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna.....	369
[SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTA.....	370
[SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTB.....	370
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP4:TX<ch>:IMAGinary.....	370
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP4:TX<ch>:REAL.....	370
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP6:TX<ch>:IMAGinary.....	371
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP6:TX<ch>:REAL.....	371
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates.....	371
[SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer.....	371
[SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE.....	371
[SOURce<hw>]:BB:EUTRa:DL:SYNC:TXANtenna.....	372
[SOURce<hw>]:BB:EUTRa:DL:SYNC:PPOWer.....	372
[SOURce<hw>]:BB:EUTRa:DL:SYNC:SPOWer.....	372
[SOURce<hw>]:BB:EUTRa:DL:BW.....	372
[SOURce<hw>]:BB:EUTRa:DL:NORB.....	373
[SOURce<hw>]:BB:EUTRa:DL:SRATe?.....	373
[SOURce<hw>]:BB:EUTRa:DL:FFT.....	373
[SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth?.....	374
[SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers?.....	374
[SOURce<hw>]:BB:EUTRa:DL:LGS?.....	374
[SOURce<hw>]:BB:EUTRa:DL:RGS?.....	375
[SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CID.....	375
[SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CIDGroup.....	376
[SOURce<hw>]:BB:EUTRa:DL[:PLCi]:PLID.....	376
[SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARNTi.....	376
[SOURce<hw>]:BB:EUTRa:DL:CPC.....	377
[SOURce<hw>]:BB:EUTRa:DL:PBCH:RATBa.....	377
[SOURce<hw>]:BB:EUTRa:DL:PDCCh:RATBa.....	377
[SOURce<hw>]:BB:EUTRa:DL:PDSCh:PB.....	378
[SOURce<hw>]:BB:EUTRa:DL:PDSCh:RATBa.....	378
[SOURce<hw>]:BB:EUTRa:DL:PHICH:DURation.....	378
[SOURce<hw>]:BB:EUTRa:DL:PHICH:NGParameter.....	379
[SOURce<hw>]:BB:EUTRa:DL:PRSS:BW.....	379
[SOURce<hw>]:BB:EUTRa:DL:PRSS:CI.....	379
[SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS?.....	380
[SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS.....	380
[SOURce<hw>]:BB:EUTRa:DL:PRSS:POW.....	380
[SOURce<hw>]:BB:EUTRa:DL:PRSS:STATE.....	380
[SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS?.....	381



---

**[ :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 manually 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 115.

\*RST:                      MANual

**Example:**

BB:EUTRa: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.

**Manual control:**        See "[PDSCH Scheduling](#)" on page 115

---

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MIMO:CONFIguration <Configuration>**

Sets the global MIMO configuration.

**Parameters:**

<Configuration>            TX1 | TX2 | TX4 | SIBF

\*RST:                      TX1

**Example:**

BB:EUTRa:DL:MIMO:CONF TX2

sets the MIMO configuration to 2 TxAntennas.

**Manual control:**        See "[Global MIMO Configuration](#)" on page 116

---

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MIMO:ANTenna <Antenna>**

Queries the simulated antenna.

This command is allowed for simulation mode set to 1 Tx Antenna only.

**Parameters:**

<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

**Manual control:** See "[Simulated Antenna](#)" on page 117

**[: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 | NONE | ALL  
\*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.

**Manual control:** See "[Simulated Antenna Path A](#)" on page 117

**[: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.

**Manual control:** See "[Simulated Antenna Path B](#)" on page 117

**[:SOURCE<hw>]:BB:EUTRa:DL:MIMO:APM:AP4:TX<ch>:IMAGinary <Imaginary>**  
**[:SOURCE<hw>]:BB:EUTRa:DL:MIMO:APM:AP4:TX<ch>:REAL <Real>**

**[ :SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP6:TX<ch>:IMAGinary <Imaginary>**  
**[ :SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP6:TX<ch>:REAL <Real>**

These commands define the mapping of the antenna ports (AP4 and AP6) to the physical antennas.

**Parameters:**

<Real> float  
 Range: -1.00 to 1.00  
 Increment: 0.01  
 \*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Antenna Port Mapping \(General DL Settings\)](#)" on page 170

**[ :SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates <MapCoord>**

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

**Parameters:**

<MapCoord> CARTesian | CYLindrical  
 \*RST: CART

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Antenna Port Mapping \(General DL Settings\)](#)" on page 170

**[ :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: 0.001 dB  
 \*RST: 0.00 dB

**Example:** BB:EUTRa:DL:REFSig:POWER -10.00  
 sets the reference signal power to -10.00dB.

**Manual control:** See "[Reference Signal Power](#)" on page 122

**[ :SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE <Epre>**

Queries the RS Power per RE relative to Level Display.

**Parameters:**

<Epre> float  
 Range: -80.00 dB to 10.00 dB  
 Increment: 0.001 dB  
 \*RST: 0.00 dB

**Example:** `BB:EUTR:DL:REFS:EPRE?`  
queries the RS Power per RE relative to Level Display.

**Manual control:** See ["RS Power per RE relative to Level Display"](#) on page 122

**[: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> ANT1 | ANT2 | ANT3 | ANT4 | NONE | ALL  
\*RST: ALL

**Example:** `BB:EUTR:DL:SYNC:TXAN ALL`  
enables all antenna ports to transmit P-/S-SYNC

**Manual control:** See ["P-/S-SYNC Tx Antenna"](#) on page 122

**[: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: 0.001 dB  
\*RST: 0 dB

**Example:** `BB:EUTR:DL:SYNC:PPOWer -10.00`  
sets the P-SYNC power to -10.00dB.

**Manual control:** See ["P-SYNC Power"](#) on page 122

**[: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: 0.001 dB  
\*RST: 0 dB

**Example:** `BB:EUTR:DL:SYNC:SPOWer -10.00`  
sets the S-SYNC power to -10.00dB.

**Manual control:** See ["S-SYNC Power"](#) on page 122

**[: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 BW20\_00

**Manual control:**

See "[Channel Bandwidth](#)" on page 113

**[:SOURCE<hw>]:BB:EUTRa:DL:NORB <Norb>**

Selects the number of physical resource blocks per slot.

**Parameters:**

<Norb> integer  
 Range: 6 to 110  
 Increment: 1  
 \*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.

**Manual control:**

See "[Number of Resource Blocks Per Slot](#)" on page 113

**[: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

**Manual control:**

See "[Sampling Rate](#)" on page 114

**[:SOURCE<hw>]:BB:EUTRa:DL:FFT <Fft>**

Sets the FFT (Fast Fourier Transformation) size. The available values depend on the selected number of resource blocks per slot.

**Parameters:**

<Fft> integer  
 Range: 128 to 2048  
 \*RST: 1024

**Example:**

BB:EUTR:DL:FFT?  
 displays the automatically set fast Fourier transformation parameter.

**Manual control:** See ["FFT Size"](#) on page 114

**[: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 19.815 MHz  
 \*RST: 9.015 MHz

**Example:**

BB:EUTR:DL:OCCB?  
 displays the automatically set occupied bandwidth in downlink.

**Usage:** Query only

**Manual control:** See ["Occupied Bandwidth"](#) on page 114

**[: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> integer  
 Range: 72 to 1321  
 \*RST: 601

**Example:**

BB:EUTR:DL:OCCS?  
 displays the number of occupied subcarriers.

**Usage:** Query only

**Manual control:** See ["Number Of Occupied Subcarriers"](#) on page 114

**[: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> integer  
 Range: 28 to 364  
 \*RST: 212

**Example:**

BB:EUTR:DL:LGS?  
 displays the number of left guard subcarriers.

**Usage:**

Query only

**Manual control:**

See "[Number Of Left Guard Subcarriers](#)" on page 114

**[ :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.

**Return values:**

<Rgs> integer  
 Range: 27 to 364  
 \*RST: 211

**Example:**

BB:EUTR:DL:RGS?  
 displays the number of right guard subcarriers.

**Usage:**

Query only

**Manual control:**

See "[Number Of Right Guard Subcarriers](#)" on page 114

**[ :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  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:DL:PLC:CID 100  
 sets the Cell ID.

**Manual control:**

See "[Cell ID](#)" on page 118

---

**[ :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>                    integer  
                                  Range:        0 to 167  
                                  Increment: 1  
                                  \*RST:        0

**Example:**                    BB:EUTR:DL:PLC:CIDG 100  
                                  sets the ID of the physical cell identity group.

**Manual control:**            See "[Physical Cell ID Group](#)" on page 118

---

**[ :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>                            integer  
                                  Range:        0 to 2  
                                  Increment: 1  
                                  \*RST:        0

**Example:**                    BB:EUTR:DL:PLC:PLID 2  
                                  sets the identity of the physical layer.

**Manual control:**            See "[Physical Layer ID](#)" on page 119

---

**[ :SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARnti <Rarnti>**

Sets the random-access response identity RA-RNTI.

The value selected here determines the value of the parameter "UE\_ID/n\_RNTI" in case a RA\_RNTI "User" is selected.

**Parameters:**

<Rarnti>                         integer  
                                  Range:        1 to 60  
                                  Increment: 1  
                                  \*RST:        1

**Example:**                    BB:EUTR:DL:PLC:CSET:RARN 5  
                                  sets the RA-RNTI

**Manual control:**            See "[RA\\_RNTI](#)" on page 121



---

**[[: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 used in 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 used in subframe 6 in downlink.  
 BB:EUTR:DL:SUBF1:CYCP EXT  
 an extended prefix is used in subframe 1 in downlink.

**Manual control:**    See "[Cyclic Prefix \(General DL Settings\)](#)" on page 119

---

**[[: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<sub>B</sub>) and such not containing one (P<sub>A</sub>).

**Parameters:**

<Ratba>                 float  
 Range:                -10.00 to 10.00  
 Increment:           0.001  
 \*RST:                 0  
 Default unit: dB

**Example:**

BB:EUTR:DL:PBCH:RATB -5.0  
 sets the transmit energie ratio

**Manual control:**    See "[PBCH Ratio rho<sub>B</sub>/rho<sub>A</sub>](#)" on page 120

---

**[[:SOURce<hw>]:BB:EUTRa:DL:PDCCCh:RATBa <Ratba>**

Sets the transmit energy ratio among the resource elements allocated for PDCCH in the OFDM symbols containing reference signal (P<sub>B</sub>) and such not containing one (P<sub>A</sub>).

**Parameters:**

<Ratba>                 float  
 Range:                -10.00 dB to 10.00 dB  
 Increment:           0.001  
 \*RST:                 0 dB

**Example:**

BB:EUTR:DL:PDCC:RATB -5.0  
 sets the transmit energie ratio

**Manual control:**    See "[PDCCH Ratio rho<sub>B</sub>/rho<sub>A</sub>](#)" on page 120

**[ :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> integer  
 Range: 0 to 3  
 Increment: 1  
 \*RST: 0

**Example:** BB:EUTRa:DL:PDsch:PB 1  
 sets the parameter PDSCH P\_B

**Manual control:** See "PDSCH P\_B" on page 119

**[ :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  
 Increment: 0.001  
 \*RST: 0 dB

**Example:** BB:EUTRa:DL:PDsch:RATBa -5.0  
 sets the transmit energie ratio

**Manual control:** See "PDSCH Ratio  $\rho_B/\rho_A$ " on page 119

**[ :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

**Manual control:** See "[PHICH Duration](#)" on page 120

**[ :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 433).

**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:EUTR:DL:PHIC:NGP NG1\_2  
sets PHICH N\_g

**Manual control:** See "[PHICH N\\_g](#)" on page 120

**[ :SOURce<hw>]:BB:EUTRa:DL:PRSS:BW <PrsBandwidth>**

Defines the RBs in which the PRS is transmitted.

**Parameters:**

<PrsBandwidth> BW1\_40 | BW3\_00 | BW5\_00 | BW10\_00 | BW15\_00 | BW20\_00

\*RST: BW1\_40

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[PRS Bandwidth](#)" on page 124

**[ :SOURce<hw>]:BB:EUTRa:DL:PRSS:CI <ConfIdx>**

Sets the PRS Configuration Index I<sub>PRS</sub> as defined in 3GPP TS 36.211, table 6.10.4.3-1.

**Parameters:**

<ConfIdx> integer

Range: 0 to 2399

Increment: 1

\*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["PRS Configuration Index"](#) on page 124

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS?**

Queries the subframe offset of the PRS generation ( $\Delta_{\text{PRS}}$ ) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

**Return values:**

<DeltaPRS> integer  
 Range: 0 to 1279  
 Increment: 1  
 \*RST: 0

**Usage:** Query only

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["PRS Subframe offset Delta\\_PRS"](#) on page 124

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS <NPRS>**

Defines the number of consecutive DL subframes in that PRS are transmitted.

**Parameters:**

<NPRS> integer  
 Range: 1 to 6  
 \*RST: 1

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["Number of PRS DL Subframes \(N\\_PRS\)"](#) on page 124

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:POW <PrsPower>**

Sets the power of a PRS resource element relative to the power of a common reference signal resource element.

**Parameters:**

<PrsPower> float  
 Range: -80.000 to 10.000  
 Increment: 0.001  
 \*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["PRS Power"](#) on page 124

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe <PrsState>**

Enables the generation of the PRS.

**Parameters:**

<PrsState> 0 | 1 | OFF | ON  
 \*RST: OFF

**Options:**

R&S SMx/AMU-K84/-K284

**Manual control:**

See "PRS State" on page 123

**[:SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS? <TPRS>**

Queries the periodicity of the PRS generation ( $T_{PRS}$ ) as defined in 3GPP TS 36.211, table 6.10.4.3-1.

**Parameters:**

<TPRS> integer  
 Range: 160 to 1280  
 \*RST: 160

**Usage:**

Query only

**Options:**

R&S SMx/AMU-K84/-K284

**Manual control:**

See "PRS Periodicity  $T_{PRS}$ " on page 124

## 9.9 General EUTRA/LTE Uplink Settings

[:SOURce<hw>]:BB:EUTRa:UL:BW.....	382
[:SOURce<hw>]:BB:EUTRa:UL:NORB.....	382
[:SOURce<hw>]:BB:EUTRa:UL:SRATE.....	382
[:SOURce<hw>]:BB:EUTRa:UL:FFT.....	383
[:SOURce<hw>]:BB:EUTRa:UL:OCCBandwidth?.....	383
[:SOURce<hw>]:BB:EUTRa:UL:OCCSubcarriers?.....	383
[:SOURce<hw>]:BB:EUTRa:UL:LGS?.....	384
[:SOURce<hw>]:BB:EUTRa:UL:RGS?.....	384
[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CID.....	384
[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:CIDGroup.....	385
[:SOURce<hw>]:BB:EUTRa:UL[:PLCi]:PLID.....	385
[:SOURce<hw>]:BB:EUTRa:UL:CPC.....	385
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:GRPHopping.....	386
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SEQHopping.....	386
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DSSHift.....	386
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:DMRS.....	387
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx.....	387
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:MUPTs.....	387
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS.....	388
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:DSFC?.....	388
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:SUConfiguration.....	388
[:SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:TSFC?.....	389
[:SOURce<hw>]:BB:EUTRa:UL:PRACH:CONFIguration.....	389
[:SOURce<hw>]:BB:EUTRa:UL:PRACH:FOFFset.....	389

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PRACH:RSET</code> .....	390
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUSCh:FHMode</code> .....	390
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUSCh:FHOFFset</code> .....	390
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUSCh:NOSM</code> .....	391
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:NORB</code> .....	391
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:DESHift</code> .....	391
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:DEOffset</code> .....	392
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:N1CS</code> .....	392
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:N2RB</code> .....	392
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:N1NMax</code> .....	393
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:N1EMax</code> .....	393
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:N2Max</code> .....	393
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:PUCCh:N3Max</code> .....	394

---

### `[: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_40`  
 selects a uplink frequency band of 1.4 MHz.

**Manual control:** See "[Channel Bandwidth \(UL\)](#)" on page 175

---

### `[:SOURce<hw>]:BB:EUTRa:UL:NORB <Norb>`

Selects the number of physical resource blocks per slot.

#### Parameters:

`<Norb>` integer  
 Range: 6 to 110  
 Increment: 1  
 \*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.

**Manual control:** See "[Number of Resource Blocks Per Slot \(UL\)](#)" on page 176

---

### `[:SOURce<hw>]:BB:EUTRa:UL:SRATe <Srate>`

Queries the sampling rate. The value for the sampling rate is set automatically according to the selected number of resource blocks per slot.

**Parameters:**

<Srate> float  
 Range: 1.92 MHz to 30.72 MHz  
 Increment: 0.001 MHz  
 \*RST: 15.36 MHz

**Example:**

BB:EUTR:UL:SRAT?  
 displays the automatically set sampling rate.

**Manual control:**

See "[Sampling Rate \(UL\)](#)" on page 176

**[: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> integer  
 Range: 128 to 2048  
 \*RST: 1024

**Example:**

BB:EUTR:UL:FFT?  
 displays the automatically set FFT size.

**Manual control:**

See "[FFT Size \(UL\)](#)" on page 176

**[: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: 1.080 to 19.800  
 \*RST: 9.000  
 Default unit: MHz

**Example:**

BB:EUTR:UL:OCCB?  
 displays the automatically set occupied bandwidth in uplink.

**Usage:**

Query only

**Manual control:**

See "[Occupied Bandwidth \(UL\)](#)" on page 176

**[: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> integer  
 Range: 72 to 1320  
 \*RST: 600

**Example:**

BB:EUTR:UL:OCCS?  
 displays the number of occupied subcarriers.

**Usage:**

Query only

**Manual control:**

See "[Number Of Occupied Subcarriers \(UL\)](#)" on page 177

**[: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> integer  
 Range: 28 to 364  
 \*RST: 212

**Example:**

BB:EUTR:UL:LGS?  
 displays the number of left guard subcarriers.

**Usage:**

Query only

**Manual control:**

See "[Number Of Left Guard Subcarriers \(UL\)](#)" on page 177

**[: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> integer  
 Range: 28 to 364  
 \*RST: 212

**Example:**

BB:EUTR:UL:RGS?  
 displays the number of right guard subcarriers.

**Usage:**

Query only

**Manual control:**

See "[Number Of Right Guard Subcarriers \(UL\)](#)" on page 177

**[: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> integer  
 Range: 0 to 503  
 Increment: 1  
 \*RST: 0

**Example:** `BB:EUTR:UL:PLC:CID 100`  
 sets the Cell ID.

**Manual control:** See "Cell ID (UL)" on page 178

`[ :SOURce<hw> ] :BB:EUTRa:UL[:PLCi]:CIDGroup <Cidgroup>`

Sets the ID of the physical cell identity group.

**Parameters:**

<Cidgroup> integer  
 Range: 0 to 167  
 Increment: 1  
 \*RST: 0

**Example:** `BB:EUTR:UL:PLC:CIDG 100`  
 sets the UL physical cell ID group

**Manual control:** See "Physical Cell ID Group (UL)" on page 178

`[ :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> integer  
 Range: 0 to 2  
 Increment: 1  
 \*RST: 0

**Example:** `BB:EUTR:UL:PLC:PLID 2`  
 sets the UL physical layer ID

**Manual control:** See "Physical Layer ID (UL)" on page 178

`[ :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 used in 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 used in subframe 6 in uplink.  
 BB:EUTR:UL:SUBF1:CYCP EXT  
 an extended prefix is used in subframe 1 in uplink.

**Manual control:**

See "[Cyclic Prefix \(General UL Settings\)](#)" on page 178

**[: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

**Manual control:**

See "[Group Hopping](#)" on page 179

**[: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

**Manual control:**

See "[Sequence Hopping](#)" on page 179

**[: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> integer  
 Range: 0 to 29  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:REFS:DSSH 3  
 sets the delta sequence shift for PUSCH

**Manual control:**

See "[Delta Sequence Shift for PUSCH](#)" on page 179

**[: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> integer  
 Range: 0 to 11  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:REFS:DMRS 4  
 sets the demodulation reference signal index to 4

**Manual control:**

See "[n\(1\)\\_DMRS](#)" on page 179

**[:SOURCE<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx <Anstx>**

Enables/disables simultaneous transmission of SRS (sounding reference signal) and ACK/NACK messages, i.e. transmission of SRS and PUCCH in the same subframe.

**Parameters:**

<Anstx> 0 | 1 | OFF | ON  
 \*RST: OFF

**Example:**

BB:EUTR:UL:REFS:SRS:ANST ON

**Manual control:**

See "[A/N + SRS simultaneous Tx](#)" on page 185

**[: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:EUTRa:UL:REFS:SRS:MUPT ON  
 enables the parameter srsMaxUpPts

**Manual control:**

See "[SRS MaxUpPTS](#)" on page 185

**[ :SOURCE<hw> ]:BB:EUTRa:UL:REFSig:SRS:CSRS <Csrs>**

Sets the cell specific parameter SRS Bandwidth Configuration ( $C_{SRS}$ ).

**Parameters:**

<Csrs> integer  
 Range: 0 to 7  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTRa:UL:REFS:SRS:CSRS 4  
 sets the SRS bandwidth configuration

**Manual control:**

See "[SRS Bandwidth Configuration C\\_SRS](#)" on page 185

**[ :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:EUTRa:UL:REFS:SRS:SUC 4  
 sets the SRS configuration  
 BB:EUTRa:UL:REFS:SRS:DSFC?  
 queries the  $\Delta_{SFC}$  parameter

**Usage:**

Query only

**Manual control:**

See "[Transmission Offset  \$\Delta\_{SFC}\$](#) " on page 185

**[ :SOURCE<hw> ]:BB:EUTRa:UL:REFSig:SRS:SUConfiguration <Suconfiguration>**

Sets the cell specific parameter SRS subframe configuration.

**Parameters:**

<Suconfiguration> integer  
 Range: 0 to 15  
 Increment: 1  
 \*RST: 0

**Example:** `BB:EUTR:UL:REFS:SRS:SUC 4`  
sets the SRS configuration

**Manual control:** See "[SRS Subframe Configuration](#)" on page 185

#### **[ :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:**

<Tsfc> 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

**Manual control:** See "[Configuration Period  \$T\_{SFC}\$](#) " on page 185

#### **[ :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 time and frequency resources in which random access preamble transmission is allowed.

**Parameters:**

<Configuration> integer  
Range: 0 to 63  
Increment: 1  
\*RST: 0

**Example:** `BB:EUTR:UL:PRAC:CONF 10`  
sets the PRACH configuration

**Manual control:** See "[PRACH Configuration](#)" on page 180

#### **[ :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> integer  
 Range: 0 to 104  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:PRAC:FOFF 2  
 sets the frequency offset

**Manual control:** See "[PRACH Frequency Offset](#)" on page 180

**[: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

**Manual control:** See "[Restricted Set \(High Speed Mode\)](#)" on page 181

**[: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

**Manual control:** See "[Frequency Hopping Mode](#)" on page 181

**[: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> integer  
 Range: 0 to max  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:PUSC:FHOF 2  
 set the PUSCH hopping offset

**Manual control:** See "[PUSCH Hopping Offset](#)" on page 182

**[: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> integer  
 Range: 1 to 4  
 Increment: 1  
 \*RST: 4

**Example:**

BB:EUTR:UL:PUSC:NOSM 3  
 sets the number of sub-bands

**Manual control:** See "[Number of Sub-bands](#)" on page 182

**[: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> integer  
 Range: 0 to 110  
 Increment: 1  
 \*RST: 4

**Example:**

BB:EUTR:UL:PUCCh:NORB 3  
 reserves 3 RBs for PUCCH

**Manual control:** See "[Number of RBs used for PUCCH](#)" on page 182

**[:SOURCE<hw>]:BB:EUTRa:UL:PUCCh:DESHift <Deshift>**

Sets the delta shift parameter.

**Parameters:**

<Deshift> integer  
 Range: 1 to 3  
 Increment: 1  
 \*RST: 2

**Example:**

BB:EUTR:PUCC:DESH 3  
 sets the delta shift parameter

**Manual control:**

See "[Delta Shift](#)" on page 183

**[: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> integer  
 Range: 0 to 2  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:PUCC:DEOF 1  
 sets the delta offset

**Manual control:**

See "[Delta Offset](#)" on page 183

**[: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> integer  
 Range: 0 to 8  
 Increment: 1  
 \*RST: 6

**Example:**

BB:EUTR:UL:PUCC: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

**Manual control:**

See "[N\(1\)\\_cs](#)" on page 183

**[: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> integer  
 Range: 0 to 5  
 Increment: 1  
 \*RST: 1

**Example:**

BB:EUTR:UL:PUCCH:N2RB 3  
 reserves 3 RB for PUCCH formats 2/2a/2b

**Manual control:**

See "[N\(2\)\\_RB](#)" on page 184

**[:SOURCE<hw>]:BB:EUTRa:UL:PUCCh:N1NMax <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.

**Parameters:**

<N1nmax> integer  
 Range: 0 to 2639  
 Increment: 1  
 \*RST: 44

**Example:**

BB:EUTR:UL:PUCCH:N1NM?  
 queries the range of the possible PUCCH formats 1/1a/1b transmissions.  
 Response: 24

**Manual control:**

See "[Range n\(1\)\\_PUCCH \(Normal CP\)](#)" on page 184

**[:SOURCE<hw>]:BB:EUTRa:UL:PUCCh:N1EMax <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.

**Parameters:**

<N1emax> integer  
 Range: 0 to 2639  
 Increment: 1  
 \*RST: 29

**Example:**

BB:EUTR:UL:PUCCH:N1EM?  
 queries the range of the possible PUCCH formats 1/1a/1b transmissions.  
 Response: 10

**Manual control:**

See "[Range n\(1\)\\_PUCCH \(Extended CP\)](#)" on page 184

**[:SOURCE<hw>]:BB:EUTRa:UL:PUCCh:N2Max <N2max>**

Queries the range of possible number of PUCCH format 2/2a/2b transmissions from different users in one subframe.

**Parameters:**

**<N2max>** integer  
 Range: 0 to 1319  
 Increment: 1  
 \*RST: 15

**Example:**

BB:EUTR:UL:PUCCH:N2M?  
 queries the range of the possible PUCCH formats 2/2a/2b transmissions.  
 Response: 16

**Manual control:** See "Range n(2)\_PUCCH" on page 184

**[:SOURCE<hw>]:BB:EUTRa:UL:PUCCh:N3Max <N3max>**

Queries the range of possible number of PUCCH format 3 transmissions from different users in one subframe.

**Parameters:**

**<N3max>** integer  
 Range: 0 to 549  
 Increment: 1  
 \*RST: 19

**Manual control:** See "Range n(3)\_PUCCH" on page 184

## 9.10 DL Frame Configuration

**SUBF<st0>**

Defines the subframe number. Value range  $\langle st0 \rangle = 0 \dots 39$ . The maximum value depends on the selected sequence length (see `[ :SOURCE<hw> ] :BB:EUTRa:SLENgth` on page 338).

**ALLoc<ch0>**

Determines the allocation number.

Value range

- for subframes with PBCH, i.e. SUBF0, SUBF10, SUBF20 and SUBF30:  
 $\langle ch0 \rangle = 0 \dots 111$
- for all other subframes:  
 $\langle ch0 \rangle = 0 \dots 110$

**CW<user>**

Determines the code word. Value range  $\langle user \rangle = 1 | 2$

<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL:VIEW:MODE</code> .....	395
<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL:BUR</code> .....	395
<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL:CONSubframes</code> .....	396
<code>[ :SOURCE&lt;hw&gt; ] :BB:EUTRa:DL:RSTFrame</code> .....	396

<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL:SFSelection</code> .....	396
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:CYCPrefix</code> .....	396
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALCount</code> .....	397
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:CODWords</code> .....	397
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:MODulation</code> .....	398
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:GAP</code> .....	398
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:RBCount</code> .....	399
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:SYMCount</code> .....	399
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:RBOffset</code> .....	400
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:SYMoffset</code> .....	400
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:AOC</code> .....	401
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:PHYSbits?</code> .....	401
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:DATA</code> .....	402
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:PATTern</code> .....	402
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:DSElect</code> .....	402
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:POWER</code> .....	403
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:CONTType</code> .....	403
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:STATE</code> .....	404
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;[:CW&lt;user&gt;]:CONFLICT?</code> .....	404
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:TXM</code> .....	404
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:UEC</code> .....	405
<code>[SOURce&lt;hw&gt;]:BB:EUTRa:DL[:SUBF&lt;st0&gt;]:USER&lt;ch&gt;:PHYSbits?</code> .....	405

---

#### `[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

**Manual control:** See "[View Mode](#)" on page 174

---

#### `[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:EUTRa:DL:BUR DUD`  
 the unscheduled resource elements are filled with dummy data.

**Manual control:** See "[Behavior In Unscheduled REs \(OCNG\)](#)" on page 126

**[[: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>      integer  
                          Range:      1 to 40  
                          Increment: 1  
                          \*RST:      10

**Example:**            BB:EUTR:DL:CONS 10  
 ten subframes are configurable in downlink.

**Manual control:**    See "[No Of Configurable \(DL\) Subframes](#)" on page 125

**[[: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

**Manual control:**    See "[Reset Subframe Configuration](#)" on page 125

**[[:SOURce<hw>]:BB:EUTRa:DL:SfSelection <Sfselection>**

Sets the subframes to be configured in the resource allocation table.

**Parameters:**

<Sfselection>        integer  
                          Range:      0 to 39  
                          Increment: 1  
                          \*RST:      0

**Example:**            BB:EUTR:DL:SFS 0  
 displays subframe 0 in the allocation list view.

**Manual control:**    See "[Subframe Selection](#)" on page 126

**[[: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 used in subframe 6 in downlink.

**Manual control:**    See "[Cyclic Prefix](#)" on page 126

**[: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>                integer  
 Range:                0 to 112  
 Increment:            1  
 \*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.

**Manual control:**    See "[No. Of Used Allocations](#)" on page 126

**[: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  
 Increment:            1  
 \*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
```

**Manual control:** See "[Codeword](#)" on page 127

**[: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
```

**Manual control:** See "[Mod.](#)" on page 128

**[: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>	integer
	<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
Increment:	0
*RST:	0

**Example:**

```
SOUR:BB:EUTR:DL:BW BW10_00
SOUR:BB:EUTR:SUBF0:ALL2:GAP2
```

**Manual control:** See "[VRB Gap](#)" on page 128

**[: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>	integer
Range:	0 to 110
Increment:	1
*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.

**Manual control:** See "[No. RB \(Resource Blocks\)](#)" on page 130

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLOc<ch0>[:CW<user>]:SYMCCount <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> integer  
 Range: 1 to 14  
 Increment: 1  
 \*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

**Manual control:** See "No. Sym." on page 131

**[: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> integer  
 Range: 0 to 109  
 Increment: 1  
 \*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.

**Manual control:** See "Offs RB" on page 131

**[: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 Cyclic 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> integer  
 Range: 0 to 13  
 Increment: 1  
 \*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.

**Manual control:** See "Offs Sym." on page 132

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC  
 <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.

**Manual control:** See "Auto" on page 132

**[: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> integer  
 Range: 0 to 105600  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF4:ALL5: CW:PHYS?  
 queries the number of physical bits for allocation five in subframe four.

**Usage:** Query only

**Manual control:** See "Phys. Bits" on page 132

---

```
[ :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 419).

```
*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
```

**Manual control:**

See "[Data List Management](#)" on page 75

---

```
[ :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.
```

**Manual control:**

See "[DList/Pattern](#)" on page 133

---

```
[ :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.

`MMEMoRY: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`.

**Manual control:**        See ["Data List Management"](#) on page 75

**[ :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:                0.001 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

**Manual control:**        See ["Rho A"](#) on page 133

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

Selects the type for the selected allocation.

PBCH can be configured in subframe 0 only.

**Parameters:**

<Contype> PDSCh | PBCH | PDCCh | RSVD | PMCH  
\*RST: PDSCh

**Example:**

BB:EUTR:DL:SUBF4:ALL5:CW:CONT PDSCh  
selects PDSCH as type for the selected allocation.

**Options:**

PMCH requires R&S SMx/AMU-K84/-K284

**Manual control:**

See "[Content Type \(DL\)](#)" on page 133

**[: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.

**Manual control:**

See "[State \(allocation\)](#)" on page 133

**[: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

**Manual control:**

See "[Conflict](#)" on page 133

**[:SOURCE<hw>]:BB:EUTRa:DL:USER<ch>:TXM <TxMode>**

(enabled for "Auto/DCI" scheduling mode)

Sets the transmission mode of the according user as defined in 3GPP TS 36.213, section 7.1.

**Parameters:**

<TxMode> USER | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8  
\*RST: USER

**Options:** Tx Mode 8 requires R&S SMx/AMU-K84/-K284

**Manual control:** See ["Tx Mode"](#) on page 167

**[:SOURCE<hw>]:BB:EUTRa:DL:USER<ch>:UEC <UECategory>**

Sets the UE Category.

**Parameters:**

<UECategory> USER | C1 | C2 | C3 | C5 | C4

\*RST: USER

**Manual control:** See ["UE Category"](#) on page 167

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:USER<ch>:PHYSbits?**

Queries the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority.

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 "Physical Bits" of all single allocations that belong to the same user in the selected subframe.

**Return values:**

<Phybits> integer

Range: 0 to 100000

Increment: 1

\*RST: 0

**Example:** BB:EUTRa:DL:SUBF1:USER3:PHYS?  
queries the number of physical bits

**Usage:** Query only

**Manual control:** See ["Number of Physical Bits \(DL\)"](#) on page 140

## 9.11 DL MBFSN Settings

**PMCH<ch0>**

Defines the PM channel number. Value range <ch0>= 0 .. 15.

<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:ID.....</a>	406
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAL?.....</a>	406
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA.....</a>	407
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLIST.....</a>	407
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS.....</a>	407
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation?.....</a>	407
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER.....</a>	408
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset.....</a>	408
<a href="#">[:SOURCE&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern.....</a>	408

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC</code> .....	408
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI</code> .....	409
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS</code> .....	409
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATtern</code> .....	409
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER</code> .....	409
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATE</code> .....	410
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize?</code> .....	410
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:NIND</code> .....	410
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:AI:NMRL</code> .....	410
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:MODE</code> .....	411
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:MTCH:CSAP</code> .....	411
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs</code> .....	411
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:PMCH&lt;ch0&gt;:DATA</code> .....	412
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:PMCH&lt;ch0&gt;:DLIST</code> .....	412
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:PMCH&lt;ch0&gt;:MCS</code> .....	412
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:PMCH&lt;ch0&gt;:PATtern</code> .....	412
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:PMCH&lt;ch0&gt;:SPERiod</code> .....	413
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:PMCH&lt;ch0&gt;:SASart</code> .....	413
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:PMCH&lt;ch0&gt;:SAENd</code> .....	413
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:RHOA</code> .....	413
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:SC:AMODE</code> .....	413
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:SC:AOffset</code> .....	414
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:SC:APER</code> .....	414
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:SC:AVAl</code> .....	414
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:MBSFn:UEC</code> .....	414

---

**`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:ID <AreaID>`**

Defines the MBSFN area ID, parameter  $N_{id}^{MBSFN}$ .

**Parameters:**

`<AreaID>` integer  
 Range: 0 to 255  
 Increment: 1  
 \*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102

---

**`[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAl? <AllocationValue>`**

Indicates the subframes of the radio frames indicated by the "MCCH repetition period" and the "MCCH offset", that may carry MCCH.

**Parameters:**

`<AllocationValue>` float  
 \*RST: 0

**Usage:** Query only

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

**[ :SOURCE<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA <DataSource>**

Sets the data source used for the MCCH.

**Parameters:**

<DataSource> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATtern |  
DLISt | ZERO | ONE  
\*RST: PN9

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

**[ :SOURCE<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt <DataList>**

Sets the data list used as data source for MCCH.

**Parameters:**

<DataList> string

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

**[ :SOURCE<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS <MCS>**

Defines the Modulation and Coding Scheme (MCS) applicable for the subframes indicated by the "MCCH Allocation value" and for the first subframe of each MCH scheduling period (which may contain the MCH scheduling information provided by MAC).

**Parameters:**

<MCS> MCS19 | MCS13 | MCS7 | MCS2  
\*RST: MCS2

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

**[ :SOURCE<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation? <Modulation>**

Displays the values as determined by the "MCCH MCS".

**Parameters:**

<Modulation> QPSK | QAM16 | QAM64  
\*RST: QPSK

**Usage:** Query only

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

---

**[ :SOURCE<hw> ] : BB : EUTRa : DL : MBSFn : AI : MCCH : MPER <ModifPeriod>**

Sets the MCCH Modification Period.

**Parameters:**

<ModifPeriod> MP512 | MP1024  
\*RST: MP512

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102

---

**[ :SOURCE<hw> ] : BB : EUTRa : DL : MBSFn : AI : MCCH : NOFFset <NotifOffset>**

Defines, together with the [\[ :SOURCE<hw> \] : BB : EUTRa : DL : MBSFn : AI : MCCH : NRC](#), the radio frames in which the MCCH information change notification is scheduled.

**Parameters:**

<NotifOffset> integer  
Range: 0 to 10  
Increment: 1  
\*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102

---

**[ :SOURCE<hw> ] : BB : EUTRa : DL : MBSFn : AI : MCCH : NPATtern <NotifPattern>**

Sets the pattern for the notification bits sent on PDCCH DCI format 1c.

**Parameters:**

<NotifPattern> integer  
\*RST: #H1,2

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102

---

**[ :SOURCE<hw> ] : BB : EUTRa : DL : MBSFn : AI : MCCH : NRC <NRC>**

Selects the current change notification repetition period common for all MCCHs that are configured.

**Parameters:**

<NRC> NRC2 | NRC4  
\*RST: NRC2

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102



**[ :SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI <Index>**

Defines the subframe used to transmit MCCH change notifications on PDCCH.

In FDD: Value 1, 2, 3, 4, 5 and 6 correspond with subframe #1, #2, #3, #6, #7 and #8 respectively

In TDD: Value 1, 2, 3, 4 and 5 correspond with subframe #3, #4, #7, #8 and #9 respectively

**Parameters:**

<Index> integer  
 Range: 0 to 10  
 Increment: 1  
 \*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102

**[ :SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS <McchOffset>**

Indicates, together with the [\[ :SOURce<hw>\]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER](#), the radio frames in which MCCH is scheduled.

**Parameters:**

<McchOffset> integer  
 Range: 0 to 10  
 Increment: 1  
 \*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102

**[ :SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATtern <Pattern>**

Sets the pattern used as data source for the MCCH.

**Parameters:**

<Pattern> integer  
 \*RST: #H0,1

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102

**[ :SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER <RepetPeriod>**

Defines the interval between transmissions of MCCH information in radio frames.

**Parameters:**

<RepetPeriod> RP64 | RP32 | RP128 | RP256  
 \*RST: RP32

**Options:** R&S SMx/AMU-K84/-K284  
**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATE <McchState>**

Enables/disables the MCCH.

**Parameters:**  
 <McchState> 0 | 1 | OFF | ON  
 \*RST: OFF

**Options:** R&S SMx/AMU-K84/-K284  
**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize? <TB\_Size>**

Displays the values as determined by the "MCCH MCS".

**Parameters:**  
 <TB\_Size> integer

**Usage:** Query only

**Options:** R&S SMx/AMU-K84/-K284  
**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MBSFn:AI:NIND <NotifIndicator>**

Defines which PDCCH bit is used to notify the UE about change of the MCCH applicable for this MBSFN area.

**Parameters:**  
 <NotifIndicator> integer  
 Range: 0 to 7  
 Increment: 1  
 \*RST: 0

**Options:** R&S SMx/AMU-K84/-K284  
**Manual control:** See ["Area Info \(SIB Type 13\)"](#) on page 102

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MBSFn:AI:NMRL <RegionLength>**

Defines how many symbols from the beginning of the subframe constitute the non-MBSFN region.

**Parameters:**

<RegionLength> integer  
 Range: 1 to 2  
 Increment: 1  
 \*RST: 2

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Area Info \(SIB Type 13\)](#)" on page 102

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MBSFn:MODE <MbsfnMode>**

Enables the MBSFN transmission and selects a mixed MBSFN Mode, i.e. the available subframes are shared between MBSFN and regular LTE operation.

**Parameters:**

<MbsfnMode> OFF | MIXed  
 \*RST: OFF

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[MBSFN Mode](#)" on page 101

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MBSFn:MTCH:CSAP <AllocPeriod>**

Defines the period during which resources corresponding with field *commonSF-Alloc* are divided between the (P)MCH that are configured for this MBSFN area.

**Parameters:**

<AllocPeriod> AP4 | AP8 | AP16 | AP32 | AP64 | AP128 | AP256  
 \*RST: AP4

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[PMCH Structure](#)" on page 106

**[ :SOURCE<hw> ]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs <NumOfPMCHs>**

Defines the number of PMCHs in this MBSFN area.

**Parameters:**

<NumOfPMCHs> int  
 Range: 1 to 15  
 Increment: 1  
 \*RST: 1

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[PMCH Structure](#)" on page 106

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA <DataSource>**

Sets the data source for the selected PMCH/MTCH.

**Parameters:**

<DataSource>      PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATtern |  
DLISt | ZERO | ONE  
\*RST:            PN9

**Options:**            R&S SMx/AMU-K84/-K284

**Manual control:**    See "[PMCH Structure](#)" on page 106

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt <DataList>**

Sets the data list of the data source for the selected PMCH/MTCH.

**Parameters:**

<DataList>            string

**Options:**            R&S SMx/AMU-K84/-K284

**Manual control:**    See "[PMCH Structure](#)" on page 106

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS <MCS>**

Defines the value for parameter according to [5] Table 7.1.7.1-1, which defines the Modulation and Coding Scheme (MCS) applicable for the subframes of this (P)MCH as indicated by the field *commonSF-Alloc*.

**Parameters:**

<MCS>                integer  
Range:            0 to 28  
Increment:        1  
\*RST:            2

**Options:**            R&S SMx/AMU-K84/-K284

**Manual control:**    See "[PMCH Structure](#)" on page 106

---

**[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATtern <Pattern>**

Sets the pattern of the data source for the selected PMCH/MTCH.

**Parameters:**

<Pattern>            integer  
\*RST:            #H0,1

**Options:**            R&S SMx/AMU-K84/-K284

**Manual control:**    See "[PMCH Structure](#)" on page 106

---

---

**[[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod <SchedPeriod>**

Defines the MCH scheduling period, i.e. the periodicity used for providing MCH scheduling information at lower layers (MAC) applicable for an MCH.

**Parameters:**

<SchedPeriod> SPM | SPRF8 | SPRF16 | SPRF32 | SPRF64 | SPRF128 |  
SPRF256 | SPRF512 | SPRF1024  
\*RST: SPM

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[PMCH Structure](#)" on page 106

---

**[[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASStart <AllocStart>**

**[[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAENd <AllocEnd>**

Defines the first/last subframe allocated to this (P)MCH within a period identified by field *commonSF-Alloc*.

**Parameters:**

<AllocEnd> integer  
Range: 0 to 1535  
Increment: 1  
\*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[PMCH Structure](#)" on page 106

---

**[[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:RHOA <RhoA>**

Defines the power of the MBSFN channels relative to the common Reference Signals.

**Parameters:**

<RhoA> float  
Range: -80.000 to 10.000  
Increment: 0.001  
\*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[MBSFN Rho A](#)" on page 101

---

**[[:SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AMODE <AllocationMode>**

Defines whether MBSFN periodic scheduling is 1 or 4 frames.

**Parameters:**

<AllocationMode> F1 | F4  
\*RST: F1

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Subframe Config \(SIB Type 2\)](#)" on page 101

**[:SOURCE<hw>]:BB:EUTRa:DL:MBSFn:SC:AOffset <Offset>**

Sets the Radio Frame Allocation Offset

**Parameters:**

<Offset> float  
 Range: 0 to 31  
 Increment: 1  
 \*RST: 0

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Subframe Config \(SIB Type 2\)](#)" on page 101

**[:SOURCE<hw>]:BB:EUTRa:DL:MBSFn:SC:APER <Period>**

Sets the Radio Frame Allocation Period.

**Parameters:**

<Period> AP1 | AP2 | AP4 | AP8 | AP16 | AP32  
 \*RST: AP1

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Subframe Config \(SIB Type 2\)](#)" on page 101

**[:SOURCE<hw>]:BB:EUTRa:DL:MBSFn:SC:AVAL <AllocationValue>**

Defines which MBSFN subframes are allocated.

**Parameters:**

<AllocationValue> integer  
 Range: 0 to 0xFFFFFFFF  
 Increment: 1  
 \*RST: 0x3F

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Subframe Config \(SIB Type 2\)](#)" on page 101

**[:SOURCE<hw>]:BB:EUTRa:DL:MBSFn:UEC <UE\_Category>**

Defines the UE category as defined in 3GPP TS 36.306.

**Parameters:**

<UE\_Category> USER | C1 | C2 | C3 | C5 | C4  
 \*RST: C5

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[UE Category](#)" on page 101

## 9.12 DL Carrier Aggregation Settings



Carrier Aggregation is LTE-A (LTE Rel 10) feature enabled for instruments equipped with software option R&S SMx/AMU-K85.

### CELL<ch0>

Value range <ch0>= 0 .. 4

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:STATE</a> .....	415
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:BB</a> .....	415
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:BW</a> .....	415
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:CIF</a> .....	416
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:DFReq</a> .....	416
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:ID</a> .....	416
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:INDEX</a> .....	417
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:POFFset</a> .....	417
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:PSTart</a> .....	417
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:SCINdex</a> .....	417
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:STATE</a> .....	418
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:CA:CELL&lt;ch0&gt;:TDElay</a> .....	418

### [\[:SOURce<hw>\]:BB:EUTRa:DL:CA:STATE <CaGlobalState>](#)

Enables/disables the generation of several component carriers.

#### Parameters:

<CaGlobalState> 0 | 1 | OFF | ON  
\*RST: OFF

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Activate Carrier Aggregation](#)" on page 110

### [\[:SOURce<hw>\]:BB:EUTRa:DL:CA:CELL<ch0>:BB <BasebandPath>](#)

Determines the baseband block that generates the selected component carrier.

#### Parameters:

<BasebandPath> A | B  
\*RST: A

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

### [\[:SOURce<hw>\]:BB:EUTRa:DL:CA:CELL<ch0>:BW <Bandwidth>](#)

Sets the bandwidth of the corresponding component carrier/SCell.

**Parameters:**

<Bandwidth> BW1\_40 | BW3\_00 | BW5\_00 | BW10\_00 | BW15\_00 |  
 BW20\_00  
 \*RST: BW10\_00

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

**[ :SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:CIF** <CifPresent>

Defines whether the CIF is included in the PDCCH DCI formats transmitted from the corresponding SCell.

**Parameters:**

<CifPresent> 0 | 1 | OFF | ON  
 \*RST: ON

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

**[ :SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DFReq** <DeltaFreq>

Sets the frequency offset between the central frequency of corresponding SCell and the frequency of the PCell.

**Parameters:**

<DeltaFreq> float  
 Range: -40 to 40  
 Increment: 0.1  
 \*RST: 0

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

**[ :SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:ID** <PhysicalCellId>

Sets the physical Cell ID of the corresponding SCell.

**Parameters:**

<PhysicalCellId> integer  
 Range: 0 to 503  
 Increment: 1  
 \*RST: 1

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110



**[ :SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:INDEX <CellIndex>**

Sets the cell index of the corresponding SCell, as specified in 36.331 [16]. The SCell Index is required for signaling on the DCI CIF field.

The cell index of the PCell is always 0.

**Parameters:**

<CellIndex> integer  
 Range: 1 to 7  
 Increment: 1  
 \*RST: 1

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

**[ :SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:POFFset <PowerOffset>**

Sets the power offset of the SCells relative to the power level of the PCell.

**Parameters:**

<PowerOffset> float  
 Range: -80 to 10  
 Increment: 0.01  
 \*RST: 0

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

**[ :SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PStart <PdschStart>**

Sets the starting symbol of the PDSCH for the corresponding SCell.

**Parameters:**

<PdschStart> integer  
 Range: 1 to 4  
 Increment: 1  
 \*RST: 2

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

**[ :SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SCINDEX <SchedCellIndex>**

Defines the component carrier/cell that signals the UL and DL grants for the selected SCell.

**Parameters:**

<SchedCellIndex> integer  
 Range: 0 to 7  
 Increment: 1  
 \*RST: 0

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

**[ :SOURce<hw> ] :BB:EUTRa:DL:CA:CELL<ch0> :STATe <CellState>**

Activates/deactivates the component carrier/SCell.

**Parameters:**

<CellState> 0 | 1 | OFF | ON  
 \*RST: OFF

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

**[ :SOURce<hw> ] :BB:EUTRa:DL:CA:CELL<ch0> :TDELay <TimeDelay>**

Sets the time delay of the SCell relative to the PCell.

**Parameters:**

<TimeDelay> integer  
 Range: 0 to 1000000000  
 Increment: 1  
 \*RST: 0

**Options:** R&S SMx/AMU-K85

**Manual control:** See "[Component Carrier Table](#)" on page 110

## 9.13 Enhanced PBCH, PDSCH, PMCH 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:SEnGth](#) on page 338).

**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.....	419
[SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset.....	420
[SOURce<hw>]:BB:EUTRa:DL:PBCH:SRPeriod.....	420
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: ISBSize.....	420
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: RVIndex.....	421
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: STATE.....	421
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: TBSize.....	421
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: TYPE?.....	422
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP.....	422
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: APM.....	423
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: CBIndex.....	423
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: CDD.....	423
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: DAFormat.....	424
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: NOLayers.....	424
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: SCHeme.....	425
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: SCID.....	425
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding: TRScheme.....	426
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling: STATE.....	426
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling: UEID.....	426

---

#### [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:EUTRa:DL:PBCH:MIB ON

**Manual control:**    See "MIB (including SFN)" on page 140

---

**[[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset <SfnOffset>**

Sets an offset for the start value of the SFN (System Frame Number).

**Parameters:**

<SfnOffset>            integer  
                           Range:     0 to 1020  
                           Increment: 4  
                           \*RST:     0

**Manual control:**    See "[SFN Offset](#)" on page 140

---

**[[:SOURce<hw>]:BB:EUTRa:DL:PBCH:SRPeriod <SfnRestPeriod>**

Determines the time span after which the SFN (System Frame Number) restarts.

By default, the SFN restart period is equal to the ARB sequence length. Selecting a SFN restart period of "1024 Frames", enables the instrument to calculate the PBCH including SFN independently from the other channels. With this setting, the SFN restarts after 1024 frames and the generation process is fully 3GPP compliant, but the calculation may take very long time.

**Parameters:**

<SfnRestPeriod>      PER3gpp | PERSlength

**PER3gpp**

Set the SFN restart period to 3GPP (1024 Frames).

**Tip:** Use the "3GPP (1024 Frames)" mode only if 3GPP compliant SFN period is required!

**PERSlength**

Set the SFN restart period to the ARB sequence length.

\*RST:            PERSlength

**Example:**

BB:EUTRa:DL:PBCH:SRP PERS

sets the restart period to the ARB sequence length.

**Manual control:**    See "[SFN Restart Period](#)" on page 140

---

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing: ISBSize <Isbsize>**

Sets the size of the IR soft buffer.

**Parameters:**

<Isbsize>            integer  
                           Range:     800 to 304000  
                           Increment: 800  
                           \*RST:     304000

**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
```

**Manual control:** See ["IR Soft Buffer Size \(PDSCH\)"](#) on page 141

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:  
RVINdex <Rvindex>**

Sets the redundancy version index.

**Parameters:**

<Rvindex> integer  
 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
```

**Manual control:** See ["Redundancy Version Index \(PDSCH\)"](#) on page 141

**[: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
```

**Manual control:** See ["State Channel Coding \(DL\)"](#) on page 139

**[: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> integer  
 Range: 1 to 100000  
 Increment: 1  
 \*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

**Manual control:** See "[Transport Block Size/Payload \(DL\)](#)" on page 141

**[[: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

**Manual control:** See "[Type Channel Coding \(DL\)](#)" on page 139

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP <AntennaPorts>**

Sets the antenna port(s) for the selected transmission mode.

**Parameters:**

<AntennaPorts> AP7 | AP5 | AP8 | AP78  
 \*RST: AP7

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Antenna Ports](#)" on page 137

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:  
PRECoding:APM <AntPortMap>**

Sets the way that the logical antenna ports are mapped to the physical Tx-antennas. See [chapter 7.9, "Antenna Port Mapping"](#), on page 169.

**Parameters:**

<AntPortMap> CB | RCB | FW  
\*RST: CB

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[Antenna Port Mapping](#)" on page 137

**[ :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> integer  
Range: 0 to 15  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF4:ALL5:CW:PREC:CBIN 2  
sets the codebook index to 2

**Manual control:** See "[Codebook Index](#)" on page 137

**[ :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

**Manual control:**

See "[Cyclic Delay Diversity](#)" on page 138

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLOc<ch0>[:CW<user>]:  
PRECoding:DAFormat <DataFormat>**

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

**Parameters:**

<DataFormat> CARTesian | CYLindrical

\*RST: CART

**Manual control:**

See "[Mapping Coordinates](#)" on page 138

**[: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

Increment: 1

\*RST: 1

**Example:**

BB:EUTR:DL:SUBF4:ALL5:CW:PREC:NOL 2  
sets the number of layers to 2

**Manual control:**

See "[Number of Layers](#)" on page 137



---

```
[ :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:**

<Scheme>

NONE | SPM | TXD | BF | 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.

**BF**

Sets the PDSCH to transmission mode selected with the command `[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRScheme.`

\*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
```

**Manual control:** See "[Precoding Scheme](#)" on page 135

---

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

Sets the scrambling identity according to 36.211, sec. 6.10.3.1.

This value is used for initialization of the sequence used for generation of the UE-specific reference signals.

**Parameters:**

<ScramIdent>

integer

Range: 0 to 1

Increment: 1

\*RST: 0

**Manual control:** See "[Scrambling Identity n\\_SCID](#)" on page 137

---

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

Determines the transmission mode (see also [table 3-3](#)).

**Parameters:**

<TranScheme>      TM7 | TM8  
 \*RST:            TM7

**Options:**            R&S SMx/AMU-K84/-K284

**Manual control:**    See "[Transmission Scheme](#)" on page 136

---

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

Enables/disables the bit-level scrambling.

**Parameters:**

<State>            ON | OFF  
 \*RST:            ON

**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 correspond-  
 ing 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
```

**Manual control:**    See "[State Scrambling \(DL\)](#)" on page 139

---

```
[: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>            integer  
 Range:            0 to 65535  
 Increment:        1  
 \*RST:            0

**Example:**            BB:EUTR:DL:SUBF0:ALL5:CW:UEID 120  
 sets the user equipment identifier.

**Manual control:** See "UE ID/n\_RNTI (PDSCH)" on page 139

## 9.14 Enhanced 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 338).

### ITEM<ch0>

Value range <ch0>= 0 .. 19

[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe.....	429
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHeme.....	429
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers?.....	430
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWer.....	430
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:SCRambling:STATe.....	431
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion.....	431
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:PMODE.....	432
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:POWer.....	432
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:GROUp<ch0>: ITEM<user0>:POW.....	432
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:NOGRoups.....	433
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:ANPattern<ch0>.....	433
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWer.....	433
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:SCRambling:STATe.....	434
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS.....	434
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVRegs.....	434
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVCCes.....	435
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:FORMat.....	435
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:NOPDcchs.....	436
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:ALRegs.....	437
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DREGs.....	437
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DATA.....	438
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATTern.....	438
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DSElect.....	438
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource.....	439
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA.....	439
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSElect.....	439
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATTern.....	440
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem.....	440
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:APPend.....	441
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:INSert.....	441
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DELeTe.....	441
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN.....	442
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UP.....	442
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SOLVe.....	442
[ :SOURce<hw> ] :BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:RESet.....	442

## Enhanced PCFICH, PHICH and PDCCH Configuration

[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIFmt.....	442
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:UEID.....	443
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CELL.....	443
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PFMT.....	443
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NCCes.....	444
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CINdex.....	444
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: NCCes.....	444
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: CONflict?.....	445
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:USER.....	445
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: SESPace.....	445
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:BITData?.....	446
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:CIField.....	446
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:F1AMode.....	446
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PRACH:PRINdex.....	447
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PRACH:MINdex.....	447
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:CSIRequest.....	448
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:CSDMrs.....	448
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:DLAindex.....	449
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:DPOffset.....	449
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:GAP.....	449
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:HPN.....	450
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:MCSR.....	450
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:NDI.....	451
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PFHopping.....	451
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PMI.....	451
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:PREInfo.....	452
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RAH.....	452
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RAHR.....	453

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RAType.....	453
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RBA.....	453
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:RV.....	454
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:SWAPflag.....	454
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TB1:MCS.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TB2:MCS.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TB1:NDI.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TB2:NDI.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TB1:RV.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TB2:RV.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:SID.....	456
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TPCC.....	456
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TPCinstr.....	457
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:TPMI.....	457
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:ULIndex.....	458
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>: DCIConf:VRBA.....	458

---

**[: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:                    ON

**Example:**                    BB:EUTRa:DL:SUBF1:ENCC:STAT ON  
enables PDCCH

**Manual control:**            See "State (Enhanced Channels)" on page 142

---

**[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHEME <Scheme>**

Selects the precoding scheme for PDCCH.

**Parameters:**

&lt;Scheme&gt;

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
```

**Manual control:**See "[Precoding Scheme \(Enhanced Channels\)](#)" on page 142

```
[: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:**

&lt;Nolayers&gt;

integer

Range: 1 to 2

Increment: 1

\*RST: 1

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PREC:NO?
queries the number of layers
Response: 1
```

**Usage:**

Query only

**Manual control:**See "[Number of Layers \(Enhanced Channels\)](#)" on page 143

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

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

&lt;Power&gt;

float

Range: -80.00 to 10.00

Increment: 0.001

\*RST: 0

**Example:**

```
BB:EUTR:DL:SUBF1:ENCC:PCF:POW -5
sets the power of the PCFICH to -5 dBm
```

**Manual control:**See "[PCFICH Power](#)" on page 143

**[ :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

**Manual control:**

See "[Scrambling State \(PCFICH\)](#)" on page 143

**[ :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>                    integer  
 Range:                    1 to 4  
 Increment:                1  
 \*RST:                    2

**Example:**

BB:EUTR:PHIC:DUR NORM  
 selects PHICH normal duration  
 BB:EUTR:DL:SUBF1:ENCC:PCF:CREG 1  
 sets the control region

**Manual control:**

See "[Control Region for PDCCH](#)" on page 143

---

```
[ :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.

**Manual control:**     See "[Power Mode](#)" on page 144

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:POWER <Power>
```

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 whitin this group.

**Parameters:**

<Power>                    float

Range:            -80.00 dB to 10.00 dB

Increment:    0.001

\*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

**Manual control:**     See "[PHICH Power](#)" on page 145

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:GROup<ch0>:
ITEM<user0>:POW <Index>
```

Sets the power of the individual PHICHs.



## Enhanced PCFICH, PHICH and PDCCH Configuration

**Parameters:**

<Index> float  
 Range: -80.00 dB to 10.00 dB  
 Increment: 0.001 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

**Manual control:** See ["Power Settings Config."](#) on page 145

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICH:NOGRoups  
 <Nogroups>**

Sets the number of available PHICH groups.

**Parameters:**

<Nogroups> integer  
 Range: 0 to 56  
 Increment: 1  
 \*RST: 2

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PHIC:NOGR 4  
 sets the number of PHICH groups

**Manual control:** See ["Number of PHICH Groups"](#) on page 144

**[[: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

**Manual control:** See ["ACK/NACK Pattern Group 0 .. 9"](#) on page 145

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWER <Power>**

Sets the power of the PDCCH ( $P_{\text{PDCCH}}$ ).

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  
 Increment: 0.001  
 \*RST: 0

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:POW -5  
 sets the power of the PDCCH to -5dB

**Manual control:**

See "[PDCCH Power](#)" on page 146

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC: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

**Manual control:**

See "[Scrambling State \(PDCCH\)](#)" on page 146

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:BITS** <Bits>

Defines the number of bits allocated for PDCCH.

**Parameters:**

<Bits> integer  
 Range: 0 to 100000  
 Increment: 1  
 \*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

**Manual control:**

See "[Number of Bits \(PDCCH\)](#)" on page 146

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:AVRegs** <Avregs>

Defines the number of the REGs that are available for the PDCCH allocation.

**Parameters:**

<Avregs> integer  
 Range: 0 to 100000  
 Increment: 1  
 \*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

**Manual control:** See "[Number of available REGs \(PDCCH\)](#)" on page 146

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:AVCCes <Avcces>**

Queries the number of the control channel elements (CCEs) that are available for the PDCCH allocation.

**Parameters:**

<Avcces> integer  
 Range: 0 to 100000  
 Increment: 1  
 \*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

**Manual control:** See "[Number of available CCEs \(PDCCH\)](#)" on page 146

**[[: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: VAR

**Example:**

BB:EUTR:DL:SUBF2:ENCC:PDCC:FORM 0  
sets the PDCCH format.

**Manual control:**

See "[PDCCH Format](#)" on page 147

**[[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:h: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;

integer

Range: 0 to max

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.

**Manual control:** See ["Number of PDCCHs"](#) on page 148

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:ALRegs <Alregs>**

Defines the number of REGs that are actually allocated for PDCCH transmission (#REGs allocated<sub>PDCCH</sub>).

**Parameters:**

<Alregs> integer  
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

**Manual control:** See ["Number of REGs allocated to PDCCH"](#) on page 148

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:DREGs <Dregs>**

Defines the the number of REGs that are available for the PDCCH allocation but are not allocated.

**Parameters:**

<Dregs> integer  
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

**Manual control:** See ["Number of Dummy REGs"](#) on page 148

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh: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
```

**Manual control:** See ["Data Source \(PDCCH\)"](#) on page 148

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATtern <Pattern>
```

Selects the bit pattern for the `PATT` selection.

**Parameters:**

```
<Pattern>      <bit pattern>
*RST:          #H0,1
```

**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.
```

**Manual control:** See ["DList/Pattern \(PDCCH\)"](#) on page 148

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh: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

**Manual control:** See ["Dummy CCE REGs"](#) on page 149

---

**[: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

**Manual control:** See ["Dummy CCE Data Source"](#) on page 149

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:DCRegs: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 `MMEemory: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.

`MMEM: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`

**Manual control:**        See "[DList/Pattern \(Dummy CCE\)](#)" on page 150

**[: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>

\*RST:                    #H0,1

**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.

**Manual control:**        See "[DList/Pattern \(Dummy CCE\)](#)" on page 150

**[: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>                    integer

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

**Manual control:** See ["Insert"](#) on page 150

**[: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

**Manual control:** See ["Append"](#) on page 150

**[: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

**Manual control:** See ["Insert"](#) on page 150

**[: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

**Manual control:** See ["Delete"](#) on page 150

---

```
[ :SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN
[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh: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:PDCCh:EXTC:SOLVe
```

Triggers a built-in algorithm that re-assigns automatically the CCE values depending on the configured "Search Space"; previously configured CCE values will not be maintained.

If the conflict can not be resolved automatically, the values are left unchanged.

**Example:** :SOURCE:BB:EUTRa:DL:SUBF1:ENCC:PDCCh:EXTC:SOLVe

**Usage:** Event

**Manual control:** See ["Resolve Conflicts"](#) on page 151

---

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

**Manual control:** See ["Reset"](#) on page 150

---

```
[ :SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh: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 | F2B  
\*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
```

**Manual control:** See "DCI Table" on page 151

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
UEID <Ueid>**

Sets the n\_RNTI for the selected PDCCH.

**Parameters:**

<Ueid> integer  
 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

**Manual control:** See "DCI Table" on page 151

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
CELL <CellIdx>**

Determines the component carrier the corresponding DCI is transmitted on.

**Parameters:**

<CellIdx> integer  
 Range: 0 to 7  
 Increment: 1  
 \*RST: 0

**Options:** R&S SMx/AMU-K85

**Manual control:** See "DCI Table" on page 151

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
PFMT <Pfmt>**

Sets the PDCCH format for the selected PDCCH.

**Parameters:**

<Pfmt> integer  
 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:PFMT 0  
 sets the PDCCH format.

**Manual control:** See "DCI Table" on page 151

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
NCCes <Ncces>**

Defines the number of control channel elements used for the transmission of the PDCCH.

**Parameters:**

<Ncces> integer  
 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

**Manual control:** See "DCI Table" on page 151

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
CINDEX <Cindex>**

Sets the CCE start index.

**Parameters:**

<Cindex> integer  
 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

**Manual control:** See "DCI Table" on page 151

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
NDCCes <Ndcces>**

Defines the number of dummy CCEs that are appended to the PDCCH.

**Parameters:**

<Ndcces> integer  
 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

**Manual control:** See "DCI Table" on page 151

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
CONFLICT?**

Indicates a conflict between two DCI formats.

**Return values:**

<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

**Manual control:**    See "DCI Table" on page 151

---

**[ :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

**Manual control:**    See "DCI Table" on page 151

---

**[ :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.

Note: The 3GPP specification defines two kinds of search spaces, the common and the UE-specific (UE) search space. Avoid the use of the AUTO and OFF values; this values are provided for backwards compatibility reasons only.

**Parameters:**

<Sespace>            OFF | AUTO | COMMON | UE | ON | 0 | 1  
\*RST:                OFF

**Example:**            BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:SESP UE  
the DCI is transmitted within the UE-specific search space.

**Manual control:**    See "DCI Table" on page 151

---

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh: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

**Manual control:**        See "[Bit Data](#)" on page 155

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
DCIConf:CIField <CalndField>**

The CIF is present in **each** DCI Format and indentifies the component carrier that carries the PDSCH or PUSCH for the particular PDCCH in the cross-carrier approach (see [figure 3-24](#)).

**Parameters:**

<CalndField>                    integer  
Range:                    0 to 7  
Increment:                1  
\*RST:                      0

**Example:**

```
BB:EUTR:DL:CA:STAT ON
BB:EUTR:DL:USER2:CA:STAT ON
BB:EUTR:DL:CA:CELL0:CIF ON
BB:EUTR:DL:ENCC:PDCC:EXTC:ITEM1:DCIC:CIF 1
```

**Options:**                    R&S SMx/AMU-K85

**Manual control:**        See "[Carrier Indicator Field \(CIF\)](#)" on page 155

---

**[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh: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

**Manual control:** See "[DCI Format 1A](#)" on page 158

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:PRAC:PRINdEx <Prindex>**

(PRACH mode only)

Sets the DCI Format 1A field Preamble index.

**Parameters:**

<Prindex> integer  
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 indexe

**Manual control:** See "[DCI Format 1A](#)" on page 158

**[[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:PRAC:MINDEx <Mindex>**

(PRACH mode only)

Sets the DCI Format 1A field PRACH Mask Index.

**Parameters:**

<Mindex> integer  
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 index

**Manual control:** See "[DCI Format 1A](#)" on page 158

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:CSIRequest <CsiRequest>**

Sets the DCI Format 0 field CSI/CQI Request.

**Parameters:**

<CsiRequest> integer  
Range: 0 to 3  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F0  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:CSIR  
1

**Manual control:** See "[DCI Format 0](#)" on page 155

**[: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> integer  
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

**Manual control:** See "[DCI Format 0](#)" on page 155



---

**[ :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> integer  
 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

**Manual control:** See "[DCI Format 0](#)" on page 155

---

**[ :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

**Manual control:** See "[DCI Format 1D](#)" on page 161

---

**[ :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

**Manual control:** See "DCI Format 1A" on page 158

**[: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> integer  
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

**Manual control:** See "DCI Format 1" on page 157

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:MCSR <Mcsr>**

Sets the DCI Format 0/1/1A/1B/1C/1D field Modulation and Coding Scheme.

**Parameters:**

<Mcsr> integer  
Range: 0 to 31  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F1B  
BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:MCSR  
5

**Manual control:** See "DCI Format 0" on page 155

---

**[ :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

**Manual control:** See "[DCI Format 0](#)" on page 155

---

**[ :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> 0 | 1 | OFF | ON  
\*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

**Manual control:** See "[DCI Format 0](#)" on page 155

---

**[ :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  
enables PMI Confirmation for Precoding

**Manual control:** See "DCI Format 1B" on page 159

---

**[: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> integer  
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

**Manual control:** See "DCI Format 2/2A/2B" on page 163

---

**[: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  
enables Resource Allocation Header

**Manual control:** See "DCI Format 1" on page 157

---

**[: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> integer  
 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

**Manual control:** See "[DCI Format 0](#)" on page 155

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:  
DCIConf:RAType <RaType>**

Sets the DCI Format 0 field Resource Allocation Type.

**Parameters:**

<RaType> integer  
 Range: 0 to 1  
 Increment: 1  
 \*RST: 0

**Manual control:** See "[DCI Format 0](#)" on page 155

---

**[: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> integer  
 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

**Manual control:** See "DCI Format 1" on page 157

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:RV <Rv>**

Sets the DCI Format 1/1A/1B/1D field Redundancy Version.

**Parameters:**

<Rv> integer  
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

**Manual control:** See "DCI Format 1" on page 157

**[: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

**Manual control:** See "DCI Format 2/2A/2B" on page 163

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB1:MCS <Mcs>
```

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB2:MCS <Mcs>
```

Sets the DCI Format 2/2A field Modulation and Coding Scheme.

**Parameters:**

<Mcs> integer  
 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
```

**Manual control:** See ["DCI Format 2/2A/2B"](#) on page 163

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB1:NDI <Ndi>
```

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh: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
```

**Manual control:** See ["DCI Format 2/2A/2B"](#) on page 163

---

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB1:RV <Rv>
```

```
[ :SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:
DCIConf:TB2:RV <Rv>
```

Sets the DCI Format 2/2A field Redundancy Version.

**Parameters:**

<Rv> integer  
 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

**Manual control:** See "[DCI Format 2/2A/2B](#)" on page 163

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 DCIConf:SID <ScramIdent>**

Enables/disables the DCI Format 2B field Scrambling Identity.

**Parameters:**

<ScramIdent> 0 | 1 | OFF | ON  
 \*RST: OFF

**Example:**

BB:EUTR:DL:SUBF1:ENCC:PDCC:FORM VAR  
 sets the PDCCH format.  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIF F2B  
 sets the DCI format  
 BB:EUTR:DL:SUBF1:ENCC:PDCC:EXTC:ITEM1:DCIC:SID  
 ON  
 enables the Scrambling Identity

**Options:** R&S SMx/AMU-K84/-K284

**Manual control:** See "[DCI Format 2/2A/2B](#)" on page 163

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
 DCIConf:TPCC <Tpcc>**

Sets the DCI Format 0/1/1A/1B/1D/2/2A field TPC Command for PUSCH.

**Parameters:**

<Tpcc> integer  
 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

**Manual control:** See "DCI Format 0" on page 155

---

**[:SOURCE<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCC:EXTC:ITEM<ch0>:  
DCIConf:TPCinstr <Tpcinstr>**

Sets the DCI Format 3/3A field TPC Command.

**Parameters:**  
<Tpcinstr> bit pattern

**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

**Manual control:** See "DCI Format 3/3A" on page 165

---

**[: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> integer  
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

**Manual control:** See "DCI Format 1B" on page 159

---

```
[ :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>          integer
                    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
```

**Manual control:** See "[DCI Format 0](#)" on page 155

---

```
[ :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
```

**Manual control:** See "[DCI Format 1A](#)" on page 158

## 9.15 UL Frame Configuration

```
SUBF<st0>
```

Defines the subframe number. The maximum value depends on the selected sequence length (see [:SOURce<hw>]:BB:EUTRa:SLENgth on page 338).

#### ALLoc<ch0>

Determines the allocation number (user equipment number). Value range <ch0> = 0 .. 3, where 0 refers to UE1

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh.....	459
[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh.....	459
[:SOURce<hw>]:BB:EUTRa:UL:SFSelection.....	460
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix.....	460
[:SOURce<hw>]:BB:EUTRa:UL:RSTFrame.....	460
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType.....	461
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:MODulation.....	461
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:FORMat.....	461
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount.....	461
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?.....	461
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:RBCount.....	461
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset.....	462
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>: VRBoffset.....	462
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:RBOffset?.....	462
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUCCh: RBOffset?.....	462
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh: SET<s2us>:RBOffset?.....	462
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?.....	463
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?.....	463
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:PHYSbits?.....	463
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWer.....	463
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWer.....	463
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWer.....	463
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe.....	464
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe.....	464
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe.....	464
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFLict?.....	464
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFLict?.....	464
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CONFLict?.....	464

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh <conf\_subf>

[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh <ConfSubf>

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 is set individually for each UE in the "User Equipment" dialog.

#### Parameters:

<ConfSubf>	integer
	Range: 1 to 40
	Increment: 1
	*RST: 1

**Example:**

```
BB:EUTR:UL:UE1:ID 100
BB:EUTR:UL:UE2:ID 100
BB:EUTR:UL:UE1:CONS:PUCH 10
BB:EUTR:UL:UE1:CONS:PUSH 10
BB:EUTR:UL:UE2:CONS:PUCH 8
BB:EUTR:UL:UE2:CONS:PUSH 8
```

**Manual control:** See ["Number Of Configurable Uplink Subframes"](#) on page 187

**[:SOURCE<hw>]:BB:EUTRa:UL:SFSelection <Sfselection>**

Sets the subframes to be displayed in the resource allocation table.

**Parameters:**

<Sfselection> integer  
 Range: 0 to the end of the ARB sequence  
 Increment: 1  
 \*RST: 0

**Example:**

```
BB:EUTR:UL:SFS 0
```

displays subframe 0 in the allocation table view.

**Manual control:** See ["Subframe"](#) on page 188

**[: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 used in subframe 6 in uplink.

**Manual control:** See ["Cyclic Prefix \(UL\)"](#) on page 188

**[: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.

**Manual control:** See ["Reset All Subframes"](#) on page 189

---

```
[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType <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.
```

**Manual control:** See "[Content \(UL\)](#)" on page 189

---

```
[ :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.
```

**Manual control:** See "[Modulation/Format](#)" on page 190

---

```
[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:FORMat <Format>
```

Sets the PUCCH Format (1/1a/1b/2/2a/2b/3).

**Parameters:**

```
<Format>           F1 | F1A | F1B | F2 | F2A | F2B | F3
                    *RST:    F1
```

**Example:**

```
SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT PUCC
SOUR:BB:EUTR:UL:SUBF4:ALL2:FORM F2A
sets the PUCCH format
```

**Manual control:** See "[Modulation/Format](#)" on page 190

---

```
[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount <Rbcount>
[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?
[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:
    RBCount <NumberOfRBs>
```

Sets the size of the selected allocation in resource blocks (per slot).

**Suffix:**

```
<user>             1..2
```

**Parameters:**

<NumberOfRBs> integer  
 Range: 0 to 110  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:REL R89  
 BB:EUTR:UL:SUBF0:ALL1:RBC 3

**Example:**

BB:EUTR:UL:UE2:REL R10  
 BB:EUTR:UL:SUBF0:ALL2:PUCH:RBC ?  
 BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:RBC 4  
 BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 5  
 BB:EUTR:UL:SUBF0:ALL2:PUSC:SET2:RBC 3  
 BB:EUTR:UL:SUBF0:ALL2:PUSC:SET2:VRB 15

**Manual control:** See "[Set 1/Set 2 No. RB](#)" on page 190

**[[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBoffset <Vrboffset>  
 [:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:  
 VRBoffset <NumberOfVRBs>**

Sets the virtual resource block offset of the selected subframe.

**Suffix:**

<user> 1..2

**Parameters:**

<NumberOfVRBs> integer  
 Range: 0 to 109  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:SUBF0:ALL1:VRB 6  
 BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 5  
 BB:EUTR:UL:SUBF0:ALL2:PUSC:SET1:VRB 15

**Manual control:** See "[Set 1/Set 2 Offset VRB](#)" on page 191

**[[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:  
 RBOffset?  
 [:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:  
 RBOffset?  
 [:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:  
 SET<s2us>:RBOffset?**

Queries the start resource block of the selected allocation in slot n of the subframe.

**Suffix:**

<user0> 0..1  
 <s2us> 1..2

**Return values:**

<RbOffs> integer  
 Range: 0 to 109  
 Increment: 1  
 \*RST: 2

**Usage:** Query only

**Manual control:** See "[Offs PRB Slot \(n/n+1\)](#)" on page 192

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?**  
**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?**  
**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:PHYSbits?**

Queries the number of physical bits for the selected allocation. The value is set automatically according to the current allocation settings.

**Return values:**

<PuscPhysBits> integer  
 Range: -1 to 105600  
 Increment: 1  
 \*RST: -1

**Usage:** Query only

**Manual control:** See "[Phys. Bits / Total Number of Physical Bits](#)" on page 192

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWER <Power>**  
**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWER**  
 <PuccPwr>  
**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWER**  
 <PuscPwr>

Sets the power for the selected allocation.

**Parameters:**

<PuscPwr> float  
 Range: -80 to 10  
 Increment: 0.001  
 \*RST: 0

**Example:**

```
BB:EUTR:UL:SUBF4:ALL1:POW 3.00
BB:EUTR:UL:SUBF4:ALL2:PUSH:POW -1.00
BB:EUTR:UL:SUBF4:ALL2:PUSCh:POW -1.00
```

**Manual control:** See "[Power \(UL\)](#)" on page 192

```
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe <State>
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe
  <PuccState>
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe
  <PuscState>
```

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:**

```
<PuscState>      0 | 1 | OFF | ON
                  *RST:      1
```

**Manual control:** See "State (UL)" on page 193

```
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFLict?
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFLict?
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CONFLict?
```

Indicates a conflict between two allocations.

**Return values:**

```
<PuscConflict>   0 | 1 | OFF | ON
                  *RST:      OFF
```

**Usage:** Query only

**Manual control:** See "Conflict (UL)" on page 193

## 9.16 UL Enhanced Settings

### SUBF<st0>

Defines the subframe number. The maximum value depends on the selected sequence length (see [:SOURce<hw>]:BB:EUTRa:SENgth on page 338).

### ALLoc<ch0>

Determines the allocation number (user equipment number). Value range <ch0> = 0 .. 3, where 0 refers to UE1.

```
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:NDMRs.....465
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe.....465
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE?.....466
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBits.....466
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE.....466
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled.....467
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS.....467
[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:CBITs.....467
```



<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:HARQ:PATtern</code>	468
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:CQI:CBITs?</code>	468
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:CQI:BITs</code>	468
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:CQI:PATtern</code>	468
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:RI:CBITs?</code>	469
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:RI:BITs</code>	469
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:RI:PATtern</code>	470
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:ULSch:BITs?</code>	470
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:CCODing:TBSize</code>	470
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUSCh:CCODing:RVINdex</code>	471
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUCCh:NPAr</code>	471
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUCCh:HARQ:BITs</code>	471
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUCCh:HARQ:CBITs?</code>	471
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUCCh:HARQ:PATtern</code>	472
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUCCh:CQI:CBITs?</code>	472
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUCCh:CQI:BITs</code>	473
<code>[ :SOURce&lt;hw&gt;]:BB:EUTRa:UL[:SUBF&lt;st0&gt;]:ALLoc&lt;ch0&gt;:PUCCh:CQI:PATtern</code>	473

---

**`[ :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>` integer  
 Range: 0 to 11  
 Increment: 1  
 \*RST: 0

**Example:** `BB:EUTR:UL:SUBF4:ALL2:PUSC:NDMR 3`  
 sets the `n_DRMS`

**Manual control:** See "[n\(2\)\\_DMRS](#)" on page 219

---

**`[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe`**  
`<State>`

Enables/disables 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

**Manual control:** See "[Frequency Hopping](#)" on page 219

---

```
[ :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 | NONE
*RST:          NONE
```

**Example:**

```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE?
queries the frequency hopping type
Response: TP2
```

**Usage:** Query only

**Manual control:** See "[Hopping Type](#)" on page 220

---

```
[ :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>      integer
Range:         0 to 3
Increment:     1
*RST:          1
```

**Example:**

```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:IIHB 0
sets the information in hopping bits
```

**Manual control:** See "[Information in Hopping Bits](#)" on page 220

---

```
[ :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
```

**Manual control:** See "[ACK/NACK Mode](#)" on page 220

---

**[[: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  
                          Increment: 1  
                          \*RST:     1

**Example:**            BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:MODE BUND  
                          BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:NBUN 2

**Manual control:**    See "[N\\_bundled](#)" on page 221

---

**[[: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>                 integer  
                          Range:     0 to 4  
                          Increment: 1  
                          \*RST:     0

**Example:**            BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:BITS 2  
                          sets the number of A/N bits

**Manual control:**    See "[Number of A/N Bits](#)" on page 221

---

**[[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:CBITS <Cbits>**

Queries the number of coded ACK/NACK bits.

**Parameters:**

<Cbits>                integer  
                          Range:     0 to max  
                          Increment: 0  
                          \*RST:     2

**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

**Manual control:**    See "[Number of Coded A/N Bits](#)" on page 221

---

**[ :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>  
\*RST:                    #H0,1

**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

**Manual control:**    See "[ACK/NACK Pattern](#)" on page 221

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs?**

Queries the number of coded CQI bits.

**Return values:**

<Cbits>                    integer  
Range:                    0 to max  
Increment:                1  
\*RST:                    22

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:CBIT?  
queries the number of coded CQI bits

**Usage:**                    Query only

**Manual control:**    See "[Number of Coded CQI Bits](#)" on page 222

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS  
<Bits>**

Sets the number of CQI bits before channel coding.

**Parameters:**

<Bits>                    integer  
Range:                    0 to 64  
Increment:                1  
\*RST:                    4

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 30  
sets the number of CQI bits

**Manual control:**    See "[Number of CQI Bits](#)" on page 222

---

**[ :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: #H0,1

**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

**Manual control:** See "[CQI Pattern](#)" on page 222

`[ :SOURce<hw> ] : BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:CBITs?`

Queries the number of coded RI bits.

**Return values:**

<Cbits> integer  
Range: 0 to max  
Increment: 1  
\*RST: 4

**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

**Manual control:** See "[Number of Coded RI Bits](#)" on page 222

`[ :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> integer  
Range: 0 to 2  
Increment: 1  
\*RST: 1

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:CQI:BITS 2  
sets the number of RI bits

**Manual control:** See "[Number of RI Bits](#)" on page 221

---

**[ :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

**Manual control:**    See "[RI Pattern](#)" on page 221

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSch:BITS?**

Queries the number of physical bits used for UL-SCH transmission.

**Return values:**

<Bits>                    integer  
 Range:                    0 to max  
 Increment:                1  
 \*RST:                    1500

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:ULSC:BITS?  
 queries the number of physical bits for UL-SCH  
 Response: 2000

**Usage:**                    Query only

**Manual control:**    See "[Number of Coded UL-SCH Bits](#)" on page 222

---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:**  
**TBSize <Tbsize>**

Sets the size of the transport block.

**Parameters:**

<Tbsize>                    integer  
 Range:                    0 to 100000  
 Increment:                1  
 \*RST:                    1500

**Example:**

BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:TBS 1500  
 sets the size of the transport block

**Manual control:**    See "[Transport Block Size/Payload \(PUSCH\)](#)" on page 223

---

**[[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:RVINdex <Rvindex>**

Sets the redundancy version index.

**Parameters:**

<Rvindex>                    integer  
                                  Range:     0 to 3  
                                  Increment: 1  
                                  \*RST:     0

**Example:**                    BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:RVIN 2  
 sets the redundancy version index

**Manual control:**        See "[Redundancy Version Index \(PUSCH\)](#)" on page 223

---

**[[: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 respectively 3.

**Parameters:**

<Npar>                        integer  
                                  Range:     0 to n(1)\_PUCCH\_max / n(2)\_PUCCH\_max /  
                                                     n(3)\_PUCCH\_max  
                                  Increment: 1  
                                  \*RST:     0

**Example:**                    BB:EUTR:UL:SUBF1:ALL2:PUC:NPAr 10  
 sets the n\_PUCCH parameter

**Manual control:**        See "[n\\_PUCCH](#)" on page 224

---

**[[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:BITs <Bits>**

(enabled for PUCCH format 3 only)

Sets the number of ACK/NACK+SR bits before channel coding.

**Parameters:**

<Bits>                        integer  
                                  Range:     1 to 21  
                                  Increment: 1  
                                  \*RST:     1

**Manual control:**        See "[PUCCH Format 3 Settings](#)" on page 226

---

**[[:SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:CBITs?**

(enabled for PUCCH format 3 only)

Queries the number of coded ACK/NACK+SR bits.

**Return values:**

<Cbits> integer  
 Range: 0 to 48  
 Increment: 1  
 \*RST: 0

**Usage:** Query only

**Manual control:** See "[PUCCH Format 3 Settings](#)" on page 226

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:PUCCh:HARQ:  
 PATTErn <Pattern>**

Sets the PUCCHACK/NACK pattern or ACK/NACK + SR pattern per subframe.

**Note:** In case of PUCCH format 3, the bits given by this pattern represent the  $\alpha^{\text{ACK}}$  bits according to 3GPP TS 36.212, i.e. the up to 21 bits that contain ACK/NACK information for up to two codewords and optionally SR.

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, respectively 2 bits for formats 1b/2b, respectively "Number of ACK/NACK + SR Bits" for format 3.

The ACK/NACK pattern has a maximal length of 32 bits and is read out cyclically.

**Parameters:**

<Pattern> <32-bit pattern>  
 \*RST: #H0,1

**Example:** BB:EUTRa:UL:SUBF4:ALL2:PUCCh:HARQ:PATT #B10,2  
 sets the ACK/NACK Pattern

**Manual control:** See "[ACK/NACK Pattern / ACK/NACK+SR Pattern](#)" on page 224

**[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLOc<ch0>:PUCCh:CQI:CBITs?**

Queries the number of coded CQI bits.

**Return values:**

<Cbits> integer  
 Range: 0 to max  
 Increment: 1  
 \*RST: 20

**Example:** BB:EUTRa: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

**Manual control:** See "[Number of Coded CQI Bits \(PUCCH\)](#)" on page 225



---

**[ :SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS**  
 <Bits>

Sets the number of CQI bits before channel coding.

**Parameters:**

<Bits> integer  
 Range: 0 to max  
 Increment: 1  
 \*RST: 4

**Example:** BB:EUTR:UL:SUBF4:ALL2:PUCCh:CQI:BITS 30  
 sets the number of CQI bits

**Manual control:** See "Number of CQI Bits (PUCCH)" on page 225

---

**[ :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

**Manual control:** See "CQI Pattern (PUCCH)" on page 226

---

## 9.17 Configure User

**USER<ch>**

Value range <ch>= [1]|2|3|4

[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP5:TX<st>:IMAGinary.....	474
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP5:TX<st>:REAL.....	474
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP7:TX<st>:IMAGinary.....	474
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP7:TX<st>:REAL.....	474
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP8:TX<st>:IMAGinary.....	474
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP8:TX<st>:REAL.....	474
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBINdex.....	474
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates.....	474
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE.....	475
[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe.....	475

<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:SCRambling:STATE</code> .....	475
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:UEID</code> .....	476
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:DATA</code> .....	476
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:DSElect</code> .....	476
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:PA</code> .....	477
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:PATTern</code> .....	477
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:USER&lt;ch&gt;:CA:STATE</code> .....	477

---

**`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP5:TX<st>:IMAGinary`**  
 <Imaginary>

**`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP5:TX<st>:REAL`** <Real>

**`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP7:TX<st>:IMAGinary`**  
 <Imaginary>

**`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP7:TX<st>:REAL`** <Real>

**`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP8:TX<st>:IMAGinary`**  
 <Imaginary>

**`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP8:TX<st>:REAL`** <Real>

Defines the mapping of the antenna ports (AP5, AP7 and AP8) to the physical antennas.

**Parameters:**

<Real>                      float  
                                  Range:        -1 to 1  
                                  Increment:  0.01  
                                  \*RST:        0

**Manual control:**        See "[Antenna Port Mapping \(User\)](#)" on page 170

---

**`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBIndex`** <CodeBookIndex>

Sets the codebook index for mapping mode Codebook.

**Parameters:**

<CodeBookIndex>        integer  
                                  Range:        0 to 15  
                                  Increment:  1  
                                  \*RST:        0

**Options:**                    R&S SMx/AMU-K84/-K284

**Manual control:**        See "[Antenna Port Mapping \(User\)](#)" on page 170

---

**`[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates`** <MapCoord>

Switches between the Cartesian (Real/Imag.) and Cylindrical (Magn./Phase) coordinates representation.

**Parameters:**

<MapCoord>                CARTesian | CYLindrical  
                                  \*RST:        CART

**Options:**                    R&S SMx/AMU-K84/-K284

**Manual control:** See ["Antenna Port Mapping \(User\)"](#) on page 170

---

**[[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE <AntPortMap>**

Defines the antenna port mapping method, see [Mapping Methods](#).

**Parameters:**

<AntPortMap>      CB | RCB | FW  
 \*RST:              FW

**Options:**              R&S SMx/AMU-K84/-K284

**Manual control:** See ["Antenna Port Mapping \(User\)"](#) on page 170

---

**[[: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.

**Manual control:** See ["State Channel Coding \(User\)"](#) on page 168

---

**[[: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:              ON

**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

**Manual control:** See ["State Scrambling \(User\)"](#) on page 167

---

```
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID <Ueid>
```

Sets the user equipment ID.

**Parameters:**

```
<Ueid>                integer
                        Range:    0 to 65535
                        Increment: 1
                        *RST:    0
```

**Example:** `BB:EUTR:DL:USER2:UEID 3308`  
sets the UE ID.

**Manual control:** See ["UE ID \(User\)"](#) on page 168

---

```
[: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 | PATTErn |
                        DLISt | ZERO | ONE
                        *RST:    PN9
```

**Example:** `BB:EUTR:DL:USER2:DATA PN9`  
PN9 is selected as data source for the user configuration.

**Manual control:** See ["Data List Management"](#) on page 75

---

```
[:SOURce<hw>]:BB:EUTRa:DL:USER<ch>: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.

**Parameters:**

```
<Dselect>            string
```

**Example:** `BB:EUTR:DL:USER2:DATA DLIS`  
selects the Data Lists data source.  
`MMEMoRY: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`.

**Manual control:** See ["Data List Management"](#) on page 75

---

---

**[ :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  
 Range:                -6.02 to 3.01  
 \*RST:                 0

**Example:**            BB:EUTR:DL:USER2:PA 2.04  
 selects the P\_A

**Manual control:**    See "P\_A" on page 168

---

**[ :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>  
 \*RST:                 #H0,1

**Example:**            BB:EUTR:DL:USER2:PATT #H3F,8  
 defines the bit pattern.

**Manual control:**    See "DList Pattern (User)" on page 168

---

**[ :SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CA:STATe <State>**

Enables/disables carrier aggregation for the selected user.

**Parameters:**

<State>                0 | 1 | OFF | ON  
 \*RST:                 0

**Options:**             R&S SMx/AMU-K85

**Manual control:**    See "Activate CA" on page 168

---

## 9.18 Dummy Data Configuration

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:MODulation.....</a>	477
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:POWer.....</a>	478
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:DATA.....</a>	478
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:DSElect.....</a>	478
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:DL:DUMD:PATTern.....</a>	479

---

**[ :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.

**Manual control:**

See "[Modulation \(Dummy Data\)](#)" on page 172

**[: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: 0.001 dB  
 \*RST: 0 dB

**Example:**

BB:EUTR:DL:DUMD:POWer 10.00  
 sets the power for dummy data to 10 dB.

**Manual control:**

See "[Power \(Dummy Data\)](#)" on page 173

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA <Data>**

Selects the data source for dummy data.

**Parameters:**

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATtern |  
 DLISt | ZERO | ONE  
 \*RST: PN9

**Example:**

BB:EUTR:DL:DUMD:DATA PN9  
 PN9 is selected as data source for dummy data.

**Manual control:**

See "[Data Source \(Dummy Data\)](#)" on page 172

**[:SOURce<hw>]:BB:EUTRa:DL:DUMD: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.

**Parameters:**

<Dselect> string

**Example:** BB:EUTR:DL:DUMD:DATA DLIS  
selects the Data Lists data source.  
MME: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.

**Manual control:** See "[Select Data List \(Dummy Data\)](#)" on page 172

**[: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.

**Manual control:** See "[Pattern \(Dummy Data\)](#)" on page 172

## 9.19 User Equipment

**UE<ch>**

Determines the User Equipment. Value range <ch>= [1]|2|3|4

**SUBF<ch0>**

Value range <ch0>= 0 .. 199

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:RELease</a> .....	480
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:DACRestart</a> .....	480
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:ID</a> .....	481
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:STATe</a> .....	481
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:MODE</a> .....	481
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:POWer</a> .....	481
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:FRC:ALRB</a> .....	482
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:FRC:MODulation?</a> .....	482
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:FRC:N2DMrs</a> .....	482
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:FRC:PASize?</a> .....	483
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:FRC:STATe</a> .....	483
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:FRC:TNOBits?</a> .....	484
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:FRC:TYPE</a> .....	484
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:FRC:VRBoffset</a> .....	485
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:PRACH:PRStAt</a> .....	485
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:PRACH:PRTT</a> .....	485
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:UE&lt;st&gt;:PRACH:PRFormat?</a> .....	486

[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:CFRames.....	486
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RBOffset.....	486
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:FRINdex.....	486
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:POWer.....	487
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:NCSConf.....	487
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RSEquence.....	487
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:SINDeX.....	488
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:DT.....	488
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:STATe.....	488
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DATA.....	489
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:PATTeRn.....	489
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DSElect.....	489
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:SCRambling:STATe.....	490
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:STATe.....	490
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:MODE.....	490
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:INTeRleaver.....	491
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:ICQioffset.....	491
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IHARqoffset.....	492
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IRloffset.....	492
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:DRS:POWoffset.....	492
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:STATe.....	493
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:POWoffset.....	493
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:CYCShift.....	493
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BHOP.....	493
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BSRS.....	494
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS.....	494
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TSRS?.....	495
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TOFFset?.....	495
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TRComb.....	496
[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:NRRC.....	496

---

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:RELease <Release>**

Determines whether the selected UE is a LTE Release 8/9 or LTE Release 10 UE.

**Parameters:**

<Release>                    R89 | R10  
                                   \*RST:            R89

**Options:**                    R&S SMx/AMU-K85

**Manual control:**        See "[3GPP Release](#)" on page 197

---

**[ :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
- Manual control:** See ["Restart Data, A/N, CQI and RI every subframe"](#) on page 197

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:ID <Id>**

Sets the radio network temporary identifier (RNTI) of the UE.

**Parameters:**

<Id> integer  
Range: 0 to 65535  
Increment: 1  
\*RST: 0

- Example:** `BB:EUTR:UL:UE3:ID 303`  
sets the UE ID

- Manual control:** See ["UE ID/n\\_RNTI \(User Equipment\)"](#) on page 197

**[: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.

- Manual control:** See ["State \(User Equipment\)"](#) on page 196

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:MODE <Mode>**

Selects whether the user equipment is in standard or in PRACH mode.

**Parameters:**

<Mode> STD | PRACH  
\*RST: STD

- Example:** `BB:EUTR:UL:UE:MODE STD`  
selects the standard mode for UE1.

- Manual control:** See ["Mode"](#) on page 197

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:POWER <Power>**

Sets the power level of the selected UE.

**Parameters:**

<Power> float  
 Range: -80.00 to 10.00  
 Increment: 0.001  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE2:POW -5.0  
 sets the power of UE2

**Manual control:**

See "UE Power" on page 197

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:ALRB <Alrb>**

Queries the number of the allocated resource blocks for the selected FRC ([ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE on page 484). For FRCs A.2.2.2.1 and A.2.2.2.2 this parameter can also be set to different values according to 3GPP TS 36.521-1.

**Parameters:**

<Alrb> integer  
 Range: 0 to 110  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE2:FRC:TYPE A34  
 sets the FRC  
 BB:EUTR:UL:UE2:FRC:ALRB?  
 Response: 25

**Manual control:**

See "Allocated Resource Blocks" on page 200

**[ :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 484).

**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> integer  
 Range: 0 to 11  
 Increment: 1  
 \*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
```

**Manual control:** See "[n\(2\)\\_DMRS \(FRC\)](#)" on page 200

**[ :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 484).

**Return values:**

<Pasize> integer  
 Range: 0 to 200000  
 Increment: 1  
 \*RST: 0

**Example:**

```
BB:EUTR:UL:UE2:FRC:TYPE A34
sets the FRC
BB:EUTR:UL:UE2:FRC:PAS?
Response: 2216
```

**Usage:** Query only

**Manual control:** See "[Payload Size \(FRC\)](#)" on page 200

**[ :SOURCE<hw> ] :BB: EUTRa:UL:UE<st> :FRC: STATE <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 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

**Manual control:**

See "[FRC State](#)" on page 198

**[: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:**

<Tnobits> integer  
 Range: 0 to max  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE2:FRC:TYPE A34  
 sets the FRC  
 BB:EUTR:UL:UE2:FRC:TNOB?  
 Response: 7200

**Usage:**

Query only

**Manual control:**

See "[Physical Bits Per Subframe \(Unshortened PUSCH\)](#)" on page 200

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE <Type>**

Selects a predefined fixed reference channel according to 3GPP TS 36.141, Annex A, respectively 3GPP TS 36.521-1, 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 | UE11 | UE12 |  
 UE21 | UE22 | UE3  
 \*RST: A11

**Example:**

BB:EUTR:UL:UE2:FRC:TYPE A34  
 selects FRC A3\_4

**Manual control:**

See "[FRC](#)" on page 199

---

**[ :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> integer  
 Range: 0 to max  
 Increment: 1  
 \*RST: 2

**Example:**

```
SOUR:BB:EUTR:UL:SUBF4:ALL0:VRB 6
SOUR:BB:EUTR:UL:UE1:FRC:STAT ON
SOUR:BB:EUTR:UL:UE1:FRC:VRB 3
SOUR:BB:EUTR:UL:SUBF4:ALL0:VRB?
Response: 3
```

**Manual control:** See ["Offset VRB \(FRC\)"](#) on page 200

---

**[ :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  
 \*RST: OFF

**Example:**

```
BB:EUTR:UL:UE1:MODE PRAC
BB:EUTR:UL:UE1:PRAC:PRST ON
```

**Manual control:** See ["State PRACH Power Ramping"](#) on page 216

---

**[ :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
```

**Manual control:** See ["Transition Time"](#) on page 216

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRFormat?**

Queries the preamble format.

**Return values:**

<Prformat> integer  
 Range: 0 to 4  
 Increment: 1  
 \*RST: 0

**Example:** BB:EUTR:UL:UE1:PRAC:PRF?  
 queries the preamble format.

**Usage:** Query only

**Manual control:** See "[Preamble Format \(Burst Format\)](#)" on page 216

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:CFrames <Cframes>**

Queries the number of configurable frames.

**Parameters:**

<Cframes> integer  
 Range: 1 to 20  
 Increment: 1  
 \*RST: 1

**Example:** BB:EUTR:UL:UE1:PRAC:CRF?  
 queries the number of frames

**Manual control:** See "[Number of Configurable Frames](#)" on page 216

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RBOffset <Rboffset>**

Queries the starting RB, as set with the command [\[ :SOURce<hw>\]:BB:EUTRa:UL:PRACH:FOFFset](#).

**Parameters:**

<Rboffset> integer  
 Range: 0 to 104  
 Increment: 1  
 \*RST: 0

**Example:** BB:EUTR:UL:UE1:PRAC:SUBF2:RBOF?  
 queries the RB offset.

**Manual control:** See "[RB Offset](#)" on page 217

**[ :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> integer  
 Range: 0 to 5  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:FRIN 2  
 sets the frequency resource index

**Manual control:** See ["Frequency Resource Index"](#) on page 217

**[: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  
 Increment: 0.001  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:POW -3  
 sets the power

**Manual control:** See ["Power \(PRACH\)"](#) on page 218

**[: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> integer  
 Range: 0 to 15  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:NCSC 2  
 sets the Ncs Configuration

**Manual control:** See ["Ncs Configuration"](#) on page 217

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RSEQUENCE <Rsequence>**

Selects the logical root sequence index for the selected subframe.

**Parameters:**

<Rsequence> integer  
 Range: 0 to 838  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:RSEQ 200  
 sets the root sequence

**Manual control:**

See "[Logical Root Sequence Index](#)" on page 217

**[: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> integer  
 Range: 0 to 63  
 Increment: 1  
 \*RST: 0

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:SIND 30  
 sets the sequence index

**Manual control:**

See "[Sequence Index \(v\)](#)" on page 218

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:DT <Dt>**

Sets the parameter delta\_t in us.

**Parameters:**

<Dt> float  
 Range: -250.00 to 250.00  
 Increment: 0.01  
 \*RST: 0  
 Default unit: us

**Example:**

BB:EUTR:UL:UE1:PRAC:SUBF2:DT 300  
 sets the parameter delta t

**Manual control:**

See "[Delta t/us](#)" on page 218

**[: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.

**Manual control:** See "[State \(PRACH\)](#)" on page 218

**[: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 | PATtern |  
DLISt | 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.

**Manual control:** See "[Data Source \(PUSCH\)](#)" on page 206

**[: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>  
\*RST: #H0,1

**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.

**Manual control:** See "[Data Pattern \(PUSCH\)](#)" on page 206

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh: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.

**Parameters:**

<Dselect> string

**Example:** BB:EUTR:UL:UE:PUSC:DATA DLIS  
selects the Data Lists data source.  
MME: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.

**Manual control:** See ["Data List \(PUSCH\)"](#) on page 206

**[: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

**Manual control:** See ["State Scrambling \(PUSCH\)"](#) on page 206

**[: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

**Manual control:** See ["State Channel Coding and Multiplexing \(PUSCH\)"](#) on page 207

**[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:MODE <Mode>**

Defines the information transmitted on the PUSCH.

**Parameters:**

<Mode> COMBined | ULSchonly | UCInonly

**COMBined**

Control information and data is multiplexed into the PUSCH.

**ULSchonly**

Only data is transmitted on PUSCH.

**UCInonly**

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

**Manual control:**

See "[Mode Channel Coding](#)" on page 207

**[: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

**Manual control:**

See "[Channel Interleaver \(PUSCH\)](#)" on page 208

**[: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> integer

Range: 2 to 15

Increment: 1

\*RST: 2

**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

**Manual control:**

See "[I\\_CQI\\_offset](#)" on page 207

---

**[[: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>            integer  
                           Range:     0 to 14  
                           Increment: 1  
                           \*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

**Manual control:**    See "["I\\_HARQ\\_offset"](#) on page 207

---

**[[: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>            integer  
                           Range:     0 to 12  
                           Increment: 1  
                           \*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

**Manual control:**    See "["I\\_RI\\_offset"](#) on page 207

---

**[[: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: 0.001 dB  
                           \*RST:     0 dB

**Example:**

BB:EUTR:UL:UE2:REFS:DRS:POW -2  
 sets the demodulation reference symbol power offser to -2dB.

**Manual control:** See "DRS Power Offset" on page 208

---

**[: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

**Manual control:** See "SRS State" on page 209

---

**[: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: 0.001 dB  
\*RST: 0 dB

**Example:** BB:EUTR:UL:UE2:REFS:SRS:POW -2  
sets the sounding reference symbol power offset to -2 dB.

**Manual control:** See "SRS Power Offset" on page 209

---

**[: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> integer  
Range: 0 to 7  
Increment: 1  
\*RST: 0

**Example:** BB:EUTR:UL:UE2:REFS:SRS:CYCS 5  
sets the SRS cyclic shift for UE2

**Manual control:** See "SRS Cyclic Shift n\_CS" on page 209

---

**[: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  $b_{\text{HOP}} < B_{\text{SRS}}$ .

**Parameters:**

<Bhop> integer  
 Range: 0 to 3  
 Increment: 1  
 \*RST: 0

**Example:** BB:EUTR:UL:UE2:REFS:SRS:BHOP 2  
 sets the SRS hopping bandwidth

**Manual control:** See "[Hopping Bandwidth b\\_hop](#)" on page 215

**[ :SOURce<hw> ]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BSRS <Bsrs>**

Sets the UE specific parameter SRS Bandwidth  $B_{\text{SRS}}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

**Parameters:**

<Bsrs> integer  
 Range: 0 to 3  
 Increment: 1  
 \*RST: 0

**Example:** BB:EUTR:UL:UE2:REFS:SRS:BSRS 2  
 sets the SRS bandwidth configuration

**Manual control:** See "[SRS Bandwidth B\\_SRS](#)" on page 212

**[ :SOURce<hw> ]:BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS <Isrs>**

Sets the UE specific parameter SRS configuration index  $I_{\text{SRS}}$ . Depending on the selected duplexing mode ([\[ :SOURce<hw> \]:BB:EUTRa:DUPLexing](#)), 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.

**Parameters:**

<Isrs> integer  
 Range: 0 to 644  
 Increment: 1  
 \*RST: 0

**Example:** BB:EUTR:DUPL FDD  
 sets the duplexing mode  
 BB:EUTR:UL:UE2:REFS:SRS:ISRS 22  
 sets the SRS configuration index

**Manual control:** See "[Configuration Index I\\_SRS](#)" on page 210

**[ :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> integer  
 Range: 0 to max  
 \*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

**Manual control:** See "Periodicity  $T_{SRS}$ " on page 210

**[ :SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TOFFset?**

Queries the UE specific parameter SRS subframe offset  $T_{offset}$ .

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:**

<Toffset> integer  
 Range: 0 to 320  
 Increment: 1  
 \*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:TOFF?
queries the SRS subframe offset
Response: 5
```

**Usage:** Query only

**Manual control:** See "Subframe Offset  $T_{offset}$ " on page 211

**[[:SOURce<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TRComb <Trcomb>**

Sets the UE specific parameter transmission combn  $k_{TC}$ , as defined in the 3GPP TS 36.211, chapter 5.5.3.2.

**Parameters:**

<Trcomb>                    0 | 1  
                                  Range:     0 to 1  
                                  Increment: 1  
                                  \*RST:     0

**Example:**                    BB:EUTR:UL:UE2:REFS:SRS:TRC 1  
                                  sets the SRS transmission comb

**Manual control:**        See "[Transmission Comb k TC](#)" on page 215

**[[: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>                         integer  
                                  Range:     0 to max  
                                  Increment: 1  
                                  \*RST:     0

**Example:**                    BB:EUTR:UL:UE2:REFS:SRS:NRRC 10  
                                  sets the SRS frequency domain position

**Manual control:**        See "[Freq. Domain Position n\\_RRC](#)" on page 215

## 9.20 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:AACK.....</a>	497
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:ACKDefinition.....</a>	497
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:ADUDelay.....</a>	497
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:BBSelector.....</a>	498
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:BEInsertion.....</a>	498
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:BERate.....</a>	499
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:CONNector.....</a>	499



<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:DMODE</code> .....	499
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:ITADvance</code> .....	500
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:MAXTrans</code> .....	500
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:MODE</code> .....	500
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:RVSequence</code> .....	500
<code>[:SOURce&lt;hw&gt;]:BB:EUTRa:UL:RTFB:SERate</code> .....	501

---

### `[:SOURce<hw>]:BB:EUTRa:UL:RTFB:AACK` <AssumeACK>

If this parameter is enabled, the signal generator will not use any external HARQ feedback from the device under test for its HARQ processes until an ACK command is received the first time.

For detailed description, refer to "[Assume ACK until first received ACK command](#)" on page 202.

#### Parameters:

<AssumeACK>      0 | 1 | OFF | ON  
 \*RST:            OFF

**Options:**            R&S SMx/AMU-K69

**Manual control:**    See "[Assume ACK until first received ACK command](#)" on page 202

---

### `[: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  
 BB:EUTR:UL:RTFB:ACKD HIGH

**Options:**            R&S SMx/AMU-K69

**Manual control:**    See "[ACK Definition](#)" on page 202

---

### `[: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: -1.00 to 6.99  
 Increment: 0.01  
 \*RST: 0  
 Default unit: subframes

**Example:**

BB:EUTR:UL:RTFB:ADUD 1  
 sets the additional user delay

**Options:**

R&S SMx/AMU-K69

**Manual control:**

See ["Additional User Delay"](#) on page 203

**[: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> integer  
 Range: 0 to 3  
 Increment: 1  
 \*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

**Options:**

R&S SMx/AMU-K69

**Manual control:**

See ["Baseband Selector"](#) on page 203

**[: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

**Options:**

R&S SMx/AMU-K69

**Manual control:** See ["Block Error Insertion"](#) on page 204

---

**[: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

**Options:** R&S SMx/AMU-K69

**Manual control:** See ["Block Error Rate"](#) on page 204

---

**[: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

**Options:** R&S SMx/AMU-K69

**Manual control:** See ["Connector"](#) on page 203

---

**[: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

**Options:** R&S SMx/AMU-K69

**Manual control:** See ["Distance Mode"](#) on page 203

**[[:SOURce<hw>]:BB:EUTRa:UL:RTFB:ITADvance <ltadvance>**

The initial timing advance of the uplink signal (at the output of the instrument's baseband unit) in units of  $16 T_S$ .

**Parameters:**

<ltadvance> integer  
 Range: 0 x 16 Ts to 1282 x 16 Ts  
 Increment: 1 x 16 Ts  
 \*RST: 0 x 16 Ts

**Example:** BB:EUTR:UL:RTFB:ITAD 16  
 sets the initial timing advance

**Options:** R&S SMx/AMU-K69

**Manual control:** See "[Realtime Feedback Mode](#)" on page 201

**[[: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> integer  
 Range: 1 to 20  
 Increment: 1  
 \*RST: 4

**Example:** BB:EUTR:UL:RTFB:MAXT 5  
 sets the maximum number of transmissions

**Options:** R&S SMx/AMU-K69

**Manual control:** See "[Max. Number of Transmissions](#)" on page 202

**[[: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

**Options:** R&S SMx/AMU-K69

**[[: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

**Options:**

R&S SMx/AMU-K69

**Manual control:**

See "[Redundancy Version Sequence](#)" on page 201

`[: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

**Options:**

R&S SMx/AMU-K69

**Manual control:**

See "[Serial Rate](#)" on page 203

## 9.21 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 502

**Options:** R&S SMx/AMU-K81

**Manual control:** See ["Logging State"](#) on page 90

**[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 502

**Options:** R&S SMx/AMU-K81

**Manual control:** See ["Output Path"](#) on page 90

**[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 82 for a description of the file naming convention used.

**Parameters:**

<Preamble> string  
\*RST: K55Log

**Example:** [example "Logfiles Generation"](#) on page 502

**Options:** R&S SMx/AMU-K81

**Manual control:** See ["Logging Files Preamble"](#) on page 91

---

```
[ :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 502

**Options:** R&S SMx/AMU-K81

**Manual control:** See ["Extended DCI/UCI Logging"](#) on page 91

---

```
[ :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 502

**Options:** R&S SMx/AMU-K81

**Manual control:** See ["Enable/Disable All"](#) on page 91

---

```
[ :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 79 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 502

**Options:** R&S SMx/AMU-K81

**Manual control:** See ["Logging Point"](#) on page 91

---

```
[ :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:DL:PMCH <State>
[:SOURce<hw>]:BB:EUTRa:LOGGen:UL:PUSCh <PuschLogState>
```

Enables the channel for that logfiles are generated.

**Parameters:**

```
<PuschLogState> 0 | 1 | OFF | ON
*RST:           ON
```

**Example:** [example "Logfiles Generation"](#) on page 502

**Options:** R&S SMx/AMU-K81

**Manual control:** See ["Physical Channels"](#) on page 91

## 9.22 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 250.

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:APPLysettings</a> .....	506
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:AWGN:PLevel?</a> .....	506
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:FA:FRALocation</a> .....	506
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:FA:RBALocation</a> .....	506
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:RELease</a> .....	506
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:ANTSubset</a> .....	507
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:GENSignals</a> .....	507
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:INSTsetup</a> .....	507
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:MODE</a> .....	507
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:MARKerconfig</a> .....	508
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:RXANtennas</a> .....	508
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:SIGRout</a> .....	508
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:GS:TRIGgerconfig</a> .....	508
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS:CHBW?</a> .....	509
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS:CLID</a> .....	509
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS:DUPLex</a> .....	509
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS:FRSHift</a> .....	509
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS2:IFTYpe?</a> .....	510
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS:IFTYpe</a> .....	510
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS:NRBlock?</a> .....	510



[SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset.....	510
[SOURce<hw>]:BB:EUTRa:TCW:IS:OCEdge.....	510
[SOURce<hw>]:BB:EUTRa:TCW:IS:OVRB?.....	511
[SOURce<hw>]:BB:EUTRa:TCW:IS2:PLLevel?.....	511
[SOURce<hw>]:BB:EUTRa:TCW:IS3:PLLevel?.....	511
[SOURce<hw>]:BB:EUTRa:TCW:IS:PLLevel?.....	511
[SOURce<hw>]:BB:EUTRa:TCW:IS:RBCFrequency.....	511
[SOURce<hw>]:BB:EUTRa:TCW:IS2:RFFFrequency?.....	511
[SOURce<hw>]:BB:EUTRa:TCW:IS:RFFFrequency.....	511
[SOURce<hw>]:BB:EUTRa:TCW:IS:TDDConfig.....	512
[SOURce<hw>]:BB:EUTRa:TCW:IS:TMODe!.....	512
[SOURce<hw>]:BB:EUTRa:TCW:IS:TREquire.....	512
[SOURce<hw>]:BB:EUTRa:TCW:IS:UEID.....	512
[SOURce<hw>]:BB:EUTRa:TCW:MUE:TSRS.....	512
[SOURce<hw>]:BB:EUTRa:TCW:SUE:TSRS.....	512
[SOURce<hw>]:BB:EUTRa:TCW:RTF:ACKDefinition.....	513
[SOURce<hw>]:BB:EUTRa:TCW:RTF:AUSDelay.....	513
[SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSMue.....	513
[SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSSue.....	513
[SOURce<hw>]:BB:EUTRa:TCW:RTF:BBSelector.....	513
[SOURce<hw>]:BB:EUTRa:TCW:RTF:CONMue.....	513
[SOURce<hw>]:BB:EUTRa:TCW:RTF:CONSue.....	513
[SOURce<hw>]:BB:EUTRa:TCW:RTF:CONnector.....	513
[SOURce<hw>]:BB:EUTRa:TCW:RTF:MODE.....	514
[SOURce<hw>]:BB:EUTRa:TCW:RTF:SERRate.....	514
[SOURce<hw>]:BB:EUTRa:TCW:TC.....	514
[SOURce<hw>]:BB:EUTRa:TCW:WS:ACPucch.....	515
[SOURce<hw>]:BB:EUTRa:TCW:WS:BFormat.....	515
[SOURce<hw>]:BB:EUTRa:TCW:WS:CHBW.....	515
[SOURce<hw>]:BB:EUTRa:TCW:WS:CLID.....	515
[SOURce<hw>]:BB:EUTRa:TCW:WS:CYCPrefix.....	515
[SOURce<hw>]:BB:EUTRa:TCW:WS:DUPLex.....	515
[SOURce<hw>]:BB:EUTRa:TCW:WS:FMThroughput.....	516
[SOURce<hw>]:BB:EUTRa:TCW:WS:FRC.....	516
[SOURce<hw>]:BB:EUTRa:TCW:WS:FROffset.....	516
[SOURce<hw>]:BB:EUTRa:TCW:WS:HSMoDe.....	516
[SOURce<hw>]:BB:EUTRa:TCW:WS:NTAOffset.....	516
[SOURce<hw>]:BB:EUTRa:TCW:IS:ORTCover?.....	517
[SOURce<hw>]:BB:EUTRa:TCW:IS2:ORTCover?.....	517
[SOURce<hw>]:BB:EUTRa:TCW:IS3:ORTCover?.....	517
[SOURce<hw>]:BB:EUTRa:TCW:WS:ORTCover?.....	517
[SOURce<hw>]:BB:EUTRa:TCW:WS:OUPLevel.....	517
[SOURce<hw>]:BB:EUTRa:TCW:MUE:OVRB.....	517
[SOURce<hw>]:BB:EUTRa:TCW:SUE:OVRB.....	517
[SOURce<hw>]:BB:EUTRa:TCW:WS:OVRB.....	517
[SOURce<hw>]:BB:EUTRa:TCW:WS:PLLevel?.....	517
[SOURce<hw>]:BB:EUTRa:TCW:WS:PLPC?.....	518
[SOURce<hw>]:BB:EUTRa:TCW:WS:PLPS?.....	518
[SOURce<hw>]:BB:EUTRa:TCW:IS:PRCOndition?.....	518
[SOURce<hw>]:BB:EUTRa:TCW:IS2:PRCOndition?.....	518

<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:IS3:PRCondition?</a> .....	518
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:WS:PROCondition</a> .....	518
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:WS:RFFrequency</a> .....	518
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:WS:SPSFrame</a> .....	519
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:WS:TDDConfig</a> .....	519
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:WS:TIOBase?</a> .....	519
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:MUE:UEID</a> .....	519
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:SUE:UEID</a> .....	519
<a href="#">[:SOURce&lt;hw&gt;]:BB:EUTRa:TCW:WS:UEID</a> .....	519

---

### **[\[:SOURce<hw>\]: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

**Manual control:** See "[Apply Settings](#)" on page 266

---

### **[\[:SOURce<hw>\]:BB:EUTRa:TCW:AWGN:PLLevel?](#)**

Queries the AWGN power level.

**Return values:**

<PowerLevel> string

**Usage:** Query only

**Manual control:** See "[AWGN Configuration](#)" on page 284

---

### **[\[:SOURce<hw>\]: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

**Manual control:** See "[Frequency Allocation](#)" on page 263

---

### **[\[:SOURce<hw>\]:BB:EUTRa:TCW:GS:RELEase](#) <Release>**

Sets the 3GPP test specification used as a guide line for the test cases.

**Parameters:**

<Release> REL8

**Manual control:** See "[Test Specification Release](#)" on page 262

---

**[: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

**Manual control:** See "[Antenna Subset](#)" on page 263

---

**[: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

**Manual control:** See "[Generated Signal](#)" on page 328

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:INSTsetup <InstrumentSetup>**

Determines whether one or both paths are used.

**Parameters:**

<InstrumentSetup> 2PATH | 1PATH

**Manual control:** See "[Instrument Setup](#)" on page 262

---

**[:SOURce<hw>]:BB:EUTRa:TCW:GS:MODE <Mode>**

Determines the measurements type, Pfa or Pd, the signal is generated for, see "[Mode](#)" on page 331.

**Parameters:**

<Mode> DRATe | FDRate | ADRate

**FDRate**

False Detection Rate (Pfa)

**DRATe**

Detection Rate (Pd)

**ADRate**

Alternating Pd and Pfa

\*RST: DRATe

**Example:** SOUR:BB:EUTRa:TCW:GS:MODE ADRate

**Manual control:** See "[Mode](#)" on page 331

---

**[[: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.

**Manual control:** See "[Marker Configuration](#)" on page 262

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:GS:RXAntennas <NumOfRXAntennas>**

For performance requirement tests, determines the number of the Rx antennas.

**Parameters:**

<NumOfRXAntennas>ANT4 | ANT2 | ANT1

**Manual control:** See "[Number of Rx Antennas](#)" on page 263

---

**[[: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

**Manual control:** See "[Signal Routing](#)" on page 263

---

**[[: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.

**Manual control:** See ["Trigger Configuration"](#) on page 262

**[: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

**Manual control:** See ["Interfering Signal"](#) on page 273

**[: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

**Manual control:** See ["Cell ID"](#) on page 279

**[:SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex <Duplex>**

Selects whether TDD or FDD duplexing mode is used.

**Parameters:**

<Duplex> TDD | FDD

**Manual control:** See ["Interfering Signal"](#) on page 273

**[: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

**Manual control:** See "[Frequency Shift m](#)" on page 280

**[ :SOURce<hw>]:BB:EUTRa:TCW:IS: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

**Manual control:** See "[Interferer Type](#)" on page 277

**[ :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

**Manual control:** See "[Number of Resource Blocks](#)" on page 279

**[ :SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset <SigAdvNTAoffset>**

Sets the parameter  $N_{TAoffset}$ .

**Parameters:**

<SigAdvNTAoffset> NTA624 | NTA0

**Manual control:** See "[Signal Advance N\\_TA\\_offset](#)" on page 279

**[ :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

**Manual control:** See ["Interfering Signal"](#) on page 273

---

**[[: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

**Manual control:** See ["Offset VRB"](#) on page 279

---

**[[: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

**Manual control:** See ["Interfering Signal"](#) on page 273

---

**[[: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

**Manual control:** See ["Interfering RB Center Frequency"](#) on page 280

---

**[[: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

**Manual control:** See ["Interfering Signal"](#) on page 273

---

**[: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

**Manual control:**    See "[TDD UL/DL Configuration](#)" on page 279

---

**[: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

**Manual control:**    See "[Interfering Signal](#)" on page 273

---

**[: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

**Manual control:**    See "[Test Requirement](#)" on page 297

---

**[: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

**Manual control:**    See "[UE ID/n\\_RNTI](#)" on page 279

---

**[: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

**Manual control:** See ["Transmit SRS"](#) on page 312

**[: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

**Manual control:** See ["Realtime Feedback Configuration"](#) on page 303

**[: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

**Manual control:** See ["Realtime Feedback Configuration"](#) on page 303

**[: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

**Manual control:** See ["Realtime Feedback Configuration"](#) on page 303

**[: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

**Manual control:** See ["Realtime Feedback Configuration"](#) on page 303

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:MODE <Mode>**

Determines the feedback mode.

**Parameters:**

<Mode>

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.

**Manual control:** See ["Realtime Feedback Configuration"](#) on page 303

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:RTF:SERRate <SerialRate>**

Sets the bit rate of the serial transmission. Possible rates are 115.2 kbps, 1.6 Mbps and 1.92 Mbps.

**Parameters:**

<SerialRate>

SR1\_92M | SR1\_6M | SR115\_2K

**Manual control:** See ["Realtime Feedback Configuration"](#) on page 303

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:TC <TestCase>**

Selects the test case.

**Parameters:**

<TestCase>

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

**Manual control:** See ["Test Case"](#) on page 262

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:ACPucch <AddConfigPUCCH>**

Enables the optional transmission of PUCCH format 2.

**Parameters:**

<AddConfigPUCCH> 0 | 1 | OFF | ON

**Manual control:** See ["Additionally Configure PUCCH"](#) on page 319

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:BFormat <BurstFormat>**

Sets the burst format.

**Parameters:**

<BurstFormat> BF4 | BF3 | BF2 | BF1 | BF0

**Manual control:** See ["Burst Format"](#) on page 332

---

**[[: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

**Manual control:** See ["Channel Bandwidth"](#) on page 265

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:CLID <CellID>**

Sets the Cell ID.

**Parameters:**

<CellID> integer  
Range: 0 to 503  
Increment: 1  
\*RST: 150

**Manual control:** See ["Cell ID"](#) on page 265

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:CYCPrefix <CyclicPrefix>**

Selects normal or extended cyclic prefix.

**Parameters:**

<CyclicPrefix> EXTended | NORMal

**Manual control:** See ["Cyclic Prefix"](#) on page 265

---

**[[:SOURce<hw>]:BB:EUTRa:TCW:WS:DUPLex <Duplex>**

Selects whether TDD or FDD duplexing mode is used.

**Parameters:**

&lt;Duplex&gt; TDD | FDD

**Manual control:** See ["Duplexing"](#) on page 264**[ :SOURCE<hw> ] : BB : EUTRa : TCW : WS : FMTthroughput <FractMaxThrough>**

Selects the fraction of maximum throughput.

**Parameters:**

&lt;FractMaxThrough&gt; FMT70 | FMT30

**Manual control:** See ["Fraction of Max. Throughput"](#) on page 308**[ :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:**

&lt;FRC&gt; 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 | UE11 | UE12 | UE21 | UE22 | UE3

**Manual control:** See ["FRC"](#) on page 265**[ :SOURCE<hw> ] : BB : EUTRa : TCW : WS : FROffset <FreqOffset>**

Sets the frequency offset.

**Parameters:**

&lt;FreqOffset&gt; FO\_1340 | FO\_625 | FO\_270 | FO\_0

**Manual control:** See ["Frequency Offset"](#) on page 332**[ :SOURCE<hw> ] : BB : EUTRa : TCW : WS : HSMMode <HighSpeedMode>**

Enables/disables high speed mode.

**Parameters:**

&lt;HighSpeedMode&gt; 0 | 1 | OFF | ON

**Manual control:** See ["High Speed Mode"](#) on page 332**[ :SOURCE<hw> ] : BB : EUTRa : TCW : WS : NTAOffset <SigAdvNTAoffset>**Sets the parameter  $N_{TAOffset}$ .

**Parameters:**

<SigAdvNTAoffset> NTA624 | NTA0

**Manual control:** See ["Signal Advance N\\_TA\\_offset"](#) on page 265

**[ :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

**Manual control:** See ["Orthogonal Cover \(n\\_PUCCH\)"](#) on page 328

**[ :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

**Manual control:** See ["Base Station Wanted Signal"](#) on page 272

**[ :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

**Manual control:** See ["Offset VRB"](#) on page 265

**[ :SOURce<hw>]:BB:EUTRa:TCW:WS:PLLevel?**

Queries the Power Level.

**Return values:**

<PowerLevel> string

**Usage:** Query only

**Manual control:** See "[Power Level](#)" on page 265

---

**[: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

**Manual control:** See "[PUCCH Power Level](#)" on page 319

---

**[:SOURce<hw>]:BB:EUTRa:TCW:WS:PLPS?**

Queries the resulting PUSCH power level.

**Return values:**

<PowerLevelPUSCH>string

**Usage:** Query only

**Manual control:** See "[Power Level \(PUSCH\)](#)" on page 319

---

**[: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

**Manual control:** See "[Propagation Conditions](#)" on page 305

---

**[: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

**Manual control:** See "[RF Frequency](#)" on page 264

**[: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

**Manual control:** See "[Configuration of Special Subframe](#)" on page 332

**[: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

**Manual control:** See "[TDD UL/DL Configuration](#)" on page 264

**[: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

**Manual control:** See "[Timing Offset Base Value](#)" on page 333

**[: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

**Manual control:** See "[UE ID/n\\_RNTI](#)" on page 265



## A 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"
- [16] 3GPP TS 36.331 "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification"
- [17] Rohde&Schwarz, C. Gessner "Long Term Evolution. A concise introduction to LTE and its measurement requirements", ISBN 978-3-939837-11-4, First edition 2011
- [18] Rohde & Schwarz, Application Note 1MA169 "LTE-Advanced Technology Introduction"
- [19] Rohde & Schwarz, Application Note 1MA166 "LTE-Advanced Signals Generation and –Analysis"

- [20] 3GPP TR 36.912 V 9.1.0 "Technical Specification Group Radio Access Network; Feasibility study for further advancements for E-UTRA (LTE-Advanced), Release 9", December 2009

## List of Commands

[SOURce<hw>]:BB:EUTRa:CLIPping:LEVel.....	346
[SOURce<hw>]:BB:EUTRa:CLIPping:MODE.....	347
[SOURce<hw>]:BB:EUTRa:CLIPping:STATe.....	347
[SOURce<hw>]:BB:EUTRa:CLOCK:CUSTom.....	351
[SOURce<hw>]:BB:EUTRa:CLOCK:MODE.....	351
[SOURce<hw>]:BB:EUTRa:CLOCK:MULTiplier.....	352
[SOURce<hw>]:BB:EUTRa:CLOCK:SOURce.....	352
[SOURce<hw>]:BB:EUTRa:CLOCK:SYNChronization:EXECute.....	353
[SOURce<hw>]:BB:EUTRa:CLOCK:SYNChronization:MODE.....	353
[SOURce<hw>]:BB:EUTRa:DL:BUR.....	395
[SOURce<hw>]:BB:EUTRa:DL:BW.....	372
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BB.....	415
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:BW.....	415
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:CIF.....	416
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:DFReq.....	416
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:ID.....	416
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:INDEX.....	417
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:POFFset.....	417
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:PStArt.....	417
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:SCIIndex.....	417
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:STATe.....	418
[SOURce<hw>]:BB:EUTRa:DL:CA:CELL<ch0>:TDElAy.....	418
[SOURce<hw>]:BB:EUTRa:DL:CA:STATe.....	415
[SOURce<hw>]:BB:EUTRa:DL:CONF:MODE.....	369
[SOURce<hw>]:BB:EUTRa:DL:CONSubframes.....	396
[SOURce<hw>]:BB:EUTRa:DL:CPC.....	377
[SOURce<hw>]:BB:EUTRa:DL:CSETtings:RARnti.....	376
[SOURce<hw>]:BB:EUTRa:DL:DUMD:DATA.....	478
[SOURce<hw>]:BB:EUTRa:DL:DUMD:DSElect.....	478
[SOURce<hw>]:BB:EUTRa:DL:DUMD:MODulation.....	477
[SOURce<hw>]:BB:EUTRa:DL:DUMD:PATtern.....	479
[SOURce<hw>]:BB:EUTRa:DL:DUMD:POWer.....	478
[SOURce<hw>]:BB:EUTRa:DL:FFT.....	373
[SOURce<hw>]:BB:EUTRa:DL:LGS?.....	374
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:ID.....	406
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:AVAl?.....	406
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DATA.....	407
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:DLISt.....	407
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MCS.....	407
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MODulation?.....	407
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:MPER.....	408
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NOFFset.....	408
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NPATtern.....	408
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NRC.....	408
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:NSI.....	409

[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:OFFS.....	409
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:PATtern.....	409
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:RPER.....	409
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:STATE.....	410
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:MCCH:TBSize?.....	410
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NIND.....	410
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:AI:NMRL.....	410
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:MODE.....	411
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:CSAP.....	411
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:MTCH:NPMChs.....	411
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DATA.....	412
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:DLISt.....	412
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:MCS.....	412
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:PATtern.....	412
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SAENd.....	413
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SASart.....	413
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:PMCH<ch0>:SPERiod.....	413
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:RHOA.....	413
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AMODE.....	413
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AOFFset.....	414
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:APER.....	414
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:SC:AVAL.....	414
[SOURce<hw>]:BB:EUTRa:DL:MBSFn:UEC.....	414
[SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTA.....	370
[SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTB.....	370
[SOURce<hw>]:BB:EUTRa:DL:MIMO:ANTenna.....	369
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP4:TX<ch>:IMAGinary.....	370
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP4:TX<ch>:REAL.....	370
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP6:TX<ch>:IMAGinary.....	371
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:AP6:TX<ch>:REAL.....	371
[SOURce<hw>]:BB:EUTRa:DL:MIMO:APM:MAPCoordinates.....	371
[SOURce<hw>]:BB:EUTRa:DL:MIMO:CONFIguration.....	369
[SOURce<hw>]:BB:EUTRa:DL:NORB.....	373
[SOURce<hw>]:BB:EUTRa:DL:OCCBandwidth?.....	374
[SOURce<hw>]:BB:EUTRa:DL:OCCSubcarriers?.....	374
[SOURce<hw>]:BB:EUTRa:DL:PBCH:MIB.....	419
[SOURce<hw>]:BB:EUTRa:DL:PBCH:RATBa.....	377
[SOURce<hw>]:BB:EUTRa:DL:PBCH:SOFFset.....	420
[SOURce<hw>]:BB:EUTRa:DL:PBCH:SRPeriod.....	420
[SOURce<hw>]:BB:EUTRa:DL:PDCCh:RATBa.....	377
[SOURce<hw>]:BB:EUTRa:DL:PDSCh:PB.....	378
[SOURce<hw>]:BB:EUTRa:DL:PDSCh:RATBa.....	378
[SOURce<hw>]:BB:EUTRa:DL:PHICh:DURation.....	378
[SOURce<hw>]:BB:EUTRa:DL:PHICh:NGParameter.....	379
[SOURce<hw>]:BB:EUTRa:DL:PRSS:BW.....	379
[SOURce<hw>]:BB:EUTRa:DL:PRSS:Cl.....	379
[SOURce<hw>]:BB:EUTRa:DL:PRSS:DPRS?.....	380
[SOURce<hw>]:BB:EUTRa:DL:PRSS:NPRS.....	380

[SOURce<hw>]:BB:EUTRa:DL:PRSS:POW.....	380
[SOURce<hw>]:BB:EUTRa:DL:PRSS:STATe.....	380
[SOURce<hw>]:BB:EUTRa:DL:PRSS:TPRS?.....	381
[SOURce<hw>]:BB:EUTRa:DL:REFSig:EPRE.....	371
[SOURce<hw>]:BB:EUTRa:DL:REFSig:POWer.....	371
[SOURce<hw>]:BB:EUTRa:DL:RGS?.....	375
[SOURce<hw>]:BB:EUTRa:DL:RSTFrame.....	396
[SOURce<hw>]:BB:EUTRa:DL:SFSelection.....	396
[SOURce<hw>]:BB:EUTRa:DL:SRATe?.....	373
[SOURce<hw>]:BB:EUTRa:DL:SYNC:PPOWer.....	372
[SOURce<hw>]:BB:EUTRa:DL:SYNC:SPOWer.....	372
[SOURce<hw>]:BB:EUTRa:DL:SYNC:TXAntenna.....	372
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP5:TX<st>:IMAGinary.....	474
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP5:TX<st>:REAL.....	474
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP7:TX<st>:IMAGinary.....	474
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP7:TX<st>:REAL.....	474
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP8:TX<st>:IMAGinary.....	474
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:AP8:TX<st>:REAL.....	474
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:CBIndex.....	474
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MAPCoordinates.....	474
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:APM:MODE.....	475
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CA:STATe.....	477
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:CCODing:STATe.....	475
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DATA.....	476
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:DSElect.....	476
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PA.....	477
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:PATTeRn.....	477
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:SCRaMbling:STATe.....	475
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:TXM.....	404
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEC.....	405
[SOURce<hw>]:BB:EUTRa:DL:USER<ch>:UEID.....	476
[SOURce<hw>]:BB:EUTRa:DL:VIEW:MODE.....	395
[SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CID.....	375
[SOURce<hw>]:BB:EUTRa:DL[:PLCi]:CIDGroup.....	376
[SOURce<hw>]:BB:EUTRa:DL[:PLCi]:PLID.....	376
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALCount.....	397
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>:CODWords.....	397
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:AOC.....	401
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:ISBSize.....	420
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:RVIndex.....	421
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:STATe.....	421
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TBSize.....	421
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CCODing:TYPE?.....	422
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONFLict?.....	404
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:CONType.....	403
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DATA.....	402
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:DSElect.....	402
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:GAP.....	398

[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:MODulation.....	398
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PATtern.....	402
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PHYSbits?.....	401
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:POWER.....	403
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:AP.....	422
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:APM.....	423
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CBINdex.....	423
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:CDD.....	423
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:DAFormat.....	424
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:NOLayers.....	424
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCHeme.....	425
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:SCID.....	425
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:PRECoding:TRSCHEME.....	426
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBCount.....	399
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:RBOffset.....	400
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:STATe.....	426
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SCRambling:UEID.....	426
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:STATe.....	404
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMCount.....	399
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ALLoc<ch0>[:CW<user>]:SYMOffset.....	400
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:CYCPrefix.....	396
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:CREGion.....	431
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:POWER.....	430
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PCFich:SCRambling:STATe.....	431
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:ALRegs.....	437
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVCCes.....	435
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:AVRegs.....	434
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:BITS.....	434
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DATA.....	438
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DATA.....	439
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:DSElect.....	439
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:PATtern.....	440
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DCRegs:TRSource.....	439
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DREGs.....	437
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:DSElect.....	438
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:APPend.....	441
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DELeTe.....	441
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:DOWN.....	442
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:INSert.....	441
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CELL.....	443
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CINdex.....	444
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:CONFlict?.....	445
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:BITData?.....	446
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CIField.....	446
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSDMrs.....	448
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:CSIRequest.....	448
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DLAindex.....	449
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:DPOFset.....	449

[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:F1AMode.....	446
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:GAP.....	449
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:HPN.....	450
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:MCSR.....	450
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:NDI.....	451
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PFHopping.....	451
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PMI.....	451
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACH: MINDex.....	447
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PRACH: PRINdex.....	447
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:PREInfo.....	452
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAH.....	452
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAHR.....	453
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RAType.....	453
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RBA.....	453
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:RV.....	454
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SID.....	456
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:SWAPflag.....	454
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:MCS.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:NDI.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB1:RV.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:MCS.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:NDI.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TB2:RV.....	455
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCC.....	456
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPCInstr.....	457
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:TPMI.....	457
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:ULINdex.....	458
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIConf:VRBA.....	458
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:DCIFmt.....	442
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NCCes.....	444
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:NDCCes.....	444
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:PFMT.....	443
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:SESPace.....	445
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:UEID.....	443
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:ITEM<ch0>:USER.....	445
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:RESet.....	442
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SITem.....	440
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:SOLVe.....	442
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:EXTC:UP.....	442
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:FORMat.....	435
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:NOPDcchs.....	436
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:PATtern.....	438
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:POWER.....	433
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PDCCh:SCRambling:STATe.....	434
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:ANPattern<ch0>.....	433
[:SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:GROup<ch0>:ITEM<user0>:POW.....	432

[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:NOGRoups.....	433
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:PMODE.....	432
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PHICh:POWer.....	432
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:NOLayers?.....	430
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:PRECoding:SCHEME.....	429
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:ENCC:STATe.....	429
[SOURce<hw>]:BB:EUTRa:DL[:SUBF<st0>]:USER<ch>:PHYSbits?.....	405
[SOURce<hw>]:BB:EUTRa:DUPLexing.....	335
[SOURce<hw>]:BB:EUTRa:FILTer:ILENgtH.....	340
[SOURce<hw>]:BB:EUTRa:FILTer:ILENgtH:AUTO.....	341
[SOURce<hw>]:BB:EUTRa:FILTer:MODE.....	340
[SOURce<hw>]:BB:EUTRa:FILTer:OSAMpling.....	341
[SOURce<hw>]:BB:EUTRa:FILTer:OSAMpling:AUTO.....	341
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:APCO25.....	341
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:COSSine.....	342
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:COSSine:COFS.....	342
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:GAUSSs.....	342
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LPASSEVM.....	343
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LPASSs.....	343
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:COFFactor.....	343
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:COFS.....	344
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:OPTimization.....	344
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:LTE:ROFFactor.....	344
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:PGAuss.....	344
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:RCOSSine.....	345
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:SPHase.....	345
[SOURce<hw>]:BB:EUTRa:FILTer:PARAmeter:USER.....	345
[SOURce<hw>]:BB:EUTRa:FILTer:TYPE.....	340
[SOURce<hw>]:BB:EUTRa:LINK.....	336
[SOURce<hw>]:BB:EUTRa:LOGGen:DL:DALL.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:DL:EALL.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:DL:EDLogging.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:DL:ENCC.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:DL:LOGPoint<ch0>.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:DL:PBCH.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:DL:PDsch.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:DL:PMCH.....	504
[SOURce<hw>]:BB:EUTRa:LOGGen:LFP.....	502
[SOURce<hw>]:BB:EUTRa:LOGGen:OUTPut.....	502
[SOURce<hw>]:BB:EUTRa:LOGGen:STATe.....	502
[SOURce<hw>]:BB:EUTRa:LOGGen:UL:DALL.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:UL:EALL.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:UL:EULogging.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:UL:LOGPoint<ch0>.....	503
[SOURce<hw>]:BB:EUTRa:LOGGen:UL:PUSch.....	504
[SOURce<hw>]:BB:EUTRa:POWC:LEVReference.....	348
[SOURce<hw>]:BB:EUTRa:POWC:ORTLevel.....	349
[SOURce<hw>]:BB:EUTRa:POWC:REFChannel.....	349



[SOURce<hw>]:BB:EUTRa:POWC:REFSubframe?	350
[SOURce<hw>]:BB:EUTRa:POWC:RUE?	350
[SOURce<hw>]:BB:EUTRa:PRESet	336
[SOURce<hw>]:BB:EUTRa:SETTing:CATalog	336
[SOURce<hw>]:BB:EUTRa:SETTing:DEL	337
[SOURce<hw>]:BB:EUTRa:SETTing:LOAD	337
[SOURce<hw>]:BB:EUTRa:SETTing:STORe	337
[SOURce<hw>]:BB:EUTRa:SETTing:STORe:FAST	337
[SOURce<hw>]:BB:EUTRa:SETTing:TMOD:DL	338
[SOURce<hw>]:BB:EUTRa:SETTing:TMOD:TDD	338
[SOURce<hw>]:BB:EUTRa:SLENgth	338
[SOURce<hw>]:BB:EUTRa:SRATe:VARiation	346
[SOURce<hw>]:BB:EUTRa:STATe	335
[SOURce<hw>]:BB:EUTRa:TCW:APPLysettings	506
[SOURce<hw>]:BB:EUTRa:TCW:AWGN:PLevel?	506
[SOURce<hw>]:BB:EUTRa:TCW:FA:FRALlocation	506
[SOURce<hw>]:BB:EUTRa:TCW:FA:RBALlocation	506
[SOURce<hw>]:BB:EUTRa:TCW:GS:ANTSubset	507
[SOURce<hw>]:BB:EUTRa:TCW:GS:GENSignals	507
[SOURce<hw>]:BB:EUTRa:TCW:GS:INSTsetup	507
[SOURce<hw>]:BB:EUTRa:TCW:GS:MARKerconfig	508
[SOURce<hw>]:BB:EUTRa:TCW:GS:MODE	507
[SOURce<hw>]:BB:EUTRa:TCW:GS:RELease	506
[SOURce<hw>]:BB:EUTRa:TCW:GS:RXAntennas	508
[SOURce<hw>]:BB:EUTRa:TCW:GS:SIGRout	508
[SOURce<hw>]:BB:EUTRa:TCW:GS:TRIGgerconfig	508
[SOURce<hw>]:BB:EUTRa:TCW:IS2:IFTYpe?	510
[SOURce<hw>]:BB:EUTRa:TCW:IS2:ORTCover?	517
[SOURce<hw>]:BB:EUTRa:TCW:IS2:PLevel?	511
[SOURce<hw>]:BB:EUTRa:TCW:IS2:PRCOndition?	518
[SOURce<hw>]:BB:EUTRa:TCW:IS2:RFFRequency?	511
[SOURce<hw>]:BB:EUTRa:TCW:IS3:ORTCover?	517
[SOURce<hw>]:BB:EUTRa:TCW:IS3:PLevel?	511
[SOURce<hw>]:BB:EUTRa:TCW:IS3:PRCOndition?	518
[SOURce<hw>]:BB:EUTRa:TCW:IS:CHBW?	509
[SOURce<hw>]:BB:EUTRa:TCW:IS:CLID	509
[SOURce<hw>]:BB:EUTRa:TCW:IS:DUPLex	509
[SOURce<hw>]:BB:EUTRa:TCW:IS:FRSHift	509
[SOURce<hw>]:BB:EUTRa:TCW:IS:IFTYpe	510
[SOURce<hw>]:BB:EUTRa:TCW:IS:NRBlock?	510
[SOURce<hw>]:BB:EUTRa:TCW:IS:NTAOffset	510
[SOURce<hw>]:BB:EUTRa:TCW:IS:OCEdge	510
[SOURce<hw>]:BB:EUTRa:TCW:IS:ORTCover?	517
[SOURce<hw>]:BB:EUTRa:TCW:IS:OVRB?	511
[SOURce<hw>]:BB:EUTRa:TCW:IS:PLevel?	511
[SOURce<hw>]:BB:EUTRa:TCW:IS:PRCOndition?	518
[SOURce<hw>]:BB:EUTRa:TCW:IS:RBCFrequency	511
[SOURce<hw>]:BB:EUTRa:TCW:IS:RFFRequency	511

[:SOURCE<hw>]:BB:EUTRa:TCW:IS:TDDConfig.....	512
[:SOURCE<hw>]:BB:EUTRa:TCW:IS:TMODeI?.....	512
[:SOURCE<hw>]:BB:EUTRa:TCW:IS:TREQUIRE.....	512
[:SOURCE<hw>]:BB:EUTRa:TCW:IS:UEID.....	512
[:SOURCE<hw>]:BB:EUTRa:TCW:MUE:OVRB.....	517
[:SOURCE<hw>]:BB:EUTRa:TCW:MUE:TSRS.....	512
[:SOURCE<hw>]:BB:EUTRa:TCW:MUE:UEID.....	519
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:ACKDefinition.....	513
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:AUSDelay.....	513
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:BBSMue.....	513
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:BBSSue.....	513
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:BBSelector.....	513
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:CONMue.....	513
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:CONSue.....	513
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:CONNector.....	513
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:MODE.....	514
[:SOURCE<hw>]:BB:EUTRa:TCW:RTF:SERRate.....	514
[:SOURCE<hw>]:BB:EUTRa:TCW:SUE:OVRB.....	517
[:SOURCE<hw>]:BB:EUTRa:TCW:SUE:TSRS.....	512
[:SOURCE<hw>]:BB:EUTRa:TCW:SUE:UEID.....	519
[:SOURCE<hw>]:BB:EUTRa:TCW:TC.....	514
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:ACPucch.....	515
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:BFormat.....	515
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:CHBW.....	515
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:CLID.....	515
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:CYCPrefix.....	515
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:DUPLex.....	515
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:FMThroughput.....	516
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:FRC.....	516
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:FROffset.....	516
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:HSMoDe.....	516
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:NTAOffset.....	516
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:ORTCover?.....	517
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:OUPLeveL.....	517
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:OVRB.....	517
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:PLPC?.....	518
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:PLPS?.....	518
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:PLeveL?.....	517
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:PROCondition.....	518
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:RFFRequency.....	518
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:SPSFrame.....	519
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:TDDConfig.....	519
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:TIOBase?.....	519
[:SOURCE<hw>]:BB:EUTRa:TCW:WS:UEID.....	519
[:SOURCE<hw>]:BB:EUTRa:TDD:SPSConf.....	367
[:SOURCE<hw>]:BB:EUTRa:TDD:UDConf.....	367
[:SOURCE<hw>]:BB:EUTRa:TDW:STATe.....	348
[:SOURCE<hw>]:BB:EUTRa:TDW:TRTime.....	348

[SOURce<hw>]:BB:EUTRa:TIMC:NTAoffset.....	354
[SOURce<hw>]:BB:EUTRa:TRIGger:ARM:EXECute.....	355
[SOURce<hw>]:BB:EUTRa:TRIGger:DELAy:UNIT.....	356
[SOURce<hw>]:BB:EUTRa:TRIGger:EXECute.....	356
[SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal:SYNChronize:OUTPut.....	357
[SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:RDELAy?.....	356
[SOURce<hw>]:BB:EUTRa:TRIGger:EXTernal<ch>:TDELAy.....	357
[SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:DELAy.....	358
[SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:INHibit.....	358
[SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:RDELAy?.....	358
[SOURce<hw>]:BB:EUTRa:TRIGger:OBASeband:TDELAy.....	359
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut:DELAy:FIXed.....	363
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELAy.....	363
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELAy:MAXimum?.....	364
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:DELAy:MINimum?.....	364
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:FOFFset.....	366
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:MODE.....	364
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:OFFTime.....	366
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ONTime.....	366
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:PERiod.....	366
[SOURce<hw>]:BB:EUTRa:TRIGger:OUTPut<ch>:ROFFset.....	366
[SOURce<hw>]:BB:EUTRa:TRIGger:RMODE?.....	359
[SOURce<hw>]:BB:EUTRa:TRIGger:SLENgth.....	360
[SOURce<hw>]:BB:EUTRa:TRIGger:SLUNit.....	360
[SOURce<hw>]:BB:EUTRa:TRIGger:SOURce.....	361
[SOURce<hw>]:BB:EUTRa:TRIGger[EXTernal<ch>]:DELAy.....	362
[SOURce<hw>]:BB:EUTRa:TRIGger[EXTernal<ch>]:INHibit.....	362
[SOURce<hw>]:BB:EUTRa:UL:BW.....	382
[SOURce<hw>]:BB:EUTRa:UL:CPC.....	385
[SOURce<hw>]:BB:EUTRa:UL:FFT.....	383
[SOURce<hw>]:BB:EUTRa:UL:LGS?.....	384
[SOURce<hw>]:BB:EUTRa:UL:NORB.....	382
[SOURce<hw>]:BB:EUTRa:UL:OCCBandwidth?.....	383
[SOURce<hw>]:BB:EUTRa:UL:OCCSubcarriers?.....	383
[SOURce<hw>]:BB:EUTRa:UL:PRACH:CONFIguration.....	389
[SOURce<hw>]:BB:EUTRa:UL:PRACH:FOFFset.....	389
[SOURce<hw>]:BB:EUTRa:UL:PRACH:RSET.....	390
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:DEOFset.....	392
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:DESHift.....	391
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1CS.....	392
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1EMax.....	393
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:N1NMax.....	393
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2Max.....	393
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:N2RB.....	392
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:N3Max.....	394
[SOURce<hw>]:BB:EUTRa:UL:PUCCh:NORB.....	391
[SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHMode.....	390
[SOURce<hw>]:BB:EUTRa:UL:PUSCh:FHOFset.....	390

[SOURce<hw>]:BB:EUTRa:UL:PUSCh:NOSM.....	391
[SOURce<hw>]:BB:EUTRa:UL:REFSig:DMRS.....	387
[SOURce<hw>]:BB:EUTRa:UL:REFSig:DSSHift.....	386
[SOURce<hw>]:BB:EUTRa:UL:REFSig:GRPHopping.....	386
[SOURce<hw>]:BB:EUTRa:UL:REFSig:SEQHopping.....	386
[SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:ANSTx.....	387
[SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:CSRS.....	388
[SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:DSFC?.....	388
[SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:MUPTs.....	387
[SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:SUConfiguration.....	388
[SOURce<hw>]:BB:EUTRa:UL:REFSig:SRS:TSFC?.....	389
[SOURce<hw>]:BB:EUTRa:UL:RGS?.....	384
[SOURce<hw>]:BB:EUTRa:UL:RSTFrame.....	460
[SOURce<hw>]:BB:EUTRa:UL:RTFB:AACK.....	497
[SOURce<hw>]:BB:EUTRa:UL:RTFB:ACKDefinition.....	497
[SOURce<hw>]:BB:EUTRa:UL:RTFB:ADUDelay.....	497
[SOURce<hw>]:BB:EUTRa:UL:RTFB:BBSelector.....	498
[SOURce<hw>]:BB:EUTRa:UL:RTFB:BEINsertion.....	498
[SOURce<hw>]:BB:EUTRa:UL:RTFB:BERate.....	499
[SOURce<hw>]:BB:EUTRa:UL:RTFB:CONNector.....	499
[SOURce<hw>]:BB:EUTRa:UL:RTFB:DMODE.....	499
[SOURce<hw>]:BB:EUTRa:UL:RTFB:ITADvance.....	500
[SOURce<hw>]:BB:EUTRa:UL:RTFB:MAXTrans.....	500
[SOURce<hw>]:BB:EUTRa:UL:RTFB:MODE.....	500
[SOURce<hw>]:BB:EUTRa:UL:RTFB:RVSequence.....	500
[SOURce<hw>]:BB:EUTRa:UL:RTFB:SERate.....	501
[SOURce<hw>]:BB:EUTRa:UL:SFSelection.....	460
[SOURce<hw>]:BB:EUTRa:UL:SRAtE.....	382
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUCCh.....	459
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:CONSubframes:PUSCh.....	459
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:DACRestart.....	480
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:ALRB.....	482
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:MODulation?.....	482
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:N2DMrs.....	482
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:PASize?.....	483
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:STATe.....	483
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TNOBits?.....	484
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:TYPE.....	484
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:FRC:VRBOffset.....	485
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:ID.....	481
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:MODE.....	481
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:POWer.....	481
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:CFRames.....	486
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRFormat?.....	486
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRState.....	485
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:PRTT.....	485
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:DT.....	488
[SOURce<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:FRINdex.....	486

[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:NCSConf.....	487
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:POWER.....	487
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RBOffset.....	486
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:RSEQUence.....	487
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:SINDEX.....	488
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PRACH:SUBF<ch0>:STATE.....	488
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:ICQioffset.....	491
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IHARqoffset.....	492
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:INTerleaver.....	491
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:IRloffset.....	492
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:MODE.....	490
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:CCODing:STATE.....	490
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DATA.....	489
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:DSElect.....	489
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:PATtern.....	489
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:PUSCh:SCRambling:STATE.....	490
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:DRS:POWoffset.....	492
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BHOP.....	493
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:BSRS.....	494
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:CYCShift.....	493
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:ISRS.....	494
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:NRRC.....	496
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:POWoffset.....	493
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:STATE.....	493
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TOFFset?.....	495
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TRComb.....	496
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:REFSig:SRS:TSRS?.....	495
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:RELease.....	480
[:SOURCE<hw>]:BB:EUTRa:UL:UE<st>:STATE.....	481
[:SOURCE<hw>]:BB:EUTRa:UL[:PLCi]:CID.....	384
[:SOURCE<hw>]:BB:EUTRa:UL[:PLCi]:CIDGroup.....	385
[:SOURCE<hw>]:BB:EUTRa:UL[:PLCi]:PLID.....	385
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONFLict?.....	464
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:CONType.....	461
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:FORMat.....	461
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:MODulation.....	461
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?.....	463
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:POWER.....	463
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CONFLict?.....	464
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:BITS.....	473
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:CBITS?.....	472
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:CQI:PATtern.....	473
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:BITS.....	471
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:CBITS?.....	471
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:HARQ:PATtern.....	472
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:NPAr.....	471
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:PHYSbits?.....	463
[:SOURCE<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:POWER.....	463

[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:RBCount?	461
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUCCh:STATe	464
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:RVINdex	471
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CCODing:TBSize	470
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CONFLict?	464
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:BITS	468
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:CBITs?	468
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:CQI:PATtern	468
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:IIHBITs	466
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:STATe	465
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:FHOP:TYPE?	466
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:BITS	467
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:CBITs	467
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:MODE	466
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:NBUNdled	467
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:HARQ:PATtern	468
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:NDMRs	465
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:PHYsbits?	463
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:POWER	463
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:BITS	469
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:CBITs?	469
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:RI:PATtern	470
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:RBCount	461
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:SET<user>:VRBOffset	462
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:STATe	464
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:PUSCh:ULSCh:BITS?	470
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:RBCount	461
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:STATe	464
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:ALLoc<ch0>:VRBOffset	462
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:CYCPrefix	460
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUCCh:RBOFset?	462
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:PUSCh:SET<s2us>: RBOFset?	462
[SOURce<hw>]:BB:EUTRa:UL[:SUBF<st0>]:SLOT<user0>:ALLoc<ch0>:RBOFset?	462
[SOURce<hw>]:BB:EUTRa:WAVeform:CREate	338
[SOURce<hw>]:BB:EUTRa[:TRIGger]:SEQuence	355
[SOURce]:BB:EUTRa:VERSion?	339

# Index

## A

A/N + SRS Simultaneous Transmission	185, 387
ACK/NACK+SR Bits	226
ACK/NACK+SR Pattern	224
ACK/NACK Mode	
Bundling	220
Multiplexing	220
ACK/NACK Pattern	221, 224, 468, 472
PHICH Group	145
ACK/NACK Pattern PHICH Group	433
ACK Definition	202, 304
Activate EUTRA/LTE Standard	73
Additional User Delay	203
Allocated Resource Blocks	200
Allocation Data List	402
Allocation Data Pattern	402
Allocation Data Source	132, 402
Allocation number	127, 135
Antenna port 4	24
Antenna Port Mapping	171
Antenna ports 5, 7 and 8	25
Append	150
Area ID (N_ID_MBSFN)	103
Arm	78, 240
Armed_Auto	355
Armed_Retrigger	355
Arm Trigger	355
Assume ACK until first received ACK command	202
Auto	355
Automatic Offset Calculation	132, 401

## B

Bandwidth	
channel	113
component carrier	111
Baseband filter	230, 340
Baseband Selector	203
Beamforming	116
Behavior in Unscheduled Resource Elements	395
Behavior In Unscheduled Resource Elements	126
Binary Mode	63, 201
Bit Data	155
Block Error Insertion	204, 498
Block Error Rate	204, 499

## C

Carrier aggregation	
activate	168
configuration	108
Carrier aggregation activate	110
Carrier Indicator Field (CIF)	155
Carrying Out a Test Case	271
Catalog	
User Filter	231
CCE Index	154
Cell ID	375, 384
Cell Index	110, 151, 188
Channel Bandwidth	372, 382
Channel Coding State	139, 421
PUSCH	207

Channel Coding State PUSCH	490
Channel Coding State User	475
Channel Coding Type	139, 422
Channel Interleaver	
PUSCH	491
Channel Interleaver (PUSCH)	208
CIF	111
Clipping Level	234, 346
Clipping Mode	235, 347
Clock Mode	247, 351
Clock Multiplier	248
Clock Source	247, 352
Closed Loop BS Tests	200
Clustered PUSCH	190
Codebook	35
Codebook Index	137, 171, 423
Coded ACK/NACK+SR Bits	226
Codeword	35, 127, 189
Code Word	135, 397
Code Words	137
Common subframe allocation period	106
Component Carrier	110
Configuration Index I_SRS	210
Configuration Period T_SFC	185
Configure	
PCFICH	127
PDCCH	127
PHICH	127
Conflict	154, 193, 404, 464
DL	133
resolve	151
Connector	203
Content DCI Format	153
Content Type	189, 219, 224, 403, 461
DL	133
Control Region for PDCCH	112, 143, 431
CQI Pattern	222, 226, 468, 473
Crest Factor	346
Crest factor - Clipping	234
Crest factor – Clipping	347
Current Range without Recalculation	246, 364
Custom External Clock	248, 351
Cut Off Frequency Factor	233
Cut Off Frequency Shift	232
Cyclic Delay Diversity	138, 423
Cyclic Prefix	119, 126, 178, 188, 377, 385, 396, 460

## D

Data Format	138
Data List	133
Data List Management	75
Data List PDCCH	148, 150
Data Pattern	133
Data Pattern (PUSCH)	206
Data Pattern PDCCH	148, 150
Data Source	
PDCCH	148
PUSCH	206, 489
DCI Format	152
DCI Format 0	155
DCI Format 1	157
DCI Format 1A	158

- DCI Format 1B ..... 159
  - DCI Format 1C ..... 161
  - DCI Format 1D ..... 161
  - DCI Format 2 ..... 163
  - DCI Format 2A ..... 163
  - DCI Format 2B ..... 163
  - DCI Format 3 ..... 165
  - DCI Format 3A ..... 165
  - Deactivate EUTRA/LTE Standard ..... 73
  - Default settings ..... 336
  - Default Settings ..... 74
  - Delay
    - SCell ..... 112
  - Delay - Marker ..... 363
  - Delay - Trigger ..... 362
  - Delete ..... 150
    - User Filter ..... 231
  - Delete User Settings ..... 337
  - Delta Offset ..... 183, 392
  - Delta Sequence Shift for PUSCH ..... 179, 386
  - Delta Shift ..... 183, 391
  - Delta t
    - PRACH ..... 218, 488
  - Demodulation Reference Signal
    - Power Offset ..... 208
  - Distance Mode ..... 203
  - DList Pattern ..... 168
  - DMRS Index ..... 219, 465
  - Documentation Overview ..... 11
  - Down ..... 150
  - Downlink ..... 77, 336
  - Downlink Reference Signal Structure
    - Reference Signal Power ..... 371
  - DRMS Index ..... 179, 387
  - Dummy CCE Data Source ..... 149
  - Dummy CCE REGs ..... 149
  - Dummy Data Configuration
    - Data List ..... 478
    - Data Pattern ..... 479
    - Data Source ..... 172, 478
    - Modulation ..... 172, 477
    - Power ..... 173, 478
  - Dummy Data Data Source ..... 478
  - Dummy Data Power ..... 173, 478
  - Dummy Data Source ..... 172
  - Duplexing ..... 77, 335
  - Dynamic range ..... 282
- E**
- Enhanced Channel Configuration ..... 141
  - Enhanced Setting
    - Precoding Scheme ..... 429
  - Enhanced settings ..... 128, 190
  - Enhanced Settings
    - Allocation number ..... 135
    - Channel Coding State ..... 139, 421
    - Channel Coding Type ..... 139, 422
    - Codebook Index ..... 137, 423
    - Code Word ..... 135
    - Code Words ..... 137
    - Cyclic Delay Diversity ..... 138, 423
    - IR Soft Buffer Size ..... 141, 420
  - MIB ..... 140
    - Number of Layers ..... 137, 424
    - Number of Physical Bits ..... 140, 405
    - Precoding Scheme ..... 135, 142, 425
    - Redundancy Version Index ..... 141, 223, 421, 471
    - Transport Block Size ..... 141, 421
  - E-RNTI ..... 197, 481
  - EUTRA/LTE operating bands ..... 258
  - EUTRA Version ..... 339
  - Execute Trigger ..... 78, 240, 356
  - Extended Logfiles ..... 85
  - External Trigger Delay ..... 362
  - External Trigger Inhibit ..... 362
- F**
- Fall Offset ..... 245
  - Fall Offset Marker ..... 366
  - FFT Size ..... 114, 176
  - File Manger ..... 74
  - Filter Mode ..... 233, 340
  - Filter Type ..... 230, 340
  - First Subframe
    - OFDMA Timeplan ..... 173
    - SC-FDMA Timeplan ..... 227
    - TDD Timeplan ..... 228
  - Fixed Marker Delay Maximum ..... 364
  - Fixed Marker Delay Minimum ..... 364
  - Fix marker delay to current range ..... 246, 363
  - FRC ..... 199
  - FRC State ..... 198
  - Freq. Domain Position n\_DRC ..... 215
  - Frequency Allocation ..... 263
  - Frequency Hopping ..... 219
  - Frequency Hopping Type ..... 220
  - Frequency offset ..... 111
  - Frequency Resource Index ..... 217
  - FTT Size ..... 373, 383
- G**
- Generate Waveform File ..... 76
  - Generation of logfiles ..... 79
  - Global MIMO Configuration ..... 116, 369
  - Global Trigger/Clock Settings ..... 248
  - Group Hopping ..... 179, 386
- H**
- High Speed Mode ..... 181
  - Hopping Bandwidth b\_hop ..... 215
  - Hopping-mode ..... 181
- I**
- I\_CQI\_offset ..... 207
  - I\_HARQ\_offset ..... 207
  - I\_RI\_offset ..... 207
  - Impulse Length ..... 234, 340
  - Impulse Length Auto State ..... 341
  - In-channel selectivity ..... 285
  - Information in Hopping Bits ..... 220
  - Initial Timing Advance ..... 202
  - Insert ..... 150
  - IR Soft Buffer Size ..... 420
    - PDSCH ..... 141



**L**

Level Reference .....	235
Link Direction .....	77, 336
Load	
EUTRA/LTE Settings .....	74
User Filter .....	231
Load user settings .....	337
Logfile Generation	
Extended Logfiles .....	85
File Formats .....	82
File Names .....	82
Output Files .....	82
Logging Point .....	79
Logical Root Sequence Index .....	217

**M**

Manual Trigger .....	356
Mapping Coordinates .....	170, 171
Mapping table .....	138, 170
antenna ports user defined .....	171
AP5 TX .....	171, 474
AP7 TX .....	171, 474
AP8 TX .....	171, 474
Marker .....	78
Marker Configuration .....	262
Marker Delay .....	363
Marker Mode .....	244, 364
Marker Period .....	366
Marker x Delay .....	246
Max. Number of Transmissions .....	202
MBSFNAreaConfiguration .....	106
MBSFN-ArealInfoList .....	102, 103
MBSFN-NotificationConfig .....	102, 105
MBSFN reference signals .....	24
MBSFN-SubframeConfig .....	101
MCCH data source .....	105
MCCH MCS .....	104
MCCH modification period .....	104
MCCH offset .....	104
MCCH repetition period .....	104
MCCH State .....	104
MCCH transport block size .....	105
MCCS modulation .....	105
MCH Scheduling Period .....	107
MCS PMCH .....	107
Measured External Clock .....	248
MIB .....	140
MIMO Configuration	
Global MIMO Configuration .....	369
Simulated Antenna .....	369
Simulated Antenna Path A .....	370
Simulated Antenna Path B .....	370
MIMO modes .....	36
Mode	
Channel Coding .....	207
User Equipment .....	197, 481
Modulation .....	128, 190, 200, 398, 461
Dummy Data .....	172, 477
Multiplier .....	248, 352

**N**

N_bundled .....	221
n_PUCCH .....	224, 471
n_RNTI .....	151

N(1)_cs .....	183, 392
N(1)_RB .....	184, 392
n(2)_DMRS .....	200, 219, 465
Ncs Configuration .....	217, 487
No. Of Occupied Subcarriers .....	114, 177
No. of Subframes	
OFDMA Timeplan .....	173
SC-FDMA Timeplan .....	227
TDD Timeplan .....	229
No. Of Used Allocations .....	126, 397
No. RB .....	130, 190, 399, 461
No. Sym. ....	131, 399
Non-MBSFN region length .....	103
No of Configurable Subframes .....	125, 187, 396
Notification Indicator .....	103
Notification offset .....	105
Notification Pattern .....	106
Notification repetition coefficient .....	105
Notification subframe index .....	105
Number CCEs .....	154
Number of ACK/NACK bits .....	221
Number of available CCEs	
PDCCH .....	146
Number of available REGs	
PDCCH .....	146
Number of Bit	
PDCCH .....	146
Number of coded ACK/NACK bits .....	221
Number of Coded CQI Bits .....	222, 225, 468, 472
Number of coded RI bits .....	222
Number of Configurable Frames .....	216
Number of CQI Bits .....	222, 225, 468, 473
Number of Dummy CCEs .....	154
Number of Dummy REGs .....	148
Number of Layers .....	137, 143, 424, 430
Number Of Left Guard Subcarriers .....	114, 177, 374, 384
Number Of Occupied Subcarriers .....	374, 383
Number of PDCCHs .....	148, 436, 437
Number of PHICH Groups .....	144, 433
Number of Physical Bits .....	405
DL .....	140
Number of Physical Bits for UL-SCH .....	222, 470
Number of PMCHs .....	106
Number of RBs used for PUCCH .....	182, 391
Number of REGs allocated to PDCCH .....	148
Number of Resource Block Per Slot .....	113, 176
Number Of Resource Blocks Per Slot .....	373, 382
Number of RI bits .....	221
Number Of Right Guard Subcarriers .....	114, 177, 375, 384
Number of Sub-bands .....	182, 391

**O**

Occupied Bandwidth .....	374, 383
Offset VRB .....	191, 200
ON/OFF Ratio Marker .....	244, 366
Open File Manager .....	74
Optimization .....	230, 344
Oversampling .....	234, 341
Oversampling Auto State .....	341

**P**

P_A .....	168, 477
-----------	----------

- Pattern
  - Dummy Data ..... 172
- Payload Size ..... 200
- PBCH Ratio rho\_B/rho\_A ..... 120
- PBCH Settings ..... 134
- PCCCH Ratio rho\_B/rho\_A ..... 120
- PCFICH
  - Power ..... 143, 430
- PCFICH Settings ..... 141
- PDCCH
  - Data Pattern ..... 438
  - Power ..... 146, 433
- PDCCH Data Source ..... 438
- PDCCH Format ..... 147, 153, 435
- PDCCH Settings ..... 141
- PDSCH P\_B ..... 119, 378
- PDSCH Ratio rho\_B/rho\_A ..... 119
- PDSCH Scheduling ..... 115
- PDSCH Settings ..... 134
- Performance Requirement Tests Overview ..... 253
- Periodicity T\_SRS ..... 210
- PHICH
  - Power ..... 145, 432
  - Power Info ..... 145
  - Power Mode ..... 144, 432
  - Power Settings ..... 145, 432
- PHICH Duration ..... 120, 378
- PHICH N\_g ..... 120, 379
- PHICH Settings ..... 141
- Phys. Bits ..... 132, 192, 222, 401, 463
- Physical Bits per ..... 200
- Physical Cell ID ..... 111
- Physical Cell ID Group ..... 376
- Physical Cell ID Group UL ..... 385
- Physical Layer ID ..... 376, 385
- PMCH
  - Data source ..... 107
- PMCH-InfoList ..... 106
- Power ..... 192, 403, 463
  - PBCH ..... 133
  - PCFICH ..... 143
  - PDCCH ..... 146
  - PDSCH ..... 133
  - PHICH ..... 145
- Power (PRACH) ..... 218
- Power Info ..... 145
- Power mode ..... 144, 432
- Power Offset
  - Demodulation Reference Signal ..... 208
  - DMRS ..... 492
  - SRS ..... 493
- Power Offset (Sounding Reference Signal) ..... 209
- Power offset relative to level display ..... 235
- Power PCFICH ..... 430
- Power PDCCH ..... 433
- Power PHICH ..... 432
- Power Settings ..... 145, 432
- PRACH Configuration ..... 180, 389
- PRACH frequency offset ..... 180
- Preamble Format ..... 216, 486
- Preamble Set ..... 181, 390
- Precoding Scheme ..... 135, 142, 425, 429
- P-SYNC Power ..... 122, 372
- P-SYNC Tx Antenna ..... 122, 372
- PUCCH Format ..... 190, 224
- PUCCH Format 3 ..... 226
- PUSCH
  - Data List ..... 206
  - Data Pattern ..... 206
  - Data Source ..... 206, 489
  - sets ..... 190
- PUSCH Channel Coding State ..... 490
- PUSCH Hopping Offset ..... 182
- R**
  - R&S SMx/AMU-K69 ..... 200
  - RA\_RNTI ..... 121, 376
  - Radio frame allocation offset ..... 102
  - Radio frame allocation period ..... 101
  - Range n(1)\_PUCCH
    - Extended CP ..... 184, 393
    - Normal CP ..... 184, 393
  - Range n(2)\_PUCCH ..... 184, 393
  - Range n(3)\_PUCCH ..... 184
  - RB Offset ..... 217
  - Realtime Feedback ..... 200
  - Realtime Feedback Mode ..... 201
  - Recall
    - EUTRA/LTE Settings ..... 74
  - Recall Configuration ..... 74
  - Recall user settings ..... 337
  - Receiver Tests Overview ..... 253
  - Redundancy Version Index ..... 223, 421, 471
    - PDSCH ..... 141
  - Redundancy Version Sequence ..... 201
  - Reference Channel ..... 236
  - Reference sensitivity levels ..... 280
  - Reference Signal Power ..... 122, 371
  - Reference Subframe ..... 236
  - Reference UE ..... 236
  - Reset Frame ..... 125, 189, 396
  - Reset Frame... ..... 460
  - Reset table ..... 150
  - Resource Allocation Configuration
    - Allocation Pattern Data ..... 402
    - Auto Offset Calculation ..... 132, 401
    - Codeword ..... 127
    - Code Word ..... 189, 397
    - Conflict ..... 133, 193, 404, 464
    - Content Type ..... 189, 403, 461
    - Data Source ..... 132, 402
    - Modulation ..... 128, 398, 461
    - Modulation/Format ..... 190
    - No.Of Physical Bits ..... 132, 192, 222, 401, 463
    - No.Of Resource Blocks ..... 130, 399, 461
    - No.Of Symbols ..... 131, 190, 399
    - Power ..... 133, 192, 403, 463
    - Resource Block Offset ..... 131, 400
    - Resource Block Offset Slot ..... 462
    - State ..... 133, 193, 404, 464
    - Symbol Offset ..... 400
    - VRB Gap ..... 128
  - Resource Allocation Configuration:Allocation Data List ..... 402
  - Resource Block Offset ..... 131, 400
  - Resource Block Offset Slot n ..... 192, 462
  - Resource Block Offset Slot n+1 ..... 462
  - Restart PUSCH Data, A/N and CQI every Subframe ..... 197
  - Restricted Set ..... 181, 390
  - Retrigger ..... 355
  - Rho A ..... 133

RI Pattern .....	221
Rise Offset .....	245
Rise Offset Marker .....	366
Roll Off Factor or BxT .....	231
Root Sequence (u) .....	217, 487
RS Power per RE relative to Level Display .....	122, 371
Running .....	239
Running - Trigger .....	359

**S**

Sample clock .....	351
Sample Clock Multiplier .....	352
Sample Rate Variation .....	233
Sample Rate Variations .....	346
Sampling Rate .....	114, 176, 373, 382
Save	
EUTRA/LTE Settings .....	74
Save Configuration .....	74
Save-Recall .....	336
Save user settings .....	337
SCell index .....	110
Scheduled cell index .....	111
Scrambling .....	206, 490
PCFICH .....	143
PDCCH .....	146
Scrambling DL .....	139, 426
Scrambling PCFICH .....	431
Scrambling PDCCH .....	434
Scrambling User .....	167, 475
Search Space .....	153, 445
Selective preset .....	266
Sequence Hopping .....	179, 386
Sequence Index (v) .....	218, 488
Sequence Length .....	77
Serial 3x8 Mode .....	201
Serial Mode .....	63, 201
Serial Rate .....	203
Set Synchronization Settings .....	247, 353
Set to default .....	336
Set to Default .....	74
SF Alloc	
end .....	107
start .....	107
SFN Offset .....	140
SFN Restart Period .....	140
Signal Advane N_TA_offset .....	243
Signal Duration	
Trigger .....	239
Signal Duration - Trigger .....	360
Signal Duration Unit .....	239, 360
Signal Routing .....	263
Simulated Antenna .....	117, 369, 370
Simulated Antenna Path A .....	117
Simulated Antenna Path B .....	117
SISO + BF .....	116
Sounding Reference Signa	
State .....	493
Sounding Reference Signal	
Power Offset .....	209
State .....	209
Spatial layer .....	35
Special Subframe Configuration .....	115, 177, 367
SRS Bandwidth Configuration B_SRS .....	212
SRS Bandwidth Configuration C_SRC .....	185
SRS Cyclic Shift .....	209, 493
SRS MaxUpPTS .....	185
SRS State .....	209
SRS Subframe Configuration .....	185
S-SYNC Power .....	122, 372
S-SYNC Tx Antenna .....	122, 372
Standard settings .....	336
Standard Settings .....	74
State .....	73, 193, 404
allocation .....	133
Channel Coding .....	139, 168
Clipping .....	234
Frequency Hopping .....	465
PDCCH .....	142, 429
PRACH .....	488
PRACH Power Ramping .....	216
SCell .....	112
SRS .....	493
User Equipment .....	196
State (PRACH) .....	218
State - Clipping .....	347
Stopped .....	239
Subframe Allocation Mode .....	102
Subframe Information .....	188
Subframe Number .....	216
Subframe Offset T_offset .....	211
Subframe Selection .....	126, 188, 396, 460
Supported Test Case .....	252
Symbol Offset .....	132
Sync. Output to External Trigger .....	240
Synchronization mode .....	246
Synchronization Mode .....	353
Synchronization Problems .....	202
SYNC Settings	
P-SYNC Power .....	122, 372
S-SYNC Power .....	122, 372

**T**

Test Case .....	262
Test Frequencies .....	257
Test Model .....	92, 338
Test requirements for PUSCH .....	306
Test Setups .....	92
Time Domain Windowing .....	229, 348
Timing Adjustment .....	200
Total Number of Physical Bits .....	192, 222
Transition Time .....	216, 230
Transmission Comb k TC .....	215
Transmission direction .....	77, 336
Transmission modes .....	36
Transmission Offset Delta_SFC .....	185
Transmission Scheme .....	136
Transmission Time .....	348
Transmission using antenna port 5 .....	25
Transmitter Tests Overview .....	252
Transport Block Size .....	223, 421, 470
DL .....	141
Trigger .....	78
Trigger Configuration .....	262
Trigger delay	
actual .....	242
unit .....	242, 356
Trigger Delay .....	242
Trigger Delay External .....	362
resulting time delay .....	356
time delay .....	357

Trigger Delay Internal	
resulting time delay .....	358
time delay .....	359
Trigger Delay Other Baseband .....	358
Trigger Inhibit .....	242
Trigger Inhibit External .....	362
Trigger Inhibit Other Baseband .....	358
Trigger Mode .....	355
Armed .....	238
Auto .....	238
Retrigger .....	238
Single .....	238
Trigger Source .....	240, 361

## U

UE ID .....	476, 481
DL .....	139, 426
UE Power .....	197, 481
UE State .....	481
Up .....	150
Uplink .....	77, 336
Uplink-Downlink Configuration .....	115, 177, 367
Uplink Feedback .....	200
Uplink Frequency Hopping Mode .....	181, 390
User .....	151, 167, 445
User Configuration	
Data List .....	476
Data Pattern .....	477
Data Source .....	476
User Configuration Data Source .....	168
User Equipment	
Mode .....	197, 481
State .....	196, 481
User Filter .....	345
User Marker / AUX I/O Settings .....	248
User Period .....	366

## V

Version .....	76, 339
View Mode .....	174
VRB Gap .....	128

## W

Waveform .....	338
Waveform File .....	76