Supplement

Digital Standard EUTRA

R&S® AMU-K55
1402.9405.02

R&S® SMATE-K55
1404.7851.02

R&S® SMJ-K55
1409.2206.02

R&S® SMU-K55
1408.7310.02

R&S® AFQ-K255
1401.5906.02

R&S® AMU-K255
1402.9457.02

R&S® SMJ-K255
1409.2258.02

R&S® SMU-K255
1408.7362.02

ROHDE&SCHWARZ
Test and Measurement

Dear Customer,

The Signal Generator includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).

Grouped Safety Messages

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

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

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

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

Symbols and safety labels

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

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

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

Tags and their meaning

DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	NOTICE indicates a property damage message. In the product documentation, the word ATTENTION is used synonymously.

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

Basic safety instructions

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

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

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

Informaciones elementales de seguridad

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

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

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

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

Símbolos y definiciones de seguridad

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

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

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

Palabras de señal y su significado

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

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

Informaciones de seguridad elementales

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

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

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

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

Contents - Digital Standard EUTRA/LTE

Digital Standard EUTRA/LTE

Preamble

The LTE standard is still under development by the 3GPP organization. This description and the R&S implementation of the LTE standard base on the LTE specifications versions and the subset of change requests listed bellow.

Supported Standards:

- 3GPP TS 36.211, Version 8.2.0 – 03/2008
- 3GPP TS 36.212, Version 8.2.0 – 03/2008
- 3GPP TS 36.213, Version 8.2.0 – 03/2008

Additional Change Requests:

- R1-081248 “PRS sequence generation for downlink reference signal”
- R1-081518 “Draft CR on Correction of the number of subcarriers in PUSCH transform precoding”
- R1-081520 “Draft CR on Correction of PUCCH resource index for PUCCH format 2”
- R1-081576 "Correction of the number of subcarriers in PUSCH precoding"
- R1-081577 "Correction of PHICH mapping"
- R1-081578 "Correction of PUCCH resource index for PUCCH format 2"

Introduction - EUTRA/LTE

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, evolution of UMTS has not reached its end. **HSPA+** will bring significant enhancements in 3GPP release 7. Objective is to enhance performance of HSPA based radio networks in terms of spectrum efficiency, peak data rate and latency, and exploit the full potential of WCDMA based 5 MHz operation. Important features of HSPA+ are downlink MIMO (Multiple Input Multiple Output), 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. 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 EUTRA (Evolved UMTS Terrestrial Radio Access) and EUTRAN (Evolved UMTS Terrestrial Radio Access Network). LTE/EUTRA will then form part of 3GPP release 8 core specifications.
This document 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 of requirements, e.g. targets for data rate, capacity, spectrum efficiency, and latency. Also commercial aspects like 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: OFDMA (Orthogonal Frequency Division Multiple Access) in downlink and SC-FDMA (Single Carrier Frequency Division Multiple Access) 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.

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 have been captured in 3GPP TR 25.913 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 2 receive antennas and 1 transmit antenna at the terminal.
- **Throughput:** Target for downlink average user throughput per MHz is 3-4 times better than release 6. Target for uplink average user throughput per MHz is 2-3 times better than release 6.
- **Spectrum Efficiency**: Downlink target is 3-4 times better than release 6. Uplink target is 2-3 times better than release 6.
- **Bandwidth:** Scaleable bandwidths of 5, 10, 15, 20 MHz shall be supported. Also bandwidths smaller than 5 MHz shall be supported for more flexibility.
- **Multimedia Broadcast Multicast Services** (MBMS): MBMS shall be further enhanced and is then referred to as E-MBMS.
- **Mobility**: The system should be optimized for low mobile speed (0-15 km/h), but higher mobile speeds shall be supported as well including high speed train environment as 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.
- **Network synchronization**: Time synchronization of different network sites shall not be mandated.

Long Term Evolution Downlink Transmission Scheme

The downlink transmission scheme for EUTRA 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 picture shows a representation of an OFDM signal. This figure is taken from 3GPP TS 25.892; Feasibility Study for Orthogonal Frequency Division Multiplexing (OFDM) for UTRAN enhancement (Release 6).

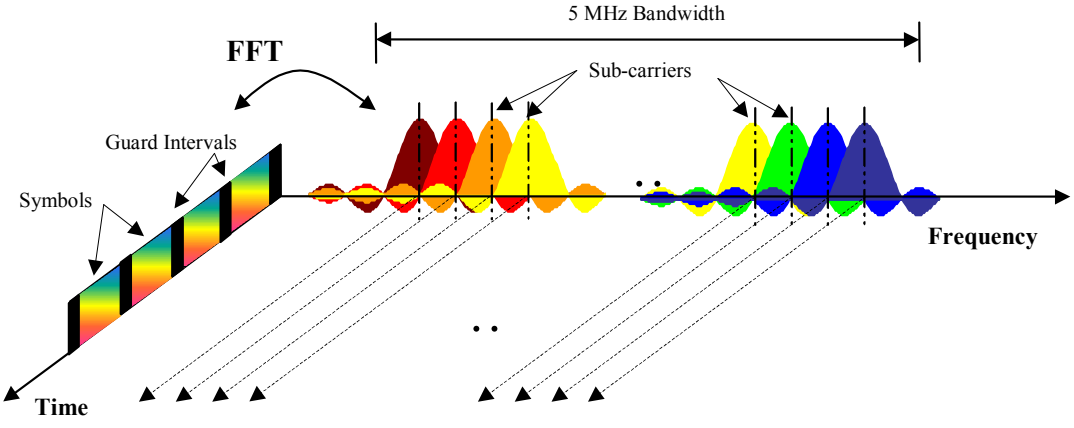


Figure 1 Frequency Time Representation of an OFDMA Signal

In this figure, a signal with 5 MHz bandwidth is shown, but the principle is of course the same for the other EUTRA bandwidths. Data symbols are independently modulated and transmitted over a high number of closely spaced orthogonal subcarriers. In EUTRA, 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 EUTRA, the guard interval is a **cyclic prefix** which is inserted prior to each OFDM symbol.

In practice, the OFDM signal can be generated using IFFT (Inverse Fast Fourier Transform) 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 the figure below, where $a(mN+n)$ refers to the n^{th} subchannel modulated data symbol, during the time period $mT_u < t \leq (m+1)T_u$:

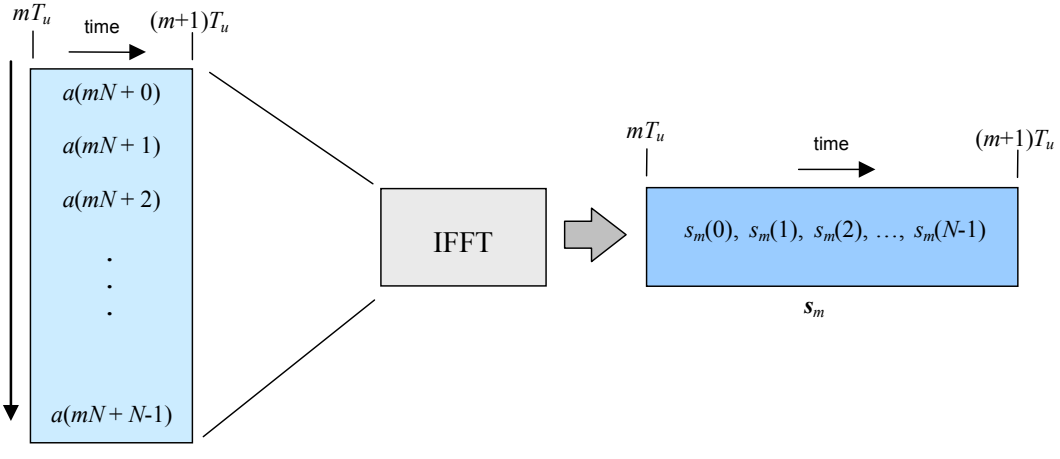


Figure 2 OFDM Useful Symbol Generation Using an IFFT

The vector $\boldsymbol{s}_m$ 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 subcarriers is obtained, with each subcarrier having the shape of a frequency *sinc* function (see figure "Frequency Time Representation of an OFDMA Signal").

The figure below 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 figure is the process of cyclic prefix insertion. This figure is taken from 3GPP TS 25.892, Feasibility Study for Orthogonal Frequency Division Multiplexing (OFDM) for UTRAN enhancement (Release 6).

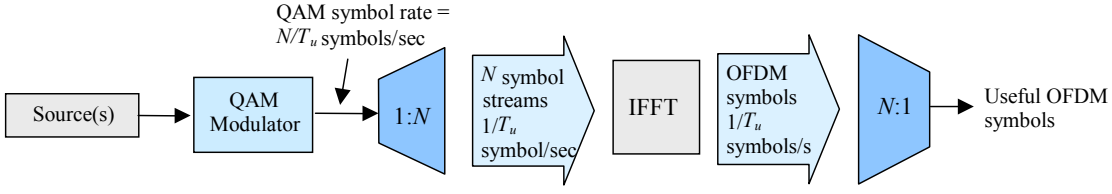


Figure 3 OFDM Signal Generation Chain

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 EUTRA/LTE, 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.

OFDMA Parameterization Scheme

A **generic frame structure** is defined for both EUTRA FDD and TDD modes. Additionally, an alternative frame structure is defined for the TDD mode only. The EUTRA frame structures are defined in 3GPP TS 36.211, Physical Channels and Modulation (Release 8). For the generic frame structure, the 10 ms radio frame 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. This is illustrated in the figure below (T_s is expressing the basic time unit corresponding to 30.72 MHz).

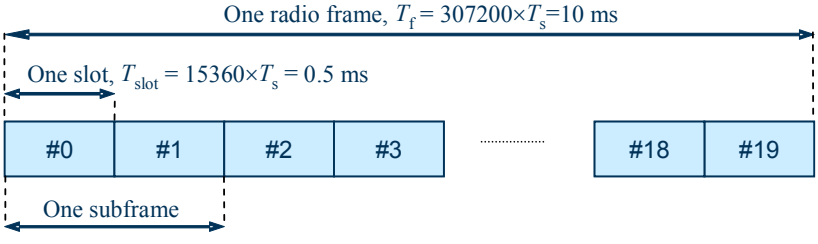


Figure 4 Generic frame structure in EUTRA downlink

The figure below (taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8)) 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 Δf = 15 kHz. In case of multi cell MBMS transmission (see "LTE MBMS Concepts"), a subcarrier spacing of Δf = 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 EUTRA/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.

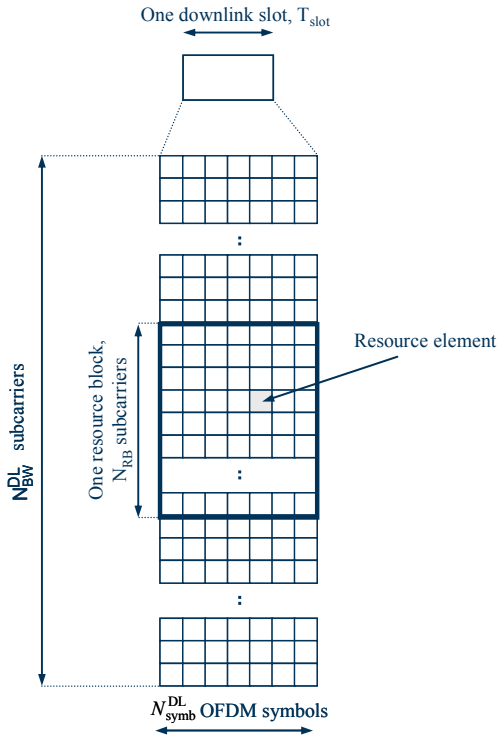


Figure 5 Downlink resource grid

One downlink slot consists of N_{symb}^{DL} OFDM symbols. To each symbol, a cyclic prefix (CP) is appended as guard time, compare figure "Frequency Time Representation of an OFDMA Signal". N_{symb}^{DL} depends on the cyclic prefix length. The generic frame structure with normal cyclic prefix length contains N_{symb}^{DL} = 7 symbols. This translates into a cyclic prefix length of T_{CP} ≈5.2µs for the first symbol and T_{CP} ≈4.7µs 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_{CP-E} ≈16.7µs contains N_{symb}^{DL} = 6 OFDM symbols (subcarrier spacing 15 kHz). The generic frame structure with extended cyclic prefix of T_{CP-E} ≈33.3µs contains N_{symb}^{DL} = 3 symbols (subcarrier spacing 7.5 kHz).
The table below gives an overview of the different parameters again for the generic frame structure.

Configuration	Number of symbols N_{symb}^{DL}	Cyclic Prefix length in samples	Cyclic Prefix length in µs
Normal cyclic prefix Δf=15 kHz	7	160 for first symbol 144 for other symbols	5.2 µs for first symbol 4.7 µs for other symbols
Extended cyclic prefix Δf=15 kHz	6	512	16.7 µs
Extended cyclic prefix Δf=7.5 kHz	3	1024	33.3 µs

Table 1 Parameters for downlink generic frame structure

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 Δf=15 kHz (Δf=7.5 kHz) case. In the time domain, a physical resource block consists of $N_{\text{symb}}^{\text{DL}}$ consecutive OFDM symbols, see figure "Downlink resource grid". $N_{\text{symb}}^{\text{DL}}$ 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**).

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 also figure "Downlink reference signal structure (normal cyclic prefix)").
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 consists of up to eight ACK/NACK processes and one PHICH group uses three REGs. 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, i.e. OFDM symbol 0...2.
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 PDCCH is mapped to the REGs not used for PHICH and PCFICH.

Downlink Reference Signal Structure and Cell Search

The downlink reference signal structure is important for cell search, channel estimation and neighbor cell monitoring. The figure below shows the principle of the downlink reference signal structure for 1 antenna, 2 antenna, and 4 antenna transmission. Specific pre-defined resource elements in the time-frequency domain are carrying the reference signal sequence. Besides first reference signals, there may be a need for second reference signals. The different colors in figure "Downlink reference signal structure (normal cyclic prefix)" represent the sequences transmitted from up to 4 transmit antennas. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

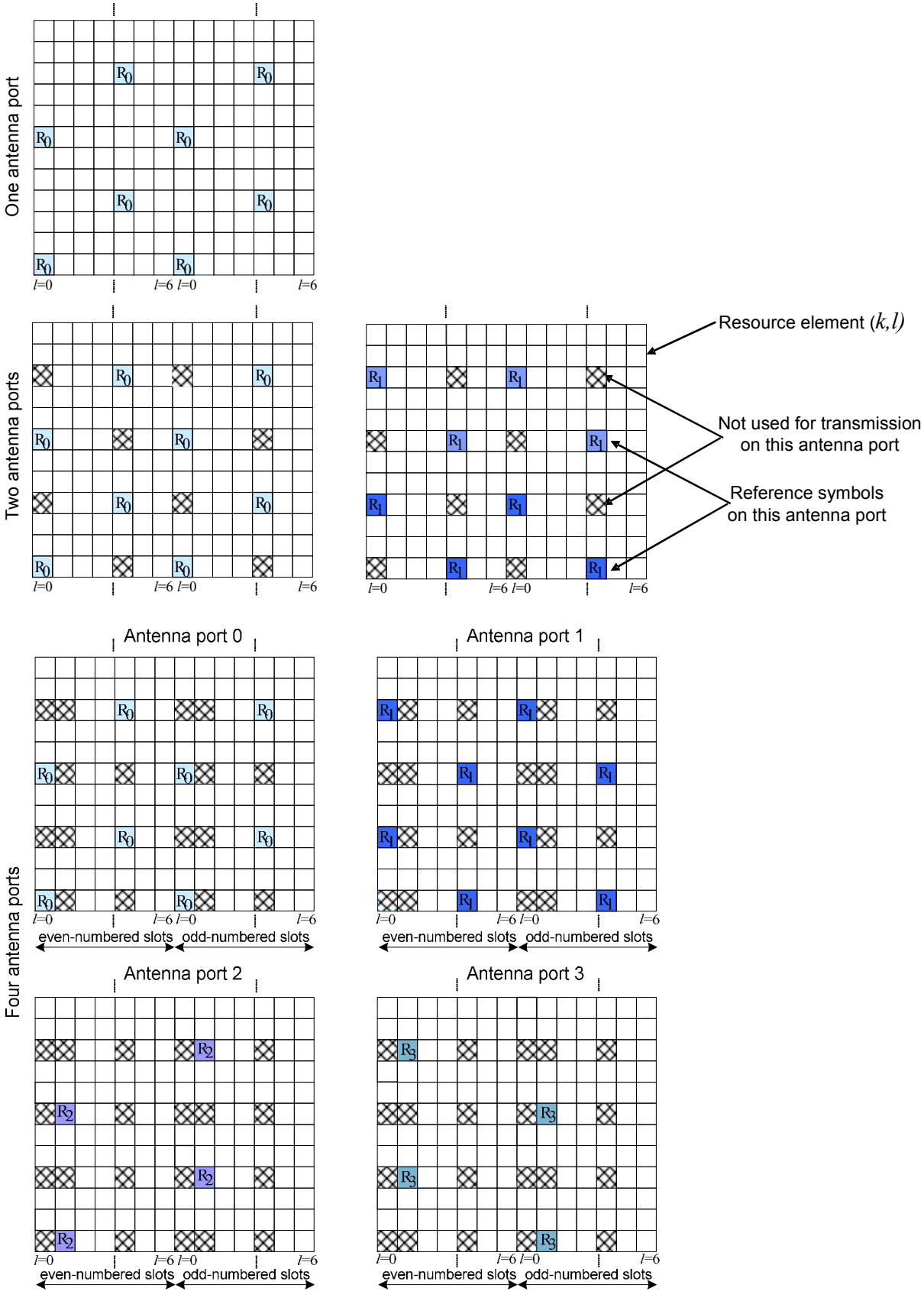


Figure 6 Downlink reference signal structure (normal cyclic prefix)

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 centre subcarriers (around DC subcarrier) within the same predefined slots (twice per 10 ms) on different resource elements, see figure below. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

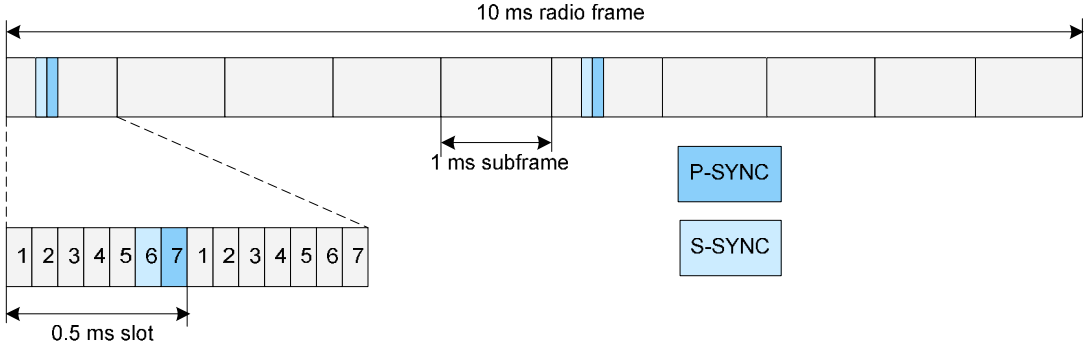


Figure 7 P-SYNC and S-SYNC structure (Normal CP; 1.25MHz bandwidth)

As additional help during cell search, a Physical broadcast channel (**PBCH**) is available which carries BCH type of information, e.g. system bandwidth. It is transmitted at pre-defined time instants on the 72 subcarriers centered around DC subcarrier, see section "Physical Broadcast Channel (PBCH)".
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.

Downlink Physical Layer Procedures

For EUTRA, the following downlink physical layer procedures are defined:

- **Cell search and synchronization**
  See ”Downlink Reference Signal Structure and Cell Search”.
- **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, buffer status.

- **Link Adaptation**
  Link adaptation is already known from HSDPA as Adaptive Modulation and Coding. Also in EUTRA, modulation and coding for the shared data channel is not fixed, but it is adapted according to radio link quality. For this purpose, the UE regularly reports Channel Quality Indications (CQI) to the eNodeB.
- **Hybrid ARQ (Automatic Repeat Request)**
  Downlink Hybrid ARQ is also known from HSDPA. It is a retransmission protocol. The UE can request retransmissions of incorrectly received data packets.

Long Term Evolution Uplink Transmission Scheme

During the study item phase of LTE, alternatives for the optimum uplink transmission scheme were investigated. While OFDMA is seen optimum to fulfill the LTE requirements in downlink, OFDMA properties are less favorable for the uplink. This is mainly due to weaker peak-to-average power ratio (PAPR) properties of an OFDMA signal, resulting in worse uplink coverage.
Thus, the LTE uplink transmission scheme for FDD and TDD mode is based on **SC-FDMA** (Single Carrier Frequency Division Multiple Access) with cyclic prefix. SC-FDMA signals have better PAPR properties compared to an OFDMA signal. This was one of the main reasons for selecting SC-FDMA as LTE uplink access scheme. The PAPR characteristics are important for cost-effective design of UE power amplifiers. Still, SC-FDMA signal processing has some similarities with OFDMA signal processing, so parameterization of downlink and uplink can be harmonized.
There are different possibilities how to generate an SC-FDMA signal. DFT-spread-OFDM (DFT-s-OFDM) has been selected for EUTRA. The principle is illustrated in the figure below. This figure is taken from 3GPP R1-050584, "EUTRA Uplink Numerology and Design".
For **DFT-s-OFDM**, a size-M DFT is first applied to a block of M modulation symbols. QPSK, 16QAM and 64 QAM are used as uplink EUTRA modulation schemes, the latter being optional for the UE. The DFT transforms the modulation symbols into the frequency domain. The result is mapped onto the available subcarriers. In EUTRA uplink, only localized transmission on consecutive subcarriers is allowed. An N point IFFT where N>M is then performed as in OFDM, followed by addition of the cyclic prefix and parallel to serial conversion.

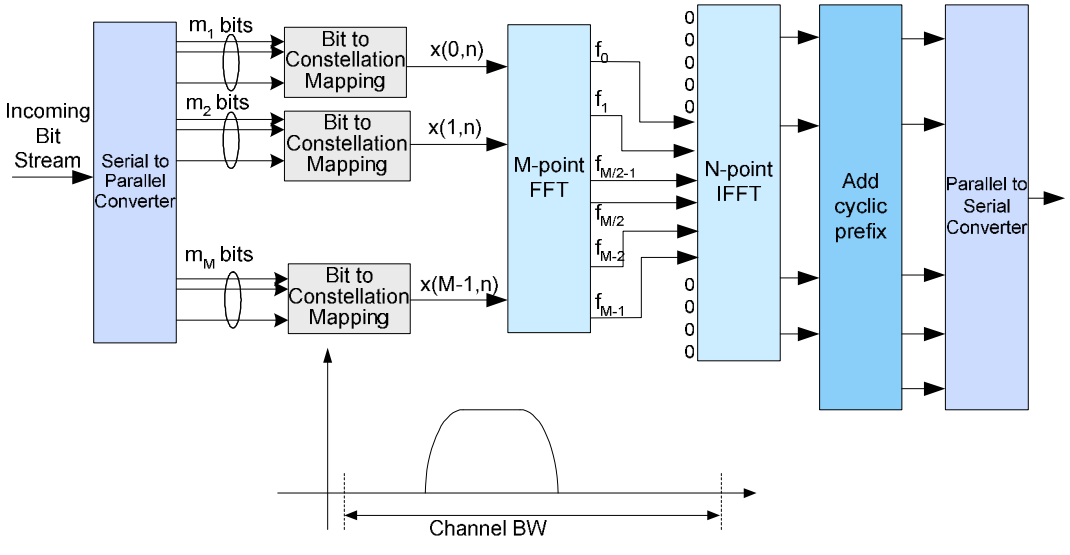


Figure 8 Block Diagram of DFT-s-OFDM (Localized transmission)

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 SC-FDMA signal, each subcarrier 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 subcarriers. In contrast to this, each subcarrier of an OFDMA signal only carries information related to specific modulation symbols.

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 $N_{\text{symb}}^{\text{UL}}$ SC-FDMA symbols, where $N_{\text{symb}}^{\text{UL}}$ = 7 for the normal cyclic prefix and $N_{\text{symb}}^{\text{UL}}$ = 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.

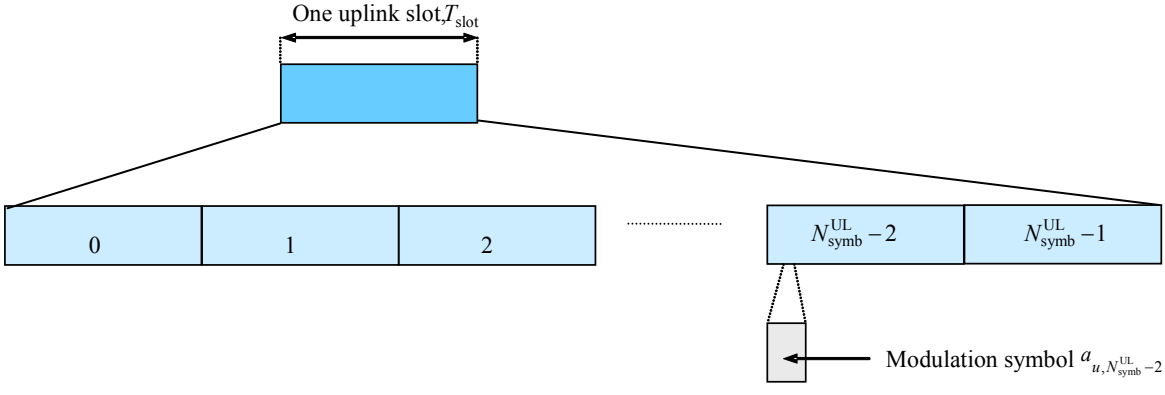


Figure 9 Uplink slot structure

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

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

Table 2 Parameters for uplink generic frame structure

Uplink Data Transmission

In uplink, data is allocated in multiples of one resource block. Uplink resource block size in the frequency domain is 12 subcarriers, 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 is 1 ms (same as downlink).
User data is carried on the Physical Uplink Shared Channel (**PUSCH**) that is determined by the transmission bandwidth N_{Tx} and the frequency hopping pattern k_0.

Uplink Control Information Transmission

In uplink, the control information is carried by the Physical Uplink Shared Channel (**PUSCH**) or by the Physical Uplink Control Channel (**PUCCH**), depending on whether an uplink resource has been assigned to the user or not. PUSCH and PUCCH of the same user are never transmitted simultaneously.
Control information (CQI reports and ACK/NACK information related to data packets received in the downlink) is multiplexed with the PUSCH, if the user has been granted with UL-SCH transmission.
The PUCCH carries uplink control information, e.g. CQI reports, HARQ ACK/NACK information or Scheduling Requests (SR), in case the user has not been assigned an UL-SCH transmission.
The PUCCH is transmitted on a reserved frequency region at the edges of the total available bandwidth in the UL. One PUCCH resource comprises a pair of resource blocks within slot 0 and 1 that are located in the upper and the lower part of the spectrum. Maximum number of 6 resource block can be allocated for PUCCH as shown in the figure below (taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8)).

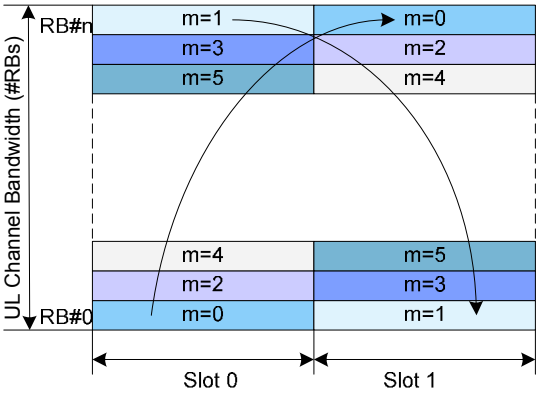


Figure 10 PUCCH Mapping

According to 3GPP 36.211, version 8.2.0 six PUCCH formats are defined (see table below).

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

Table 3 PUCCH formats

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

For simultaneous transmission of multiple users on the PUCCH, different PUCCH resource indices are used. Multiple users are distinguished within one resource block by using different cyclic shifts (CS) of the CAZAC (Constant Amplitude Zero Auto-Correlation) sequence. For PUCCH formats 1/1a/1b additionally three different orthogonal cover sequences (OC) can be used. Hence, for PUCCH format 2/2a/2b a total number of 12 different PUCCH resource indices (N(2)_PUCCH) are available within a resource block; for PUCCH format 1/1a/1b and for normal and extended CP, the number of the available PUCCH resource indices (N(1)_PUCCH) within a resource block is 36 and respectively 24. The actual number of the used orthogonal sequences is additionally determinate by the parameter delta_shift, employed to support working by different channel conditions.
The orthogonal sequences are calculated according to R1-080035, "Joint proposal on uplink ACK/NACK channelization".

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 sequences.

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).

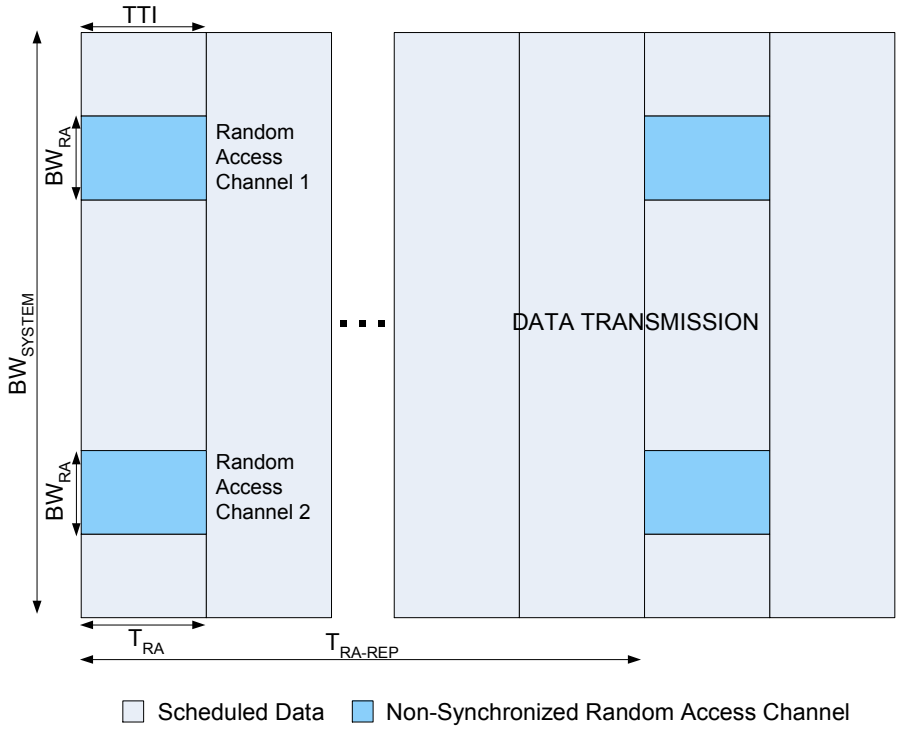


Figure 11 Random access structure, principle

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 sequence occupies T_{PRE} = 0.8 ms and the cyclic prefix occupies T_{CP} = 0.1 ms within one subframe of 1 ms. During the guard time T_{GT}, nothing is transmitted. 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.

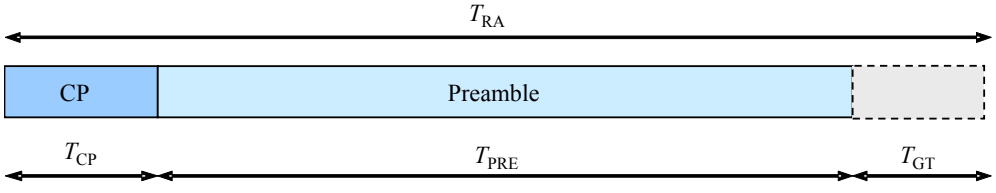


Figure 12 Random access preamble

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

- **Uplink scheduling**

  Scheduling of uplink resources is done by eNodeB. The eNodeB assigns certain time/frequency resources to the UEs and informs UEs about transmission formats to use. Scheduling decisions affecting the uplink are communicated to the UEs via the 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 for time aligning 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 ARQ**
  Uplink Hybrid ARQ protocol is already known from HSUPA. The eNodeB has the capability to request retransmissions of incorrectly received data packets.

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.

Downlink MIMO

For the LTE downlink, a 2x2 configuration for MIMO is assumed as baseline configuration, i.e. 2 transmit antennas at the base station and 2 receive antennas at the terminal side. Configurations with 4 antennas are also being considered.
Different MIMO modes are envisaged. It has to be differentiated between spatial multiplexing and transmit diversity, and it depends on the channel condition which scheme to select.

- **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.

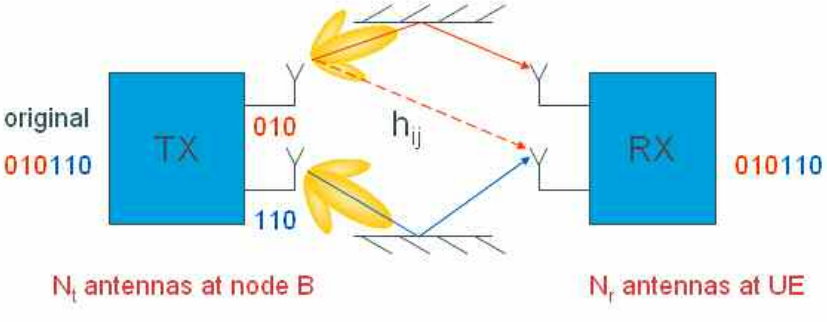


Figure 13 Spatial multiplexing

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:

$$H = \begin{bmatrix} h_{11} & h_{12} & \cdots & h_{1Nt} \\ h_{21} & h_{22} & & h_{2Nt} \\ \vdots & & \ddots & \vdots \\ h_{Nr1} & h_{Nr2} & \cdots & h_{NrNt} \end{bmatrix}$$

N_t (number of columns) and N_r (number of rows)

In this general description, Nt is the number of transmit antennas, Nr 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 {Nt, Nr} and is limited by the rank of the matrix H. The transmission quality degrades significantly in case the singular values of matrix H are not sufficiently strong. This can happen in case the 2 antennas are not sufficiently de-correlated, for example in an environment with little scattering or when antennas are too closely spaced.
In LTE, up to 2 code words can be mapped onto different so-called layers. The number of layers for transmission is equal to the rank of the matrix H. There is a fixed mapping between code words to layers.
Precoding on transmitter side is used to support spatial multiplexing, see figure below. This is achieved by applying a precoding matrix **W** to the signal before transmission. The figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

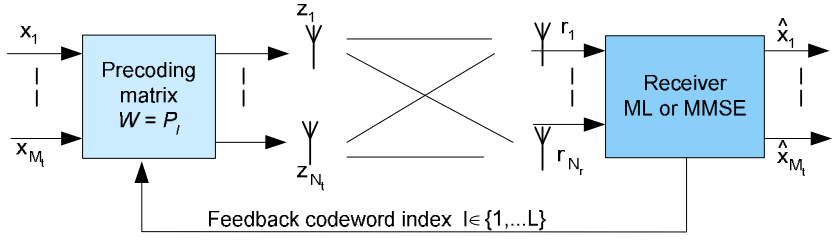


Figure 14 Precoding principle

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

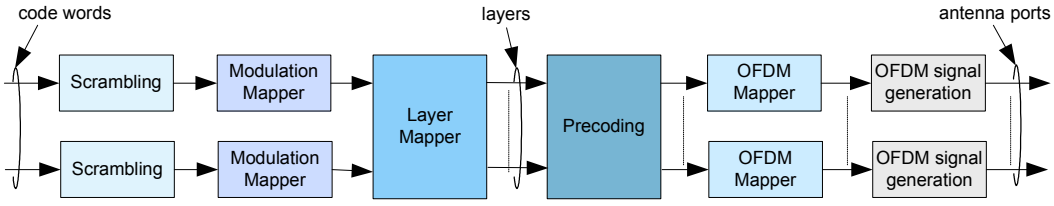


Figure 15 Overview of downlink baseband signal generation

- **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.

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 transmit chain and amplifier. A switch will then choose the antenna that provides the best channel to the eNodeB.

LTE MBMS Concepts

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

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

EUTRA/LTE Parameterization

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 the table below.

Channel Bandwidth, MHz	1.4	3	5	10	15	20
Number of Resource Blocks	6	15	25	50	75	100

Table 4 DL Channel Bandwidth for FDD mode according to 3GPP TS 36.804 v.1.0.0

For backwards compatibility with previous version of this software, the R&S Signal Generator supports these predefined bandwidths (1.4, 3, 5, 10, 15 and 20 MHz), the predefined bandwidths of the first specification (1.5 and 2.5 MHz) and a user defined channel bandwidth.
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.

- Regarding frame structure, focus is on the frame structure type 1 for FDD mode.

Note:
In this version, only FDD mode is supported. TDD will be supported in a later version.

- 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.

Reference Signals

- R&S Signal Generator offers to select the antenna to simulate (1, 2, 3, or 4), and adjust the correct reference signal pattern accordingly. An example for the possible distribution of downlink reference signals for the normal cyclic prefix is shown in figure “Downlink reference signal structure (normal cyclic prefix)”. The reference signal pattern for the extended cyclic prefix is also done according to 3GPP TS 36.211.
- Availability of secondary reference signal, subcarrier offset of the reference signal sequence in the frequency domain and existence of empty resource elements depend on the antenna selected.
- Power of the first and second reference signals can be set independently in the signal generator.
- 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.

Synchronization Signal (SYNC)

- Primary and secondary synchronization signal (P-SYNC and S-SYNC) are supported.
- The P-SYNC and S-SYNC are located on the last two OFDM symbols of slot (see figure ”P-SYNC and S-SYNC structure”). 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 centre 72/64 subcarriers. Resource blocks containing P-SYNC/ S-SYNC thus have less resource elements available for user data allocation.

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 below shows the default location of PBCH in case of normal CP.

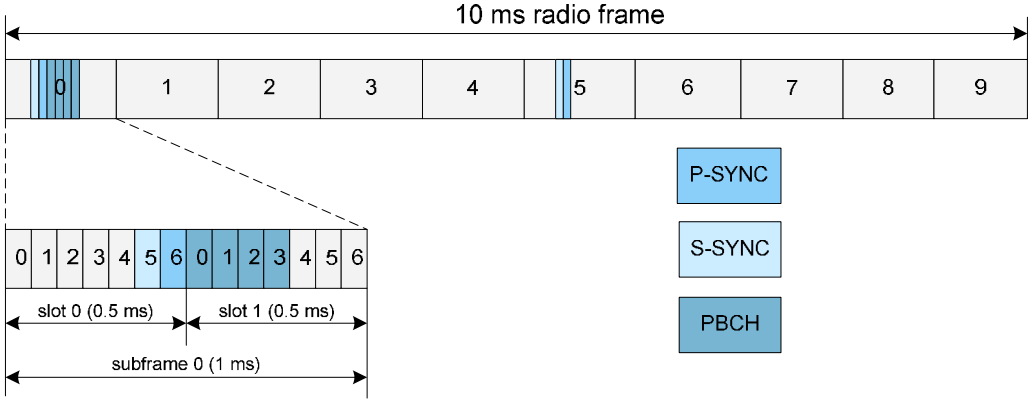


Figure 16 Default location of PBCH for normal CP

- 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.
- PBCH is occupying the centre 72 subcarriers around DC subcarrier; see also section "Downlink Subframe 0 in Case of Bandwidths with Odd Number of Resource Blocks".
- Contents of PBCH remain to be defined. In the signal generator, an arbitrary data source can be selected for the PBCH.

Physical Control Format Indictor 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, version 8.2.0.

Physical Hybrid ARQ Indicator Channel (PHICH)

- PHICH is BPSK modulated.
- PHICH is layer mapped and precoded according to 3GPP TS 36.211, version 8.2.0.
- Different orthogonal sequences are used for the PHICHs within the same PHICH group.

Physical Downlink Control Channel (PDCCH)

- Since the PDCCH formats are still not completely defined, the R&S Signal Generator provides the possibility to select an arbitrary data source or user defined lists for the PDCCH content.
  The user defined lists can be used to simulate different DCI formats and multiplexing of several PDCCHs. The proper content of these lists is under the responsibility of the user.
- In the R&S Signal Generator, the PDCCH processing starts with the scrambling. PDCCH scrambling can be activated or deactivated.
- PDCCH is layer mapped, precoded and mapped to the resource elements (incl. permutation and cyclically shifting) according to 3GPP TS 36.211, version 8.2.0.

Data Allocations

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

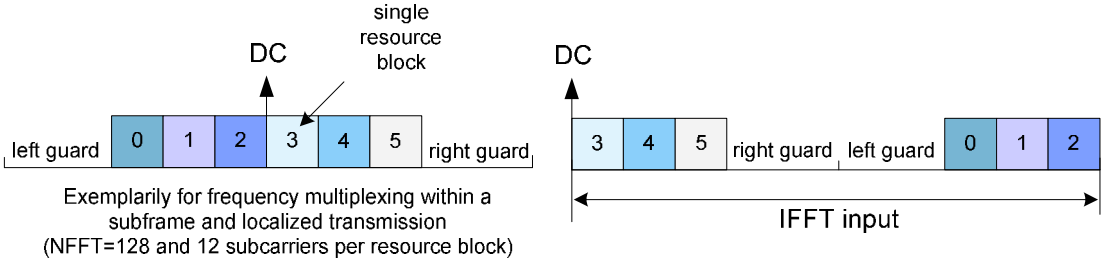


Figure 17 Numbering of Resource Blocks

- 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.

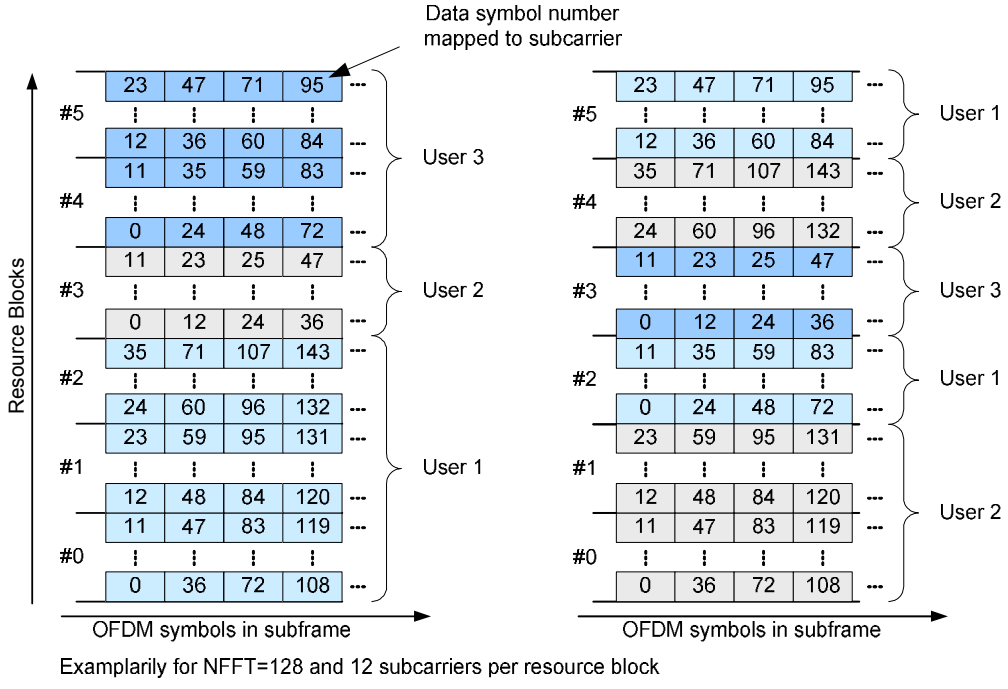


Figure 18 Data symbol numbering

- 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, Version 8.2.0. Additionally, channel coding configuration can be changed per PDSCH data allocations.

Modulation Mapping

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

MIMO

- R&S Signal Generator supports all precoding schemes of 3GPP TS 36.211, V8.2.0.
- R&S Signal Generator supports all layer mapping schemes of 3GPP TS 36.211, V8.2.0.

SC-FDMA Parameterization

- SC-FDMA physical layer parameterization is based on a bandwidth agnostic layer 1. However, current 3GPP specifications focus on some channel bandwidth (1.4, 3, 5, 10, 15 and 20 MHz).
  For backwards compatibility with previous version of this software, the R&S Signal Generator supports these predefined bandwidths, the predefined bandwidths of the first specification (1.5 and 2.5 MHz) and a user defined channel bandwidth.
  To configure the bandwidth of the signal to be and analyzed, 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.
- The supported frame structure is FDD frame type 1 according to 3GPP TS 36.211 (see figure "Uplink slot structure").

Note:
In this version, only FDD mode is supported. TDD will be supported in a later version.

- Both normal and extended cyclic prefix are supported.

Demodulation Reference Signal (DRS)

- If the uplink demodulation reference signal (DRS) is multiplexed with the PUSCH, the DRS is carried within the 4th SC-FDMA symbol of a slot (i.e. symbol number l = 3). 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 "PUCCH formats").
- 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, version 8.2.0. A CAZAC sequence is used and the DRS is derived from a Zadoff-Chu (ZC) sequence using the extension method.

Sounding Reference Signal (SRS)

- Position of sounding reference signal can be configured in terms of frequency and symbol location (restricted to one symbol per subframe), hopping pattern, and periodicity over several frames.
- 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 simultaneously, except a simultaneous transmission of ACK/NACK messages and SRS for PUCCH format 1a or 1b is explicitly enabled.

Physical Uplink Control Channel (PUCCH)

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

- Position of PUCCH can be configured in terms of PUCCH region.
- The content of PUCCH can be set individually for each TTI.
- All six PUCCH formats as defined in the 3GPP TS 36.211, version 8.2.0 are supported.
- One of 12 cyclic shifts and for PUCCH formats 1/1a/1b one of three orthogonal codes can be selected indirectly by choosing the appropriate PUCCH index.

Physical Random Access Channel (PRACH)

Note:
RACH will be supported in a later version.

Data Allocation

- Localized transmission on PUSCH is supported, i.e. only adjacent resource blocks can be allocated to the user.
- Frequency hopping is supported.
- Resource block size is 12 subcarriers in the frequency domain.
- A generation of uplink signals for up to 4 UEs is supported.
- Data can be allocated per subframe.
- Channel coding is performed according to 3GPP 36.211 version 8.2.0.
- 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 below.

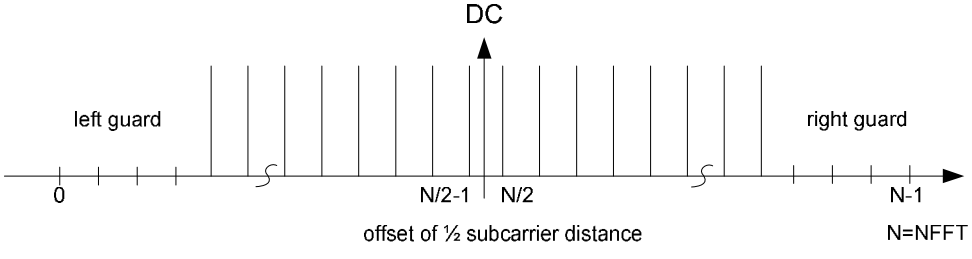


Figure 19 Numbering of the subcarriers

- 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.

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.

R&S Signal Generator Specific Information

The different topics discussed in the following paragraphs give essential information for better understanding and effective work with R&S signal generator equipped with option Digital Standard EUTRA/LTE. The topics provide information about some specific functions of the R&S Signal Generator that are provided for backward compatibility with previous version of this software.

Conflict Handling in the R&S Signal Generator

In 3GPP TS 36.211, 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).

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.

Note:
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.

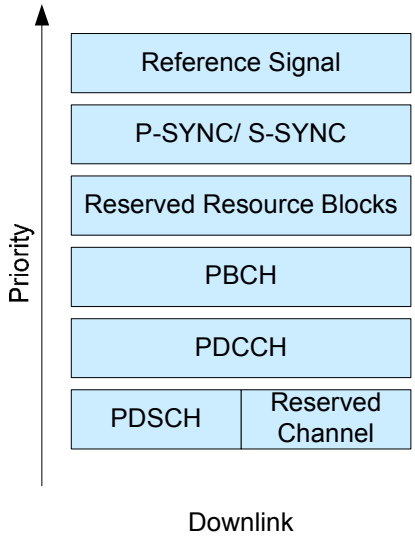


Figure 20 Priority of different allocations, channels and signals in the downlink

R&S conflict handling concept applies in following situations:

- 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.

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

- Overlapping between allocation and reserved resource blocks
  A reserved resource block will appear in subframe 0 in case of a selected bandwidth with odd number of resource blocks and enabled allocation mapping according to 3GPP 36.211 version 8.0.0 (see "Downlink Subframe 0 in Case of Bandwidths with Odd Number of Resource Blocks"). The affected subcarriers will be stamped out of any other channel allocation that tries to occupy this resource. No conflict is indicated, but the displayed number of physical bits of the allocation can be used to verify the correct behavior.

Uplink

In the uplink implementation of the R&S signal generator it is possible to configure different user equipments to use the same physical resources. The signals of the different UEs are simply added, but nevertheless a conflict is indicated in the resource allocation table.
Inside one UE it is not possible to provoke a conflict, as there will be no PUSCH (and also no demodulation reference signal) transmitted during a symbol that is used for sounding purposes, regardless of the used bandwidth of the sounding reference signal. However, a conflict can occur between the sounding reference signal of a certain UE and the PUSCH of another UE.

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 PDCCH and PDSCH allocations for the downlink and PUSCH and PUCCH allocations for the uplink are copied. P-SYNC/S-SYNC, PBCH and Sounding reference Signals are not considered. This is due to the fact that the P-SYNC/S-SYNC are configured globally in the General DL Settings menu and can 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 is set individually for each user equipment in the User Equipment menu.
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 section "Conflict Handling in the R&S Signal Generator" become effective.
However, a configurations can occur where in different subframes allocations which are identical by means of scheduled resource blocks have a different amount of physical bits available, due to the out stamping of overlapping subcarriers.

Number of Configurable Subframes

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

Functions for Backward Compability

This section summarizes all functions, available for backward compatibility with previous versions of this software. It is recommended to use the 3GPP compliant default settings.

User-defined Downlink Reference Signal and Synchronisation Signals

Regarding the Reference Signals, the following user-definable settings can be made:

- A shifting sequence for the reference signal can be defined by user. The shifting sequence has length 10 (subframes), and the values of the shifting sequence indicate an additional shift of the reference signal sequence in the frequency domain. Default shifting sequence is $\{0,0,\ldots,0\}$, i.e., no shifting is applied.
- One of the 3 possible orthogonal sequences $\mathbf{r}^{OS}$ can be selected. Sequence r^{OS} contains 340 elements for the primary reference signal and additional 340 elements for the secondary reference signal. The number 340 results from the fact that for a (maximum theoretical) bandwidth of 170 resource blocks, 2 reference signals are needed per resource block of 12 subcarriers.
- The pseudo-random sequence $\mathbf{r}^{PRS}$ can be uploaded from a text file for signal generation and analysis.
- The maximum length of r^{PRS} is the same as r^{OS} for each slot, but r^{PRS} may vary from slot to slot. Hence, the maximum composite length of all 20 sequences (20 slots per radio frame) r^{PRS} is given by 340 * 2 * 20 * 2 [QPSK] Bits = 27200 Bits.

- QPSK modulation can be selected for the pseudo-random sequence $\mathbf{r}^{PRS}$, or alternatively, an IQ-File can be uploaded to determine $\mathbf{r}^{PRS}$ (see section "IQ-File"). This approach also reflects the possibility to use a complex scrambling code as sequence r^{PRS}.
- In case of QPSK, the first 680 bits of the reference signal sequence are used for the primary reference signal and will be mapped on the first slot. Then the next 680 bits are read out for the secondary reference signal of the first slot; the next 680 bits are read out for the primary reference signal of the second slot etc. In case the second reference symbols are deactivated, the bit sequence will be skipped.
- If the data file contains a shorter list, the information is read out cyclically. Thus, if the reference signal sequence should be the same for each slot, it would be sufficient to have a list with 27200 bits / 20 = 1360 bits.

Regarding the Synchronization Signals, the following user-definable settings can be made:

- Different repetition periods for SYNC can be reflected. Five repetition periods are available: 2, 4, 5, 10 and 20 slots.
- First SYNC slot can also be configured. P-SYNC and S-SYNC always occur in the same subframe.
- P-SYNC is determined per default by an uploadable IQ-File so that any modulation scheme can be configured. The three possible Zadoff-Chu sequences for P-SYNC are provided. Alternatively, a QPSK modulated sequence can be selected.
  The IQ-File has the same format as described for the reference signal sequence, see section "IQ-File".
- The default modulation scheme for S-SYNC is QPSK. Alternatively, an IQ-File can be uploaded.
  The IQ-File has the same format as described for the reference signal sequence, see section "IQ-File".
- Each 10 ms radio frame, the P-SYNC and S-SYNC sequences are uploaded again from the text file. If the text file is shorter, it is started again from the beginning. As default settings it is assumed that P-SYNC contents are the same in each subframe, and S-SYNC contents are different from subframe to subframe. Precoding vector switching can be supported with this approach.
  The text file for the SYNC bit sequence respectively the IQ-File has therefore a maximum length of 72 [symbols] * 10 [subframes].

IQ-File

For generation of the reference signals in downlink and uplink, and for the P-SYNC/S-SYNC it is possible to upload an IQ-file directly containing the IQ samples. The format of the IQ-File must be a 32-bit floating point data, Little Endian format (also known as LSB Order or Intel format). The data order is IQIQIQ.
To generate IQ-Files of the correct format, the following Matlab code can be used, assuming that x is the complex valued IQ-symbol vector and the file name is stored in sExportFileName as string:

```
% open file
fid = fopen(sExportFileName, 'w');
% make complex data real according to I Q I Q I Q ...
x= [real(x) imag(x)].';
fwrite(fid, x(:), 'float32');
fclose(fid);
```

Downlink Subframe 0 in Case of Bandwidths with Odd Number of Resource Blocks

R&S Signal Generator supports two ways of resource blocks mapping for bandwidth with odd number of resource blocks, according to 3GPP TS 36.211 V8.0.0 and according to any latter version of this standard.
According to 3GPP TS 36.211 V8.0.0, in case of a bandwidth with odd number of resource blocks (e.g. 5 MHz -> 25 RBs), one resource block less can be allocated with PDCCH and PDSCH in subframe 0. Nevertheless this resource block is counted when defining the size of the resource allocation, but it is not allocated (i.e. when the resource allocation spans over this "reserved" resource block and a length of x is selected, then the actual allocation has only x-1 resource blocks). The figure below shows the described principle. This figure is taken from 3GPP TS 36.211, Physical Channels and Modulation (Release 8).

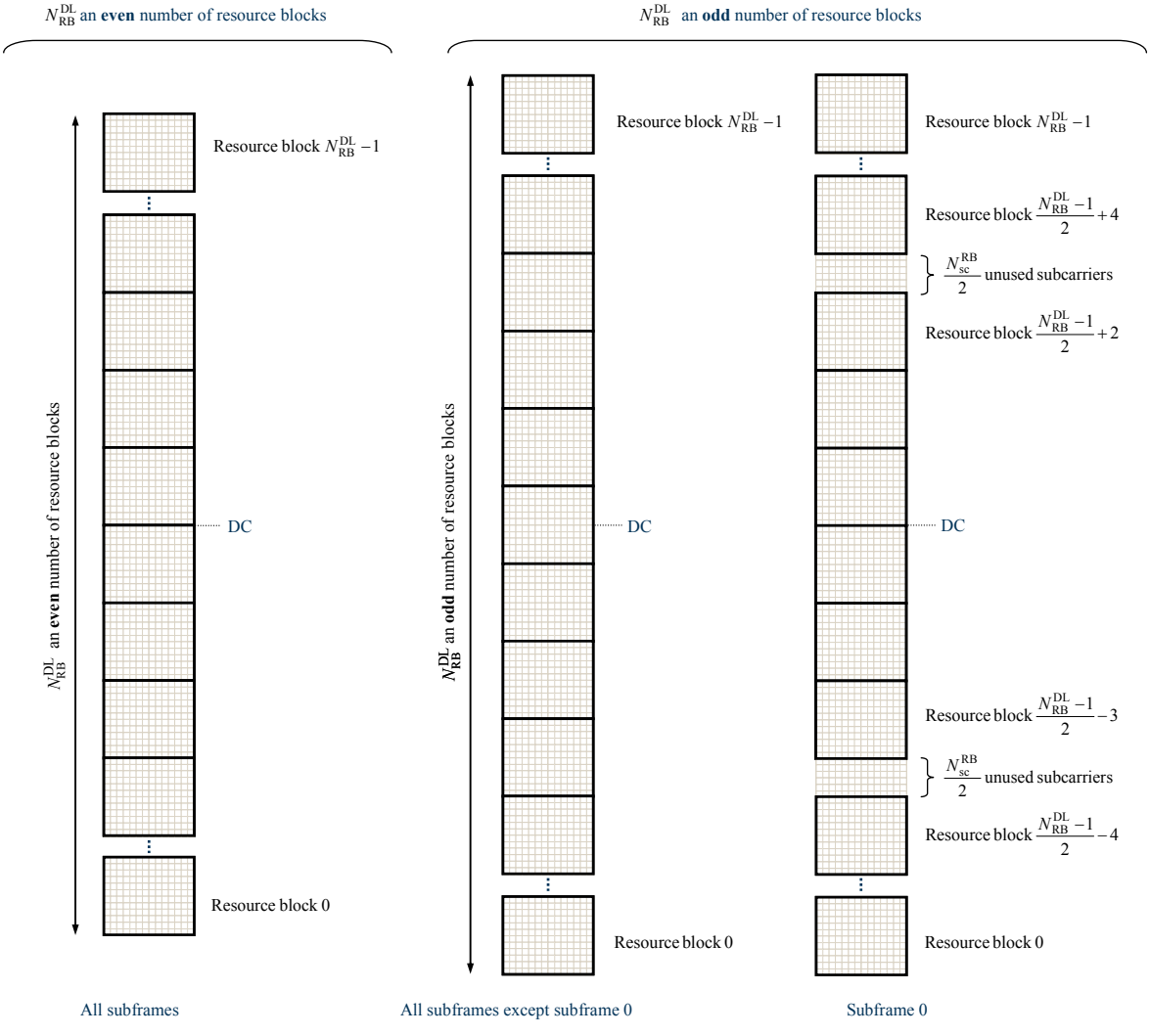
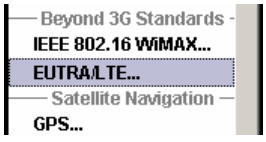


Figure 21 Handling of even/odd resource block numbers

In the R&S Signal Generator, the timeplan (see "OFDMA Timeplan - EUTRA/LTE") shows the resource blocks over time and does not include the mapping of the resource blocks to the subcarriers. Therefore, in the timeplan the unused (reserved) resource block is drawn above the SYNC/PBCH as defined in the figure above. Nevertheless this leads to 6 unused subcarriers above and 6 unused subcarriers below the SYNC/PBCH in the frequency domain.

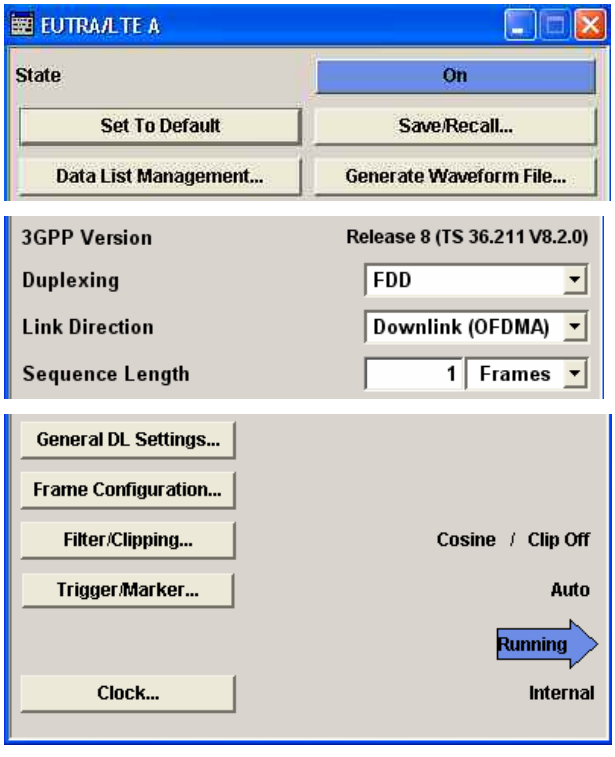
EUTRA/LTE Menu

The menu for setting the EUTRA/LTE digital standard is either called from the baseband block or from the menu tree under **Baseband**.



Main Menu for EUTRA/LTE Signals

The menu is split into several sections for configuring the standard.
The upper menu section is where the EUTRA/LTE digital standard is enabled and reset, the default settings are called, and where the generated waveform file can be selected.
The middle menu section is where EUTRA/LTE related settings such as the link direction and the sequence length can be selected.
The buttons in the lower menu section lead to submenus to configure the EUTRA/LTE signal and setting the filter, trigger, and clock parameters.



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.

State – EUTRA/LTE Activates or deactivates the EUTRA/LTE standard.

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

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

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

Remote-control command:
`SOUR:BB:EUTR:STAT ON`

Set to Default - EUTRA/LTE Calls the default settings.

Remote-control command:
`SOUR:BB:EUTR:PRES`

Parameter	Values
Main Settings	
State	OFF
Duplexing	FDD
Link Direction	Downlink (OFDMA)
Sequence Length	1 Frame
General DL Settings	
Physical Settings	
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
Number Of Occupied Subcarriers	601
Number Of Left Guard Subcarriers	212
Number Of Right Guard Subcarriers	211
Cell Specific Settings	
Physical Cell ID Group	0
Physical Layer ID	0
Fast Forward (N_c)	0
PDSCH ratio P_B/P_A	0 dB
PDCCH ratio P_B/P_A	0 dB
PHICH Duration	Normal
RS/SYNC Configuration Mode	3GPP
MIMO Settings	
Global MIMO Configuration	1 TxAntenna
Simulated Antenna	Antenna 1

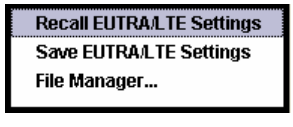
Parameter	Values
Downlink Reference Signal Structure	
First Reference Signal Power	0 dB
Second Reference Signal Power	0 dB
Synchronization Signal Settings	
P-SYNC Power	0 dB
S-SYNC Power	0 dB
DL Frame Configuration	
General Frame Configuration	
No. Of Configurable Subframes	10
Behaviour In Unscheduled Resource Elements	Dummy Data
Subframe Configuration	
Subframe Selection	0
Cyclic Prefix	Normal
No. Of Used Allocations	1
Allocation Table	
Code Word	1/1
Modulation	QPSK
Enchanced Settings	Config...
No. Of Resource Blocks	6 (for content type PBCH)
No. Of Symbols	4 (for content type PBCH)
Resource Block Offset	22 (for content type PBCH)
Symbol Offset	7(1/0) for PBCH
Auto	Off (for content type PBCH)
Physical Bits	528
Data Source	PN9
DList Pattern	-
Power/dB	0 dB
Content Type	PBCH
State	On
User Settings	
Channel Coding	Off
Data Source	PN9
Dummy Data Settings	
Modulation	QPSK
Data Source	PN9
Power	0 dB
General UL Settings	
Physical Settings	
Channel Bandwidth	10 MHz
Physical Resource Block Bandwidth	12 * 15 kHz
Number Of Resource Blocks per Slot	50
Occupied Bandwidth /MHz	9.000
Sampling Rate /MHz	15.360
FFT Size	1024

Parameter	Values
Number Of Occupied Subcarriers	600
Number Of Left Guard Subcarriers	212
Number Of Right Guard Subcarriers	212
Cell Specific Settings	
Physical Cell ID Group	0
Physical Layer ID	0
UL reference Signals	
Group Hopping	Off
Sequence Hopping	Off
Delta Sequence Shift for PUSCH	0
Number Of Shifts Available In Cell	12
PUSCH Structure	
Uplink Frequency Hopping Mode	None
Number Of Sub-bands/M	4
Cell-Specific Hopping Pattern	0:0
PUCCH Structure	
Number of RBs used for PUCCH	4
Delta Shift	2
Delta Offset	0
N(1)_cs	8
N(2)_RB	1
UL Frame Configuration	
Select User Equipment	
UE 1	ON
General Frame Configuration	
No. Of Configurable Subframes	1
Subframe Configuration	
Subframe Selection	0
Cyclic Prefix	Normal
Allocation Table	
Content Type	PUSCH
UE	UE1
Modulation	QPSK (for UE1)
No. of RB	11 (for UE1)
Offs. RB Slot n	2 (for UE1)
Offs. RB Slot n+1	2 (for UE1)
Physical Bits	- (for UE1)
Power/dB	0 dB (for UE1)
State	ON (for UE1)
Conflict	-
User Equipment 1 Settings	
Common Settings	
State	ON
UE ID	0

Parameter	Values
Mode	Standard
PUSCH	
Data Source	PN9
Scrambling	Off
Channel Coding State	Off
Transport Block CRC	Off
Code Block CRC	Off
CRC Version	Release 8
Rate Matcher Version	TS 36.211 v8.2.0
PUCCH	
Data Source	PN9
Reference Signal Structure	
DRS Power Offset	0 dB
SRS State	Off
A/N + SRS simultaneous Tx	Off
SRS Power Offset	0 dB
SRS Cyclic Shift	0
SRS Structure	
First SRS Subframe	0
SRS Periodicity	2 ms
Last SRS Subframe	0
Symbol in Subframe	First
No. of RBs/BW	2
Frequency Hopping Pattern	0:0

Save/Recall... - EUTRA/LTE 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** menu 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.

Remote-control command:
`MMEM:CDIR 'F:\gen_list\eutra'`
`SOUR:BB:EUTR:SETT:CAT?`
Response: `'e_utra_1', 'e_utra_2'`
`SOUR:BB:EUTR:SETT:LOAD 'e_utra_1'`

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.

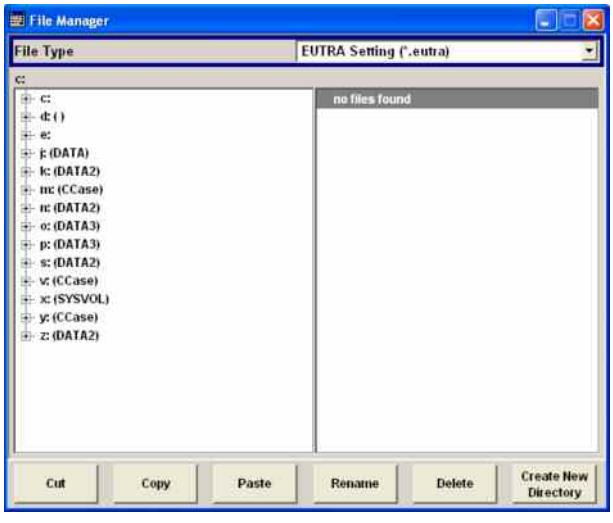
Remote-control command:

```
MMEM:CDIR 'F:\gen_list\eutra'
SOUR:BB:EUTR:SETT:STOR 'e_utra_1'
```

File Manager

Calls the **File Manager**.

The **File Manager** is used to copy, delete, and rename files and to create new directories.



Remote-control command:

```
MMEM:CDIR 'F:\gen_list\eutra'
SOUR:BB:EUTR:SETT:DEL 'e_utra_1'
```

Data List Management - EUTRA/LTE

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.

Remote-control commands:

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.*

Creating and editing the data list:

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

Selecting the data list:

```
SOUR:BB:EUTR:DL:SUBF1:ALL1:DATA DLIS
SOUR:BB:EUTR:DL:SUBF1:ALL1:DSEL "e_utra_1"
SOUR:BB:EUTR:DL:USER3:DATA DLIS
SOUR:BB:EUTR:DL:USER3:DSEL "e_utra_1"
```

Generate Waveform File... - EUTRA/LTE

Calls the **Generate Waveform** menu. This menu is used to store the current EUTRA/LTE signal as ARB signal in a waveform file.

This file can be loaded in the **ARB** menu and processed as multicarrier or multisegment signal.

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

Remote-control command:

```
SOUR:BB:EUTR:WAV:CRE "\temp\eutra.wv"
```

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

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.

Remote-control command:

```
SOUR:BB:EUTR:VERS?
```

Response: `Release 8.0 (TS 36.211 V8.2.0)`

Duplexing - EUTRA/LTE 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 or downlink and uplink frames can be generated.

Note:
The TDD mode is not implemented in this release.

Remote-control command:
`SOUR:BB:EUTR:DUPL TDD`

FDD In FDD mode, different frequencies are used for downlink and uplink directions. If only one link direction is considered at once, the EUTRA/LTE standard defines no differences between TDD and FDD signals on the physical layer.

Note:
In this release, only the FDD mode is supported.

Remote-control command:
`SOUR:BB:EUTR:DUPL FDD`

Link Direction - EUTRA/LTE 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.

Remote-control command:
`SOUR:BB:EUTR:LINK DOWN`

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.

Remote-control command:
`SOUR:BB:EUTR:LINK UP`

Sequence Length - EUTRA/LTE

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).

Remote-control command:
`SOUR:BB:EUTR:SLEN 20`

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

General DL Settings…/ General UL Settings… - EUTRA/LTE

The name of the button depends on the chosen link direction (uplink or downlink).
Calls the **General DL Settings**/ **General UL Settings** menu for configuring the EUTRA/LTE system.

The menus are described respectively in section "General DL Settings - EUTRA/LTE", page 39 and "General UL Settings - EUTRA/LTE", page 65.

Remote-control command: n.a.

Frame Configuration… - EUTRA/LTE

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

The menu depends on the chosen link direction. The menu is described in section "DL Frame Configuration – EUTRA/LTE", page 49 and "UL Frame Configuration – EUTRA/LTE", page 74 respectively.

Remote-control command: n.a.

Filtering, Clipping... - EUTRA/LTE

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

The menu is described in section "Filter / Clipping Settings - EUTRA/LTE", page 95.

Remote-control command: n.a.

Trigger - Marker - EUTRA/LTE

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

Calls the menu 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 menu is described in section "Trigger/Marker/Clock - EUTRA/LTE", page 98.

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

Remote-control command: n.a.

Execute Trigger - EUTRA/LTE

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

Executes the trigger manually.

A manual trigger can be executed only if an internal trigger source and a trigger mode other than **Auto** have been selected.

Remote-control command:
`SOUR:BB:EUTR:TRIG:EXEC`

Arm - EUTRA/LTE

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

Stops signal generation manually.

The **Arm** button is displayed only if the trigger modes **Armed Retrigger** or **Armed Auto** have been selected.

Remote-control command:
`SOUR:BB:EUTR:TRIG:ARM:EXEC`

Clock - EUTRA/LTE

(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 section "Trigger/Marker/Clock - EUTRA/LTE", page 98.

Remote-control command: n.a.

General DL Settings - EUTRA/LTE

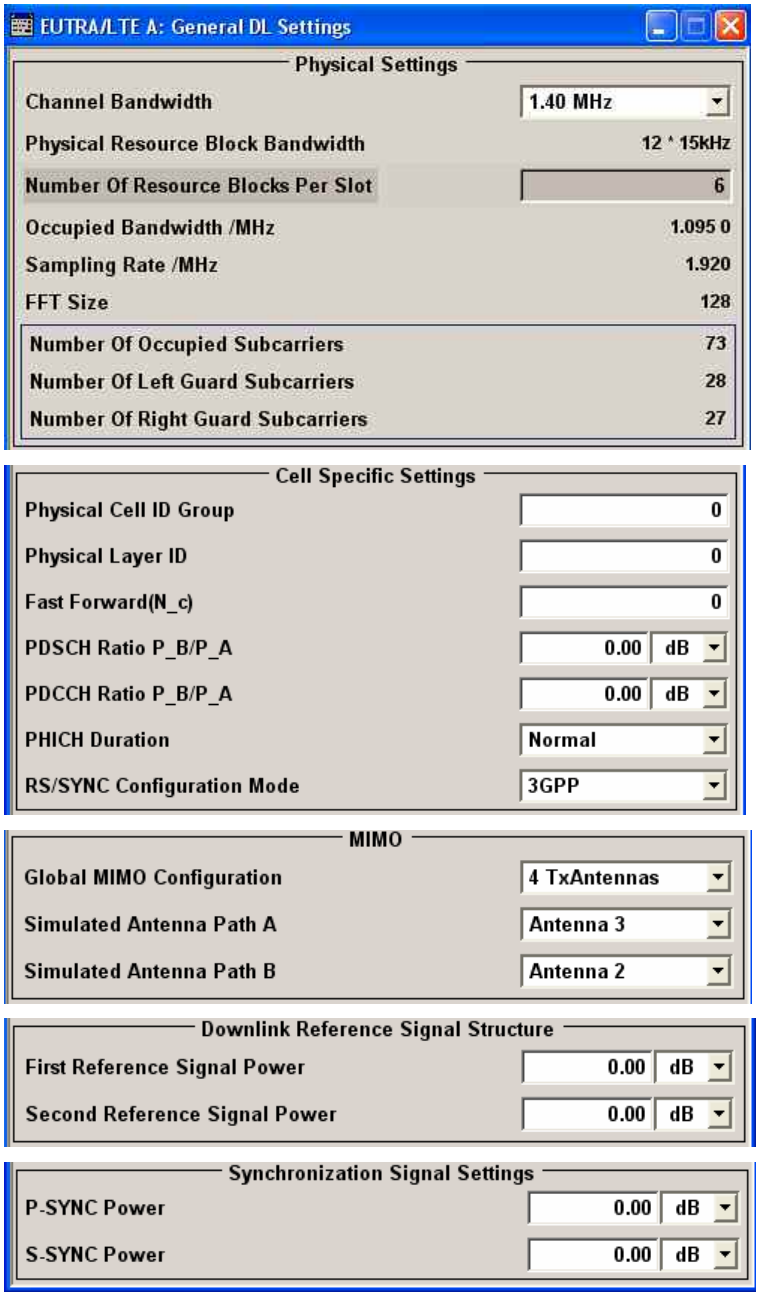
The **General DL Settings** menu allows configuring the EUTRA/LTE system for transmission direction downlink and consists of four sections, **Physical Settings, Cell Specific Settings, MIMO, Downlink Reference Signal Structure and Synchronization Signal Settings**.

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

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

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

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.



Channel Bandwidth - EUTRA/LTE

Sets the channel bandwidth of the EUTRA/LTE system.

Although the 3GPP specification bases on bandwidth agonistic layer 1 and channel bandwidth is determined by specifying the desired number of resource blocks, the current EUTRA standardization (TS 36.804 v.1.0.0 11/2007) 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 always determined by the parameter **Number of Resource Blocks Per Slot**.

Remote-control command:
`SOUR:BB:EUTR:DL:BW BW5_00`

Physical Resource Block Bandwidth - EUTRA/LTE

Displays the bandwidth of one physical resource block.

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

Remote-control command: `n.a.`

Number of Resource Blocks Per Slot - EUTRA/LTE

This parameter determines the channel bandwidth.

If the parameter **Channel Bandwidth** is set to one of the pre-defined channel bandwidths (1.25, 1.4, 2.5, 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, occupied bandwidth and FFT size are always determined by the parameter **Number of Resource Blocks Per Slot**.

Remote-control command:
`SOUR:BB:EUTR:DL:NORB?`

Resource Block Mapping - EUTRA/LTE

(Enabled for odd number of resource blocks only)

Selects the way the resource blocks are mapped.

TS 36.211 V8.0.0

The resource blocks mapping will be performed according to the 3GPP TS 36.211, Version 8.0.0 (see "Downlink Subframe 0 in Case of Bandwidths with Odd Number of Resource Blocks").

Remote-control command:
`SOUR:BB:EUTR:DL:RBM V80`

TS 36.211 V8.1.0

The resource blocks mapping will be performed according to the 3GPP TS 36.211, Version 8.1.0 and higher.

Remote-control command:
`SOUR:BB:EUTR:DL:RBM V81`

Occupied Bandwidth - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:OCCB?`

Sampling Rate - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:SRAT?`

FFT Size - EUTRA/LTE

Displays the FFT (Fast Fourier Transformation) size. The value is automatically set according to the parameter **Number of Resource Blocks Per Slot**.

Remote-control command:
`SOUR:BB:EUTR:DL:FFT?`

Number Of Occupied Subcarriers - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:OCCS?`

Number Of Left Guard Subcarriers - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:LGS?`

Number Of Right Guard Subcarriers - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:RGS?`

Cell Specific Settings

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

Physical Cell ID Group - EUTRA/LTE

Sets 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 within a cell ID group, set the parameter **Physical Layer ID**.

The Physical Cell ID, set with the combination of the parameters **Physical Cell ID Group** and **Physical Layer 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:
`SOUR:BB:EUTR:DL:PLC:CIDG 100`

Physical Layer ID - EUTRA/LTE

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.

Remote-control command:
`SOUR:BB:EUTR:DL:PLC:CIDG 100`
`SOUR:BB:EUTR:DL:PLC:PLID 1`

Fast Forward (N_c) DL- EUTRA/LTE

Sets the initial value of the generator of pseudo-random sequence according to R1-081248, "PRS sequence generation for downlink reference signal".

The generated pseudo-random sequence is used for the reference signal and for scrambling.

Remote-control command:
`SOUR:BB:EUTR:DL:CSS:FFNC 1685`

PDSCH Ratio P_B/P_A - EUTRA/LTE

Sets the transmit energy ratio among the resource elements allocated for PDSCH in the OFDM symbols containing reference signal (P_A) and such not containing one (P_B).

Remote-control command:
`SOUR:BB:EUTR:DL:PDSC:RATB -9.1`

PDCCH Ratio P_B/P_A - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:PDCC:RATB -9.0`

PHICH Duration - EUTRA/LTE

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** that is signaled by the PCFICH.

Normal

All ressource element groups of PHICH (see **Number of PHICH Groups**) are allocated on the first OFDM symbol (OFDM Symbol 0).

Remote-control command:
`SOUR:BB:EUTR:DL:PHIC:DUR NORM`

Extended

The ressource element groups of PHICH are distributed over three OFDM symbol (OFDM Symbols 0 .. 2).

Remote-control command:
`SOUR:BB:EUTR:DL:PHIC:DUR EXT`

RS/SYNC Configuration Mode - EUTRA/LTE

Selects the way the DL reference and synchronizations signals are configured

3GPP

The synchronization signal and downlink reference signal settings are set according to the 3GPP TS 36.211.

Remote-control command:
`SOUR:BB:EUTR:DL:CSS:RSCM STAN`

User

All DL synchronizations signal settings and downlink reference signal settings are enabled for configuration.

Remote-control command:
`SOUR:BB:EUTR:DL:CSS:RSCM USER`

MIMO

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

Global MIMO Configuration - EUTRA/LTE

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 figure "Downlink reference signal structure (normal cyclic prefix)").

Note:
One baseband simulates one antenna.

Remote-control command:
`SOUR:BB:EUTR:DL:MIMO:CONF TX2`

Simulated Antenna- EUTRA/LTE

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 "Downlink reference signal structure (normal cyclic prefix)").

Remote-control command:
`SOUR:BB:EUTR:DL:MIMO:CONF TX1`
`SOUR:BB:EUTR:DL:MIMO:ANT ANT1`

Simulated Antenna Path A- EUTRA/LTE

Determines the simulated antenna for path A. The configuration of the Downlink Reference Signal structure is set accordingly (see figure "Downlink reference signal structure (normal cyclic prefix)").
The possible values of this parameter depend on the setting of the parameter **Global MIMO Configuration**.

Remote-control command:
`SOUR:BB:EUTR:DL:MIMO:CONF TX2`
`SOUR:BB:EUTR:DL:MIMO:ANTA ANT2`

Simulated Antenna Path B- EUTRA/LTE

(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 figure "Downlink reference signal structure (normal cyclic prefix)").
The possible values of this parameter depend on the setting of the parameter **Global MIMO Configuration**.

Remote-control command:
`SOUR:BB:EUTR:DL:MIMO:CONF TX4`
`SOUR:BB:EUTR:DL:MIMO:ANTB NONE`

Downlink Reference Signal Structure

In the **Downlink Reference Signal Structure** section, the power of the reference signals is set.
The settings for defining the structure of the downlink reference signal are only available, if **Configuration Mode User** is selected.

First Reference Signal Position - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Selects the position (OFDM symbol number) in the subframe for the first reference signal.

This parameter is automatically set according to the selected **Global MIMO Configuration** and **Simulated Antenna**.

Remote-control command:
`SOUR:BB:EUTR:DL:REFS:FSTP?`

Subcarrier Offset - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Displays the offset in subcarriers within one resource block.
This parameter is automatically set according to the selected **Global MIMO Configuration** and **Simulated Antenna**.

Remote-control command:
`SOUR:BB:EUTR:DL:REFS:SCOF 1`

Use Second Reference Signal - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Displays whether second reference signal are used or not.
This parameter is read-only and is automatically set according to the selected **Global MIMO Configuration** and **Simulated Antenna**.

Remote-control command:
`SOUR:BB:EUTR:DL:REFS:S2AC?`

First Reference Signal Power - EUTRA/LTE

Sets the power of the first reference signal.

Remote-control command:
`SOUR:BB:EUTR:DL:REFS:FPOW 1.0`

Second Reference Signal Power - EUTRA/LTE

Sets the power of the second reference signal.

Remote-control command:
`SOUR:BB:EUTR:DL:REFS:SPOW -10.00`

Shifting Sequence - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Determines the cell-specific integer sequence f_shift(.) and is used to shift the reference signal in the frequency domain in addition to the parameter **Subcarrier Offset**. One value out of the sequence is used for one subframe, so there can be up to 10 entries. If less than 10 entries are available, the sequence is read out cyclically.

***Note**:*
The value range of the entries for the shifting sequence is 0 .. 5. Be aware that by input of each entry its value is immediately and individually checked against the value range.
Only valid values are allowed and accepted.

Remote-control command:
`SOUR:BB:EUTR:DL:REFS:SHIF '1:2:3:1:4:5:3'`

Orthogonal Sequence - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Determines the orthogonal sequence R^{OS} used for generation of the reference signal.

Remote-control command:
`SOUR:BB:EUTR:DL:REFS:ORTS ORS1`

PRS Modulation Scheme - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Determines the type of the pseudo-random sequence R_prs used for generation of the reference signal. Either QPSK with user-definable data list or a file directly containing IQ-samples can be selected.
For detailed information about generating of an IQ-File, see "IQ-File", on page 27.

Remote-control command:
`SOUR:BB:EUTR:DL:REFS:PRSM QPSK`

Pseudo-Random Sequence R_prs… - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Opens the **Load Data List** window for loading a saved dataset for pseudo-random sequence R_prs for reference signal generation. The data list of the selected (highlighted) file is loaded by pressing the **Select** button.
If QPSK is selected as PRS Modulation Scheme, this sequence has to be in SMU data list format.
If IQ-File is chosen, a file in iqw format is required.
For detailed information about generating of an IQ-File, see "IQ-File", on page 27.

Remote-control command:
```
MMEM:CDIR 'F:\gen_list\eutra'
SOUR:BB:EUTR:DL:REFS:PRS 'prs'
SOUR:BB:EUTR:DL:REFS:PRSI 'prs'
```

Synchronization Signal Settings

In the **Synchronization Signal Settings** section, the power of the P-SYNC/S-SYNC is set.
Additional settings regarding the P-SYNC/S-SYNC are only available, if **Configuration Mode User** is
.

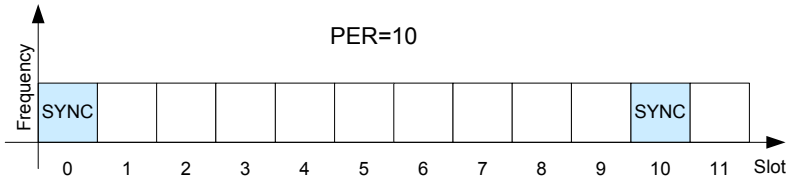
P-/S-SYNC Repetition Period - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Sets the period in slots between two P-SYNC/S-SYNC slots.

Example:

PER = 10 results in 9 slots between two SYNC slots.



Remote-control command:
`SOUR:BB:EUTR:DL:SYNC:PER 10`

First P-/S-SYNC Slot - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Sets the slot in the radio frame, in which the P-SYNC and the S-SYNC are transmitted the first time.

Example:

FSTS = 0 means that slot 0 is the first slot, in which the P-SYNC and S-SYNC are transmitted. The next P-SYNC/S-SYNC depends on the value for the SYNC repetition period, see “P-/S-SYNC Repetition Period - EUTRA/LTE”, on page 47.

The maximal value depends on the selected SYNC repetition period (PER): $FSTS_{max}$ = PER - 1.

Note:
The P-SYNC/S-SYNC is automatically mapped to the 72 center subcarriers of the last two OFDM symbols of the slot.

Remote-control command:
`SOUR:BB:EUTR:DL:SYNC:FSTS 0`
`SOUR:BB:EUTR:DL:SYNC:PER 10`

P-SYNC Modulation Scheme - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Determines the type of the sequences used for generation of the P-SYNC. Either QPSK with user-definable data list or a file directly containing IQ-samples can be selected.
For detailed information about generation of an IQ-File, see "IQ-File", on page 27.

Remote-control command:
`SOUR:BB:EUTR:DL:SYNC:PMOD IQF`

P-SYNC Sequence - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Opens the **Load Data List** window for loading a saved dataset for P-SYNC generation. The data list of the selected (highlighted) file is loaded by pressing the **Select** button.
If QPSK is selected as SYNC Modulation Scheme, this sequence has to be in SMU data list format.
If IQ-File is chosen, a file in iqw format is required.
For detailed information about generation of an IQ-File, see "IQ-File", on page 27.

Note:
The sequence is restarted at the beginning of each generated frame.

Remote-control command:
```
MMEM:CDIR 'F:\gen_list\eutra'
SOUR:BB:EUTR:DL:SYNC:PSEQ 'psync'
SOUR:BB:EUTR:DL:SYNC:PIQS 'psync'
```

S-SYNC Modulation Scheme - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Determines the type of the sequences used for generation of the S-SYNC. Either QPSK with user-definable data list or a file directly containing IQ-samples can be selected.
For detailed information about generation of an IQ-File, see "IQ-File", on page 27.

Remote-control command:
```
SOUR:BB:EUTR:DL:SYNC:SMOD IQF
```

S-SYNC Sequence - EUTRA/LTE

(Enabled for **Configuration Mode User** only)

Opens the **Load Data List** window for loading a saved dataset for S-SYNC generation. The data list of the selected (highlighted) file is loaded by pressing the **Select** button.
If QPSK is selected as SYNC Modulation Scheme, this sequence has to be in SMU data list format.
If IQ-File is chosen, a file in iqw format is required.

Note:
The sequence is restarted at the beginning of each generated frame.

Remote-control command:
```
MMEM:CDIR 'F:\gen_list\eutra'
SOUR:BB:EUTR:DL:SYNC:SSEQ 'ssync'
SOUR:BB:EUTR:SYNC:SIQS 'ssync'
```

P-SYNC Power - EUTRA/LTE

Sets the power of the P-SYNC allocations.

Remote-control command:
```
SOUR:BB:EUTR:DL:SYNC:PPOW -10.00
```

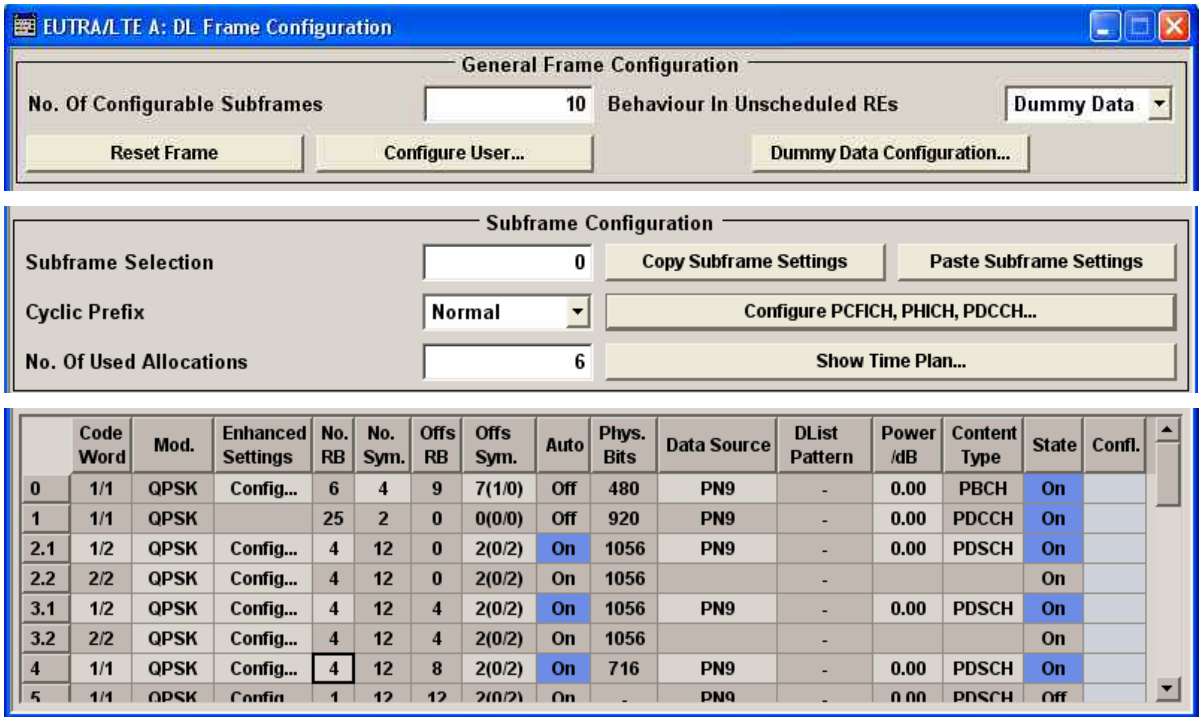
S-SYNC Power - EUTRA/LTE

Sets the power of the S-SYNC allocations.

Remote-control command:
```
SOUR:BB:EUTR:DL:SYNC:SPOW -10.00
```

DL Frame Configuration – EUTRA/LTE

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**.



No Of Configurable Subframes - EUTRA/LTE

Sets the number of configurable subframes. All ten subframes of a frame 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, see "Number of Configurable Subframes", page 26.

Remote-control command:
`SOUR:BB:EUTR:DL:CONS 10`

Reset Frame - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:RSTF`

Configure User.. - EUTRA/LTE

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

The menu is described in section "Configure User - EUTRA/LTE", page 62.

Remote-control command: `n.a.`

Behavior In Unscheduled REs - EUTRA/LTE

Selects either to fill unscheduled resource elements and subframes with dummy data or DTX.
This applies also for the unused subcarrier above and bellow the P-SYNC/S-SYNC and PBCH in subframe 0 in case of **Resource Block Mapping** according to 3GPP TS 36.211 v8.0.0, i.e. odd number of resource blocks per slot applies (see figure "Handling of even/odd resource block numbers", on page 28).

If the P-SYNC/S-SYNC or the IQ-File for generating the reference signal includes unused subcarrier, these are not filled in.

Remote-control command:
`SOUR:BB:EUTR:DL:BUR DTX`

Dummy Data Configuration... - EUTRA/LTE

(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 section “Dummy Data Configuration - EUTRA/LTE“, page 63.

Remote-control command: `n.a.`

Subframe Selection - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:SFS 1`

Cyclic Prefix - EUTRA/LTE

Sets the cyclic prefix for the according subframe.
The number of the OFDM symbols per subframe is set automatically

Remote-control command:
`SOUR:BB:EUTR:DL:SUBF1:CYCP NORM`

No. Of Used Allocations - EUTRA/LTE

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 1, otherwise 0.

Remote-control command:
`SOUR:BB:EUTR:DL:SUBF1:ALC 2`

Copy Subframe Settings - EUTRA/LTE

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

For more detailed information, see “Copy/Paste Subframe”, page 26.

Remote-control command: `n.a.`

Paste Subframe Settings - EUTRA/LTE

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

For more detailed information, see “Copy/Paste Subframe” page 26.

Remote-control command: `n.a.`

Show Time Plan - EUTRA/LTE

Calls the time plan for the OFDMA resource allocation.

The menu is described in detail in section “OFDMA Timeplan - EUTRA/LTE”, page 64.

Remote-control command: `n.a.`

Configure PCFICH, PHICH, PDCCH... - EUTRA/LTE

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

The menu is described in detail in section *"Enhanced Channel Configuration - EUTRA/LTE"*, page *59*.

Remote-control command: `n.a.`

Resource Allocation Table DL - EUTRA/LTE

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 - EUTRA/LTE

Displays the consecutive number of the allocation.

Remote-control command: `n.a.`
(selected via the suffix to the keyword)

Code Word - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:DL:SUBF0:ALL5:CODW 2`

Mod. - EUTRA/LTE

Selects the modulation scheme for the allocation.

Remote-control command:
`SOUR:BB:EUTR:DL:SUBF0:ALL5:CW2:MOD QPSK`

Enhanced Settings DL - EUTRA/LTE

Calls the **Enhanced Settings** dialog for configuration of precoding and channel coding (see *"Enhanced Settings - EUTRA/LTE"*).

Remote-control command: `n.a.`

No. RB (Resource Blocks) - EUTRA/LTE

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

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

Remote-control command:
`SOUR:BB:EUTR:DL:SUBF2:ALL5:CW:RBC 1`

No. Sym. - EUTRA/LTE

Sets the size of the selected allocation in OFDM symbols. For 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 code words are configured, the size of the allocation with the second code word is determinate by the size of the first one.

Remote-control command:

```
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
```

Offs RB - EUTRA/LTE

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 code words are configured, the start resource block of the allocation with the second code word is determinate by the selected start resource block of the first one.

Remote-control command:

```
SOUR:BB:EUTR:DL:SUBF1:ALL2:CW:RBOF 100
```

Offs Sym. - EUTRA/LTE

Sets the start OFDM symbol of the selected allocation.
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 code words are configured, the start OFDM symbol of the allocation with the second code word is determinate by the selected start OFDM symbol of the first one.

Remote-control command:

```
SOUR:BB:EUTR:DL:SUBF2:ALL2:CW:SYM 2
```

Auto - EUTRA/LTE

Sets whether automatic offset calculation is used or not.

Note:
*If the **Auto Offset Calculation** mode is activated, the resource block offset is 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 code words are configured, the state of the **Auto Offset Calculation** mode of the second code word is set to the state of the first one.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL2:CW:AOC ON
```

Phys. Bits - EUTRA/LTE

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 section "Conflict Handling in the R&S Signal Generator").

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL1:PHYS?
```

Data Source - EUTRA/LTE

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** window.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL1:CW:DATA PN9

SOUR:BB:EUTR:DL:SUBF1:ALL1:CW:DATA PATT
SOUR:BB:EUTR:DL:SUBF1:ALL1:CW:PATT #H3F,8

SOUR:BB:EUTR:DL:SUBF1:ALL1:CW:DATA DLIST
MMEM:CDIR '\Lists\DM\IqData'
SOUR:BB:EUTR:DL:SUBF1:ALL1:CW:DSEL 'e_utra_1'
```

DList/Pattern - EUTRA/LTE

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

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL1:CW:DATA PATT
SOUR:BB:EUTR:DL:SUBF1:ALL1:CW:PATT #H3F,8
```

Power - EUTRA/LTE

Sets the power P_{PDSCH} respectivelly P_{PDCCH} for the selected allocation.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL2:POW 10.00
```

Content Type (DL) – EUTRA/LTE

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.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL1:CONT PDSCh
```

State - EUTRA/LTE

Sets the allocation to active or inactive state.

In case two code words are configured, the state of the allocation with the second code word is determinate by the state of the first one.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL5:CW:STAT OFF
```

Conflict - EUTRA/LTE

Indicates a conflict between allocations.

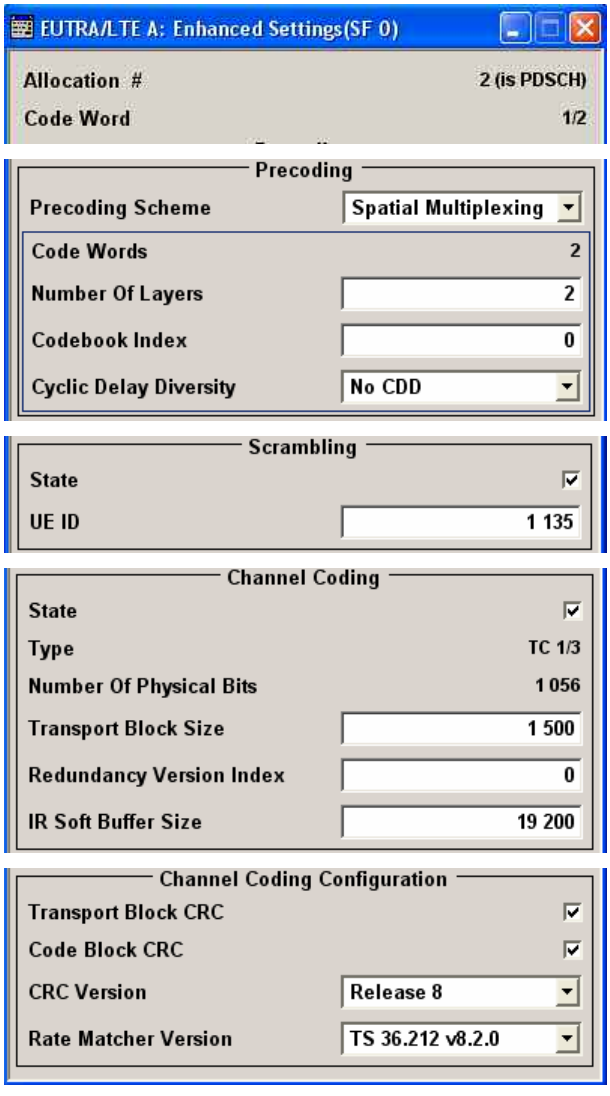
For more information, see "Conflict Handling in the R&S Signal Generator", on page 24.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL1:CW2:CONF?
```

Enhanced Settings - EUTRA/LTE

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 parameters available for configuration in section **Precoding** depend on the global MIMO configuration, the content of the allocation and the selected code word.



Allocation # - EUTRA/LTE Displays the number of the allocation and the channel type the enhanced settings are configured for.

Remote-control command: `n.a.`

Code Word - EUTRA/LTE Displays the number of the code word and the total number of code words used for the selected allocation.

Remote-control command:
`SOUR:BB:EUTR:DL:SUBF0:ALL5:CODW?`

Precoding Scheme - EUTRA/LTE

Selects the precoding scheme.
This parameter is available for the first code word only.

Note:
The available selections depend on the selected Content Type and the MIMO Configuration.

None

Disables precoding.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:PREC:SCH NONE
```

Spatial Multiplexing

Precoding for spatial multiplexing will be performed according to 3GPP TS 36.211, Version 8.2.0 and the selected parameters.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL1:CONT PDSC
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:PREC:SCH SPM
```

Tx Diversity

Precoding for transmit diversity will be performed according to 3GPP TS 36.211, Version 8.2.0 and the selected parameters.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL1:CONT PDCC
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:PREC:SCH TXD
```

Code Words - EUTRA/LTE

Displays the number of the code words used for the selected allocation.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CODW?
Response: 2
```

Number of Layers - EUTRA/LTE

(Enabled for Precoding Scheme set to Tx Diversity or Spatial Multiplexing only)

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.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:PREC:NOL 3
```

Codebook Index - EUTRA/LTE

(Enabled for Precoding Scheme set to Spatial Multiplexing 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** (number of antennas).
The combination of codebook index and the selected **Number of Layers** determines the pre-coding matrix used for precoding.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:PREC:CBIN 3
```

Cyclic Delay Diversity - EUTRA/LTE

(Enabled for Precoding Scheme set to Spatial Multiplexing 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.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:PREC:CDD SMD
```

State Scrambling (DL) - EUTRA/LTE

Enables/disables the bit-level scrambling.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:SCR:STAT ON
```

UE ID (PDSCH) - EUTRA/LTE

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** menu for the corresponding user.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW:SCR:UEID 120
```

State Channel Coding (DL) - EUTRA/LTE

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

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW2:CCOD:STAT ON
```

Type Channel Coding (DL) - EUTRA/LTE

Displays the used channel coding scheme and channel coding rate.

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

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF1:ALL1:CONT?
Response: PDSCH
SOUR:BB:EUTR:DL:SUBF0:ALL5:CW2:CCOD:TYPE?
Response: TC 1/3
```

Number of Physical Bits (DL) - EUTRA/LTE

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 section "Conflict Handling in the R&S Signal Generator").

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:PHYS?
Response: 2400
```

Transport Block Size (DL) - EUTRA/LTE

Sets the size of the transport block.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:PHYS?
Response: 2400
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:TBS 1500
```

Redundancy Version Index (PDSCH) - EUTRA/LTE

Sets the redundancy version index.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:RVIN 1
```

IR Soft Buffer Size (PDSCH) - EUTRA/LTE

Sets the size of the IR soft buffer.

Remote-control command:
```
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
```

Transport Block CRC (PDSCH) - EUTRA/LTE

Enables/disables calculation of the transport block CRC according to 3GPP TS 36.211, version 8.2.0.

The calculated CRC is appended for error detection of the entire transport block.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:TBCR OFF
```

Code Block CRC (PDSCH) - EUTRA/LTE

Enables/disables attachment of CRC to the code block.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:CBCR ON
```

CRC Version (DL) - EUTRA/LTE

Sets the standard, Release 99 or Release 8, according to that the CRC will be calculated.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:CRCV R8V
```

Rate Matcher Version (PDSCH) - EUTRA/LTE

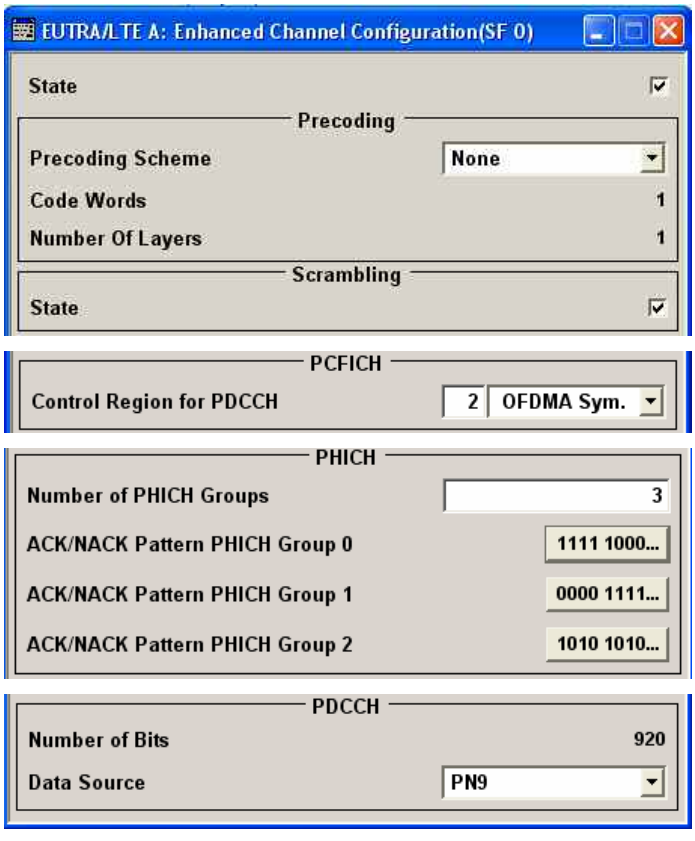
Sets the standard, 3GPP TS 26.212 version 1.1.0, version 8.0.0 or version 8.2.0, according to that the rate matching will be performed.

Remote-control command:
```
SOUR:BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:RMV R11V
```

Enhanced Channel Configuration - EUTRA/LTE

The **Enhanced Channel Configuration** menu allows you to define and configure the PDFICH, PHICH and PDCCH settings.

The parameters available for configuration in section **Precoding** depend on the **Global MIMO Configuration**.



State (PDCCH) - EUTRA/LTE

Enables/disables the PDCCH, PCFICH and PHICH allocations.

Remote-control command:
`SOUR:BB:EUTR:DL:ENCC:STAT ON`

Precoding Scheme (PDCCH) - EUTRA/LTE

Selects the precoding scheme for PDCCH, PCFICH and PHICH.

None

Disables precoding.

Remote-control command:
`SOUR:BB:EUTR:DL:ENCC:PREC:SCH NONE`

Tx Diversity

Precoding for transmit diversity will be performed according to 3GPP TS 36.211, Version 8.2.0 and the selected parameters.

Remote-control command:
`SOUR:BB:EUTR:DL:ENCC:PREC:SCH TXD`

Code Words (PDCCH) - EUTRA/LTE

Displays the number of the code words used for PDCCH, PCFICH and PHICH.
PDCCH, PCFICH and PHICH use always 1 code word.

Remote-control command: `n.a.`

Number of Layers (PDCCH) - EUTRA/LTE

(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.
The combination of number of **Code Words** and number of layers determines the layer mapping for the selected precoding scheme.

Remote-control command:
```
SOUR:BB:EUTR:DL:ENCC:PREC:NOL?
Response: 1
```

State Scrambling (PDCCH) - EUTRA/LTE

Enables/disables the scrambling.

Remote-control command:
```
SOUR:BB:EUTR:DL:ENCC:SCR:STAT ON
```

Control Region for PDCCH - EUTRA/LTE

Sets the number of OFDM Symbols to be used for PDCCH.

Whether 1, 2 or 3 OFDM Symbols can be reserved for PDCCH depends on the selection made for the **PHICH Duration**.
For extended **PHICH Duration** the **Control Region for PDCCH** is always 3 OFDM Symbols.

Remote-control command:
```
SOUR:BB:EUTR:DL:PHIC:DUR NORM
SOUR:BB:EUTR:DL:ENCC:PCF:CREG 2
```

Number of PHICH Groups - EUTRA/LTE

Sets the number of available PHICH groups.
One PHICH group consists of 8 ACK/NACK messages from several users.
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.

Depending on the selection made for the parameter **PHICH Duration** (normal or extended) this total number of REGs is allocated over the first or the first three OFDM symbols.

Remote-control command:
```
SOUR:BB:EUTR:DL:ENCC:PHIC:NORG 4
```

ACK/NACK Pattern PHICH Group 1...8 - EUTRA/LTE

Sets the ACK/NACK pattern for the corresponding PHICH group.

Note:
DTX will be supported in a latter version.

Remote-control command:
```
SOUR:BB:EUTR:DL:ENCC:PHIC:ANP2 #H5,3
```

Number of Bits (PDCCH) - EUTRA/LTE

Displays the number of bits allocated for PDCCH.

The number of bits available for PDCCH allocation depends on the selected channel bandwidth, the antenna configuration, the number of PHICH groups, the PHICH duration and the control region for PDCCH.

Remote-control command: `n.a.`

Data Source (PDCCH) - EUTRA/LTE

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**.

Since the PDCCH formats are still not completely defined, the R&S Signal Generator provides the possibility to select an arbitrary data source or user defined lists for the PDCCH content.

Note:
The user defined lists can be used to simulate different DCI formats and multiplexing of several PDCCHs. The proper content of these lists is under the responsibility of the user.

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.

Remote-control command:

```
SOUR:BB:EUTR:DL:ENCC:PDCC:DATA PN9

SOUR:BB:EUTR:DL:ENCC:PDCC:DATA PATT
SOUR:BB:EUTR:DL:ENCC:PDCC:PATT #H3F,8

SOUR:BB:EUTR:DL:ENCC:PDCC:DATA DLIST
MMEM:CDIR '\Lists\DM\IqData'
SOUR:BB:EUTR:DL:ENCC:PDCC:DSEL 'pdcch_1'
```

DList/Pattern (PDCCH) - EUTRA/LTE

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

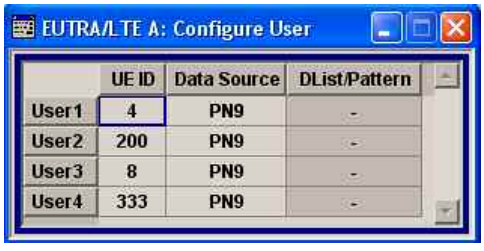
Remote-control command:

```
SOUR:BB:EUTR:DL:ENCC:PDCC:DATA PATT
SOUR:BB:EUTR:DL:ENCC:PDCC:PATT #H3F,8
```

Configure User - EUTRA/LTE

The **Configure User** menu allows 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**. Using this feature ensures that a common data source is used for allocations of one user equippment also in case that these allocations are non-adjacent.

For more details, see "Data Allocations", page 19.



User (Configure User) - EUTRA/LTE

Displays the consecutive number of the users.

Remote-control command: n.a.

UE ID (Configure User) - EUTRA/LTE

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** menu.

Remote-control command:

```
SOUR:BB:EUTR:DL:USER3:UEID 8
```

Data Source (Configure User) - EUTRA/LTE

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.

Remote-control command:

```
SOUR:BB:EUTR:DL:USER3:DATA PN9
```

```
SOUR:BB:EUTR:DL:USER3:DATA PATT
SOUR:BB:EUTR:DL:USER3:PATT #H3F,8
```

```
SOUR:BB:EUTR:DL:USER3:DATA DLIST
MMEM:CDIR '\Lists\DM\IqData'
SOUR:BB:EUTR:DL:USER3:DSEL 'e_utra_1'
```

DList Pattern (Configure User) - EUTRA/LTE

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

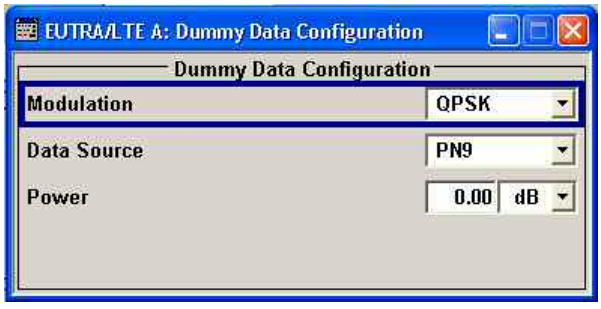
Remote-control command:

```
SOUR:BB:EUTR:DL:USER3:DATA DLIST
MMEM:CDIR '\Lists\DM\IqData'
SOUR:BB:EUTR:DL:USER3:DSEL 'eutra_list1'
```

```
SOUR:BB:EUTR:DL:USER3:DATA PATT
SOUR:BB:EUTR:DL:USER3:PATT #H3F,8
```

Dummy Data Configuration - EUTRA/LTE

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) - EUTRA/LTE

Selects the modulation of the dummy data.

Remote-control command:
```
SOUR:BB:EUTR:DL:DUMD:MOD QPSK
```

Data Source (Dummy Data) - EUTRA/LTE

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.

Remote-control command:
```
SOUR:BB:EUTR:DL:DUMD:DATA PN9

SOUR:BB:EUTR:DL:DUMD:DATA PATT
SOUR:BB:EUTR:DL:DUMD:PATT #B1001,4

SOUR:BB:EUTR:DL:DUMD:DATA DLISt
MMEM:CDIR '\Lists\DM\IqData'
SOUR:BB:EUTR:DL:DUMD:DSEL 'eutra_list1'
```

Pattern (Dummy Data) - EUTRA/LTE

(Available for data source Pattern only)

Opens the editor for configuring a bit pattern. The length is limited to 64 bits.

Remote-control command:
```
SOUR:BB:EUTR:DL:DUMD:DATA PATT
SOUR:BB:EUTR:DL:DUMD:PATT #B1001,4
```

Select Data List (Dummy Data) - EUTRA/LTE

(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.

Remote-control command:
```
SOUR:BB:EUTR:DL:DUMD:DATA DLIST
MMEM:CDIR '\Lists\DM\IqData'
SOUR:BB:EUTR:DL:DUMD:DSEL 'eutra_list1'
```

Power (Dummy Data) - EUTRA/LTE

Sets the power of the subcarriers allocated with dummy data.

Remote-control command:
`SOUR:BB:EUTR:DL:DUMD:POW 5`

OFDMA Timeplan - EUTRA/LTE

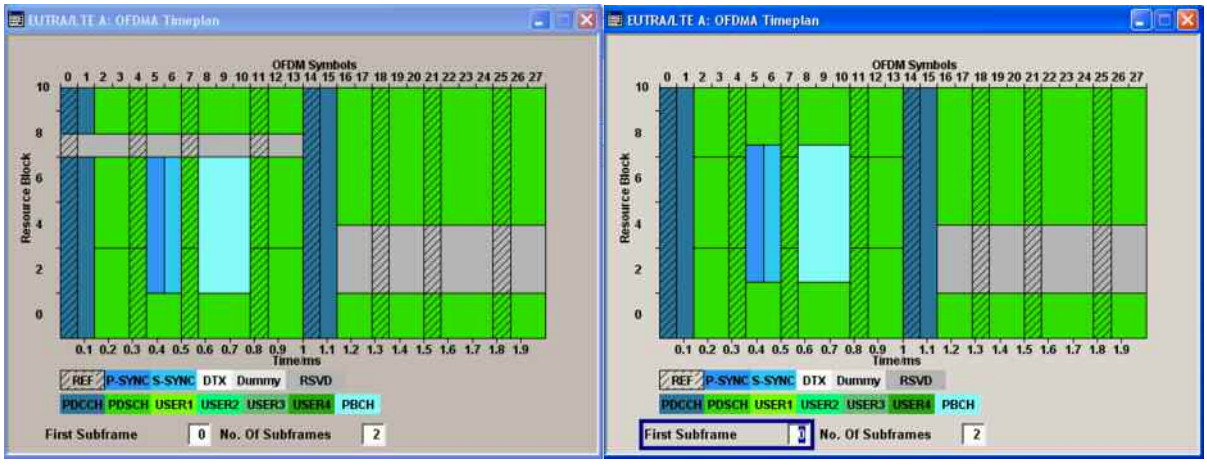
The **OFDMA Timeplan** menu is called in the **Frame Configuration** menu with the button **Show Time Plan.**

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation to a UE can span 1 to up to **No. of Resource Blocks** in the frequency domain.

P-SYNC/S-SYNC is automatically calculated according to the settings in **General DL Settings** dialog.

Depending on the selection made for the parameter **Resource Block Mapping**, channel bandwidths with odd number of resource blocks are mapped and displayed different in the timeplan. The unscheduled resource blocks will be filled with dummy data or DTX, as selected in **Behavior On Unscheduled REs**. However, in case of odd number of resource blocks per slot in subframe 0 and resource block mapping according to TS 36.211 version 8.0.0, the unscheduled resource blocks will be displayed as reserved and no allocation can be configured for them.

For more information about handling of bandwidth with odd number of resource blocks in case of resource block mapping according to TS 36.211 version 8.0.0, see section "Downlink Subframe 0 in Case of Bandwidths with Odd Number of Resource Blocks".



First Subframe - EUTRA/LTE

Selects the first subframe to be displayed.

Remote-control command: `n.a`

No. of Subframes - EUTRA/LTE

Selects the number of subframes to be displayed.

Remote-control command: `n.a`

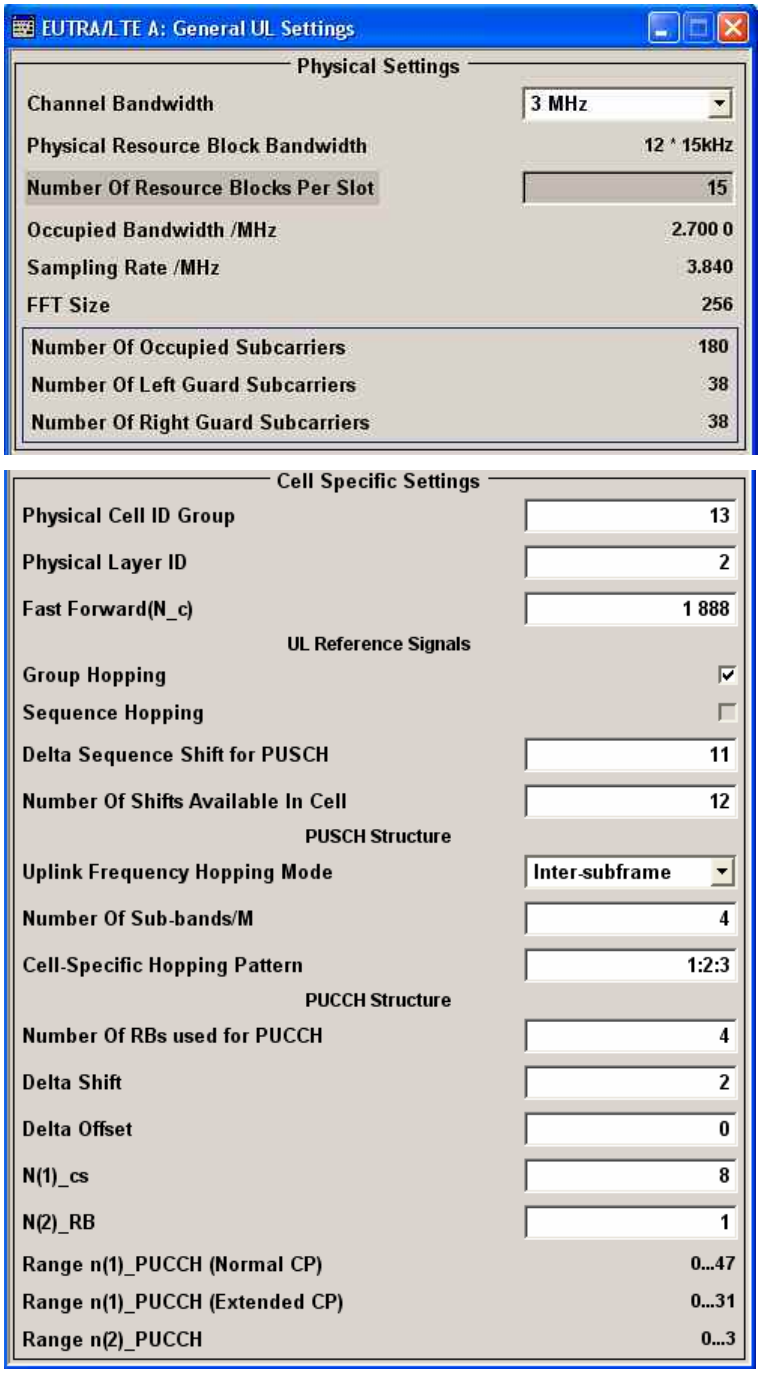
General UL Settings - EUTRA/LTE

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

In the **Physical Settings** section, the channel bandwith 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 and the uplink reference signals are set.

The other parameters are fixed and read-only.



Physical Settings

Channel Bandwidth (UL) - EUTRA/LTE

Sets the channel bandwidth of the EUTRA/LTE system.

Although the 3GPP specification bases on bandwidth agonistic layer 1 and channel bandwidth is determined by specifying the desired number of resource blocks, the current EUTRA standardization (TS 306.804 v.1.0.0 11/2007) focuses on seven bandwidths (1.4, 3, 3.2, 5, 10, 15 and 20 MHz).

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

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

The sampling rate, occupied bandwidth and FFT size are therefore always determined by the parameter **Number of Resource Blocks Per Slot.**

Remote-control command:
`SOUR:BB:EUTR:UL:BW BW5_00`

Physical Resource Block Bandwidth (UL) - EUTRA/LTE

Displays the bandwidth of one physical resource block.

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

Remote-control command: `n.a.`

Number of Resource Blocks Per Slot (UL) - EUTRA/LTE

This parameter determines the channel bandwidth.

If the parameter **Channel Bandwidth** is set to one of the pre-defined channel bandwidths (1.25, 2.5, 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, occupied bandwidth and FFT size are always determined by the parameter **Number of Resource Blocks Per Slot**.

Remote-control command:
`SOUR:BB:EUTR:UL:BW USER`
`SOUR:BB:EUTR:UL:NORB 15`

Occupied Bandwidth (UL) - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:UL:OCCB?`

Sampling Rate (UL) - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:UL:SRAT?`

FFT Size (UL) - EUTRA/LTE

Displays the FFT (Fast Fourier Transformation) size. The value is automatically set according to the parameter **Number of Resource Blocks Per Slot**.

Remote-control command:
`SOUR:BB:EUTR:UL:FFT?`

Number Of Occupied Subcarriers (UL) - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:UL:OCCS?`

Number Of Left Guard Subcarriers (UL) - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:UL:LGS?`

Number Of Right Guard Subcarriers (UL) - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:UL:RGS?`

Cell Specific Settings

In the **Cell Specific Settings** section, the physical layer cell ID settings, the UL Reference Signal settings, the PUSCH and PUCCH structures are selected.

Physical Cell ID Group (UL) - EUTRA/LTE

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, set the parameter **Physical Layer ID**.

The physical layer cell identities determine the sequence shift pattern used for PUCCH.

The Physical Cell ID, set with the combination of the parameters **Physical Cell ID Group** and **Physical Layer ID**, determinates:

- the reference signal grouping hopping pattern,
- the reference signal sequence hopping,
- the PUSCH demodulation reference signal pseudo-random sequence,
- the cyclic shifts for PUCCH formats 1/1a/1b and sequences for PUCCH formats 2/2a/2b and
- the pseudo-random sequence used for scrambling.

Note:
The pseudo-random sequence generator shall be initialized with value c_{init} at the beginning of each frame.
For the generation of several sequences, the definition of the calculation of this initialization value c_{init} is still not completed in the current 3GPP specifications.
In each of these cases in this implementation, the initialization value c_{init} is set as c_{init}=Physical Cell ID.

Remote-control command:
```
SOUR:BB:EUTR:UL:PLC:CIDG 100
```

Physical Layer ID (UL) - EUTRA/LTE

Sets the identity of the physical layer within the selected physical cell identity group, set with parameter **Physical Cell ID Group**.

Remote-control command:
```
SOUR:BB:EUTR:UL:PLC:CIDG 100
SOUR:BB:EUTR:UL:PLC:PLID 1
```

Fast Forward (N_c) UL - EUTRA/LTE

Sets the initial value of the generator of pseudo-random sequence according to R1-081248, "PRS sequence generation for downlink reference signal".

The generated pseudo-random sequence is used for the reference signal and for scrambling.

Remote-control command:
```
SOUR:BB:EUTR:DL:CSS:FFNC 1685
```

Group Hopping - EUTRA/LTE

Enables/disables group hopping for the uplink reference signals demodulation reference signal (DRS) 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.

Note:
The pseudo-random sequence generator shall be initialized with value c_{init} at the beginning of each frame.
For the generation of several sequences, the definition of the calculation of this initialization value c_{init} is still not completed in the current 3GPP specifications.
In each of these cases in this implementation, the initialization value c_{init} is set as c_{init}=Physical Cell ID.

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**.

Note:
The definition of the sequence shift pattern of PUCCH is still not completed in the 3GPP specification. In this implementation, the sequence shift of PUCCH is always set to 0.

The PUSCH sequence shift pattern is determinate by the parameter **Delta Sequence Shift for PUSCH**.

The group hopping pattern is

Remote-control command:
`SOUR:BB:EUTR:UL:REFS:GRPH ON`

Sequence Hopping - EUTRA/LTE

Enables/disables sequence hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

Sequence Hopping can only be enabled, if **Group Hopping** is disabled.

The sequence hopping is generated by a pseudo-random sequence generator.

Note:
The pseudo-random sequence generator shall be initialized with value c_{init} at the beginning of each frame.
For the generation of several sequences, the definition of the calculation of this initialization value c_{init} is still not completed in the current 3GPP specifications.
In each of these cases in this implementation, the initialization value c_{init} is set as c_{init}=Physical Cell ID.

Remote-control command:
`SOUR:BB:EUTR:UL:REFS:SEQH ON`

Delta Sequence Shift for PUSCH - EUTRA/LTE

Sets the delta sequence shift for PUSCH needed for the calculation of the group hopping pattern.

Remote-control command:
`SOUR:BB:EUTR:UL:REFS:PUSC:DSSH 3`

Number of Shifts available in Cell - EUTRA/LTE

Sets the number of available shifts in a cell.

This parameter is used for the DRS (demodulation reference signal) sequence calculation.

Remote-control command:
`SOUR:BB:EUTR:UL:REFS:SAIC 4`

Uplink Frequency Hopping Mode - EUTRA/LTE

Enables/disables the frequency hopping for PUSCH and sets the frequency hopping mode.

None

No uplink frequency hopping is performed.

If frequency hopping is disabled, the enchanced PUSCH parameters **Frequency Hopping**, **Mode** and **Mirroring** are also disabled.

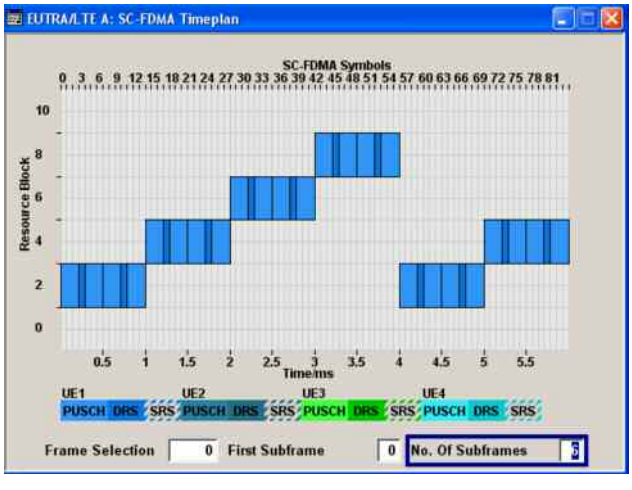
Remote-control command:
`SOUR:BB:EUTR:UL:PUSC:FHM NONE`

Inter-subframe

An inter subframe hopping is performed.

The PUSCH position in terms of used resource blocks is changed each subframe and is determinated by the selected **Number of Sub-bands** and **Cell-Specific Hopping Pattern**.

The timelan below illustrates the following example:
Number of Resource Blocks = 10
Number of Sub-Bands = 4
UL Frequency Hopping Mode = Inter-subframe
Cell-Specific Hopping Patter = 0:1:2:3
PUSCH Frquency Hopping = Type 2

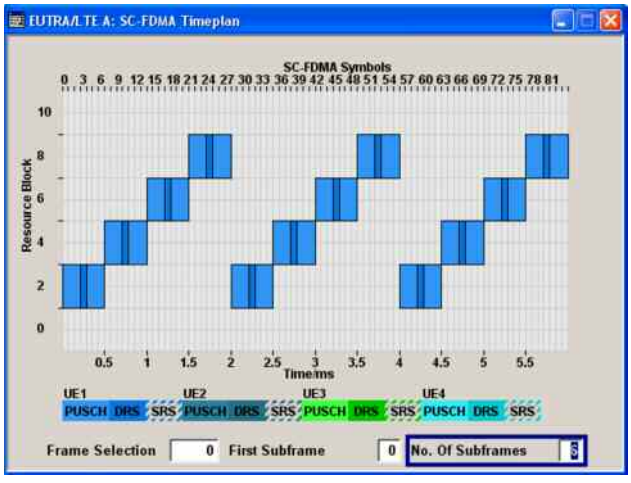


Remote-control command:
`SOUR:BB:EUTR:UL:PUSC:FHM INT`

Intra-subframe An intra subframe hopping is performed.

The PUSCH position in terms of used resource blocks is changed each slot and is determinated by the selected **Number of Sub-bands** and **Cell-Specific Hopping Pattern**.

The timelan below illustrates the same example for intra-subframe UL frequency hopping mode.



Remote-control command:
`SOUR:BB:EUTR:UL:PUSC:FHM INTR`

Number of Sub-bands / M - EUTRA/LTE Sets the number of sub-bands (M) that are used for frequency hopping.

The size of one sub-band is determinate by the number of resource blocks available for PUSCH transmission and the **Number of Sub-bands**, where number of resource blocks for PUSCH is the difference between the **Number of RBs per Slot (UL)** and the **Number of RBs used for PUCCH**.

Remote-control command:
`SOUR:BB:EUTR:UL:NORB 50`
`SOUR:BB:EUTR:UL:PUCC:NORB 4`
`SOUR:BB:EUTR:UL:PUSC:NOSM 4`
(4 sub-bands, 11 subcarriers each are selected)

Cell-Specific Hopping Pattern - EUTRA/LTE Sets the cell-specific PUSCH hopping pattern, i.e. determinates the PUSCH position within the sub-bands (see also "Uplink Frequency Hopping Mode - EUTRA/LTE").

The cell-specific PUSCH hopping pattern is a sequence of sub-bands number and is applied only for **Frequency Hopping** Type 2.

The allowed maximum length of the hopping pattern depends on the selected **Uplink Frequency Hopping Mode**.
For inter-subframe hopping mode, the length of the hopping pattern is limited to 10 entries.
20 entities are allowed for intra-subframe hoping mode.
Shorter hopping patterns are read-out cyclically.

Remote-control command:
`SOUR:BB:EUTR:UL:PUSC:CSHP 1:2`

Number of RBs used for PUCCH - EUTRA/LTE

Sets the PUCCH region in terms of reserved pairs of resource blocks, located at the edges of the channel bandwidth (see figure *"PUCCH Mapping"*).
2, 4 or 6 paires of RBs can be used by PUCCH.

Remote-control command:
`SOUR:BB:EUTR:UL:PUCC:NORB 4`

Delta Shift - EUTRA/LTE

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 determinates the number of available sequences in a resource block that can be used for PUCCH formats 1/1a/1b (see also section *"Uplink Control Information Transmission"*).

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

Remote-control command:
`SOUR:BB:EUTR:UL:PUCC:DESH 2`

Delta Offset - EUTRA/LTE

Sets the PUCCH delta offset parameter, i.e. the cyclic shift offset. The value range depends on the selected **Cyclic Prefix**.

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

Remote-control command:
`SOUR:BB:EUTR:UL:PUCC:DEOF 2`

N(1)_cs - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:UL:PUCC:N1CS 5`

N(2)_RB - EUTRA/LTE

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**.

Remote-control command:
`SOUR:BB:EUTR:UL:PUCC:N2RB 3`

Range n(1)_PUCCH (Normal CP) - EUTRA/LTE

Displays the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of normal CP.

Remote-control command:
```
SOUR:BB:EUTR:UL:PUCC:N1NM?
Response: 24
```

Range n(1)_PUCCH (Extended CP) - EUTRA/LTE

Displays the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of Extended CP.

Remote-control command:
```
SOUR:BB:EUTR:UL:PUCC:N1EM?
Response: 16
```

Range n(2)_PUCCH - EUTRA/LTE

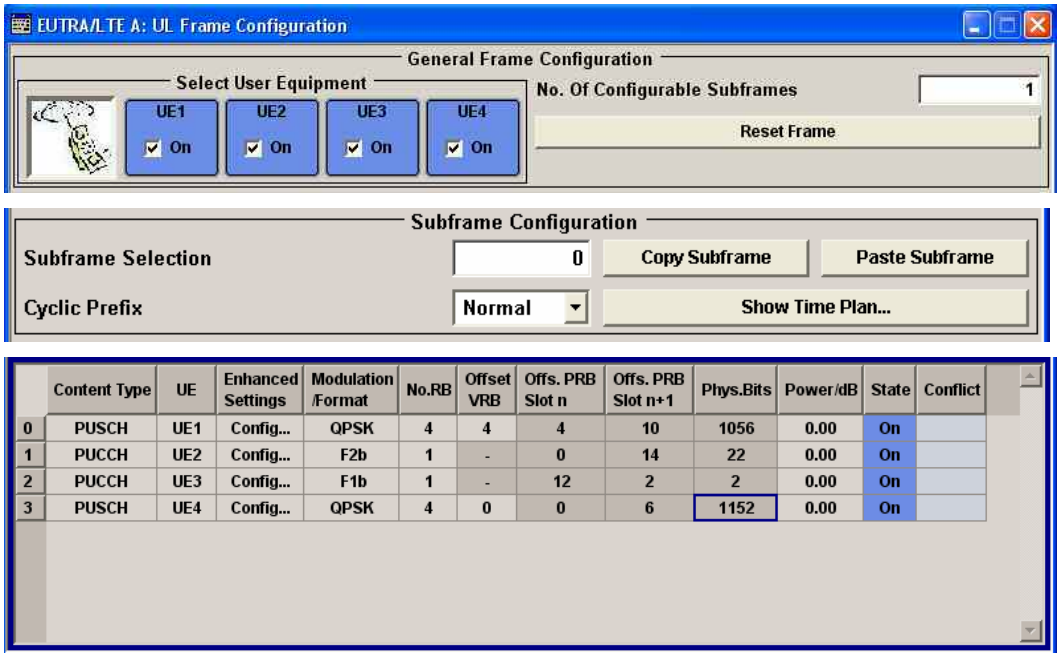
Displays the range of possible number of PUCCH format 2/2a/2b transmissions from different users in one subframe.

Remote-control command:
```
SOUR:BB:EUTR:UL:PUCC:N2M?
Response: 40
```

UL Frame Configuration – EUTRA/LTE

The **UL Frame Configuration** menu for uplink allows configuring the subframes and the SC-FDMA resource allocations. The **UL Frame Configuration** menu consists of three sections, **General Frame Configuration**, **Subframe Configuration** and the **Allocation Table**.

Section **General Frame Configuration** includes the configuration of the different user equipment.



Select User Equipment (UE1...UE4) - EUTRA/LTE

Calls the **User Equipment** menu for configuring Reference Signals for different users.
The menu is described in section "User Equipment 1 .. 4", page 78.
The check box activates or deactivates selected UE.

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

Remote-control command: `n.a.`

No Of Configurable Subframes- EUTRA/LTE

Sets the number of configurable subframes. All ten subframes of a frame are filled periodically with the configured subframes with the exception of the Sounding Reference Signal which are set individually for each UE in the **User Equipment** menu.

For more detailed information, see "Number of Configurable Subframes", page 26.

Remote-control command:
`SOUR:BB:EUTR:UL:CONS 10`

Reset Frame - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:UL:RSTF`

Subframe Selection - EUTRA/LTE

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

Remote-control command:
`SOUR:BB:EUTR:UL:SFS 1`

Cyclic Prefix (UL) - EUTRA/LTE

Sets the cyclic prefix for the according subframe.
The number of the SC-FDMA symbols per subframe is set automatically

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF1:CYCP NORM`

Copy Subframe Settings - EUTRA/LTE

Copies the settings of the selected subframe. Sounding Reference signals are not considered.

For more detailed information, see “Copy/Paste Subframe”, page 26.

Remote-control command: `n.a.`

Paste Subframe Settings - EUTRA/LTE

Pastes the subframe settings to the selected subframe. Sounding Reference signals are not considered.

For more detailed information, see “Copy/Paste Subframe” page 26.

Remote-control command: `n.a.`

Show Time Plan - EUTRA/LTE

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

The menu is described in detail in section “SC-FDMA Timeplan - EUTRA/LTE”, page 94.

Remote-control command: `n.a.`

Allocation Table UL- EUTRA/LTE

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

Allocation number (UL) - EUTRA/LTE

Displays the consecutive number of the allocation.

Remote-control command: `n.a.`
(selected via the suffix to the keyword)

Content Type (UL) – EUTRA/LTE

Selects the content type of the selected allocation.

Data source settings for PUSCH is configurable in menu **User Equipment 1...4**.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF1:ALL2:CONT PUSCh`

User Equipment - EUTRA/LTE

Selects the UE the selected allocation belongs to.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:UET UE1`

Enhanced Settings UL - EUTRA/LTE

Calls dialog for configuration of PUSCH/PUCCH depending on the selected allocation (see *"Enhanced PUSCH Settings"* and *"Enhanced PUCCH Settings"*).

Remote-control command: `n.a.`

Modulation/Format - EUTRA/LTE

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

For PUCCH allocation, this parameter sets the PUCCH Format (1/1a/1b/2/2a/2b).

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT PUSC`
`SOUR:BB:EUTR:UL:SUBF4:ALL2:MOD QPSK`

`SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT PUCC`
`SOUR:BB:EUTR:UL:SUBF4:ALL2:FORM F2A`

o. RB (Resource Blocks) - EUTRA/LTE

Sets the size of the selected allocation in resource blocks.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:RBC 1`

Offset VRB - EUTRA/LTE

Sets the virtual resource block offset of the selected subframe.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:VRB 6`

Offs PRB Slot n - EUTRA/LTE

Displays the start resource block of the selected allocation in slot 0 of the subframe.

The start resource block in slot 0 is set automatically depending on the selected **Frequency Hopping** type.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:SLOT0:ALL2:RBOF?`
`Response: 2`

Offs PRB Slot n+1 - EUTRA/LTE

Displays the start resource block of the selected allocation in slot 1 of the subframe.

The start resource block in slot 1 is set automatically depending on the selected **Frequency Hopping** type and **Frequency Hopping Mode**. 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** and the **Cell-specific Hopping Pattern**.

Remote-control command: `n.a.`
```
SOUR:BB:EUTR:UL:SUBF4:SLOT1:ALL2:RBOF?
Response: 2
```

Phys. Bits (UL) - EUTRA/LTE

Displays the size of this allocation in bits.

The value is set automatically according to the current allocation's settings.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:PHYS?
Response: 2400
```

Power (UL) - EUTRA/LTE

Sets the power for the selected allocation, i.e. PUSCH or PUCCH power level.

The PUSCH power level (P_{PUSCH}) and the PUCCH power level (P_{PUCCH}) can vary per subframe.
For global adjustment of the transmit power of the corresponding UE, use the parameter **UE Power** (P_{UE}).

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.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF1:ALL2:POW 10
```

State (UL) - EUTRA/LTE

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.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF1:ALL1:STAT ON
```

Conflict (UL) - EUTRA/LTE

Indicates a conflict between UEs and in case an allocation exceeds the available number of resource blocks.

For more information, see "Conflict Handling in the R&S Signal Generator", on page 24.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF1:ALL2:CONF?
```

User Equipment 1 .. 4 – EUTRA/LTE

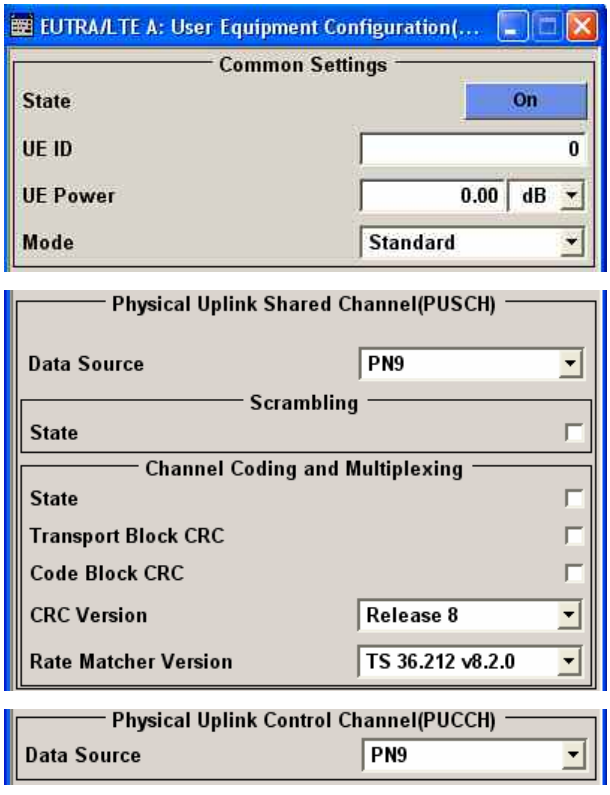
The **User Equipment 1 - 4** menus for users 1 to 4 allows to define and configure up to four scheduled user equipments that can be freely distributed over the whole frame. For each user equipment, the structure of the demodulation reference signal and the sounding reference signal can be configured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

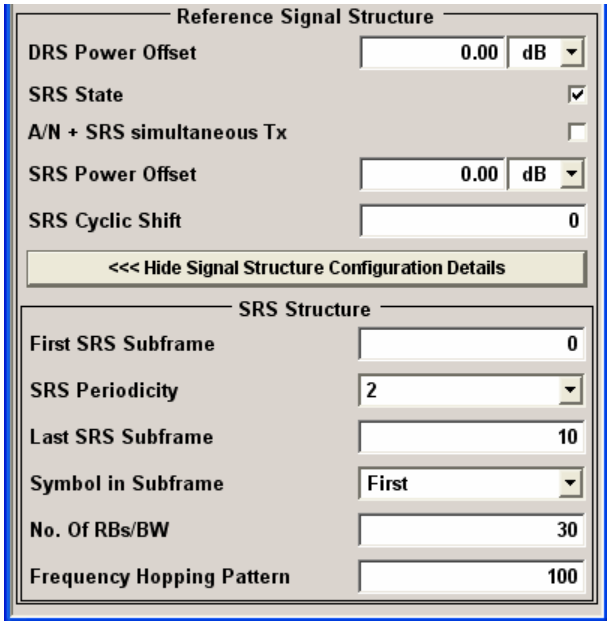
The **User Equipment 1 – 4** menu consists of four main sections, **Common Settings**, **Physical Uplink Shared Channel (PUSCH)** and **Reference Signal Structure**.

In section **Common Settings**, the state of the user equipment, UE ID and the operational mode can be set.

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.

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





The upper menu section is where the user equipment common settings are set.

State (User Equipment) - EUTRA/LTE

Activates or deactivates the user equipment.

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

Remote-control command:
`SOUR:BB:EUTR:UL:UE3:STAT ON`

UE ID (User Equipment) - EUTRA/LTE

Sets the radio network temporary identifier (RNTI) of the UE.

Remote-control command:
`SOUR:BB:EUTR:UL:UE3:ID 303`

UE Power - EUTRA/LTE

Sets the power level of the selected UE (P_{UE}).

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_{DSR_offset}) and **SRS Power Offset** (P_{SRS_offset}) respectively.

Remote-control command:
`SOUR:BB:EUTR:UL:UE3:POW -9.6`

Mode (User Equipment) - EUTRA/LTE

Selects whether the user equipment is in standard or in PRACH mode.

Standard

Sets the operational mode of the user equipment to standard.

Note:
In this release, only Standard mode is supported.

Remote-control command:
`SOUR:BB:EUTR:UL:UE:MOD STD`

PRACH

Sets the operational mode of the user equipment to PRACH.

Note:
PRACH mode will be supported in a later version.

Remote-control command: `n.a.`

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) - EUTRA/LTE

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 .

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.

Remote-control command:

```
SOUR:BB:EUTR:UL:UE2:PUSC:DATA PN9

SOUR:BB:EUTR:UL:UE2:PUSC:DATA PATT
SOUR:BB:EUTR:UL:UE2:PUSC:PATT #H3F,8

SOUR:BB:EUTR:UL:UE2:PUSC:DATA DLIST
MMEM:CDIR '\Lists\DM\IqData'
SOUR:BB:EUTR:UL:UE2:PUSC:DSEL 'e_utra_1'
```

Data Pattern (PUSCH) - EUTRA/LTE

(Available for data source Pattern only)

Displays the bit pattern.

Remote-control command:
```
SOUR:BB:EUTR:UL:UE2:PUSC:DATA PATT
SOUR:BB:EUTR:UL:UE2:PUSC:PATT #H3F,8
```

Data List (PUSCH) - EUTRA/LTE

(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.

Remote-control command:
```
SOUR:BB:EUTR:UL:UE2:PUSC:DATA DLIST
MMEM:CDIR '\Lists\DM\IqData'
SOUR:BB:EUTR:UL:UE2:PUSC:DSEL 'e_utra_1'
```

State Scrambling (PUSCH) - EUTRA/LTE

Enables/disables scrambling for all PUSCH allocations of the corresponding UE.

Remote-control command:
```
SOUR:BB:EUTR:UL:UE2:PUSC:SCR:STAT ON
```

State Channel Coding (PUSCH) - EUTRA/LTE

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.

Remote-control command:
```
SOUR:BB:EUTR:UL:UE2:PUSC:CCOD:STAT ON
```

Transport Block CRC (PUSCH) - EUTRA/LTE

Enables/disables calculation of the transport block CRC.

The calculated CRC is appended for error detection of the entire transport block.

Remote-control command:
```
SOUR:BB:EUTR:UL:UE2:PUSC:CCOD:TBCR ON
```

Code Block CRC (PUSCH) - EUTRA/LTE

Enables/disables attachment of CRC to the code block.

Remote-control command:
```
SOUR:BB:EUTR:UL:UE2:PUSC:CCOD:CBCR ON
```

CRC Version (PUSCH) - EUTRA/LTE

Sets the standard, Release 99 or Release 8, according to that the CRC will be calculated.

Remote-control command:
```
SOUR:BB:EUTR:UL:UE2:PUSC:CCOD:CRCV R8V
```

Rate Matcher Version (PUSCH) - EUTRA/LTE

Sets the standard, 3GPP TS 26.212 version 1.1.0, version 8.0.0 or version 8.2.0, according to that the rate matching will be performed.

Remote-control command:
`SOUR:BB:EUTR:UL:UE2:PUSC:CCOD:RMV R82V`

Reference Signal Structure

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

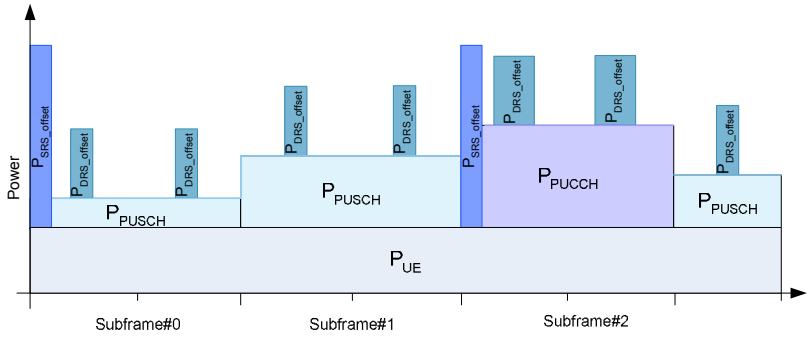
DRS Power Offset - EUTRA/LTE

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_{DRS_Offse}) applies for all subframes.

Depending on the allocation of the subframe, the effective power level of the DRS is calculated as following:

$P_{DRS}=P_{UE}+P_{PUSCH}+P_{DRS\_Offset}$ (for PUSCH allocation) or
$P_{DRS}=P_{UE}+P_{PUCCH}+P_{DRS\_Offset}$ (for PUCCH allocation)

The PUSCH and PUCCH **Power** levels (P_{PUSCH} and P_{PUCCH}) can vary per subframe.
For global adjustment of the transmit power of the corresponding UE, use the parameter **UE Power** (P_{UE}).



Remote-control command:
`SOUR:BB:EUTR:UL:UE2:REFS:DRS:POW -2`

SRS State - EUTRA/LTE

Enables/disables sending of SRS for the corresponding UE.

In the symbols reserved for SRS transmission, PUSCH is not transmitted.

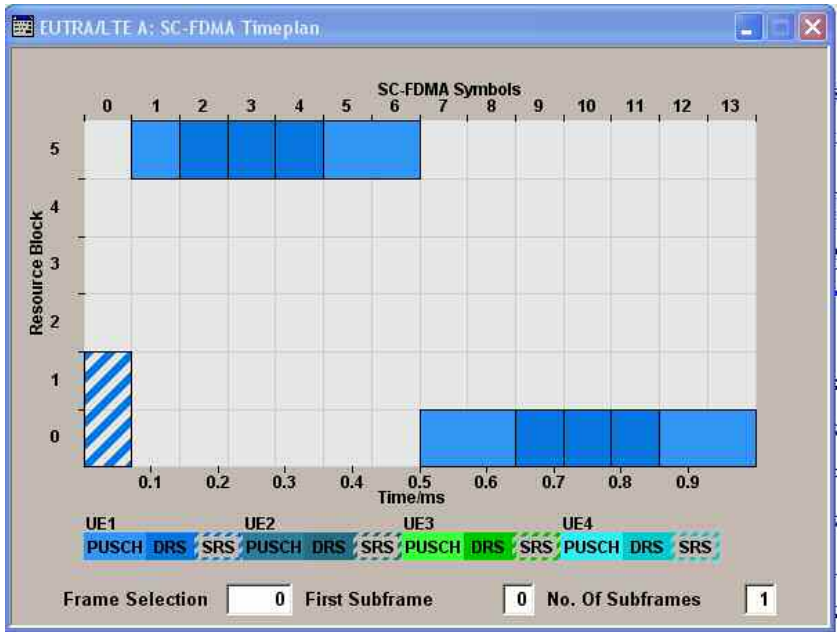
Remote-control command:
`SOUR:BB:EUTR:UL:UE2:REFS:SRS:STAT ON`

A/N + SRS simultaneous Tx - EUTRA/LTE

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

Simultaneous transmission of SRS and PUCCH is allowed only for PUCCH formats 1a and 1b, since CQI reports and scheduling request (SR) are never simultaneously transmitted with SRS.

When this parameter is enabled, a shortened PUCCH is transmitted, i.e. the symbol of the PUCCH where the SRS is located is punctured.



If this parameter is disabled, the SRS is not transmitted in the corresponding subframe.

Remote-control command:
`SOUR:BB:EUTR:UL:UE2:REFS:ANST ON`

SRS Power Offset- EUTRA/LTE

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}).

Remote-control command:
`SOUR:BB:EUTR:UL:UE2:REFS:SRS:POW -2`

SRS Cyclic Shift - EUTRA/LTE

Sets the cyclic shift 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.

Remote-control command:
`SOUR:BB:EUTR:UL:UE2:REFS:SRS:CYCS 5`

Show Signal Structure Configuration Details>>> - EUTRA/LTE

Opens the menu for configuring the sounding reference signal structure.

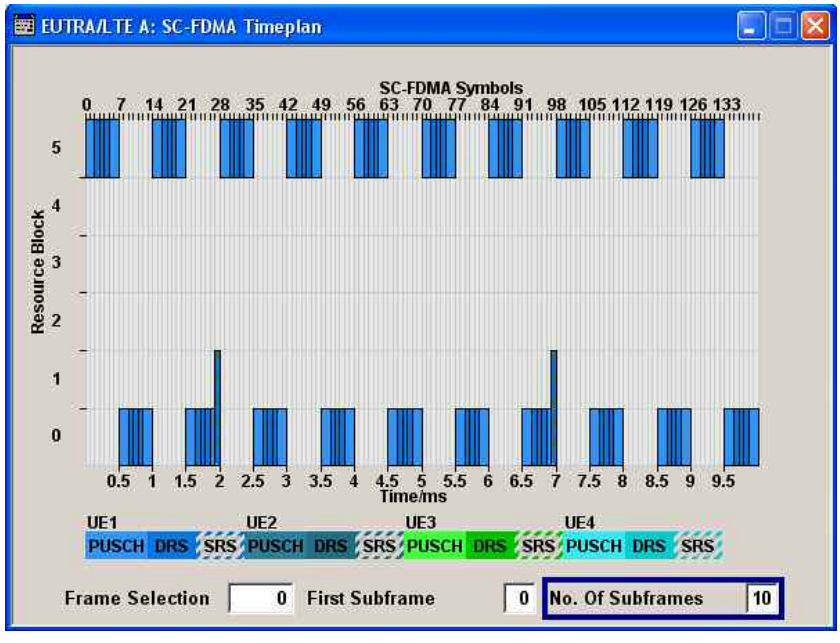
Remote-control command: n.a.

First SRS Subframe - EUTRA/LTE

Sets the first subframe which is used for transmission of the sounding reference signal (SRS).

Together with the parameters **SRS Periodicity**, **Last SRS Subframe** and **Symbol in Subframe**, this parameter is used for allocating multiple users to share the SRS resource over the time.

To visualize the SRS transmission, use the SC-FDMA timeplan.



Remote-control command:
`SOUR:BB:EUTR:UL:UE:REFS:SRS:FSTS 2`

SRS Periodicity - EUTRA/LTE

Sets the SRS periodicity over several frames.

The SRS periodicity is set in terms of interval of milliseconds after which the SRS is transmitted.

Remote-control command:
`SOUR:BB:EUTR:UL:UE:REFS:SRS:PER 5`
(the SRS is transmitted each 5ms, i.e. 2 times per frame)

Last SRS Subframe - EUTRA/LTE

Sets the last subframe which is used for transmission of the sounding reference signal (SRS).

Remote-control command:
`SOUR:BB:EUTR:UL:UE:REFS:SRS:LSTS 20`

Symbol in Subframe - EUTRA/LTE

Sets the sounding reference signal (SRS) location in a subframe, i.e. selects whether the first or the last SC-FDMA symbol of a subframe is used for SRS transmission.

Note:
During this symbol, the UE is transmitting no PUSCH.
During PUCCH transmission, the UE is transmitting no SRS.

Remote-control command:
`SOUR:BB:EUTR:UL:UE:REFS:SRS:SPOS FIRS`

No. RB (Resource Blocks)/ BW - EUTRA/LTE

Sets the number of resource blocks that are used for the transmission of the sounding reference signal (SRS).

The maximum bandwidth the SRS can span is the selected **Channel Bandwidth**.

In this selected bandwidth, every second subcarrier is used for SRS.

Remote-control command:
`SOUR:BB:EUTR:UL:NORB 15`
`Response: 15`
`SOUR:BB:EUTR:UL:UE:REFS:SRS:NORB 14`

Frequency Hopping Pattern (k0) - EUTRA/LTE

Sets the first subcarrier that is used for the transmission of the Sounding Reference Signal (SRS) for the corresponding UE.

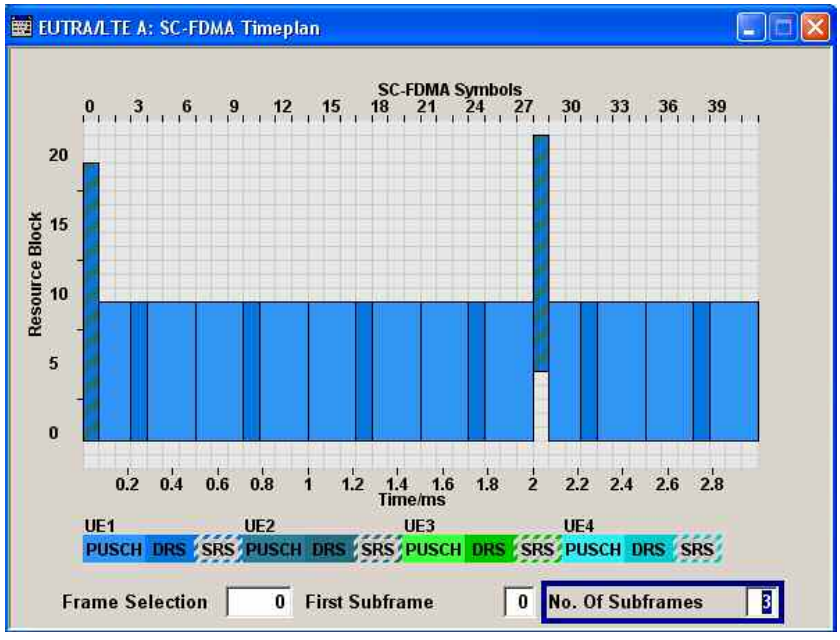
One value out of the pattern is used for one subframe with SRS allocation. Ten entries can be configured. If less than 10 entries are available the sequence is read out cyclically.

The separator ":" can be input via the [.] hardkey on the front panel of the signal generator.

The frequency spacing of the SRS is fixed to 2, i.e. every second subcarrier carries the SRS.

This parameter is used to allocate multiple users to share the SRS in the frequency domain.

To allocate two users to send an SRS within the same resource blocks, the start subcarriers of both UEs have to differ with one subcarrier. This is illustrated with the following example:
Number of Resource Blocks for SRS = 20
Frequency Hopping Pattern of UE1 = '24:86'
Frequency Hopping Pattern of UE2 = '25:87'
UE1 and UE2 share the same 20 resource blocks and in the first subframe UE1 will use the subcarriers 24, 26, … 142 and UE2 the subcarriers 25, 27, … 143 respectively.

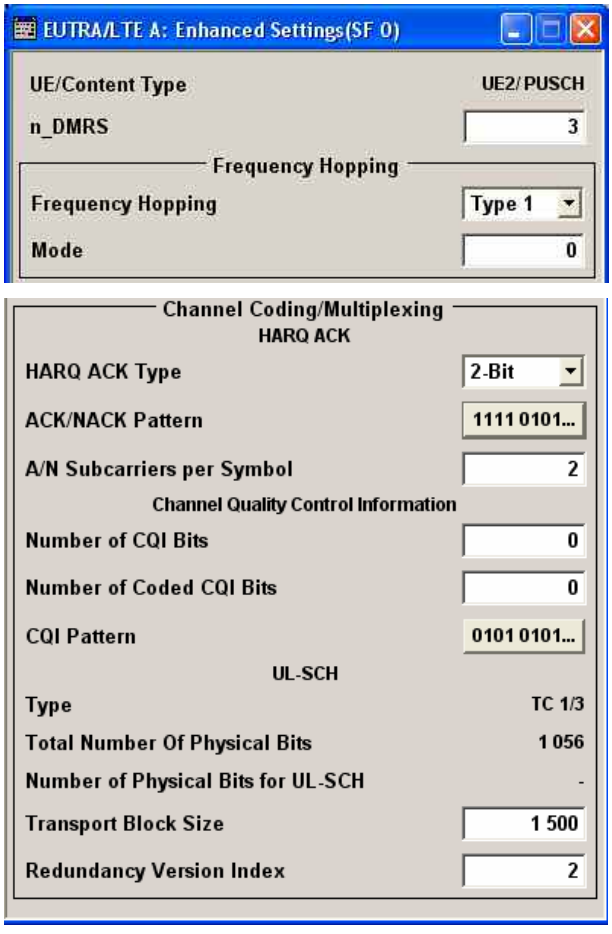


Remote-control command:

```
SOUR:BB:EUTR:UL:UE:REFS:SRS:NORB 20
SOUR:BB:EUTR:UL:UE1:REFS:SRS:FHP '24:144'
```

Enhanced PUSCH Settings - EUTRA/LTE

The **Enhanced Settings** menu for PUSCH allows you to define and configure additional PUSCH parameters, such as the settings of the uplink schared 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.



UE/Content Type (PUSCH) – EUTRA/LTE

Displays the UE number and the content type (PUSCH) of the selected allocation.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:CONT?`

n_DMRS – EUTRA/LTE

Sets the demodulation reference signal (DRS) index. This index applies when multiple shifts within a cell are used and is used by the calculation of the DRS sequence.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:NDMR 3`

Frequency Hopping – EUTRA/LTE

(enabled only for enabled **Uplink frequency Hopping Mode**)

Enables/disabled frequency hopping for PUSCH and sets one of the two possible PUSCH frequency hopping types.

None Disables frequency hopping.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE NONE`

Type 1 Applies PUSCH frequency hopping type 1, as defined in 3GPP TS36.213, Version 8.2.0.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE TP1`

Type 2 Applies PUSCH frequency hopping type 2, as defined in 3GPP TS36.213, Version 8.2.0.

For PUSCH frequency hopping type 2, the **Uplink Frequency Hopping Mode** can be configured, i.e. whether intra-subframe or inter-subframe frequency hopping is performed.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE TP2`

Mode (Frequency Hopping) – EUTRA/LTE

(available for Frequency Hopping Type 1 and Channel Bandwidth ≥ 50 RBs only)

Sets the PUSCH frequency hopping mode according to TS 36.211, version 8.2.0.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:MODE 1`

Mirroring (Frequency Hopping) – EUTRA/LTE

(available for Frequency Hopping Type 2 only)

Enables/disables mirroring according to TS 36.211, version 8.2.0

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:MIRR ON`

Channel Coding / Multiplexing

Note:
All parameters in this section are enabled for configuration only if the Channel Coding for the corresponding user equipment is activated.

HARQ ACK Type – EUTRA/LTE

Enables/disables sending of HARQ-ACK control information and sets its duration.

None
HARQ-ACK control information is not send.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT NONE`

1-Bit
A 1-bit HARQ-ACK control information is used.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT BIT1`

2-Bit
A 2-bits HARQ-ACK control information is used.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT BIT2`

ACK/NACK Pattern - EUTRA/LTE

Sets the ACK/NACK pattern for the PUSCH.

A "0" indicates an ACK, a "1" - a NACK; the symbol "-" is used for DTX indication, i.e. incorrect detection of PDCCH CRC.

In case of **HARQ ACK Type 2**, the only allowed combinations are "00", "01", "10", "11" and "-".
A combination of ACK/NACK and DTX is not allowed.

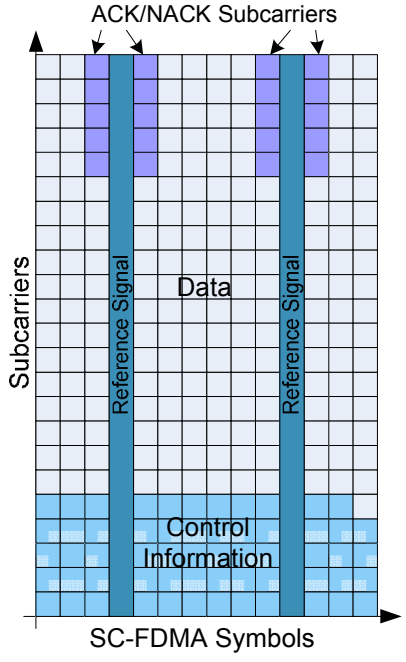
Note:
DTX will be supported in a latter version.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT BIT2`
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ANP 10`

A/N Subcarrier per Symbol - EUTRA/LTE

The ACK/NACK control information is carried on the two adjacent SC-FDMA symbols to the DRS, i.e. two SC-FDMA symbols per slot respectively 4 SC-FDMA symbols per subframe are used.

Every SC-FDMA symbol, which is used for caring an ACK/NACK messages, carries the same number of A/N subcarriers and the same ACK/NACK control information.



Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ANS 5`

Number of CQI Bits - EUTRA/LTE

Sets the number of CQI bits before channel coding.

The **Number of Physical Bits for UL-SCH** is determinate by the number of bits used for CQI transmission.

Set this parameter to 0 to reserve all available physical bits for UL-SCH transmission.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:CQCI:BITS 30`

Number of Coded CQI Bits - EUTRA/LTE

Sets the number of coded CQI bits.

This parameter is adjustable only if more than 11 **Number of CQI Bits** are selected; otherwise it is always set to 20.

Since the bits available for the UL-SCH transmission are those bits from the total physical bits in the PUSCH allocation not used for coded CQI transmission, there will be no UL-SCH transmission on the PUSCH if the **Number of Coded CQI Bits** is equal to the **Total Number of Physical Bits**.

To allocate all available physical bits for UL-SCH transmission, set the number of coded CQI bits to 0.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:CQCI:CBIT 21
```

CQI Pattern - EUTRA/LTE

Sets the CQI pattern for the PUSCH.

The length of the pattern is determinate by the value of the parameter **Number of CQI Bits**.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:CQCI:BITS 6
SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:CQCI:PATT '101101'
```

Type Channel Coding (UL-SCH) - EUTRA/LTE

Displays the used channel coding scheme and channel coding rate for the UL-SCH.

UL-SCH always uses turbo code with code rate 1/3.

Remote-control command: `n.a.`

Total Number of Physical Bits - EUTRA/LTE

Displays the size of the selected PUSCH allocation in bits. The value is calculated automatically and is also displayed in the allocation table.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:PHYS?
Response: 2400
```

Number of Physical Bits for UL-SCH - EUTRA/LTE

Displays the number of physical bits used for UL-SCH transmission.

The value is calculated as the difference between the **Total Number of Physical Bits** and the **Number of Coded CQI Bits**.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:ULSC:BITS?
Response: 2000
```

Transport Block Size (PUSCH) - EUTRA/LTE

Sets the size of the transport block.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:PHYS?
Response: 2400
SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:TBS 1500
```

Redundancy Version Index (PUSCH) - EUTRA/LTE

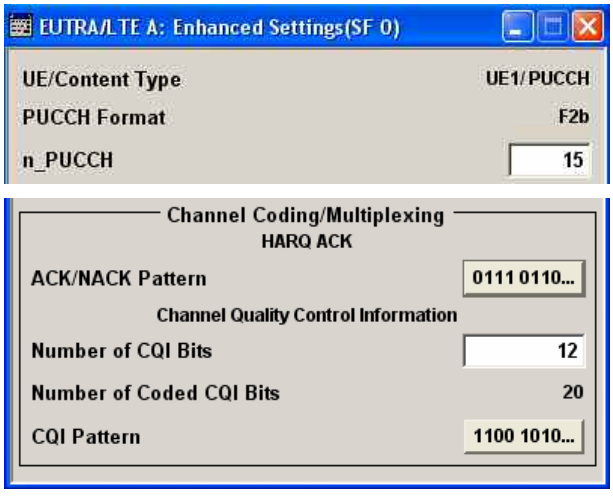
Sets the redundancy version index.

Remote-control command:
```
SOUR:BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:RVIN 2
```

Enhanced PUCCH Settings - EUTRA/LTE

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 deppend on the selected **PUCCH Format** for the corresponding user equipment.
PUCCH Format 1 carries no contol information, i.e. the entire Channel Coding/Multiplexing section is not displayed. CQI cotrol 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 (PUCCH) – EUTRA/LTE

Displays the UE number and the content type of the selected allocation.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF1:ALL2:CONT?`

PUCCH Format - EUTRA/LTE

Displays the selected PUCCH Format.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF1:ALL2:FORM?`
`Response: F2A`

n_PUCCH - EUTRA/LTE

Sets the resource index for PUCCH format 1/1a/1b respectively 2/2a/2b.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF1:ALL2:PUCC:NPAR 10`

ACK/NACK Pattern (PUCCH) - EUTRA/LTE

(enabled for PUCCH formats 1a/1b and 2a/2b only)

Sets the ACK/NACK pattern for the PUCCH.

A "0" indicates an ACK, a "1" - a NACK; the symbol "-" is used for DTX indication, i.e. incorrect detection of PDCCH CRC.

In case of **PUCCH Format** 1b or 2b, the only allowed combinations are "00", "01", "10", "11" and "-".
A combination of ACK/NACK and DTX is not allowed.

Note:
DTX will be supported in a latter version.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUCC:HARQ:ANP 10`

Number of CQI Bits (PUCCH) - EUTRA/LTE

(enabled for PUCCH formats 2/2a/2b only)

Sets the number of CQI bits before channel coding.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUCC:CQCI:BITS 13`

Number of Coded CQI Bits (PUCCH) - EUTRA/LTE

Displays the number of coded CQI bits.

The number of coded CQI bits for PUCCH is always 20.

Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUCC:CQCI:CBIT 21`

CQI Pattern (PUCCH) - EUTRA/LTE

Sets the CQI pattern for the PUCCH.

The length of the pattern is determinate by the value of the parameter **Number of CQI Bits**.

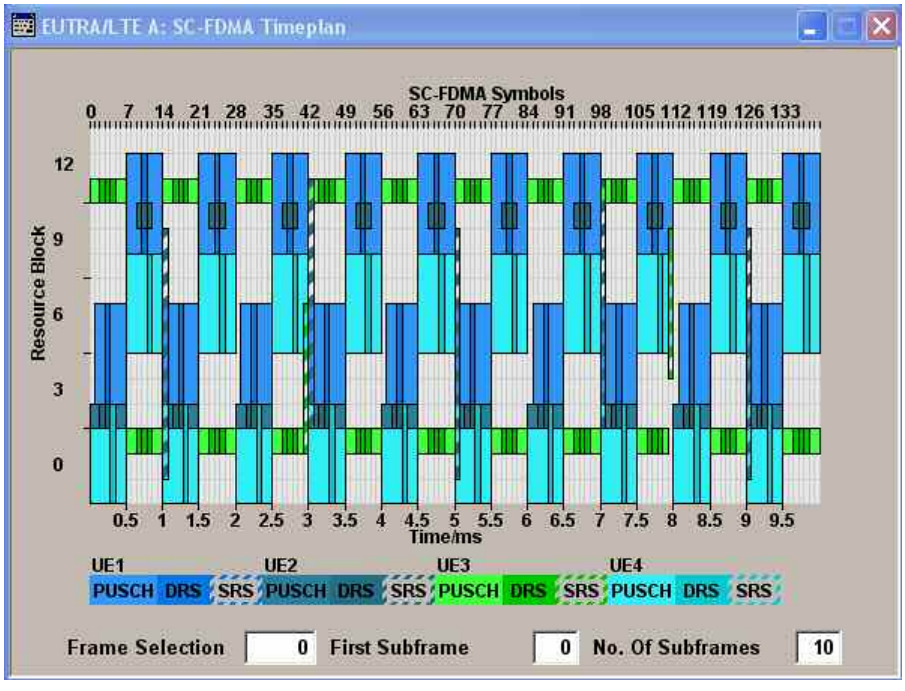
Remote-control command:
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUCC:CQCI:CBIT 6`
`SOUR:BB:EUTR:UL:SUBF4:ALL2:PUCC:CQCI:PATT '101101'`

SC-FDMA Timeplan - EUTRA/LTE

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 to 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**.



Frame Selection - EUTRA/LTE

Selects the frame to be displayed.

Remote-control command: `n.a`

First Subframe - EUTRA/LTE

Selects the first subframe to be displayed.

Remote-control command: `n.a`

No. of Subframes - EUTRA/LTE

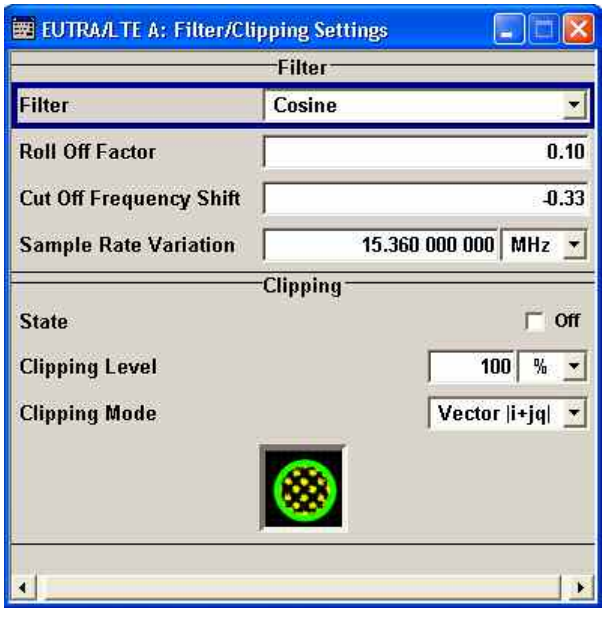
Selects the number of subframes to be displayed.

Remote-control command: `n.a`

Filter / Clipping Settings - EUTRA/LTE

The **Filter / Clipping** menu is reached via the EUTRA/LTE main menu.

The baseband filter, sample rate variation and clipping are defined in this menu.



Filter - EUTRA/LTE

Sets the baseband filter.

Remote-control command:
`SOUR:BB:EUTR:FILT:TYPE COS`

Load User Filter - EUTRA/LTE

(available for **Filter** Type User only)

Calls the menu **Select List File User Filter** for selecting a user-defined filter file with extension ***.vaf**.

The user filter can be created with the R&S filter wizard.

The filter wizard (filtwiz) is a tool from Rohde & Schwarz designed for creating filter files that can be imported on an R&S Signal Generator. Its main purpose is the conversion of user-defined finite impulse response (FIR) filters into the filter format (*.vaf).

Beyond this filtwiz provides designs for standard filters (e.g. Root Raised Cosine, Gaussian) as well as a tool to automatically derive a receiver filter from a given transmitter filter with respect to the Nyquist condition for zero intersymbol interference (ISI).

The program was developed on a 32-bit Microsoft Windows platform under MATLAB.

For more information, refer to the description "Introduction to "filtwiz" Filter Editor" on the Rohde&Schwarz Internet page.

Remote-control command:
`SOUR:BB:EUTR:FILT:PAR:USER 'eutra_user_filter'`

Roll Off Factor or BxT - EUTRA/LTE

Sets the filter parameter.

For the default cosine filter, a roll off factor of 0.10 is used.

Remote-control command:

```
SOUR:BB:EUTR:FILT:PAR:COS 0.05
SOUR:BB:EUTR:FILT:PAR:RCOS 0.05
SOUR:BB:EUTR:FILT:PAR:PGA 0.15
SOUR:BB:EUTR:FILT:PAR:GAUS 0.15
SOUR:BB:EUTR:FILT:PAR:SPH 0.15
SOUR:BB:EUTR:FILT:PAR:APCO25 0.05
```

Cut Off Frequency Shift - EUTRA/LTE

(available for filter parameter Cosine only)

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

The value range is -1.0 to 1.0.

Remote-control command:

```
SOUR:BB:EUTR:FILT:PAR:COS:COFS 1.0
```

Cut Off Frequency Factor - EUTRA/LTE

(available for filter parameter Lowpass only)

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

Remote-control command:

```
SOUR:BB:EUTR:FILT:PAR:LPAS 0.5
```

Sample Rate Variation - EUTRA/LTE

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.

Remote-control command:

```
SOUR:BB:EUTR:SRAT:VAR 4000
```

Impulse Length - EUTRA/LTE

(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.

Remote-control command:

```
SOUR:BB:EUTR:FILT:ILEN:AUTO ON
SOUR:BB:EUTR:FILT:ILEN 120
```

Oversampling - EUTRA/LTE **(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.

Remote-control command:
```
SOUR:BB:EUTR:FILT:OSAM:AUTO ON
SOUR:BB:EUTR:FILT:OSAM 20
```

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

Clipping State - EUTRA/LTE 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.

Remote-control command:
```
SOUR:BB:EUTR:CLIP:STAT ON
```

Clipping Level - EUTRA/LTE

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.

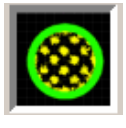
Remote-control command:
```
SOUR:BB:EUTR:CLIP:LEV 50
```

Clipping Mode - EUTRA/LTE

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

Vector | i + q |

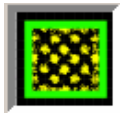
The limit is related to the amplitude | i + q |. The I and Q components are mapped together, the angle is retained (see also Clipping State - EUTRA/LTE).



Remote-control command:
```
SOUR:BB:EUTR:CLIP:MODE VECT
```

Scalar | i | + | q |

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



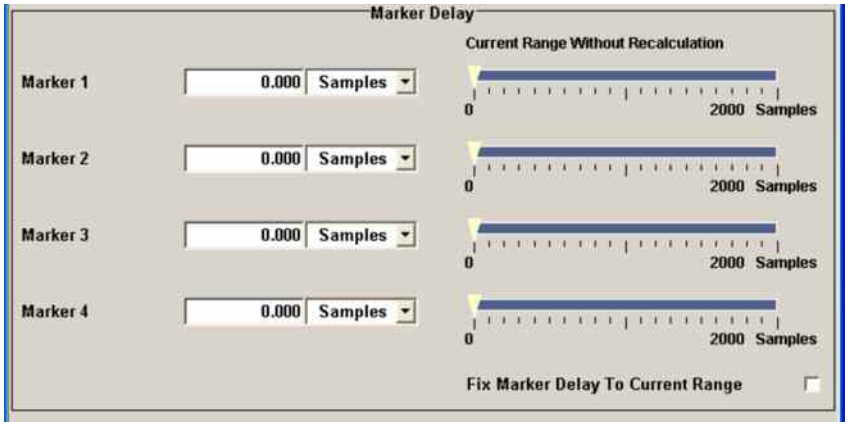
The I and Q components are mapped separately, the angle changes.

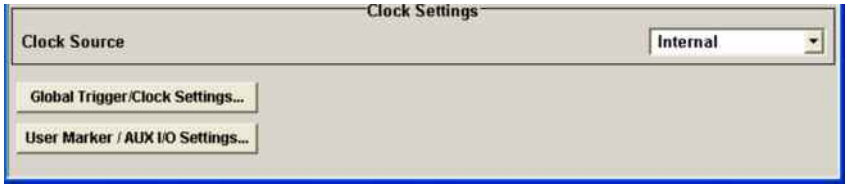
Remote-control command:
```
SOUR:BB:EUTR:CLIP:MODE SCAL
```

Trigger/Marker/Clock - EUTRA/LTE

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

The **Trigger/Marker/Clock** menu can be reached via the EUTRA/LTE main menu.
The **Trigger In** section is where the trigger for the EUTRA/LTE 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 **Global Trigger/Clock Settings** button leads to a submenu for general trigger and clock settings.





Trigger Mode - EUTRA/LTE **(R&S SMx and R&S AMU instruments only)**

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

Auto

The EUTRA/LTE signal is generated continuously.

Remote-control command:
`SOUR:BB:EUTR:TRIG:SEQ AUTO`

Retrigger

The EUTRA/LTE signal is generated continuously. A trigger event (internal or external) causes a restart.

Remote-control command:
`SOUR:BB:EUTR:TRIG:SEQ RETR`

Armed_Auto

The EUTRA/LTE-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously.

Button **Arm** stops signal generation. A subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:EUTR:TRIG:SEQ AAUT`

Armed_Retrigger

The EUTRA/LTE-Signal 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.

Remote-control command:
`SOUR:BB:EUTR:TRIG:SEQ ARET`

Single

The EUTRA/LTE 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.

Remote-control command:
`SOUR:BB:EUTR:TRIG:SEQ SING`

Signal Duration Unit - EUTRA/LTE

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

Defines the unit for the entry of the length of the signal sequence to be output in the **Single** trigger mode. Available units are frame and sequence length (SL).

Remote-control commands:
`SOUR:BB:EUTR:TRIG:SLUN FRAM`

Signal Duration - EUTRA/LTE

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

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.

Remote-control commands:
`SOUR:BB:EUTR:TRIG:SLEN 2000`

Running - Stopped - EUTRA/LTE

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

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

Remote-control command:
`SOUR:BB:EUTR:TRIG:RMOD?`
Response: `RUN or STOP`

Running The EUTRA/LTE 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).

Arm - EUTRA/LTE

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

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).

Remote-control command:
`SOUR:BB:EUTRA:TRIG:ARM:EXEC`

Execute Trigger - EUTRA/LTE

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

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

Remote-control commands:
```
SOUR:BB:EUTR:TRIG:SOUR INT
SOUR:BB:EUTR:TRIG:SEQ RETR
SOUR:BB:EUTR:TRIG:EXEC
```

Trigger Source - EUTRA/LTE

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

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**.

Remote-control command::
```
SOUR:BB:EUTR:TRIG:SOUR INT
```

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

Remote-control command:
```
SOUR:BB:EUTR:TRIG:SOUR OBAS
```

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 1 or TRIGGER 2 connector.

The polarity, the trigger threshold and the input impedance of the TRIGGER input can be set in the **Global Trigger/Clock Settings** menu.

Remote-control command:
```
SOUR:BB:EUTR:TRIG:SOUR EXT | BEXT
```

External / Trigger Delay - EUTRA/LTE

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

Sets the trigger signal delay in samples on external triggering (or on internal triggering via the second path for two-path instruments).

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

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

Remote-control command:
```
SOUR:BB:EUTR:TRIG:EXT:DEL 3
SOUR:BB:EUTR:TRIG:OBAS:DEL 3
```

External / Trigger Inhibit - EUTRA/LTE **(R&S SMx and R&S AMU instruments only)**

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.

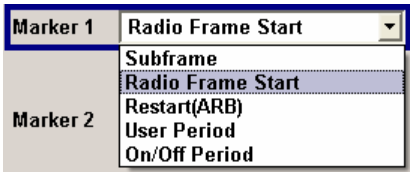
This parameter is only available on external triggering (or on internal triggering via the second path for two-path instruments).

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

Remote-control command:
`SOUR:BB:EUTR:TRIG:EXT:INH 1000`
`SOUR:BB:EUTR:TRIG:OBAS:INH 1000`

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

Marker Mode - EUTRA/LTE Selects a marker signal for the associated MARKER output.



Restart (ARB) A marker signal is generated at the start of each ARB sequence.

Remote-control command:
`SOUR:BB:EUTR:TRIG:OUTP1:MODE REST`

Radio Frame Start A marker signal is generated at the start of each radio frame.

Remote-control command:
`SOUR:BB:EUTR:TRIG:OUTP1:MODE FRAM`

Subframe A marker signal is generated at the start of each subframe.

Remote-control command:
`SOUR:BB:EUTR:TRIG:OUTP1:MODE SUBF`

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

Remote-control command:
`SOUR:BB:EUTR:TRIG:OUTP1:MODE PER`
`SOUR:BB:EUTR:TRIG:OUTP1:PER 2`

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.

Remote-control commands:

```
SOUR:BB:EUTR:TRIG:OUTP1:MODE RAT
SOUR:BB:EUTR:TRIG:OUTP1:OFFT 20
SOUR:BB:EUTR:TRIG:OUTP1:ONT 20
```

Rise Offset - EUTRA/LTE **(Available for marker mode Subframe, Radio Frame Start, and Restart (ARB) only)**

Sets the value for the rise 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.

Remote-control command:

```
SOUR:BB:EUTR:TRIG:OUTP2:ROFF 5000
```

Fall Offset - EUTRA/LTE **(Available for marker mode Subframe, Radio Frame Start, and Restart (ARB) only)**

Sets the value for the fall offset. The falling ramp of the marker is shifted by the set value in samples. Positive values shift the falling ramp to later positions, negative values shift it to earlier positions.

The value range is -640000 to 640000.

Remote-control command:

```
SOUR:BB:EUTR:TRIG:OUTP2:FOFF 5000
```

The **Marker Delay** section can be used to set a delay for the markers.

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

Marker x Delay - EUTRA/LTE

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

Enters the delay between the marker signal at the marker outputs and the start of the signal.

The input is expressed as a number of 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.

The allocation of marker signals to the outputs is described in the section "*Marker Output Signals*".

Remote-control command:
`SOUR:BB:EUTR:TRIG:OUTP2:DEL 20`

Current Range without Calculation - EUTRA/LTE

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

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.

Remote-control command:
`SOUR:BB:EUTR:TRIG:OUTP2:DEL:MAX?`
`SOUR:BB:EUTR:TRIG:OUTP2:DEL:MIN?`

Fix marker delay to current range - EUTRA/LTE

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

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

Remote-control command:
`SOUR:BB:EUTR:TRIG:OUTP:DEL:FIX ON`

The clock source is selected in the **Clock Settings** section.

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

Clock Source - EUTRA/LTE

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

Selects the clock source (also see section "*Clock Signals*").

Internal

The internal clock reference is used to generate the sample clock.

Remote-control command:
`SOUR:BB:EUTR:CLOC:SOUR INT`

External

The external clock reference is fed in as the sample clock, multiple clock or customer specific external clock thereof via the CLOCK connector.

The sample 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.

Note:
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.

Remote-control command:
`SOUR:BB:EUTR:CLOC:SOUR EXT`

Clock Mode - EUTRA/LTE **(R&S SMx and R&S AMU instruments only)**

Enters the type of the externally supplied clock.

Sample

A sample clock is supplied via the CLOCK connector.

Remote-control command:
`SOUR:BB:EUTR:CLOC:MODE SAMP`

Multiple Sample

A multiple of the sample clock is supplied via the CLOCK connector; the sample clock is derived internally from this.

The **Multiplier** window provided allows the multiplication factor to be entered.

Remote-control command:
`SOUR:EUTR:CLOC:MODE MSAM`

Custom

An external custom clock is supplied via the CLOCK connector.

Note:
*The exact frequency of the provided clock has to be defined with parameter **Custom External Clock**.*

Remote-control command:
`SOUR:EUTR:CLOC:MODE CUST`

Sample Clock Multiplier - EUTRA/LTE **(R&S SMx and R&S AMU instruments only)**

Enters the multiplication factor for clock type **Multiple Sample**.

Remote-control command:
`SOUR:BB:EUTR:CLOC:MULT 4`

Custom External Clock - EUTRA/LTE

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

Specifies the parameter for clock type **Custom** in case of external clock source.

Remote-control command:

```
SOUR:BB:EUTR:CLOC:SOUR EXT
SOUR:BB:EUTR:CLOC:MODE CUST
SOUR:BB:EUTR:CLOC:CUST 38400000
```

Measured External Clock - EUTRA/LTE

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

Displays 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.

Remote-control command:

```
:CLOC:INP:FREQ?
```

Global Trigger/Clock Settings - EUTRA/LTE

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

Calls the **Global Trigger/Clock/Input Settings** menu. This menu 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 the section "*Global Trigger/Clock/Input Settings – Setup -Environment*".

User Marker / AUX I/O Settings - EUTRA/LTE

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

Calls the **User Marker AUX I/O Settings** menu. This menu is used to map the connector on the rear of the instruments see section "*User Marker - AUX IO - Setup-Environment-Global...Settings*".

SOURce:BB:EUTRa Subsystem Remote-Control Commands

Introduction - EUTRa - General Remote-Control Commands

This subsystem contains commands for the primary and general settings of the EUTRa standard. These settings concern activation and deactivation of the standard, setting the transmission direction, filter, clock, trigger and clipping settings, defining the frame duration and the sequence length, as well as the preset setting.
The commands for defining the frame configuration for physical layer mode OFDMA and SC-FDMA are described in the next sections. The commands are divided up in this way to make the comprehensive `SOURce:BB:EUTRa` subsystem clearer.
The numerical suffix at SOURce distinguishes between path A and path B for two-path instruments:
SOURce<1> = path A
SOURce2 = path B
For two-path instruments, the keyword SOURce is optional with commands for path A and can be omitted. For path B, the command must include the keyword with the suffix 2.
For one-path instruments, the keyword SOURce is optional and can be omitted.

Command Table – EUTRA/LTE

Commands	Parameters	Def. unit	Comments
Main Menu for EUTRA/LTE Signals			
[SOURce<[1]|2>:]BB:EUTRa:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:PRESet			
[SOURce<[1]|2>:]BB:EUTRa:SETTing:LOAD	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:SETTing:CATalog	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:SETTing:DELete	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:SETTing:STORe	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:VERSion			
[SOURce<[1]|2>:]BB:EUTRa:DUPLexing	TDD | FDD		
[SOURce<[1]|2>:]BB:EUTRa:LINK	DOWN | UP		
[SOURce<[1]|2>:]BB:EUTRa:SLENgth	1…max.		
[SOURce<[1]|2>:]BB:EUTRa:WAVeform:CREate	<file name>		
Filter/Clipping Settings			
[SOURce<[1]|2>:]BB:EUTRa:FILTer:TYPE	RCOSine | COSine | GAUSs | LGAuss | CONE | COEQ| COF| C2K3x | APCO25 | SPHase | RECTangle | PGAuss | LPASs | DIRac | ENPShape | EWPShape | USER		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:APCO25	0.05…0.99		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:COSine	0.05…0.99		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:GAUSs	0.15…2.5		

Commands	Parameters	Def. unit	Comments
[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:PGAuss	0.15…2.5		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:RCOSine	0.00…0.99		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:SPHase	0.15…2.5		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:LPASs	0.05…2.00		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:COSine:COFS	-0.1…1.0		
[SOURce<[1]|2>]:BB:EUTRa:FILTer:PARameter:USER	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:ILENgth	1 .. 128		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:ILENgth:AUTO	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:OSAMpling	1 .. 32		
[SOURce<[1]|2>:]BB:EUTRa:FILTer:OSAMpling:AUTO	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:SRATe:VARiation	400Hz…40MHz	MHz	
[SOURce<[1]|2>:]BB:EUTRa:CLIPping:LEVel	0…100PCT		
[SOURce<[1]|2>:]BB:EUTRa:CLIPping:MODe	VECTor | SCALar		
[SOURce<[1]|2>:]BB:EUTRa:CLIPping:STATe	ON | OFF		
Trigger/Marker/Clock			
[SOURce<[1]|2>:]BB:EUTRa:CLOCk:MODE	SAMPle | MSAMple | CUSTom		
[SOURce<[1]|2>:]BB:EUTRa:CLOCk:MULTiplier	1…64		
[SOURce<[1]|2>:]BB:EUTRa:CLOCk:CUSTom	0.025 … 40	MHz	
[SOURce<[1]|2>:]BB:EUTRa:CLOCk:SOURce	INT | EXT		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:SEQuence	AUTO | RETR | AAUT | ARET | SING		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:ARM:EXECute			
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:EXECute			
[SOURce<[1]|2>:]BB:EUTRa:TRIGger[:EXTernal<[1]|2>]:DELay	0…65535		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger[:EXTernal<[1]|2>]:INHibit	0…(2^32-1)		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OBASeband:DELay	0…65535		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OBASeband:INHibit	0…(2^32-1)		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>:DELay	0…(2^24-1)	Samples	
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut:DELay:FIXed	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>:DELay:MAXimum			
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>:DELay:MINimum			
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>:FOFFset	-640000… +640000	Samples	
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>:MODE	REST | FRAM | PER | SFR | RAT		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>:OFFTime	1..(2^24-1)	Samples	
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>ONTime	1…(2^24-1)	Samples	
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>:PERiod	2 … (2^32-1)	Symbols	
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPUT<[1]…4>:ROFFset	-640000 … +640000	Samples	
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:SOURce	INT | EXT | BEXT | OBAS		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:RMODe	STOP | RUN		Query only

Commands	Parameters	Def. unit	Comments
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:SLENgth	0 .. (2^32-1)		
[SOURce<[1]|2>:]BB:EUTRa:TRIGger:SLUNit	FRAM | SEQ		
General DL Settings			
[SOURce<[1]|2>:]BB:EUTRa:DL:MIMO:CONFiguration	TX1 | TX2 | TX4		
[SOURce<[1]|2>:]BB:EUTRa:DL:MIMO:ANTenna	ANT1		
[SOURce<[1]|2>:]BB:EUTRa:DL:MIMO:ANTA	ANT1 | ANT2 | ANT3 | ANT4		
[SOURce<[1]|2>:]BB:EUTRa:DL:MIMO:ANTB	NONE | ANT1 | ANT2 | ANT3 | ANT4		
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:FSTPosition	SYM0 | SYM1		
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:SCOFfset	0 … 7		
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:FPOWer	-80 dB...10 dB	dB	
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:S2ACtive	ON | OFF		Query only
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:SPOWer	-80 dB...10 dB	dB	
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:SHIFsequence	0:0		
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:ORTSequence	ORS0 | ORS1 | ORS2		
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:PRSModulation	QPSK | IQFile		
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:PRS	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:PRSI	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:DL:RSCMode	STANdard | USED		
[SOURce<[1]|2>:]BB:EUTRa:DL:CSS:FFNC	0 .. 5000		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PERiod	2 | 4 | 5 | 10 | 20		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:FSTSlot	0...19		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PMODulation	QPSK | IQFile		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:SMODulation	QPSK | IQFile		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PSEQuence	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PIQSequence	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:SSEQuence	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:SIQSequence	<file name>		
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PPOWer	-80 dB...10 dB	dB	
[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:SPOWer	-80 dB...10 dB	dB	
[SOURce<[1]|2>:]BB:EUTRa:DL:BW	USER | BW1_25 | BW1_40 | BW2_50 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00		
[SOURce<[1]|2>:]BB:EUTRa:DL:NORB	6...110		
[SOURce<[1]|2>:]BB:EUTRa:DL:SRATe	1.92 … 30.72	MHz	
[SOURce<[1]|2>:]BB:EUTRa:DL:RBM	V80 | V81		
[SOURce<[1]|2>:]BB:EUTRa:DL:OCCBandwidth	1.095 … 30.72	MHz	
[SOURce<[1]|2>:]BB:EUTRa:DL:OCCSubcarriers	72…1321		
[SOURce<[1]|2>:]BB:EUTRa:DL:FFT	128 … 2048		
[SOURce<[1]|2>:]BB:EUTRa:DL:LGS	28 … 364		
[SOURce<[1]|2>:]BB:EUTRa:DL:RGS	27 … 364		
[SOURce<[1]|2>:]BB:EUTRa:DL:PLCi:CIDGroup	0 .. 167		
[SOURce<[1]|2>:]BB:EUTRa:DL:PLCi:PLID	0 … 2		
[SOURce<[1]|2>:]BB:EUTRa:DL:PDSCh:RATBa	-10.00 .. 10.00	dB	

Commands	Parameters	Def. unit	Comments
[SOURce<[1]|2>:]BB:EUTRa:DL:PDCCh:RATBa	-10.00 .. 10.00	dB	
[SOURce<[1]|2>:]BB:EUTRa:DL:PHICh:DURation	NORMal | EXTended		
DL Frame Configuration			
[SOURce<[1]|2>:]BB:EUTRa:DL:BUR	DUData | DTX		
[SOURce<[1]|2>:]BB:EUTRa:DL:CONSubframes	1...10		
[SOURce<[1]|2>:]BB:EUTRa:DL:RSTFrame			
[SOURce<[1]|2>:]BB:EUTRa:DL:SFSelection	0...9		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:CYCPrefix	NORMal | EXTended		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALCount	0...112		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>:CODWords	1 | 2		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:MODulation	QPSK | QAM16 | QAM64		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:RBCount	1...110		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:SYMCount	1...14		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:RBOFfset	0...109		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:SYMoffset	0...13		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:AOC	ON |OFF		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:PHYSbits	0...105600		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:DATA	USER1 | USER2 | USER3 | USER4 | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLISt | ZERO | ONE		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:PATTern	<bit pattern>		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:DSELect	<data list>		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:POWer	-80 dB...10 dB	dB	
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CONType	PDSCh | PBCH | PDCCh | RSVD		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CONFlict	ON | OFF		
DL Enhanced Settings			
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:CBCRc	ON |OFF		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:CRCVersion	R99V | R8V		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:ISBSize	800 .. 30400		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:RMVersion	R80V | R11V		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:RVIndex	0 … 3		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:STATe	ON |OFF		

Commands	Parameters	Def. unit	Comments
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:TBCRc	ON |OFF		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:TBSize	1 … 100000		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:CCODing:TYPE	NONE | CONV | TC		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:PRECoding:CBINdex	0 … 15		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:PRECoding:CDD	NOCD | SMD | LAD		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:PRECoding:NOLayers	1 | 2 | 3 | 4		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:PRECoding:SCHeme	NONE | SPM | TXD		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:SCRambling:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALLoc<0...111>[:CW<[1]|2>]:SCRambling:UEID	0 .. 65535		
PCFICH, PHICH, PDCCH Configuration			
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:PRECoding:SCHeme	NONE | TXD		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:PRECoding:NOLayers	1 .. 4		Query only
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:SCRambling:STATe	ON |OFF		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:PCFich:CREGion	1 .. 3		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:PHICh:NOGRoups	0 .. 15		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:PHICh:ANPattern<0..15>	00 .. FF		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:PDCCh:DATA	PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLIS | ZERO | ONE		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:PDCCh:PATTern	<bit pattern>		
[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ENCC:PDCCh:DSELect	<data list>		
General UL Settings			
[SOURce<[1]|2>:]BB:EUTRa:UL:BW	USER | BW1_25 | BW1_40 | BW2_50 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00		
[SOURce<[1]|2>:]BB:EUTRa:UL:NORB	6...110		
[SOURce<[1]|2>:]BB:EUTRa:UL:SRATe	1.92 … 30.72	MHz	
[SOURce<[1]|2>:]BB:EUTRa:UL:FFT	128 … 2048		
[SOURce<[1]|2>:]BB:EUTRa:UL:OCCBandwidth	1.095 … 30.72	MHz	
[SOURce<[1]|2>:]BB:EUTRa:UL:OCCSubcarriers	72…1320		
[SOURce<[1]|2>:]BB:EUTRa:UL:LGS	28 … 364		
[SOURce<[1]|2>:]BB:EUTRa:UL:RGS	28 … 364		
[SOURce<[1]|2>:]BB:EUTRa:UL:PLCi:CIDGroup	0 .. 167		
[SOURce<[1]|2>:]BB:EUTRa:UL:PLCi:PLID	0 .. 2		
[SOURce<[1]|2>:]BB:EUTRa:UL:CSS:FFNC	0 .. 5000		
[SOURce<[1]|2>:]BB:EUTRa:UL:REFSig:GRPHopping	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:REFSig:SEQHopping	ON | OFF		

Commands	Parameters	Def. unit	Comments
[SOURce<[1]|2>:]BB:EUTRa:UL:REFSig:PUSCh:DSSHift	0 .. 11		
[SOURce<[1]|2>:]BB:EUTRa:UL:REFSig:SAICell	1 .. 12		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUSCh:FHMode	NONE | INTer | INTRa		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUSCh:NOSM	1 .. 4		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUSCh:CSHPattern	<hopping pattern>		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:NORB	2 | 4 | 6		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:DESHift	1 .. 3		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:DEOFfset	0 .. 2		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N1CS	0 .. 8		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N2RB	0 .. 5		
[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N1NMax			Query only
[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N1EMax			Query only
[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N2Max			Query only
UL Frame Configuration			
[SOURce<[1]|2>:]BB:EUTRa:UL:CONSubframes	1...10		
[SOURce<[1]|2>:]BB:EUTRa:UL:RSTFrame			
[SOURce<[1]|2>:]BB:EUTRa:UL:SFSelection	0...9		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:CYCPrefix	NORMal | EXTended		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:MODulation	QPSK | QAM16 | QAM64		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:FORMat	F1 | F1A | F1B | F2 | F2A | F2B		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:RBC	1...110		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:VRBoffset	0...109		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:SLOT<0|[1]>:ALLoc<0...3>:RBOF	0...109		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PHYSbits	0...105600		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:POWer	-80 dB...10 dB	dB	
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:CONType	PUSCh | PUCCh		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:CONFlict	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:UEType	UE1 | UE2 | UE3 | UE4		
UL Enhanced Settings			
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:NDMRs	0 .. 11		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:FHOP:TYPE	NONE | TP1 | TP2		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:FHOP:MODE	0 .. 2		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:FHOP:MIRRoring	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:HARQ:ACKType	BIT1 | BIT2		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:HARQ:ANPattern	<bit pattern>		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:HARQ:ANSubcarriers	1 .. 10		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:ULSCh:BITSs			Query only

Commands	Parameters	Def. unit	Comments
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:CCODing:TBSize	0 .. 100000		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:CCODing:RVINdex	0 .. 3		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUCCh:NPAR	0 .. n(1)_PUCCH_max/n(2)_PUCCH_max		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:CQCI:BITS	0 .. 32		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:CQCI:CBIT	0 .. (Number of Physical Bits)		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUSCh:CQCI:PATTern	<pattern>		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUCCh:HARQ:ANPattern	<bit pattern>		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUCCh:CQCI:BITS	0 .. 32		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUCCh:CQCI:CBIT	0 .. (Number of Physical Bits)		
[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALLoc<0...3>:PUCCh:CQCI:PATTern	<pattern>		
Dummy Data Configuration			
[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:MODulation	QPSK | QAM16 | QAM64		
[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:DATA	PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLISt | ZERO | ONE		
[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:PATTern	<data pattern>		
[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:DSELect	<data list>		
[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:POWer	-80 dB...10 dB	dB	
User Configuration			
[SOURce<[1]|2>:]BB:EUTRa:DL:USER<[1]|2|3|4>:UEID	0 .. 65535		
[SOURce<[1]|2>:]BB:EUTRa:DL:USER<[1]|2|3|4>:DATA	PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLIS | ZERO | ONE		
[SOURce<[1]|2>:]BB:EUTRa:DL:USER<[1]|2|3|4>:PATTern	<data pattern>		
[SOURce<[1]|2>:]BB:EUTRa:DL:USER<[1]|2|3|4>:DSELect	<data list>		
User Equipment			
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:ID	0 .. 65535		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:MODe	STD | PRACh		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:POWer	-80.00 .. 10.00		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:DATA	PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLIS | ZERO | ONE		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:PATTern	<data pattern>		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:DSELect	<data list>		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:SCRambling:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:TBCRc	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:CBCRc	ON | OFF		

Commands	Parameters	Def. unit	Comments
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:CRCVersion	R99V | R8V		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:RMVersion	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUCCh:DATA	PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLIS | ZERO | ONE		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUCCh:PATTern	<bit pattern>		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUCCh:DSELect	<data list>		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:DRS:POWoffset	-80.00 .. 10.00	dB	
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:ANSTx	ON | OFF		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:POWoffset	-80.00 .. 10.00	dB	
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:CYCShift	0 .. 11		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:FSTSubframe	0 .. (Last SRS Subframe)		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:PERiodicity	2,5,10,20,40, 80,160,320	ms	
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:LSTSubframe	(First Subframe) .. (10*Number of Frames - 1)		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:SPOSition	FIRSt | LAST		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:NORB	0 .. (Number of RB - 1)		
[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:FHPattern	0 .. (12*Number of RB - 1)		

SOURce-EUTRa - Primary Commands

[SOURce<[1]|2>:]BB:EUTRa:STATe ON | OFF

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).

Example:
```
BB:EUTR:STAT ON
```
'activates modulation in accordance with the EUTRA/LTE standard.

*RST value	Resolution	Dependencies	SCPI
OFF	-	BB:EUTR:STAT ON deactivates the other standards and digital modulation.	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DUPLexing TDD | FDD

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

Note:
In this release, only FDD is supported.

Parameter:

TDD
The same frequency is used for both directions of transmission (uplink and downlink). With one baseband, either only downlink/ only uplink or uplink and downlink frames can be generated.

FDD
Different frequencies are used for downlink and uplink directions. If only one link direction is considered at once, the EUTRA/LTE standard defines no differences between TDD and FDD signals on the physical layer.

Example:
```
BB:EUTR:DUPL FDD
```
'selects frequency division duplexing.

*RST value	Resolution	SCPI
FDD	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:LINK DOWN | UP

Defines the transmission direction. The signal either corresponds to that of a base station (DOWN) or that of a subscriber station (UP).

Example:
```
BB:EUTR:LINK DOWN
```
'the transmission direction selected is base station to subscriber station. The signal corresponds to that of a base station.

*RST value	Resolution	SCPI
DOWN	-	Device-specific

[SOURce<[1]|2>:]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.

This command triggers an action and therefore has no *RST value and no query form.

Example:
```
BB:EUTR:PRES
```
'resets all the EUTRA/LTE settings to default values.

*RST value	Resolution	Dependencies	SCPI
-	-	All EUTRA/LTE settings are preset.	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:SETTing: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.

The command is a query command and therefore has no *RST value.

Example:
```
MMEM:CDIR '\user\eutra'
```
'sets the default directory to `\user\eutra`.
```
BB:EUTR:SETT:CAT?
```
'reads out all the files with EUTRA/LTE settings in the default directory.

Response: `'e_utra1','e_utra2'`
'the files `'e_utra1'` and `'e_utra2'` are available.

*RST value	Resolution	SCPI
	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:SETTing:DELete <file_name>

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.

This command triggers an event and therefore has no *RST value and no query form.

Example:
```
BB:EUTR:SETT:DEL 'e_utra_1'
```
'deletes file 'e_utra_1'.

*RST value	Resolution	SCPI
	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:SETTing:LOAD <file_name>

`L`oads 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.

This command triggers an event and therefore has no *RST value and no query form.

Example:
```
BB:EUTR:SETT:LOAD 'e_utra_1'
```
'loads file `'e_utra_1'`.

*RST value	Resolution	SCPI
	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:SETTing:STORe <file_name>

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**.

This command triggers an event and therefore has no *RST value and no query form.

Example:
```
BB:EUTR:SETT:STOR 'e_utra_1'
```
'stores the current settings into file '`e_utra_1`'.

*RST value	Resolution	SCPI
	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:SLENgth 1...max

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).

Example:
```
BB:EUTR:SLEN 4
```
'selects the generation of 4 frames.

*RST value	Resolution	SCPI
1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:WAVeform:CREate <file_name>

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.

This command triggers an event and therefore has no *RST value and no query form.

Example:
```
MMEM:CDIR '\user\waveform
```
'sets the default directory to \user\waveform.

```
BB:EUTR:WAV:CRE 'eutra_1'
```
'creates the waveform file `eutra_1.wv` in the default directory.

*RST value	Resolution	SCPI
-	-	device-specific

[SOURce<[1]|2>:]BB:EUTRa:VERSion?

The command queries the version of the 3GPP standard underlying the definitions.

The command is a query command and therefore does not have an *RST value.

Example:
```
BB:EUTR:VERS?
```
'queries the 3GPP version.

*RST value	Resolution	SCPI
-	-	Device-specific

SOURce-EUTRa - Filter/Clipping Settings

[SOURce<[1]|2>:]BB:EUTRa:FILTer:TYPE RCOSine | COSine | GAUSs | LGAuss | CONE | COF705 | COEQualizer | COFequalizer | C2K3x | APCO25 | SPHase | RECTangle | PGAuss | LPASs| DIRac | ENPShape | EWPShape | USER

Selects the baseband filter type.

Example: `BB:EUTR:FILT:TYPE COS`
'sets the baseband filter type.

*RST value	Resolution	SCPI
COSine		Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:APCO25 0.05 .. 0.99

Sets the roll-off factor for the APCO25 filter type.

Example: `BB:EUTR:FILT:PAR:APCO25 0.06`
'the roll-off factor is set to 0.06.

*RST value	Resolution	SCPI
0.20		Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:COSine 0.00 .. 0.99

Sets the roll-off factor for the Cosine filter type.

Example: `BB:EUTR:FILT:PAR:COS 0.04`
'the roll-off factor is set to 0.04.

*RST value	Resolution	SCPI
0.1	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:COSine:COFS -1.0 .. 1.0

Sets the "cut of frequency shift" value for the Cosine filter type.

Example: `BB:EUTR:FILT:PAR:COS:COFS 0.04`
'the "cut of frequency shift" value is set to 0.04.

*RST value	Resolution	SCPI
-0.33	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:GAUSs 0.15 .. 2.5

Sets the BxT for the Gauss filter type (FSK).

Example: `BB:EUTR:FILT:PAR:GAUS 0.5`
'the BxT is set to 0.5.

*RST value	Resolution	SCPI
0.5		Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:LPASs 0.05 .. 2.0

Sets the cut off frequency factor for the Lowpass filter type.

Example:
```
BB:EUTR:FILT:PAR:LPAS 0.5
```
'the cut of frequency factor is set to 0.5.

*RST value	Resolution	SCPI
0.50	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:PGAuss 0.15 .. 2.5

Sets the BxT for the Gauss filter type (pure).

Example:
```
BB:EUTR:FILT:PAR:PGA 0.5
```
'the BxT is set to 0.5.

*RST value	Resolution	SCPI
0.5		Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:RCOSine 0.00 .. 0.99

Sets the roll-off factor for the Root Cosine filter type.

Example:
```
BB:EUTR:FILT:PAR:RCOS 0.4
```
'the roll-off factor is set to 0.4.

*RST value	Resolution	SCPI
0.22		Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:PARameter:SPHase 0.15 .. 2.5

Sets the BxT for the Split Phase filter type.

Example:
```
BB:EUTR:FILT:PAR:SPH 2
```
'the BxT is set to 2.0

*RST value	Resolution	SCPI
2.00		Device-specific

[SOURce<[1]|2>]:BB:EUTRa:FILTer:PARameter:USER <file name>

The command selects the user-defined filter (*.vaf).

The directory applicable to the following command is defined with the command `MMEMory:CDIR`. To access the files in this directory, only the file name is required, without the path and the file extension.

Example:
```
BB:EUTR:FILT:TYPE USER
```
'selects the User filter type.
```
MMEM:CDIR 'D:\Filter_List'
```
'selects the directory for the user-defined filters.
```
BB:EUTR:FILT:PAR:USER eutra_user_filter
```
'selects the user-defined filter.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:ILENgth 1 .. 128

Note:
This command is available for WinIQSIM2 only.

Sets the impulse length (number of filter tabs).

Example:
```
BB:EUTR:FILT:ILEN 10
```
'sets the number of filter tabs to 10.

*RST value	Resolution	SCPI
10	1	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:ILENgth:AUTO ON | OFF

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.

Example:
```
BB:EUTR:FILT:ILEN:AUTO ON
```
'the most sensible parameters are selected automatically.

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:OSAMpling 1 .. 32

Note:
This command is available for WinIQSIM2 only.

Sets the upsampling factor.

Example:
```
BB:EUTR:FILT:OSAM 32
```
'sets the upsampling factor to 32.

*RST value	Resolution	SCPI
32	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:FILTer:OSAMpling:AUTO ON | OFF

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.

Example:
```
BB:EUTR:FILT:OSAM:AUTO ON
```
'the most sensible parameters are selected automatically.

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:SRATe:VARiation 400 Hz .. 40 MHz

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.

Example:
```
BB:EUTR:SRAT:VAR 400Hz
```
'sets the output sample rate to 400 Hz.

*RST value	Resolution	SCPI
15.36 MHz	0.001 Hz	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:CLIPping:LEVel 0 .. 100 PCT

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`

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.

*RST value	Resolution	SCPI
100 PCT	1	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:CLIPping:MODE: VECTor | SCALar

Sets the method for level clipping.

Parameter:

VECTor
The reference level is the amplitude | i+jq |.

SCALar
The reference level is the absolute maximum of the I and Q values.

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.

*RST value	Resolution	SCPI
VECTor	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:CLIPping:STATe ON | OFF

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`.

Example:
```
BB:EUTR:CLIP:STAT ON
```
'activates level clipping.

*RST value	Resolution	SCPI
OFF		Device-specific

SOURce-EUTRa - Trigger/Marker/Clock Settings

[SOURce<[1]|2>:]BB:EUTRa:CLOCk:MODE SAMPle | MSAMple | CUSTom

Note:
This command is available for R&S SMx and R&S AMU instruments only.

Enters the type of externally supplied clock (`BB:EUTRa:CLOCk:SOURce EXTernal`).

Parameter:

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
An external customer specific clock is supplied vie 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.

Example:

```
BB:EUTR:CLOC:MODE SAMP
```
'selects clock type **SAMPle**, i.e. the supplied clock is a sample clock.

*RST value	Resolution	SCPI
SAMPle	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:CLOCk:MULTiplier 1 .. 64

Specifies the multiplier for clock type **Multiplied** (`BB:EUTRa:CLOCk:MODE MSAMple`) in the case of an external clock source.

Note:
This command is available for R&S SMx and R&S AMU instruments only.

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.

*RST value	Resolution	SCPI
4	1	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:CLOCk:SOURce INTernal | EXTernal

Note:
This command is available for R&S SMx and R&S AMU instruments only.

Selects the clock source.

Parameter:

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`

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:

*RST value	Resolution	SCPI
INTernal	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:CLOCk:CUSTom 25000 .. 40000000

Note:
This command is available for R&S SMx and R&S AMU instruments only.

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.

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..

*RST value	Resolution	SCPI
38.4 MHz	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:SEQuence AUTO | RETRigger | AAUTo | ARETrigger | SINGle

Note:
This command is available for R&S SMx and R&S AMU instruments only.

Selects the trigger mode.

Parameter:

AUTO
The modulation signal is generated continuously.

RETRigger
The modulation signal is generated continuously. A trigger event (internal or external) causes a restart.

AAUTo
The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command `BB:EUTR:TRIG:ARM:EXEC` and started again when a trigger event occurs.

ARETrigger
The modulation signal is generated only when a trigger event occurs. The device automatically toggles to RETRIG 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.

Example:

```
BB:EUTR:TRIG: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.

*RST value	Resolution	SCPI
AUTO	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:ARM:EXECute

Note:
This command is available for R&S SMx and R&S AMU instruments only.

Stops signal generation for trigger modes **Armed_Auto** and **Armed_Retrigger**. A subsequent internal or external trigger event restarts signal generation.

This command triggers an event and therefore has no *RST value and no query form.

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.

*RST value	Resolution	SCPI
		Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:EXECute

Note:
This command is available for R&S SMx and R&S AMU instruments only.

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`.

This command triggers an event and therefore has no *RST value and no query form.

Example:
```
BB:EUTR:TRIG:SOUR INT
```
'sets internal triggering.
```
BB:EUTR:TRIG:SEQ RETR
```
'sets Retrigger mode, i.e. every trigger event causes signal generation to restart.
```
BB:EUTR:TRIG:EXEC
```
'executes a trigger.

*RST value	Resolution	SCPI
		Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger[:EXTernal<[1]|2>]:DELay 0 .. 65535

Note:
This command is available for R&S SMx and R&S AMU instruments only.

Specifies the trigger delay (expressed as a number of samples) for external triggering. The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

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.

*RST value	Resolution	SCPI
0 samples	1 sample	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger[:EXTernal<[1]|2>]:INHibit 0 .. (2^32-1)

Note:
This command is available for R&S SMx and R&S AMU instruments only.

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. The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

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.

*RST value	Resolution	SCPI
0 samples	1 sample	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OBASeband:DELay 0 .. 65535

Note:
This command is available for R&S SMx and R&S AMU two-path instruments only.

Specifies the trigger delay (expressed as a number of samples) for triggering by the trigger signal from the second path (two-path instruments only).

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.

RST value	Resolution	SCPI
0 samples	1 sample	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OBASeband:INHibit 0 .. (2^32-1)

Note:
This command is available for R&S SMx and R&S AMU two-path instruments only.

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.

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.

*RST value	Resolution	SCPI
0 samples	1 sample	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:DELay 0 .. (2^24 - 1) Samples

Note:
This command is available for R&S SMx and R&S AMU instruments only.

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.

Example:
```
BB:EUTR:TRIG:OUTP2:DEL 1600
```
'sets a delay of 1600 samples for the signal on connector MARKER 2.

*RST value	Resolution	SCPI
0	1 sample	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut:DELay:FIXed ON | OFF

Note:
This command is available 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.

Example:
```
BB:EUTR:TRIG:OUTP:DEL:FIX ON
```
'restricts the marker signal delay setting range to the dynamic range.

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:DELay:MAXimum?

Note:
This command is available for R&S SMx and R&S AMU instruments only.

The command queries the maximum marker delay for setting `BB:EUTRa:TRIG:OUTP:DEL:FIX ON`.

The command is a query only and therefore has no *RST value.

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.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:DELay:MINimum?

Note:
This command is available for R&S SMx and R&S AMU instruments only.

The command queries the minimum marker delay for setting
`BB:EUTRa:TRIGger:OUTPut:DELay:FIXed ON`.

The command is a query only and therefore has no *RST value.

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.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:FOFFset -640000 .. +640000 samples

Sets the fall offset for an on/off ratio marker in number of samples.

Example:
`BB:EUTR:TRIG:OUTP2:FOFF 2000`
'sets a fall offset of 2000 samples for marker signal 2 on path A.

*RST value	Resolution	SCPI
0	1	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:MODE RESTart | FRAM | PERiod | SUBFram | RATio

Defines the signal for the selected marker output.

Parameter:

SUBFram
A marker signal is generated at the start of each subframe. The rise and fall offsets are defined with the commands
`BB:EUTRa:TRIGger:OUTPut:FOFFset` and
`BB:EUTRa:TRIGger:OUTPut:ROFFset`.

FRAM
A marker signal is generated at the start of each radio frame. The rise and fall offsets are defined with the commands
`BB:EUTRa:TRIGger:OUTPut:FOFFset` and
`BB:EUTRa:TRIGger:OUTPut:ROFFset`.

RESTart
A marker signal is generated at the start of each ARB sequence. The rise and fall offsets are defined with the commands
`BB:EUTRa:TRIGger:OUTPut:FOFFset` and
`BB:EUTRa:TRIGger:OUTPut:ROFFset`.

PERiod
A marker signal is generated at the beginning of every user-defined period. The period is defined with the command
`BB:EUTRa:TRIGger:OUTPut:PERiod`.

RATio
A marker signal corresponding to the Time Off / Time On specifications in the commands `BB:EUTRa:TRIGger:OUTPut:OFFTime` and `BB:EUTRa:TRIGger:OUTPut:ONTime` is generated.

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.

*RST value	Resolution	SCPI
FRAM	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:OFFTime 1 .. (2^24 - 1) samples

Sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting `BB:EUTRa:TRIGger:OUTPut:MODE RATio` on the marker outputs is OFF.

Example:
```
BB:EUTR:TRIG:OUTP2:MODE RAT
```
'selects the ratio marker signal on output MARKER 2.
```
BB:EUTR:TRIG:OUTP2:OFFT 200
```
'sets an OFF time of 200 samples for marker signal 2.

*RST value	Resolution	SCPI
1	1	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:ONTime 1 .. (2^24 - 1) samples

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.

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.

*RST value	Resolution	SCPI
1	1	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:PERiod 2 .. (2^32-1) symbols

Sets the repetition rate for the signal at the marker outputs, expressed in terms of symbols. The setting is only valid for selection **USER** in `BB:EUTR:TRIG:OUTP:MODE`.

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 symbols, i.e. the marker signal is repeated every 1600th symbol.

*RST value	Resolution	SCPI
2	1 symbol	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:OUTPut<[1]...4>:ROFFset -640000 .. +640000 samples

Sets the rise offset for on/off ratio marker in number of samples.

Example: `BB:EUTR:TRIG:OUTP2:ROFF 20`
'sets a rise offset of 20 samples for marker signal 2.

*RST value	Resolution	SCPI
0	1	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:RMODe RUN | STOP

Note:
This command is available for R&S SMx and R&S AMU instruments only.

The command queries the current status of signal generation for all trigger modes with EUTRA/LTE modulation on.

The command is a query command and therefore has no *RST value.

Parameter:

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.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:SLENgth 0 .. (2^32-1)

Note:
This command is available for R&S SMx and R&S AMU instruments only.

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.

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`

*RST value	Resolution	SCPI
1	1	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:SLUNit FRAMe | SEQuence | SUBFrame | SLOT | SAMPle

Note:
This command is available for R&S SMx and R&S AMU instruments only.

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`).

Parameter:

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.

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.

*RST value	Resolution	SCPI
SEQuence	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:TRIGger:SOURce INTernal | EXTernal | BEXTernal | OBASeband

Note:
This command is available for R&S SMx and R&S AMU instruments only.

Selects the trigger source.

Parameter:

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).

Example:

```
BB:EUTR:TRIG:SOUR EXT
```

'sets external triggering via the TRIGGER 1 connector.

*RST value	Resolution	SCPI
INTernal	-	Device-specific

SOURce-EUTRa - General EUTRA/LTE Downlink Settings

[SOURce<[1]|2>:]BB:EUTRa:DL:MIMO:CONFiguration TX1 | TX2 | TX4

Sets the global MIMO configuration.

Example:
```
BB:EUTR:DL:MIMO:CONF TX2
```
'sets the MIMO configuration to 2 TxAntennas.

*RST value	Resolution	SCPI
TX1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:MIMO:ANTenna?

Queries the simulated antenna.
This command is allowed for simulation mode set to 1 Tx Antenna only.

Example:
```
BB:EUTR:DL:MIMO:CONF TX1
```
'sets 1 TxAntenna simulation mode.

```
BB:EUTR:DL:MIMO:ANT?
```
'queries the simulated antenna.

Response: `ANT1`

*RST value	Resolution	SCPI
ANT1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:MIMO:ANTA ANT1 | ANT2 | ANT3 | ANT4

Sets the simulated antenna for path A. The available selections depend on the current MIMO configuration.

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.

*RST value	Resolution	SCPI
ANT1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:MIMO:ANTB NONE | ANT1 | ANT2 | ANT3 | ANT4

Sets the simulated antenna for path B. The available selections depend on the current MIMO configuration.

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.

*RST value	Resolution	SCPI
NONE	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:FSTPosition SYM0 | SYM1

Displays the position of the first reference signal. The value is set automatically according to the current MIMO configuration.

Example:
```
BB:EUTR:DL:REFSig:FSTPosition?
```
'displays the position of the first reference signal.

*RST value	Resolution	SCPI
SYM0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:SCOFfset 0 … 7

Displays the reference symbol subcarrier offset. The value is set automatically according to the current MIMO configuration.

Example:
```
BB:EUTR:DL:REFSig:SCOFfset?
```
'displays the subcarrier offset of the reference symbol.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:FPOWer -80.00…10.00

Sets the first reference signal power.

Example:
```
BB:EUTR:DL:REFSig:FPOWer -10.00
```
'sets the first reference signal power to -10.00dB.

*RST value	Resolution	SCPI
0.00	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:S2ACtive ON | OFF

Displays the usage of the second reference signal. The value is set automatically according to the current MIMO settings.

Example:
```
BB:EUTR:DL:REFSog:S2ACtive?
```
'displays the usage of the second reference signal.

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:SPOWer -80.00 .. 10.00

Sets the second reference signal power.

Example:
```
BB:EUTR:DL:REFSig:SPOWer -10.00
```
'sets the second reference signal power to -10.00dB.

*RST value	Resolution	SCPI
0.00	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:SHIFsequence 0:0

Sets the shifting sequence for the reference signal.

Example:
```
BB:EUTR:DL:REFSig:SHIFsequence "1:2:3:1:4:5:3"
```
'sets the shifting sequence 1:2:3:1:4:5:3:1:2:3.

*RST value	Resolution	SCPI
0:0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:ORTSequence ORS0 | ORS1 | ORS2

Selects the orthogonal sequence.

Example:
```
BB:EUTR:DL:REFSig:ORTSequence ORS1
```
'selects the orthogonal sequence S1.

*RST value	Resolution	SCPI
ORS0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:PRSModulation QPSK | IQFile

Selects the modulation scheme used for the pseudo-random sequence R_{PRS}.

Example:
```
BB:EUTR:DL:REFSig:PRSModulation QPSK
```
'sets the modulation scheme to QPSK.

*RST value	Resolution	SCPI
QPSK	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:PRS <file name>

Loads the selected pseudo-random sequence R_{PRS} data list. 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 dataset for R_{PRS} must be in *.iqw file format.

Example:
```
MMEM:CDIR 'F:\gen_list\eutra'
```
'selects the directory for the sequence data lists.
```
BB:EUTR:DL:REFSig:PRS 'prs'
```
'selects the sequence file prs.dm_iqd as the data source.

*RST value	Resolution	SCPI
none	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:REFSig:PRSI <file name>

Loads the selected pseudo-random sequence R_{PRS} data list. 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 dataset for R_{PRS} must be in *.iqw file format.

Example:
```
MMEM:CDIR 'F:\gen_list\eutra'
```
'selects the directory for the sequence data lists.
```
BB:EUTR:DL:REFSig:PRSI 'prs'
```
'selects the sequence file prs.iqw as the data source.

*RST value	Resolution	SCPI
none	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:RSCMode STANdard |USER

Enables/disables the synchronization and reference signals settings for configuration.

Example:
```
BB:EUTR:DL:RSCM STAN
```
'the synchronization and reference signals settings are set according to the 3GPP TS 36.211

*RST value	Resolution	SCPI
STAN	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:CSS:FFNC

Sets the initial value of the generator of pseudo-random sequence according to R1-081248, "PRS sequence generation for downlink reference signal".

Example:
```
BB:EUTR:DL:CSS:FFNC 1875
```
'sets the N_c parameter

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PERiod 2 | 4 | 5 | 10 | 20

Sets the period in slots between two S-SYNC/P-SYNC slots.

Example:
```
BB:EUTR:DL:SYNC:PER 5
```
'sets a period of 4 slots between two P-SYNC/ S-SYNC slots.

*RST value	Resolution	SCPI
10	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:FSTSlot 0 .. 19

Sets the slot in the frame, in which the P-SYNC and the S-SYNC are transmitted the first time.

Example:
```
BB:EUTR:DL:SYNC:FSTS 4
```
'determines that the SYNC is transmitted in slot 4 for the first time.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PMODulation QPSK | IQFile

Selects the modulation scheme used for the P-SYNC sequences.

Example:
```
BB:EUTR:DL:SYNC:PMOD IQF
```
'sets the modulation scheme to IQFile.

*RST value	Resolution	SCPI
IQFile	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PSEQ <file name>

Loads the selected P-SYNC sequence data list. 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 dataset for P-SYNC must be in SMU data list-format.

Note:
The sequence is restarted at the beginning of each generated frame.

Example:
```
MMEM:CDIR 'F:\gen_list\eutra'
```
'selects the directory for the sequence data lists.
```
BB:EUTR:DL:SYNC:PSEQ 'psync'
```
'selects the sequence file psync.dm_iqd as the data source.

*RST value	Resolution	SCPI
none	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PIQSequence <file name>

Loads the selected P-SYNC sequence data list. 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 dataset for P-SYNC must be in *.iqw file format.

Example:
```
MMEM:CDIR 'F:\gen_list\eutra'
```
'selects the directory for the sequence data lists.
```
BB:EUTR:DL:SYNC:PIQS 'psync'
```
'selects the sequence file psync.iqw as the data source.

*RST value	Resolution	SCPI
none	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:SMODulation QPSK | IQFile

Selects the modulation scheme used for the S-SYNC sequences.

Example:
```
BB:EUTR:DL:SYNC:SMOD IQF
```
'sets the modulation scheme to IQFile.

*RST value	Resolution	SCPI
QPSK	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:SSEQ <file name>

Loads the selected S-SYNC sequence data list. 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 dataset for S-SYNC must be in SMU datalist-format.

Note:
The sequence is restarted at the beginning of each generated frame.

Example:
```
MMEM:CDIR 'F:\gen_list\eutra'
```
'selects the directory for the sequence data lists.
```
BB:EUTR:DL:SYNC:SSEQ 'ssync'
```
'selects the sequence file ssync.dm_iqd as the data source.

*RST value	Resolution	SCPI
none	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:SIQSequence <file name>

Loads the selected S-SYNC sequence data list. 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.

If IQ file is chosen, a file in iqw format is required.

Example:
```
MMEM:CDIR 'F:\gen_list\eutra'
```
'selects the directory for the sequence data lists.
```
BB:EUTR:DL:SYNC:SIQS 'ssync'
```
'selects the sequence file ssync.iqw as the data source.

*RST value	Resolution	SCPI
none	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:PPOWer -80.00 .. 10.00

Sets the power of the primary synchronization signal (P-SYNC).

Example:
```
BB:EUTR:DL:SYNC:PPOWer -10.00
```
'sets the P-SYNC power to -10.00dB.

*RST value	Resolution	SCPI
0.00	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SYNC:SPOWer -80.00 .. 10.00

Sets the power of the secondary synchronization signal (S-SYNC).

Example:
```
BB:EUTR:DL:SYNC:SPOWer -10.00
```
'sets the S-SYNC power to -10.00dB.

*RST value	Resolution	SCPI
0.00	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:BW USER | BW1_25 | BW1_40 | BW2_50 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00

Sets the DL channel bandwidth.

Example:
```
BB:EUTR:DL:BW BW1_25
```
'selects a downlink frequency band of 1.25 MHz.

*RST value	Resolution	SCPI
BW10_00	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:NORB 6 .. 110

Selects the number of physical resource blocks per slot.

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.

*RST value	Resolution	SCPI
50	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SRATe 1.92 .. 30.72

Displays the sampling rate. The value for the sampling rate is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:DL:SRAT?
```
'displays the automatically set sampling rate.

*RST value	Resolution	SCPI
15.36	0.001	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:RBM V80 | V81

Selects the way the resorce blocks are mapped.

Example:
```
BB:EUTR:DL:RBM V81
```
'the resource block mapping will be performed according to the standard 3GPP TS 36.211, Version 8.1.0

*RST value	Resolution	SCPI
V81	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:FFT 128 .. 2048

Displays the FFT (Fast Fourier Transformation) size. The FFT size is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:DL:FFT?
```
'displays the automatically set fast Fourier transformation parameter.

*RST value	Resolution	SCPI
1024	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:OCCBandwidth 1.095 .. 20.00

Displays the of occupied bandwidth. This value is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:DL:OCCB?
```
'displays the automatically set occupied bandwidth in downlink.

*RST value	Resolution	SCPI
9.015	MHz	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:OCCSubcarriers 72 .. 1321

Displays the occupied subcarriers. The value is set automatically according to the selected number of physical resource blocks.

Example:
```
BB:EUTR:DL:OCCS?
```
'displays the number of occupied subcarriers.

*RST value	Resolution	SCPI
601	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:LGS 28 .. 364

Displays the number of left guard subcarriers. The value is set automatically according to the selected number of physical resource blocks.

Example:
```
BB:EUTR:DL:LGS?
```
'displays the number of left guard subcarriers.

*RST value	Resolution	SCPI
212	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:RGS 27 .. 364

Displays the number of right guard subcarriers. The value is set automatically according to the selected channel bandwidth and the number of physical resource blocks.

Example:
```
BB:EUTR:DL:RGS?
```
'displays the number of right guard subcarriers.

*RST value	Resolution	SCPI
211	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:PLCi:CIDGroup 0 … 167

Sets the ID of the physical cell identity group.
There are 504 unique physical layer cell identities, grouped into 168 uniquie physical cell identity groups that contain three unique identities each.
To configure these identities, use the command `BB:EUTR:DL:PLC:PLID`.

Example:
```
BB:EUTR:DL:PLC:CIDG 100
```
'sets the ID of the physical cell identity group.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:PLCi:PLID 0 … 2

Sets the identity of the physical layer within the selected physical cell identity group, set with the command `BB:EUTR:DL:PLC:CIDG`.

Example:
```
BB:EUTR:DL:PLC:PLID 2
```
'sets the identity of the physical layer.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:PDSCh:RATBa -10.00 .. 10.00

Sets the transmit energy ratio among the resource elements allocated for PDSCH in the OFDM symbols containing reference signal (P_A) and such not containing one (P_B).

Example:
```
BB:EUTR:DL:PDSC:RATB -5.0
```
'sets the transmit energie ratio

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:PDCCh:RATBa -10.00 .. 10.00

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

Example:
```
BB:EUTR:DL:PDCC:RATB -5.0
```
'sets the transmit energie ratio

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:PHICh:DURation NORMal | EXTended

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 (`BB:EUTR:DL:ENCC:PCF:CREG`) that is signaled by the PCFICH.

Parameter:

NORMal
All ressource element groups of PHICH (`BB:EUTR:DL:ENCC:PHIC:NOGR`) 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).

Example:

```
BB:EUTR:DL:PHIC:DUR NORM
```
'sets PHICH normal duration

*RST value	Resolution	SCPI
NORMal	-	Device-specific

SOURce-EUTRa - General EUTRA/LTE Uplink Settings

[SOURce<[1]|2>:]BB:EUTRa:UL:BW USER | BW1_25 | BW1_40 | BW2_50 | BW3_00 | BW5_00 | BW10_00 | BW15_00 | BW20_00

Sets the UL channel bandwidth.

Example:
```
BB:EUTR:UL:BW BW1_25
```
'selects a uplink frequency band of 1.25 MHz.

*RST value	Resolution	SCPI
BW10_00	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:NORB 6 .. 110

Selects the number of physical resource blocks per slot.

Example:
```
BB:EUTR:UL:BW USER
```
'sets the bandwidth mode to USER in downlink.
```
BB:EUTR:UL:NORB 7
```
'sets the number of resource blocks to 7.

*RST value	Resolution	SCPI
50	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SRATe 1.92 .. 30.72

Displays the sampling rate. The value for the sampling rate is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:UL:SRAT?
```
'displays the automatically set sampling rate.

*RST value	Resolution	SCPI
15.36	0.001	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:FFT 128 .. 2048

Displays the FFT (Fast Fourier Transformation) size. The FFT size is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:UL:FFT?
```
'displays the automatically set FFT size.

*RST value	Resolution	SCPI
1024	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:OCCBandwidth 1.095 .. 20.00

Displays the occupied bandwidth. This value is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:UL:OCCB?
```
'displays the automatically set occupied bandwidth in uplink.

*RST value	Resolution	SCPI
9.015	MHz	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:OCCSubcarriers 72 .. 1320

Displays the occupied subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:UL:OCCS?
```
'displays the number of occupied subcarriers.

*RST value	Resolution	SCPI
600	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:LGS 28 .. 364

Displays the number of left guard subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:UL:LGS?
```
'displays the number of left guard subcarriers.

*RST value	Resolution	SCPI
212	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:RGS 28 .. 364

Displays the number of right guard subcarriers. The value is set automatically according to the selected number of resource blocks per slot.

Example:
```
BB:EUTR:UL:RGS?
```
'displays the number of right guard subcarriers.

*RST value	Resolution	SCPI
212	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PLCi:CIDGroup 0 .. 167

Sets the ID of the physical cell identity group.

Example:
```
BB:EUTR:UL:PLC:CIDG 100
```
'sets the UL physical cell ID group

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PLCi:PLID 0 .. 2

Sets the identity of the physical layer within the selected physical cell identity group, set with the command `BB:EUTR:UL:PLC:CIDG`.

Example:
```
BB:EUTR:UL:PLC:PLID 2
```
'sets the UL physical layer ID

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:CSS:FFNC 0 .. 5000

Sets the initial value of the generator of pseudo-random sequence according to R1-081248, "PRS sequence generation for downlink reference signal".

Example:
```
BB:EUTR:UL:CSS:FFNC 298
```

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:REFSig:GRPHopping OFF | ON

Enables/disables group hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

Example:
```
BB:EUTR:UL:REFS:GRPH ON
```
'enables group hopping

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:REFSig:SEQHopping OFF | ON

Enables/disables sequence hopping for the uplink reference signals demodulation reference signal (DRS) and sounding reference signal (SRS).

Sequence Hopping can only be enabled, if Group Hopping is disabled (`BB:EUTR:UL:REFS:GRPH OFF`).

Example:
```
BB:EUTR:UL:REFS:GRPH OFF
```
'disables group hopping
```
BB:EUTR:UL:REFS:SEQH ON
```
'enables sequence hopping

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:REFSig:PUSCh:DSSHift 0 .. 11

Sets the delta sequence shift for PUSCH needed for the calculation of the group hopping pattern.

Example:
```
BB:EUTR:UL:REFS:PUSC:DSSH 3
```
'sets the delta sequence shift for PUSCH

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:REGSig:PUSCh:SAICell 1 .. 12

Sets the number of available shifts in a cell.

Example:
```
BB:EUTR:UL:REFS:PUSC:SAIC 4
```

*RST value	Resolution	SCPI
12	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUSCh:FHMode NONE | INTer | INTRa

Enables/disables the frequency hopping for PUSCH and sets the frequency hopping mode.

Parameter:

NONE
No uplink frequency hopping is performed.

INTer
An inter subframe hopping is performed.

INTRa
An intra subframe hopping is performed.

Example:
```
BB:EUTR:UL:PUSC:FHM INT
```
'selects inter subframe hopping mode

*RST value	Resolution	SCPI
NONE	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUSCh:NOSM 1 .. 4

Sets the number of sub-bands (M) that are used for frequency hopping.

Example:
```
BB:EUTR:UL:PUSC:NOSM 3
```
'sets the number of sub-bands

*RST value	Resolution	SCPI
4	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUSCh:CSHPattern <hopping pattern>

Sets the cell-specific PUSCH hopping pattern, i.e. determinates the PUSCH position within the sub-bands.

Example:
```
BB:EUTR:UL:PUSC:CSHP 1:2
```
'sets the hopping pattern

*RST value	Resolution	SCPI
0:0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:NORB 2 | 4| 6

Sets the PUCCH region in terms of reserved pairs of resource blocks, located at the edges of the channel bandwidth.

Example:
```
BB:EUTR:UL:PUCC:NORB 4
```
'reserves 4 RBs for PUCCH

*RST value	Resolution	SCPI
4	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:DESHift 1 .. 3

Sets the delta shift parameter.

Example:
```
BB:EUTR:PUCC:DESH 3
```
'sets the delta shift parameter

*RST value	Resolution	SCPI
2	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:DEOFfset 0 .. 2

Sets the PUCCH delta offset parameter. The value range depends on the selected Cyclic Prefix (`BB:EUTR:UL:SUBF:CYCP`).

Example:
```
BB:EUTR:UL:PUCC:DEOF 1
```
'sets the delta offset

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N1CS 0 .. 8

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.

Example:
```
BB:EUTR:UL:PUCC:N1CS 5
```
'5 cyclic shifts will be used for PUCCH format 1/1a!b in a RB used for a combination of the PUCCH formates 1/1a/1b and 2/2a/2b

*RST value	Resolution	SCPI
8	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N2RB 0 .. 5

Sets bandwidth in terms of resource blocks that are reserved for PUCCH formats 2/2a/2b transmission in each subframe.

Example:
```
BB:EUTR:UL:PUCC:N2RB 3
```
'reserves 3 RB for PUCCH formats 2/2a/2b

*RST value	Resolution	SCPI
1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N1NMax?

Queries the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of normal CP.

Example:
```
BB:EUTR:UL:PUCC:N1NM?
```
'queries the range of the possible PUCCH formates 1/1a/1b transmissions.

```
Response: 24
```

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:E1NMax?

Queries the range of the possible PUCCH format 1/1a/1b transmissions from different users in one subframe and in case of extended CP.

Example:

```
BB:EUTR:UL:PUCC:E1NM?
```

'queries the range of the possible PUCCH formates 1/1a/1b transmissions.

```
Response: 10
```

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:PUCCh:N2Max?

Queries the range of possible number of PUCCH format 2/2a/2b transmissions from different users in one subframe.

Example:

```
BB:EUTR:UL:PUCC:N2M?
```

'queries the range of the possible PUCCH formates 2/2a/2b transmissions.

```
Response: 16
```

*RST value	Resolution	SCPI
-	-	Device-specific

SOURce-EUTRa - DL Frame Configuration

[SOURce<[1]|2>:]BB:EUTRa:DL:BUR DUData | DTX

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

Example:
```
BB:EUTR:DL:BUR DUD
```
'the unscheduled resource elements are filled with dummy data.

*RST value	Resolution	SCPI
DUData	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:CONSubframes 1 .. 10

Sets the number of configurable subframes. All ten subframes of a frame 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.

Example:
```
BB:EUTR:DL:CONS 10
```
'all ten subframes of a frame are configurable in downlink.

*RST value	Resolution	SCPI
10	-	Device-specific

[SOURce<[1]|2>:]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.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SFSelection 0 .. 9

Sets the subframes to be configured in the resource allocation table.

Example:
```
BB:EUTR:DL:SFS 0
```
'displays subframe 0 in the allocation list view.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:CYCPrefix NORMal | EXTended

Sets the cyclic prefix for the according subframe.

Example:
```
BB:EUTR:DL:SUBF6:CYCP NORM
```
'a normal prefix is added to subframe 6 in downlink.

*RST value	Resolution	SCPI
NORMal	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALCount 0 .. 112

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.

Example:
```
BB:EUTR:DL:SUBF4:ALC 5
```
'five scheduled allocations are assigned to subframe four.

*RST value	Resolution	SCPI
1(DL/Subframe 0) 0(DL/Subframe 1.. 9)	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>:CODWords 1 | 2

Sets the number of code word for an allocation.

Example:
```
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.

*RST value	Resolution	SCPI
1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:MODulation QPSK | QAM16 | QAM64

Selects the modulation scheme for the allocation.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW2:MOD QPSK
```
'selects QPSK as modulation scheme for the allocation.

*RST value	Resolution	SCPI
QPSK	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:RBCount 0 .. 110

Sets the size of the selected allocation in resource blocks (per slot).

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:RBC 3
```
'the size of allocation five for subframe 4 is set to three resource blocks.

*RST value	Resolution	SCPI
1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:SYMCount 1 .. 14

Sets the size of the selected allocation in OFDM symbols.

For content type PDCH, PDCCH and PDSCH, this value is set automatically.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:SYMC 6
```
'the size of allocation five for subframe 4 is set to six OFDM symbols.

*RST value	Resolution	SCPI
6 (PBCH) 12 (PDSCH)	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:RBOFfset 0 .. 109

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.*

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.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:SYMoffset 0 .. 13

Sets the start OFDM symbol of the selected allocation.

The allowed values depend on the selected Content Type, Number of Symbols and Cycic Prefix.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:SYM 5
```
'OFDM symbol five is the start OFDM symbol for allocation five in subframe four.

*RST value	Resolution	SCPI
2(PDSCH)	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:AOC ON | OFF

Sets whether automatic offset calculation is used or not.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:AOC ON
```
'activates the automatic offset calculation for the selected allocation.

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:PHYSbits 0 .. 105600

Displays the number of physical bits for the selected allocation. The value is set automatically according to the current allocation settings.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:PHYS?
```
'displays the number of physical bits for allocation five in subframe four.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:DATA USER1 | USER2 | USER3 | USER4 | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLISt | ZERO | ONE

Sets the data source for the selected allocation.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:DATA PN9
```
'PN9 is the data source for the selected allocation.

*RST value	Resolution	SCPI
PN9	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:PATTern <bit pattern>

Selects the bit pattern for the PATTern selection. The maximum length is 64 bits.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:PATT #H3F,8
```
'defines the bit pattern.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:DSELect <file name>

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.

Example:
```
BB:EUTR:DL:SUBF2:ALL5:CW:DATA DLISt
```
'selects the Data Lists data source.
```
MMEM:CDIR '\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 `\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:POWer -80.00 dB .. 10.00 dB

Sets the power for the selected allocation.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:POW 10.00
```
'sets the power for the selected allocation to 10 dB.

*RST value	Resolution	SCPI
0 dB	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0...111>[:CW<[1]|2>]:CONType PDSCh | PBCH | PDCCh | RSVD

Selects the type for the selected allocation.
PBCH can be configured in subframe 0 only.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:CONT PDSC
```
'selects PDSCH as type for the selected allocation.

*RST value	Resolution	SCPI
PDSCh	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:STATe ON | OFF

Sets the allocation state to active or inactive.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:STAT OFF
```
'deactivates the selected allocation.

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CONFlict?

Indicates a conflict between two allocations.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CONF?
```
'displays for the selected allocation whether there is a conflict with another allocation.

*RST value	Resolution	SCPI
OFF	-	Device-specific

SOURce-EUTRa - DL Enhanced Settings

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CCODing:CBCRc ON | OFF

Enables/disables attachment of CRC to the code block.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:CBCR OFF
```
'disables attachment of CRC to the code block

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CCODing:CRCVersion R99V | R8V

Sets the standard according to that the CRC will be calculated.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:CRCV R99V
```
'the CRC will be generated according to Release 99.

*RST value	Resolution	SCPI
R8V	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[SUBF<0..9>:]ALLoc<0..111>[:CW<[1]|2>]:CCODing:ISBSize 800 .. 30400

Sets the size of the IR soft buffer.

Example:
```
BB:EUTR:DL:SUBF9:ALL5:CW2:CCOD:ISBS 1600
```
'sete the IR soft buffer size

*RST value	Resolution	SCPI
800	800	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CCODing:RMVersion R80V | R11V

Sets the standard according to that the rate matching will be performed.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:RMV R11V
```
'the rate matching will be performed according to 3GPP 36.211, Version 1.1.0

*RST value	Resolution	SCPI
R80V	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CCODing:RVIndex 0 … 3

Sets the redundancy version index.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:RVI 2
```
'sets the redundancy version index to 2

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CCODing:STATE ON | OFF

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

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:STAT OFF
```
'disables channel coding for allocation 5 and code word 2

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CCODing:TBCRc ON | OFF

Enables/disables attachment of CRC to the transport block.

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW2:CCOD:TBCR OFF
```
'disables attachment of CRC to the transport block

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CCODing:TBSize 0 … 100000

Sets the size of the transport block.

Note:
The parameter depends on the content type and the global MIMO configuration.

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

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:CCODing:TYPE TC |CONV | NONE

Queries the used channel coding scheme and channel coding rate.

Note:
The parameter depends on the allocation's content type.

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

*RST value	Resolution	SCPI
NONE	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:PRECoding:CBINdex 0 … 15

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.

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:PREC:CBIN 2`
'sets the codebook index to 2

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:PRECoding:CDD NOCDd | SMDelay | LADelay

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.

Parameter:

NOCDd
Zero CDD

SMDelay
Small CDD

LADelay
Large CDD

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:PREC:CDD SMD`
'selects small CDD

*RST value	Resolution	SCPI
NOCD	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:PRECoding:NOLayers 0 … 4

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.

Example: `BB:EUTR:DL:SUBF4:ALL5:CW:PREC:NOL 2`
'sets the number of layers to 2

*RST value	Resolution	SCPI
1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:SUBF<0...9>:ALL<0…111>[:CW<[1]|2>]:PRECoding:SCHeme NONE | SPM | TXD

Selects the precoding scheme.
This parameter is available for the first code word only.

Note:
The available selections depend on the selected content type.

Parameter:

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

Example:
```
BB:EUTR:DL:SUBF4:ALL5:CW:PREC:SCH SPM
```
'sets the precoding scheme to spatial multiplexing

*RST value	Resolution	SCPI
NONE	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[SUBF<0..9>:]ALLoc<0..111>[:CW<[1]|2>]:SCRambling:STATe OFF | ON

Enables/disables the bit-level scrambling.

Example:
```
BB:EUTR:DL:SUBF0:ALL5:CW:SCR:STAT ON
```
'enables scrambling

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[SUBF<0..9>:]ALLoc<0..111>[:CW<[1]|2>]:SCRambling:UEID 0 .. 65535

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.

Example:
```
BB:EUTR:DL:SUBF0:ALL5:CW:UEID 120
```
'sets the UE ID

*RST value	Resolution	SCPI
0	-	Device-specific

SOURce-EUTRa - PCFICH, PHICH and PDCCH Configuration

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>]:ENCC:STATe OFF | ON

Enables/disables the PDCCH allocation.

Example:
```
BB:EUTR:DL:ENCC:STAT ON
```
'enables PDCCH

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>]:ENCC:PRECoding:SCHeme NONE | TXD

Selects the precoding scheme for PDCCH.

Parameter:

NONE
Disables precoding.

TXD
Precoding for transmit diversity will be performed according to 3GPP TS 36.211, Version 8.1.0 and the selected parameters

Example:
```
BB:EUTR:DL:ENCC:PREC:SCH TXD
```
'selects the precoding scheme

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>]:ENCC:PRECoding:NOLayers?

Queries the number of layers for PDCCH.

This value is fixed to 1 for PDCCH.

Example:
```
BB:EUTR:DL:ENCC:PREC:NOL?
```
'queries the number of layers
```
Response: 1
```

*RST value	Resolution	SCPI
1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>]:ENCC:SCRambling:STATe OFF | ON

Enables/disables the scrambling.

Example:
```
BB:EUTR:DL:ENCC:SCR:STAT ON
```
'enables scrambling

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>]:ENCC:PCFich:CREGion 1 .. 3

Sets the number of OFDM Symbols to be used for PDCCH.

Example:
```
BB:EUTR:PHIC:DUR NORM
```
'selects PHICH normal duration
```
BB:EUTR:DL:ENCC:PCF:CREG 1
```
'sets the control region

*RST value	Resolution	SCPI
2	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>]:ENCC:PHICh:NOGRoups 0 .. 15

Sets the number of available PHICH groups.

Example:
```
BB:EUTR:DL:ENCC:PHIC:NOGR 4
```
'sets the number of PHICH groups

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>]:ENCC:PHICh:ANPattern<0..15> 00 .. FF

Sets the ACK/NACK pattern for the corresponding PHICH group.

Example:
```
BB:EUTR:DL:ENCC:PHIC:ANP2 #H5,3
```
'sets the ACK/NACK pattern for PHICH Group number 2

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>]:ENCC:PDCCh:DATA PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLIST | ZERO | ONE

Selects the data source for PDCCH.

Since the PDCCH formats are still not completely defined, the R&S Signal Generator provides the possibility to select an arbitrary data source or user defined lists for the PDCCH content.

Note:
The user defined lists can be used to simulate different DCI formats and multiplexing of several PDCCHs. The proper content of these lists is under the responsibility of the user.

Example:
```
BB:EUTR:DL:ENCC:PDCC:DATA PN9
```
'PN9 is selected as data source

*RST value	Resolution	SCPI
PN9	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>:]ENCC:PDCCh:PATTern <bit pattern>

Selects the bit pattern for the PATData selection.

Example:
```
BB:EUTR:DL:ENCC:PDCC:PATT #H3F,8
```
'defines the bit pattern.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL[:SUBF<0..9>:]ENCC:PDCCh:DSELect <data list>

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.

Example:
```
BB:EUTR:DL:ENCC:PDCC:DATA DLIS
```
'selects the Data Lists data source.

```
MMEM:CDIR 'Lists\'
```
'selects the directory for the data lists.

```
BB:EUTR:DL:ENCC:PDCC:DSEL 'eutra_pdcch'
```
'selects file '`eutra_pdcch`' as the data source. This file must be in the directory `\Lists`

*RST value	Resolution	SCPI
-	-	Device-specific

SOURce-EUTRa - UL Frame Configuration

[SOURce<[1]|2>:]BB:EUTRa:UL:CONSubframes 1 .. 10

Sets the number of configurable subframes. All ten subframes of a frame are filled periodically with the configured subframes with the exception of the Sounding Reference Signal which are set individually for each UE in the **User Equipment** menu.

Example:
```
BB:EUTR:UL:CONS 10
```
'all ten subframes of a frame are configurable.

*RST value	Resolution	SCPI
1	-	Device-specific

[SOURce<[1]|2>:]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.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SFSelection 0 .. 9

Sets the subframes to be displayed in the resource allocation table.

Example:
```
BB:EUTR:UL:SFS 0
```
'displays subframe 0 in the allocation list view.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:CYCPrefix NORMal | EXTended

Sets the cyclic prefix for the according subframe.

Example:
```
BB:EUTR:UL:SUBF6:CYCP NORM
```
'a normal prefix is added to subframe 6 in uplink.

*RST value	Resolution	SCPI
NORMal	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALL<0...3>:MODulation QPSK | QAM16 | QAM64

Selects the modulation scheme for the allocation.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:MOD QPSK
```
'selects QPSK as modulation scheme for the allocation.

*RST value	Resolution	SCPI
QPSK	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[:SUBF<0..9>:]ALLoc<0..3>:FORMat F1 | F1A | F1B | F2 | F2A | F2B

Sets the PUCCH Format (1/1a/1b/2/2a/2b).

Example:
```
BB:EUTR:UL:SUBF4:ALL2:FORM F2A
```
'sets the PUCCH format

*RST value	Resolution	SCPI
F1	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALL<0...3>:RBCount 1 .. 110

Sets the size of the selected allocation in resource blocks (per slot).

Example:
```
BB:EUTR:UL:SUBF4:ALL2:RBC 3
```
'the size of allocation two for subframe 4 is set to three resource blocks.

*RST value	Resolution	SCPI
11 (for UE1 in subframe 0)	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[:SUBF<0..9>:]ALLoc<0..3>:VRBoffset 0 .. 109

Sets the virtual resource block offset of the selected subframe.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:VRB 6
```
'sets the VRB Offset

*RST value	Resolution	SCPI
2	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:SLOT<0|[1]>:ALL<0...3>:RBOFfset 0 .. 109

Sets the start resource block for slot 0 and 1 of the selected allocation.

Example:
```
BB:EUTR:UL:SUBF4:SLOT0:ALL2:RBOF 6
```
'resource block six is the start resource block for allocation two in subframe four, slot 0.

```
BB:EUTR:UL:SUBF4:SLOT:ALL2:RBOF 5
```
'resource block five is the start resource block for allocation two in subframe four, slot 1.

*RST value	Resolution	SCPI
2 (for UE1 in subframe 0)	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALL<0...3>:PHYSbits 0 .. 105600

Displays the number of physical bits for the selected allocation. The value is set automatically according to the current allocation settings.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PHYS?
```
'displays the number of physical bits for allocation two in subframe four.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALL<0...3>:POWer -80.00 dB .. 10.00 dB

Sets the power for the selected allocation.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:POW 10.00
```
'sets the power for the selected allocation to 10 dB.

*RST value	Resolution	SCPI
0 dB	0.01	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALL<0...3>:CONType PUSCh | PUCCh

Selects the content type for the selected allocation.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:CONT PUSC
```
'selects PUSCH as type for the selected allocation.

*RST value	Resolution	SCPI
PUSCh	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALL<0…3>:STATe ON | OFF

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.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:STAT OFF
```
'deactivates the selected allocation and the corresponding PUSCH/PUCCH and demodulation reference signal. However the sounding reference signal of this allocation remains active.

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALL<0…3>:CONFlict?

Indicates a conflict between two allocations.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:CONF?
```
'displays for the selected allocation whether there is a conflict with another allocation.

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:SUBF<0...9>:ALL<0...3>:UEType UE1| UE2 | UE3 | UE4

Sets the UE type for the selected allocation.

Example:
```
BB:EUTR:UL:SUBF4:ALL1:UET UE2
```
'selects UE2 for the selected allocation.

*RST value	Resolution	SCPI
UE1 (for allocation 0) UE2 (for allocation 1) UE3 (for allocation 2) UE4 (for allocation 3)	-	Device-specific

SOURce-EUTRa - UL Enhanced Settings

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:NDMRs 0 .. 11

Sets the demodulation reference signal (DRS) index. This index applies when multiple shifts within a cell are used and is used by the calculation of the DRS sequence.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:NDMR 3
```
'sets the n_DRMS

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:FHOP:TYPE NONE | TP1 | TP2

Enables/disabled frequency hopping for PUSCH and sets one of the two possible PUSCH frequency hopping types.

Parameter:

NONE
Disables frequency hopping.

TP1
Applies PUSCH frequency hopping type 1, as defined in 3GPP TS36.213, Version 8.2.0.

TP2
Applies PUSCH frequency hopping type 2, as defined in 3GPP TS36.213, Version 8.2.0.
For PUSCH frequency hopping type 2, the Uplink Frequency Hopping Mode can be configured, i.e. whether intra-subframe or inter-subframe frequency hopping is performed (`BB:EUTR:UL:PUSC:FHM`).

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE TP2
```
'selects frequency hopping type 2

*RST value	Resolution	SCPI
NONE	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3:PUSCh:FHOP:MODE

(available for Frequency Hopping Type 1 and Channel Bandwidth ≥ 50 RBs only)

Sets the PUSCH frequency hopping mode according to TS 36.211, version 8.2.0.

Example:

```
BB:EUTR:UL:NORB 50
```
'sets the UL channel bandwidth

```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE TP1
```
'selects frequency hopping type 1

```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:MODE 1
```
'sets the frequency hopping mode

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:FHOP:MIRRoring OFF | ON

(available for Frequency Hopping Type 2 only)

Enables/disables mirroring according to TS 36.211, version 8.2.0

Example:

```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:TYPE TP2
```
'selects frequency hopping type 2

```
BB:EUTR:UL:SUBF4:ALL2:PUSC:FHOP:MIRR ON
```
'enables mirroring

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:HARQ:ACKType NONE | BIT1 | BIT2

Enables/disables sending of HARQ-ACK control information and sets its duration.

Parameter:

NONE
HARQ-ACK control information is not send.

BIT1
A 1-bit HARQ-ACK control information is used.

BIT2
A 2-bits HARQ-ACK control information is used.

Example:

```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT BIT2
```
'selects 2-bit HARQ-ACK control information

*RST value	Resolution	SCPI
NONE	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:HARQ:ANPattern <bit pattern>

Sets the ACK/NACK pattern for the PUSCH.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ACKT BIT2
```
'selects 2-bit HARQ-ACK control information
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ANP 10
```
'sets the ACK/NACK Pattern

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:HARQ:ANSubcarriers 0 .. 10

Sets the number of subcarriers per SC-FDMA symbol used for ACK/NACK information.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:HARQ:ANS 5
```
'5 subcarriers per symbol will be used for ACK/NACK information.

*RST value	Resolution	SCPI
5	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:CQCI:CBITs 0 .. (Number of Physical Bits>

Sets the number of coded CQI bits.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:CQCI:CBIT 21
```
'sets the number of coded CQI bits

*RST value	Resolution	SCPI
20	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:CQCI:BITS 0 .. 32

Sets the number of CQI bits before channel coding.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:CQCI:BITS 30
```
'sets the number of CQI bits

*RST value	Resolution	SCPI
4	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:CQCI:PATTern <bit pattern>

Sets the CQI pattern for the PUSCH.

The length of the pattern is determinated by the number of CQI bits (`BB:EUTR:UL:SUBF:ALL:PUSC:CQCI:BITS`).

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:CQCI:BITS 6
```
'sets the number of CQI bits
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:CQCI:PATT '100100'
```
'sets the CQI pattern

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:ULSCh:BITS?

Queries the number of physical bits used for UL-SCH transmission.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:ULSC:BITS?
```
'queries the number of physical bits for UL-SCH
```
Response: 2000
```

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:CCODing:TBSize

Sets the size of the transport block.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:TBS 1500
```
'sets the size of the transport block

*RST value	Resolution	SCPI
1500	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUSCh:CCODing:RVINdex 0 .. 3

Sets the redundancy version index.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUSC:CCOD:RVIN 2
```
'sets the redundancy version index

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUCCh:NPAR 0 .. 65535

Sets the resource index for PUCCH format 1/1a/1b respectively 2/2a/2b.

Example:
```
BB:EUTR:UL:SUBF1:ALL2:PUCC:NPAR 10
```
'sets the n_PUCCH parameter

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUCCh:HARQ:ANPattern <bit pattern>

Sets the ACK/NACK pattern for the PUCCH.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUCC:HARQ:ANP 10
```
'sets the ACK/NACK Pattern

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUCCh:CQCI:CBITs 0 .. (Number of Physical Bits>

Sets the number of coded CQI bits.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUCC:CQCI:CBIT 21
```
'sets the number of coded CQI bits

*RST value	Resolution	SCPI
20	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUCCh:CQCI:BITS 0 .. 32

Sets the number of CQI bits before channel coding.

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUCC:CQCI:BITS 30
```
'sets the number of CQI bits

*RST value	Resolution	SCPI
4	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL[SUBF<0..9>:]ALLoc<0..3>:PUCCh:CQCI:PATTern <bit pattern>

Sets the CQI pattern for the PUCCH.

The length of the pattern is determinated by the number of CQI bits (`BB:EUTR:UL:SUBF:ALL:PUCC:CQCI:BITS`).

Example:
```
BB:EUTR:UL:SUBF4:ALL2:PUCC:CQCI:BITS 6
```
'sets the number of CQI bits

```
BB:EUTR:UL:SUBF4:ALL2:PUCC:CQCI:PATT '100100'
```
'sets the CQI pattern

*RST value	Resolution	SCPI
0	-	Device-specific

SOURce-EUTRa - Configure User

[SOURce<[1]|2>:]BB:EUTRa:DL:USER<[1]|2|3|4>:UEID 0 .. 65535

Sets the user equipment ID.

Example:
```
BB:EUTR:DL:USER2:UEID 3308
```
'sets the UE ID.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:USER<[1]|2|3|4>:DATA PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLIST | ZERO | ONE

Selects the data source for the selected user configuration.

Example:
```
BB:EUTR:DL:USER2:DATA PN9
```
'PN9 is selected as data source for the user configuration.

*RST value	Resolution	SCPI
PN9	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:USER<[1]|2|3|4>:PATTern <bit pattern>

Selects the bit pattern for the PATData selection. The maximum length is 64 bits.

Example:
```
BB:EUTR:DL:USER2:PATT #H3F,8
```
'defines the bit pattern.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:USER<[1]|2|3|4>:DSELect <data list>

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.

Example:
```
BB:EUTR:DL:USER2:DATA DLIS
```
'selects the Data Lists data source.

```
MMEM:CDIR '\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 `\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	SCPI
-	-	Device-specific

SOURce-EUTRa - Dummy Data Configuration

[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:MODulation QPSK | QAM16 | QAM64

Selects modulation for dummy data.

Example:
```
BB:EUTR:DL:DUMD:MOD QAM16
```
'QAM16 is selected as modulation for dummy data.

*RST value	Resolution	SCPI
QPSK	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:DATA PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLISt | ZERO | ONE

Selects the data source for dummy data.

Example:
```
BB:EUTR:DL:DUMD:DATA PN9
```
'PN9 is selected as data source for dummy data.

*RST value	Resolution	SCPI
PN9	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:PATTern <data pattern>

Selects the bit pattern for the PATTern selection. The maximum length is 64 bits.

Example:
```
BB:EUTR:DL:DUMD:PATTern #H1E,8
```
'defines the bit pattern to #H1E,8.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:DSELect <data list>

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.

Example:
```
BB:EUTR:DL:DUMD:DATA DLIS
```
'selects the Data Lists data source.

```
MMEM:CDIR '\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 `\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:DL:DUMD:POWer -80.00 dB...10.00 dB

Sets the power for dummy data.

Example:
```
BB:EUTR:DL:DUMD:POWer 10.00
```
'sets the power for dummy data to 10 dB.

*RST value	Resolution	SCPI
0 dB	0.01	Device-specific

SOURce-EUTRa – User Equipment

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:ID 0 .. 65535

Sets the radio network temporary identifier (RNTI) of the UE.

Example:
```
BB:EUTR:UL:UE3:ID 303
```
'sets the UE ID

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:STATe ON | OFF

Selects the user equipment state.

Example:
```
BB:EUTR:UL:UE2:STAT ON
```
'activates UE2.

*RST value	Resolution	SCPI
ON(UE1) OFF(UE2..UE4)	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:MODe STD | PRACh

Selects whether the user equipment is in standard or in PRACH mode.

Note:
PRACH mode will be supported in later version.

Parameter:

STD
Sets the operational mode of the user equipment to standard.

PRACh
Sets the operational mode of the user equipment to PRACH mode.

Example:
```
BB:EUTR:UL:UE:MODe STD
```
'selects the standard mode for UE1.

*RST value	Resolution	SCPI
STD	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:POWer -80.00 .. 10.00

Sets the power level of the selected UE.

Example:
```
BB:EUTR:UL:UE2:POW -5.0
```
'sets the power of UE2

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:DATA PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATT | DLISt | ZERO | ONE

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.

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.

*RST value	Resolution	SCPI
PN9	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:PATTern <data pattern>

Selects the bit pattern for the PATTern selection. The maximum length is 64 bits.

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.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:DSELect <data list>

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.

Example:
```
BB:EUTR:UL:UE:PUSC:DATA DLIS
```
'selects the Data Lists data source.
```
MMEM:CDIR '\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 `\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:SCRambling:STATe OFF | ON

Enables/disables scrambling for all PUSCH allocations of the corresponding UE.

Example:
```
BB:EUTR:UL:UE2:PUSC:SCR:STAT ON
```
'enables scrambling for UE2

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:STATe OFF | ON

Enables/disables channel coding and multiplexing of data and control information for all PUSCH allocations of the corresponding UE.

Example:
```
BB:EUTR:UL:UE2:PUSC:CCOD:STAT ON
```
'enables channel coding for UE2

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:TBCRc OFF | ON

Enables/disables calculation of the transport block CRC.

Example:
```
BB:EUTR:UL:UE2:PUSC:CCOD:TBCR ON
```
'enables transport block CRC for UE2

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:CBCRc OFF | ON

Enables/disables attachment of CRC to the code block.

Example:
```
BB:EUTR:UL:UE2:PUSC:CCOD:CBCR ON
```
'enables code block CRC for UE2

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:CRCVersion R99V | R8V

Sets the standard, Release 99 or Release 8, according to that the CRC will be calculated.

Example:
```
BB:EUTR:UL:UE2:PUSC:CCOD:CRCV R8V
```
'the CRC for UE2 will be calculated according to Rellease 8

*RST value	Resolution	SCPI
R8V	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:PUSCh:CCODing:RMVersion R82V | R80V | R11V

Sets the standard, 3GPP TS 26.212 version 1.1.0, version 8.0.0 or version 8.2.0, according to that the rate matching will be performed.

Example:
```
BB:EUTR:UL:UE2:PUSC:CCOD:RMV R80V
```
'the rate matcher version for UE2 will be calculated according to 3GPP TS26.212, version 8.0.0

*RST value	Resolution	SCPI
R82V	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:DRS:POWoffset -80.00 .. 10.00

Sets the power offset of the Demodulation Reference Signal (DRS) relative to the power level of the PUSCH/PUCCH allocation of the corresponding subframe.

Example:
```
BB:EUTR:UL:UE2:REFS:DRS:POW -2
```
'sets the demodulation reference symbol power offser to -2dB.

*RST value	Resolution	SCPI
0 dB	0.01 dB	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:STATe OFF | ON

Enables/disables sending of SRS for the corresponding UE.

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:STAT ON
```
'enables the SRS for UE2

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:ANSTx OFF | ON

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

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:ANST ON
```
'enables the A/N ans SRS simultaneous transmission for UE2

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:POWoffset -80.00 .. 10.00

Sets the power offset of the Sounding Reference Signal (SRS) relative to the power of the corresponding UE.

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:POW -2
```
'sets the sounding reference symbol power offset to -2 dB.

*RST value	Resolution	SCPI
0 dB	0.01 dB	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:CYCShift 0 .. 11

Sets the cyclic shift used for the generation of the sounding reference signal CAZAC sequence.

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:CYCS 5
```
'sets the SRS cyclic shift for UE2

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:FSTSubframe 0 .. (lasr SRS Subframe)

Sets the first subframe which is used for transmission of the sounding reference signal (SRS).

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:FSTS 5
```
'sets the first SRS subframe

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:PERiodicity MS2 | MS5 | MS10 | MS20 | MS40 | MS80 | MS160 | MS320

Sets the SRS periodicity over several frames.

The SRS periodicity is set in terms of interval of milliseconds after which the SRS is transmitted.

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:PER MS2
```
'sets the SRS perodicity to 2 ms

*RST value	Resolution	SCPI
MS2	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:LSTSubframe (First SRS Subframe) .. (10*Number of Subframes - 1)

Sets the last subframe which is used for transmission of the sounding reference signal (SRS).

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:LSTS 10
```
'sets the last SRS subframe

*RST value	Resolution	SCPI
9	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:SPOS FIRSt | LAST

Sets the sounding reference signal (SRS) location in a subframe, i.e. selects whether the first or the last SC-FDMA symbol of a subframe is used for SRS transmission.

Note:
During this symbol, the UE is transmitting no PUSCH.
During PUCCH transmission, the UE is transmitting no SRS.

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:SPOS FIRS
```
'the SRS will be transmitted during the first symbol in a subframe

*RST value	Resolution	SCPI
LAST	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:NORB 0 .. 109

Sets the number of resource blocks that are used for the transmission of the sounding reference signal (SRS).

The maximum bandwidth the SRS can span is the selected Channel Bandwidth.

Example:
```
BB:EUTR:UL:NORB 7
```
'sets the number of resource blocks to 7.
```
BB:EUTR:UL:UE2:REFS:SRS:NORB 7
```
'the SRS uses 7 RB

*RST value	Resolution	SCPI
2	-	Device-specific

[SOURce<[1]|2>:]BB:EUTRa:UL:UE<[1]|2|3|4>:REFSig:SRS:HOPSequence <hopping pattern>

Sets the first subcarrier that is used for the transmission of the Sounding Reference Signal (SRS) for the corresponding UE.

One value out of the pattern is used for one subframe with SRS allocation. Ten entries can be configured. If less than 10 entries are available the sequence is read out cyclically.

Example:
```
BB:EUTR:UL:UE2:REFS:SRS:HOPS '24:144'
```
'sets the SRS hopping pattern

*RST value	Resolution	SCPI
36:36	-	Device-specific

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