

# R&S®FSQ-K100 / -K102 / -K104 R&S®FSV-K100 / -K102 / -K104 EUTRA / LTE Downlink Software Manual



1308.9029.42 – 07

The Software Manual describes the following software applications:

- R&S® FSQ-K100 (1308.9006.02)
- R&S® FSQ-K102 (1309.9000.02)
- R&S® FSQ-K104 (1309.9422.02)
- R&S® FSV-K100 (1310.9051.02)
- R&S® FSV-K102 (1310.9151.02)
- R&S® FSV-K104 (1309.9774.02)

© 2010 Rohde & Schwarz GmbH & Co. KG

Muehldorfstr. 15, 81671 Munich, Germany

Phone: +49 89 4129-0

Fax: +49 89 4129-12 164

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

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

81671 Munich, Germany

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

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

Trade names are trademarks of the owners.

The following abbreviations are used throughout this manual:

The software applications R&S®FSQ-K100, R&S®FSQ-K102 and R&S®FSQ-K104 are abbreviated as R&S FSQ-K100/-K102/-K104.

The software applications R&S®FSV-K100, R&S®FSV-K102 and R&S®FSV-K104 are abbreviated as R&S FSV-K100/-K102/-K104.

The signal analyzer R&S®FSQ is abbreviated as R&S FSQ.

The signal analyzer R&S®FSV is abbreviated as R&S FSV.

The R&S®AFQ, AMU, SMATE, SMJ and SMU vector signal generators are referred to as R&S Signal Generator.

# Basic Safety Instructions

## Always read through and comply with the following safety instructions!

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

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

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

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

## Symbols and safety labels

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

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

### Tags and their meaning

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

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

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

### Operating states and operating positions

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

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

### Electrical safety

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

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

## Basic Safety Instructions

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

### Operation

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

### Repair and service

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

### Batteries and rechargeable batteries/cells

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

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

### Transport

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

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

### **Waste disposal**

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

## Informaciones elementales de seguridad

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

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

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



## Informaciones elementales de seguridad

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

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

### Símbolos y definiciones de seguridad

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

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

## Palabras de señal y su significado

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



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



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



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



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

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

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

## Estados operativos y posiciones de funcionamiento

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

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

## Seguridad eléctrica

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

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

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

## Funcionamiento

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

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

### **Reparación y mantenimiento**

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

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

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

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

## Informaciones elementales de seguridad

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

### Transporte

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

### Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

# Customer Support

## Technical support – where and when you need it

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

## Up-to-date information and upgrades

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

### USA & Canada

Monday to Friday (except US public holidays)  
8:00 AM – 8:00 PM Eastern Standard Time (EST)

Tel. from USA 888-test-rsa (888-837-8772) (opt 2)  
From outside USA +1 410 910 7800 (opt 2)  
Fax +1 410 910 7801

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

### East Asia

Monday to Friday (except Singaporean public holidays)  
8:30 AM – 6:00 PM Singapore Time (SGT)

Tel. +65 6 513 0488  
Fax +65 6 846 1090

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

### Rest of the World

Monday to Friday (except German public holidays)  
08:00 – 17:00 Central European Time (CET)

Tel. +49 89 4129 13774  
Fax +49 (0) 89 41 29 637 78

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



# Qualitätszertifikat

## Certificate of quality

## Certificat de qualité

Certified Quality System  
**ISO 9001**

Certified Environmental System  
**ISO 14001**

### Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

### Der Umwelt verpflichtet

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

### Dear Customer,

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

### Environmental commitment

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

### Cher client,

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.

### Engagement écologique

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

**75** Years of  
Driving  
Innovation



# Table of Contents

<b>1</b>	<b>Introduction</b>	<b>9</b>
<b>1.1</b>	<b>EUTRA/LTE</b>	<b>9</b>
1.1.1	Requirements for UMTS Long-Term Evolution	10
1.1.2	Long-Term Evolution Downlink Transmission Scheme	11
1.1.2.1	OFDMA	11
1.1.2.2	OFDMA Parameterization	13
1.1.2.3	Downlink Data Transmission	14
1.1.2.4	Downlink Reference Signal Structure and Cell Search	15
1.1.2.5	Downlink Physical Layer Procedures	16
<b>1.2</b>	<b>EUTRA/LTE Test &amp; Measurement Assumptions made by Rohde &amp; Schwarz</b>	<b>17</b>
1.2.1	OFDMA Parameterization	17
<b>2</b>	<b>Installation and Test Setup</b>	<b>18</b>
<b>2.1</b>	<b>Software Installation</b>	<b>18</b>
<b>2.2</b>	<b>Connection to the Instrument</b>	<b>18</b>
2.2.1	R&S FSQ / FSV Requirements	18
2.2.2	Configuration Settings	18
2.2.2.1	How to Obtain the GPIB or LAN Address in the R&S FSQ Instrument	18
2.2.2.2	How to Obtain the GPIB or LAN Address in the R&S FSV Instrument	21
<b>2.3</b>	<b>MIMO Measurement Guide</b>	<b>23</b>
2.3.1	Hardware Setup	23
2.3.2	Performing MIMO Measurements	25
2.3.2.1	Delayed trigger signal setup	25
2.3.2.2	Frame trigger signal setup using identical LTE frames	25
2.3.3	Performing Time Alignment Measurements	27
<b>2.4</b>	<b>TDD Transmit ON/OFF Power Measurement Guide</b>	<b>28</b>
2.4.1	Hardware Setup	29
2.4.2	Performing Transmitter ON/OFF Power measurements	29
<b>3</b>	<b>Quick Start Guide</b>	<b>31</b>
<b>3.1</b>	<b>Setting up the Measurement</b>	<b>31</b>
3.1.1	General Setup (Frequency, Level, etc.)	31
3.1.2	Demodulation Setup (Tracking Modes, etc.)	32

3.2	Performing the Main Measurement.....	32
<b>4</b>	<b>Operating the Software .....</b>	<b>33</b>
4.1	Starting the Software.....	33
4.2	Loading a Frame Setup .....	34
4.3	Loading a Frame Setup .....	34
4.4	Preparing for Instrument Connection.....	34
4.5	Performing Measurements .....	35
4.5.1	Running the Measurement .....	35
4.5.2	Events during a Measurement.....	35
4.5.3	Measurement Header Table .....	35
4.6	Evaluating the Results – Operating the Graph .....	36
4.6.1	Context Menu (Marker, Zoom, Pan, Copy Image to Clipboard, Show Data Points) ...	36
4.6.1.1	Marker.....	37
4.6.1.2	Zoom.....	37
4.6.1.3	Pan.....	38
4.6.1.4	Copy Image to Clipboard .....	38
4.6.1.5	Show Data Points .....	38
4.6.1.6	Default Zoom On Update.....	38
4.6.2	Arrows Indicating Data out of Display Range.....	38
<b>5</b>	<b>Measurements.....</b>	<b>39</b>
5.1	Numerical Results.....	39
5.1.1	EVM Measurements .....	39
5.1.2	I/Q Constellation Measurements .....	39
5.1.3	MIMO Measurements .....	40
5.1.4	Power Measurement.....	40
5.2	Graphical Results .....	41
5.2.1	Power vs. Time Measurements .....	41
5.2.2	EVM Measurements .....	41
5.2.3	Spectrum Measurements.....	42
5.2.4	Constellation Measurements .....	43
5.2.5	Statistic / Misc. Measurements .....	43
5.3	I/Q Measurements .....	44
5.3.1	Capture Buffer.....	44

5.3.2	ON/OFF Power .....	45
5.3.3	Power vs. Symbol X Carrier .....	46
5.3.4	EVM vs. Carrier .....	46
5.3.5	EVM vs. Symbol .....	47
5.3.6	EVM vs. Symbol X Carrier .....	47
5.3.7	Frequency Error vs. Symbol .....	48
5.3.8	EVM vs. Subframe .....	48
5.3.9	Power Spectrum .....	49
5.3.10	Power vs. RB PDSCH .....	49
5.3.11	Power vs. RB RS .....	50
5.3.12	Channel Flatness .....	50
5.3.13	Channel Group Delay .....	51
5.3.14	Channel Flatness Difference .....	51
5.3.15	Constellation Diagram .....	52
5.3.16	Constellation Selection .....	52
5.3.17	CCDF (Complementary Cumulative Distribution Function) .....	53
5.3.18	Signal Flow .....	54
5.3.19	Allocation Summary .....	54
5.3.20	Bit Stream .....	55
5.3.21	Allocation ID vs. Symbol X Carrier .....	55
<b>5.4</b>	<b>Frequency Sweep Measurements .....</b>	<b>56</b>
5.4.1	Spectrum Emission Mask .....	57
5.4.2	Spectrum ACLR .....	58
<b>5.5</b>	<b>Result Summary .....</b>	<b>59</b>
<b>6</b>	<b>Settings .....</b>	<b>60</b>
<b>6.1</b>	<b>General Settings .....</b>	<b>60</b>
6.1.1.1	Signal Characteristics .....	61
6.1.1.2	Input .....	62
6.1.1.3	Level Settings .....	62
6.1.1.4	Trigger Settings .....	64
6.1.1.5	Data Capture Settings .....	64
6.1.1.6	Result Settings .....	65
6.1.1.7	SEM and ACLR Settings .....	67

6.1.1.8	ON/OFF Power Measurement Settings .....	68
6.1.1.9	MIMO Analyzer Configuration .....	68
6.1.2	Advanced Settings .....	70
6.1.2.1	IQ Settings .....	70
6.1.2.2	Baseband Settings .....	71
6.1.2.3	Input Settings Advanced .....	72
6.1.2.4	Digital IQ Settings .....	72
6.1.2.5	Global Settings .....	72
<b>6.2</b>	<b>Demodulation Settings .....</b>	<b>73</b>
6.2.1	Downlink Demodulation Settings .....	73
6.2.1.1	Data Analysis .....	74
6.2.1.2	Tracking Settings .....	76
6.2.1.3	MIMO Settings .....	77
6.2.2	Downlink Signal Characteristics .....	77
6.2.2.1	Physical Settings .....	78
6.2.2.2	Physical Layer Cell Identity .....	79
6.2.2.3	MIMO Configuration .....	79
6.2.2.4	Subframe Configuration .....	80
6.2.2.5	Allocation Settings Table .....	81
6.2.3	Downlink Advanced Signal Characteristics .....	83
6.2.3.1	Synchronization Signal Settings .....	83
6.2.3.2	Reference Signal Structure .....	84
6.2.3.3	Misc Settings .....	84
<b>6.3</b>	<b>Display Settings .....</b>	<b>88</b>
<b>6.4</b>	<b>File Management .....</b>	<b>89</b>
<b>6.5</b>	<b>Software Setup .....</b>	<b>90</b>
6.5.1	Configure Analyzer Connection .....	90
6.5.2	Data Source (Instrument or File) .....	91
6.5.3	Show Logging .....	91
6.5.4	System Info .....	92
<b>6.6</b>	<b>Marker .....</b>	<b>93</b>
<b>6.7</b>	<b>Open in separate window .....</b>	<b>93</b>
<b>6.8</b>	<b>Preset .....</b>	<b>93</b>

<b>7</b>	<b>Remote Control</b> .....	<b>94</b>
<b>7.1</b>	<b>Description of commands</b> .....	<b>94</b>
7.1.1	Notation.....	94
7.1.1.1	Table of Commands.....	94
<b>7.2</b>	<b>CALCulate Subsystem</b> .....	<b>97</b>
<b>7.3</b>	<b>CONFigure Subsystem</b> .....	<b>101</b>
<b>7.4</b>	<b>DISPlay Subsystem</b> .....	<b>123</b>
<b>7.5</b>	<b>FETCh Subsystem</b> .....	<b>124</b>
<b>7.6</b>	<b>FORMat Subsystem</b> .....	<b>133</b>
<b>7.7</b>	<b>INITiate Subsystem</b> .....	<b>134</b>
<b>7.8</b>	<b>INPut Subsystem</b> .....	<b>135</b>
<b>7.9</b>	<b>MMEMy Subsystem</b> .....	<b>138</b>
<b>7.10</b>	<b>SENSE Subsystem</b> .....	<b>140</b>
<b>7.11</b>	<b>TRACe Subsystem</b> .....	<b>154</b>
<b>7.12</b>	<b>TRIGger Subsystem</b> .....	<b>163</b>
<b>7.13</b>	<b>UNIT Subsystem</b> .....	<b>165</b>
<b>7.14</b>	<b>Table of Softkeys with Assignment of Remote Commands</b> .....	<b>166</b>
<b>A</b>	<b>Import and Export of Data</b> .....	<b>171</b>
A.1	IQ Data.....	171
A.2	Frame Description.....	172
A.3	User-Defined P-SYNC, S-SYNC and Reference Symbols.....	173
A.4	Limits.....	174
<b>B</b>	<b>Measurements in Detail</b> .....	<b>176</b>
B.1	Introduction .....	177
B.2	Signal Processing .....	177
B.3	UTRA/LTE Downlink Measurement Application .....	178
B.4	References.....	181
<b>C</b>	<b>Common Errors and Remedies</b> .....	<b>181</b>
<b>D</b>	<b>References</b> .....	<b>182</b>



# Conventions Used in the Documentation

The following conventions are used throughout the R&S FSQ / FSV-K100 / -K102 / -K104 Software Manual:

## Typographical conventions

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

## Other conventions

- **Remote commands:** Remote commands may include abbreviations to simplify input. In the description of such commands, all parts that have to be entered are written in capital letters. Additional text in lower-case characters is for information only.
- The terms "**select**" and "**press**" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the device or on a keyboard.





# 1 Introduction

The R&S FSQ / FSV-K100 / -K102 / -K104 EUTRA/LTE downlink analysis software application uses the I/Q capture functionality of the R&S FSQ / FSV spectrum analyzer to enable EUTRA/LTE TX measurements in line with the EUTRA specification using PC-based software.

This manual supports the user in working with this software. It describes how to prepare, execute, and evaluate a measurement and gives many helpful hints and examples.

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

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

This introduction focuses on LTE/E-UTRA technology. In the following, the terms LTE or E-UTRA 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 such as costs for installing and operating the network were considered. Based on these requirements, technical concepts for the air interface transmission schemes and protocols were studied. Notably, LTE uses new multiple access schemes on the air interface: orthogonal frequency division multiple access (OFDMA) in downlink and single carrier frequency division multiple access (SC-FDMA) in uplink. Furthermore, MIMO antenna schemes form an essential part of LTE. In an attempt to simplify protocol architecture, LTE brings some major changes to the existing UMTS protocol concepts. Impact on the overall network architecture including the core network is being investigated in the context of 3GPP system architecture evolution (SAE).

### 1.1.1 Requirements for UMTS Long-Term Evolution

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

- Data Rate: Peak data rates target 100 Mbps (downlink) and 50 Mbps (uplink) for 20 MHz spectrum allocation, assuming two receive antennas and one transmit antenna are at the terminal.
- Throughput: The target for downlink average user throughput per MHz is three to four times better than Release 6. The target for uplink average user throughput per MHz is two to three times better than Release 6.
- Spectrum efficiency: The downlink target is three to four times better than Release 6. The uplink target is two to three times better than Release 6.
- Latency: The one-way transit time between a packet being available at the IP layer in either the UE or radio access network and the availability of this packet at IP layer in the radio access network/UE shall be less than 5 ms. Also C-plane latency shall be reduced, e.g. to allow fast transition times of less than 100 ms from camped state to active state.
- Bandwidth: Scaleable bandwidths of 5 MHz, 10 MHz, 15 MHz, and 20 MHz shall be supported. Also bandwidths smaller than 5 MHz shall be supported for more flexibility.
- Interworking: Interworking with existing UTRAN/GERAN systems and non-3GPP systems shall be ensured. Multimode terminals shall support handover to and from UTRAN and GERAN as well as inter-RAT measurements. Interruption time for handover between E-UTRAN and UTRAN/GERAN shall be less than 300 ms for realtime services and less than 500 ms for non-realtime services.
- Multimedia broadcast multicast services (MBMS): MBMS shall be further enhanced and is then referred to as E-MBMS.
- Costs: Reduced CAPEX and OPEX including backhaul shall be achieved. Cost-effective migration from Release 6 UTRA radio interface and architecture shall be possible. Reasonable system and terminal complexity, cost, and power consumption shall be ensured. All the interfaces specified shall be open for multi-vendor equipment interoperability.
- Mobility: The system should be optimized for low mobile speed (0 to 15 km/h), but higher mobile speeds shall be supported as well, including high speed train environment as a special case.
- Spectrum allocation: Operation in paired (frequency division duplex / FDD mode) and unpaired spectrum (time division duplex / TDD mode) is possible.
- Co-existence: Co-existence in the same geographical area and co-location with GERAN/UTRAN shall be ensured. Also, co-existence between operators in adjacent bands as well as cross-border co-existence is a requirement.
- Quality of Service: End-to-end quality of service (QoS) shall be supported. VoIP should be supported with at least as good radio and backhaul efficiency and latency as voice traffic over the UMTS circuit switched networks.
- Network synchronization: Time synchronization of different network sites shall not be mandated.

## 1.1.2 Long-Term Evolution Downlink Transmission Scheme

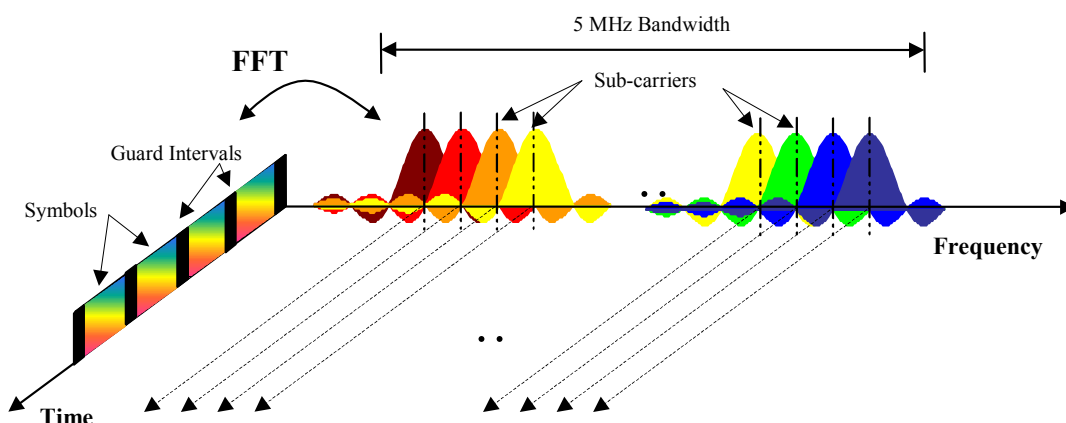
### 1.1.2.1 OFDMA

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

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

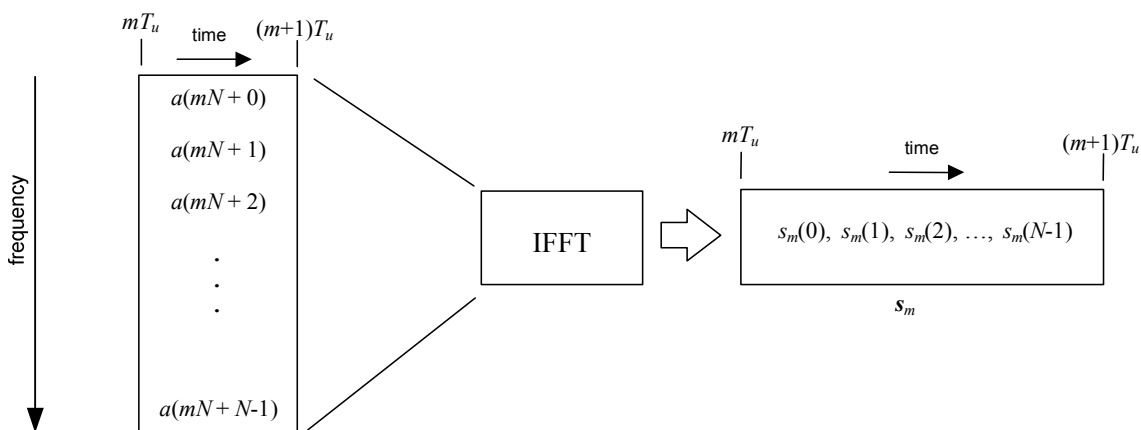
Figure 1-1 shows a representation of an OFDM signal taken from [2]. In this figure, a signal with 5 MHz bandwidth is shown, but the principle is of course the same for the other E-UTRA bandwidths. Data symbols are independently modulated and transmitted over a high number of closely spaced orthogonal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

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



**Figure 1-1: Frequency-Time Representation of an OFDM Signal**

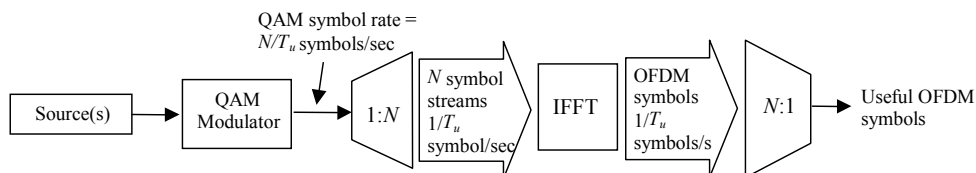
In practice, the OFDM signal can be generated using the inverse fast Fourier transform (IFFT) digital signal processing. The IFFT converts a number  $N$  of complex data symbols used as frequency domain bins into the time domain signal. Such an  $N$ -point IFFT is illustrated in Figure 1-2, where  $a(mN+n)$  refers to the  $n$ th subchannel modulated data symbol, during the time period  $mT_u < t \leq (m+1)T_u$ .



**Figure 1-2: OFDM Useful Symbol Generation Using an IFFT**

The vector  $s_m$  is defined as the useful OFDM symbol. It is the time superposition of the  $N$  narrowband modulated subcarriers. Therefore, from a parallel stream of  $N$  sources of data, each one independently modulated, a waveform composed of  $N$  orthogonal subcarriers is obtained, with each subcarrier having the shape of a frequency sinc function (see Figure 1-2).

Figure 1-3 illustrates the mapping from a serial stream of QAM symbols to  $N$  parallel streams, used as frequency domain bins for the IFFT. The  $N$ -point time domain blocks obtained from the IFFT are then serialized to create a time domain signal. Not shown in Figure 1-3 is the process of cyclic prefix insertion.



**Figure 1-3: 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 E-UTRA, the data channels are shared channels, i.e. for each transmission time interval of 1 ms, a new scheduling decision is taken regarding which users are assigned to which time/frequency resources during this transmission time interval.

1.1.2.2 OFDMA Parameterization

A generic frame structure is defined for both E-UTRA FDD and TDD modes. Additionally, an alternative frame structure is defined for the TDD mode only. The E-UTRA frame structures are defined in [3]. 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 Figure 1-4 ( $T_s$  expresses the basic time unit corresponding to 30.72 MHz).

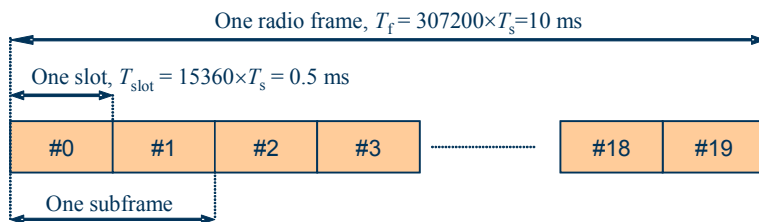


Figure 1-4: Generic Frame Structure in E-UTRA Downlink

Figure 1-5 shows the structure of the downlink resource grid for the duration of one downlink slot. The available downlink bandwidth consists of  $N_{BW}^{DL}$  subcarriers with a spacing of  $\Delta f = 15$  kHz. In the case of multi-cell MBMS transmission, a subcarrier spacing of  $\Delta f = 7.5$  kHz is also possible.  $N_{BW}^{DL}$  can vary in order to allow for scalable bandwidth operation up to 20 MHz. Initially, the bandwidths for LTE were explicitly defined within layer 1 specifications. Later on a bandwidth agnostic layer 1 was introduced, with  $N_{BW}^{DL}$  for the different bandwidths to be specified by 3GPP RAN4 to meet performance requirements, e.g. for out-of-band emission requirements and regulatory emission limits.

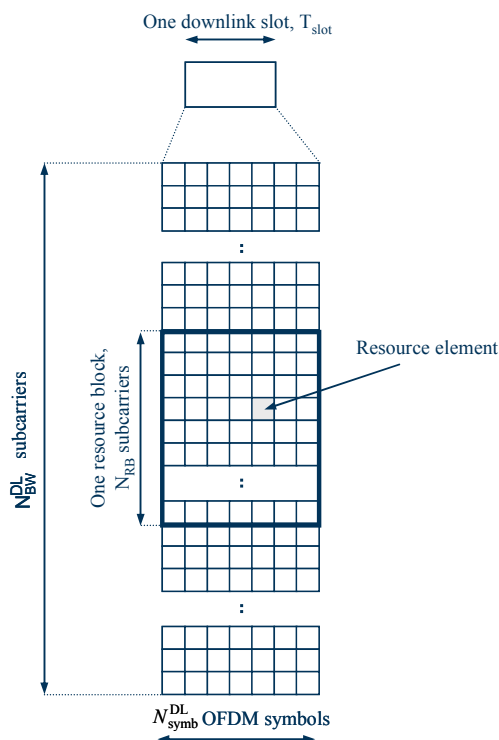


Figure 1-5: Downlink Resource Grid

One downlink slot consists of  $N_{\text{symp}}^{\text{DL}}$  OFDM symbols. To each symbol, a cyclic prefix (CP) is appended as guard time, compare Figure 1-5.  $N_{\text{symp}}^{\text{DL}}$  depends on the cyclic prefix length. The generic frame structure with normal cyclic prefix length contains  $N_{\text{symp}}^{\text{DL}} = 7$  symbols. This translates into a cyclic prefix length of  $T_{\text{CP}} \approx 5.2\mu\text{s}$  for the first symbol and  $T_{\text{CP}} \approx 4.7\mu\text{s}$  for the remaining 6 symbols. Additionally, an extended cyclic prefix is defined in order to cover large cell scenarios with higher delay spread and MBMS transmission. The generic frame structure with extended cyclic prefix of  $T_{\text{CP-E}} \approx 16.7\mu\text{s}$  contains  $N_{\text{symp}}^{\text{DL}} = 6$  OFDM symbols (subcarrier spacing 15 kHz). The generic frame structure with extended cyclic prefix of  $T_{\text{CP-E}} \approx 33.3\mu\text{s}$  contains  $N_{\text{symp}}^{\text{DL}} = 3$  symbols (subcarrier spacing 7.5 kHz).

Table 1 gives an overview of the different parameters for the generic frame structure.

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

Configuration	Number of symbols $N_{\text{symp}}^{\text{DL}}$	Cyclic prefix length in samples	Cyclic prefix length in $\mu\text{s}$
Normal cyclic prefix $\Delta f=15$ kHz	7	160 for first symbol 144 for other symbols	5.2 $\mu\text{s}$ for first symbol 4.7 $\mu\text{s}$ for other symbols
Extended cyclic prefix $\Delta f=15$ kHz	6	512	16.7 $\mu\text{s}$
Extended cyclic prefix $\Delta f=7.5$ kHz	3	1024	33.3 $\mu\text{s}$

### 1.1.2.3 Downlink Data Transmission

Data is allocated to the UEs in terms of resource blocks. A physical resource block consists of 12 (24) consecutive subcarriers in the frequency domain for the  $\Delta f=15$  kHz ( $\Delta f=7.5$  kHz) case. In the time domain, a physical resource block consists of  $N_{\text{symp}}^{\text{DL}}$

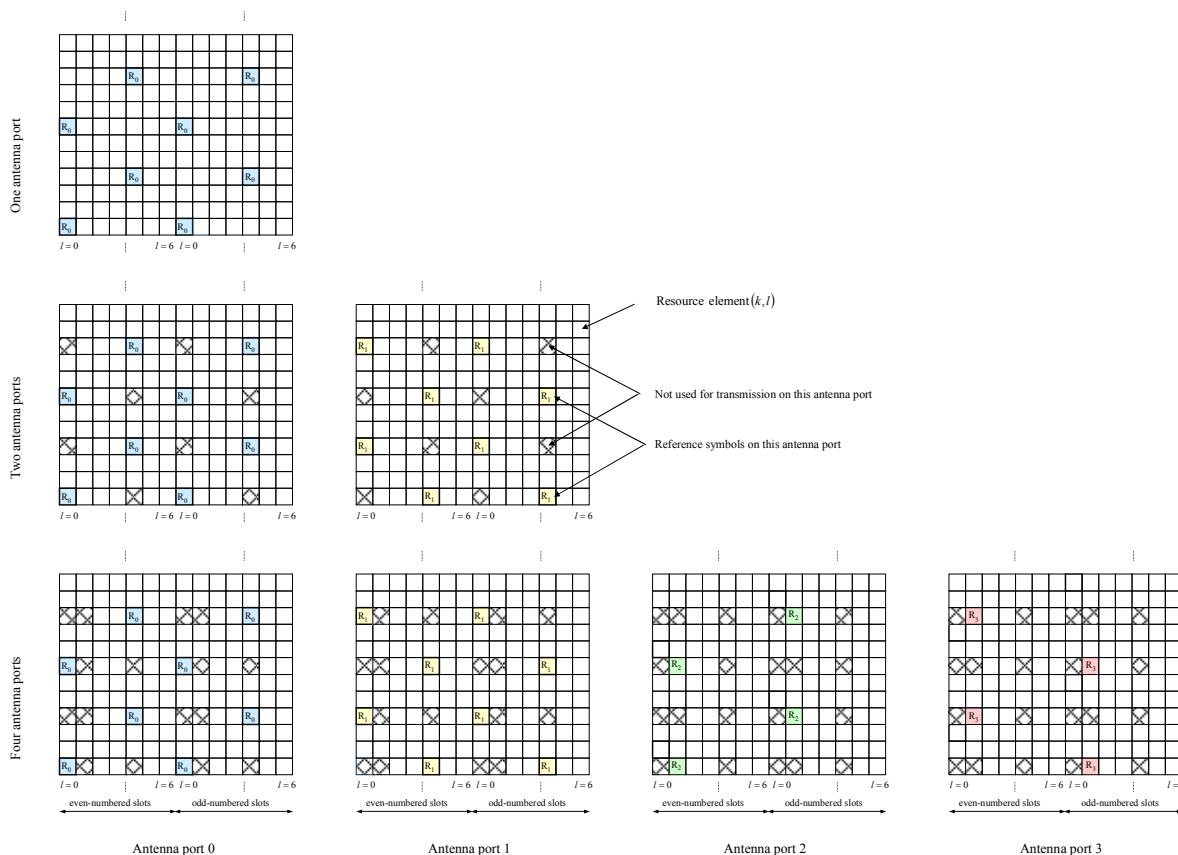
consecutive OFDM symbols, see Figure 1-5.  $N_{\text{symp}}^{\text{DL}}$  is equal to the number of OFDM symbols in a slot. The resource block size is the same for all bandwidths, therefore the number of available physical resource blocks depends on the bandwidth.

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 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.

### 1.1.2.4 Downlink Reference Signal Structure and Cell Search

The downlink reference signal structure is important for cell search, channel estimation and neighbor cell monitoring. Figure 1-6 shows the principle of the downlink reference signal structure for one-antenna, two-antenna, and four-antenna transmission. Specific predefined resource elements in the time-frequency domain carry the reference signal sequence. Besides first reference symbols, there may be a need for second reference symbols. The different colors in Figure 1-6 represent the sequences transmitted from up to four transmit antennas.



**Figure 1-6: Downlink Reference Signal Structure (Normal Cyclic Prefix)**

The reference signal sequence carries the cell identity. Each reference signal sequence is generated as a symbol-by-symbol product of an orthogonal sequence  $r^{OS}$  (three of them existing) and a pseudo-random sequence  $r^{PRS}$  (170 of them existing). Each cell identity corresponds to a unique combination of one orthogonal sequence  $r^{OS}$  and one pseudo-random sequence  $r^{PRS}$ , allowing 510 different cell identities.

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 symbols, synchronization signals are therefore needed during cell search. E-UTRA uses a hierarchical cell search scheme similar to WCDMA. This means that the synchronization acquisition and the cell group identifier are obtained from different synchronization signals. Thus, a primary synchronization signal (P-SYNC) and a secondary synchronization signal (S-SYNC) are assigned a predefined structure. They are transmitted on the 72 center subcarriers (around the DC subcarrier) within the same predefined slots (twice per 10 ms) on different resource elements, see Figure 1-7.

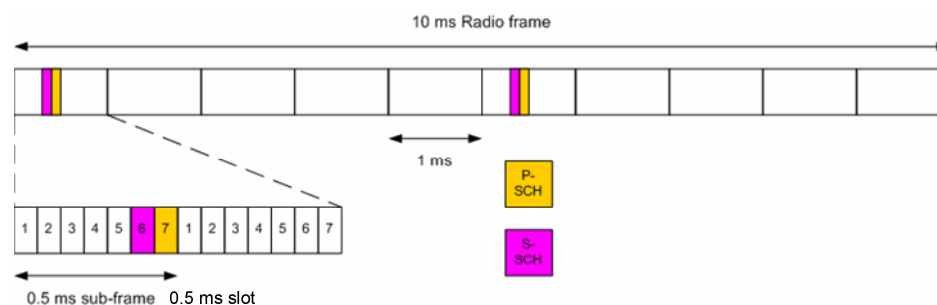


Figure 1-7: P-SYNC and S-SYNC Structure

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

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

#### 1.1.2.5 Downlink Physical Layer Procedures

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

- **Cell search and synchronization:** See above.
- **Scheduling:** Scheduling is done in the base station (eNodeB). The downlink control channel PDCCH informs the users about their allocated time/frequency resources and the transmission formats to use. The scheduler evaluates different types of information, e.g. quality of service parameters, measurements from the UE, UE capabilities, and buffer status.
- **Link adaptation:** Link adaptation is already known from HSDPA as adaptive modulation and coding. Also in E-UTRA, modulation and coding for the shared data channel is not fixed, but rather is adapted according to radio link quality. For this purpose, the UE regularly reports channel quality indications (CQI) to the eNodeB.
- **Hybrid automatic repeat request (ARQ):** Downlink hybrid ARQ is also known from HSDPA. It is a retransmission protocol. The UE can request retransmissions of incorrectly received data packets.



## 1.2 EUTRA/LTE Test & Measurement Assumptions made by Rohde & Schwarz

This section describes working assumptions for EUTRA/LTE test & measurement solutions that cannot yet be derived from 3GPP specifications. These assumptions are valid for all current implementations on R&S signal generators and R&S signal analyzers.

### 1.2.1 OFDMA Parameterization

In order to configure the bandwidth of the signal to be generated 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 resulting FFT size is derived from the following formula:

$$N_{FFT} = 2^{\text{nextpow2}(\lceil 1.4 \cdot (12n+1) \rceil)}$$

- n is the selected number of resource blocks
- nextpow2(N) returns the first P such that  $2^P \geq \text{abs}(N)$
- $\lceil \rceil$  rounds up to the next highest integer

## 2 Installation and Test Setup

### 2.1 Software Installation

Please refer to the release notes for detailed instructions on the installation process.

### 2.2 Connection to the Instrument

In order to be able to communicate with the instruments, the PC must be connected to the R&S FSQ / FSV using either an IEEE bus or LAN connection.

#### 2.2.1 R&S FSQ / FSV Requirements

To capture I/Q data, any R&S FSQ / FSV available can be used.

To connect the instrument using TCP/IP, you must either use firmware version 3.65 or higher or have the RSIB Passport driver installed on your PC. The driver can be downloaded from this website: <http://www.rohde-schwarz.com/appnote/1EF47>

#### 2.2.2 Configuration Settings

The R&S FSQ / FSV address (either GPIB or LAN address) has to be set in the R&S FSQ / FSV-K100 / -K102 / -K104 EUTRA/LTE analysis software. Please refer to section "MIMO Analyzer Configuration" for details about this setting.

The description about the GPIB and LAN Address is separated for the R&S FSQ and the R&S FSV.

##### 2.2.2.1 How to Obtain the GPIB or LAN Address in the R&S FSQ Instrument

In this section it is described how to obtain the GPIB or LAN address of the R&S FSQ instrument.

#### GPIB address

1. Press the "SETUP" key.  
The Setup menu opens.
2. Press the "General Setup" softkey.
3. Press the "GPIB" softkey.

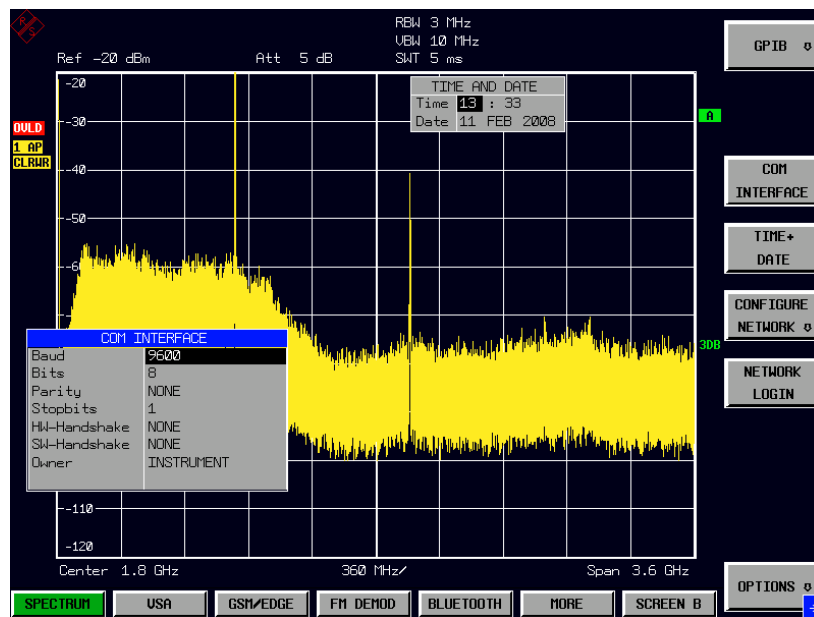


Figure 2-1: Softkey: GPIB Address

#### LAN address

4. Press the "SETUP" key.  
The Setup menu opens.
5. Press the "General Setup" softkey.
6. Press the "Configure Network" softkey.

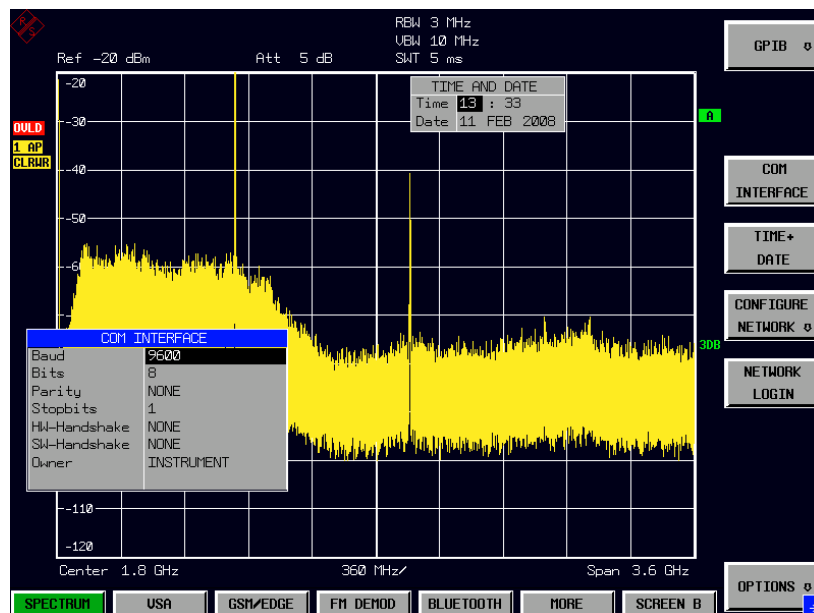


Figure 2-2: Softkey: Configure Network

7. Select "Local Area Connection" and press ENTER.

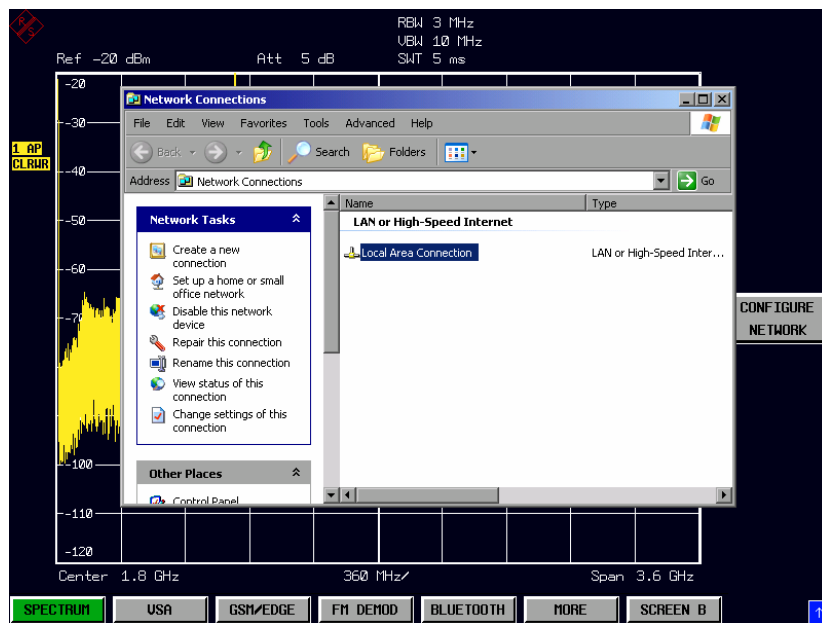


Figure 2-3: Local Area Connection

8. Click on the "Support" tab of the "Local Area Connection Status" dialog.

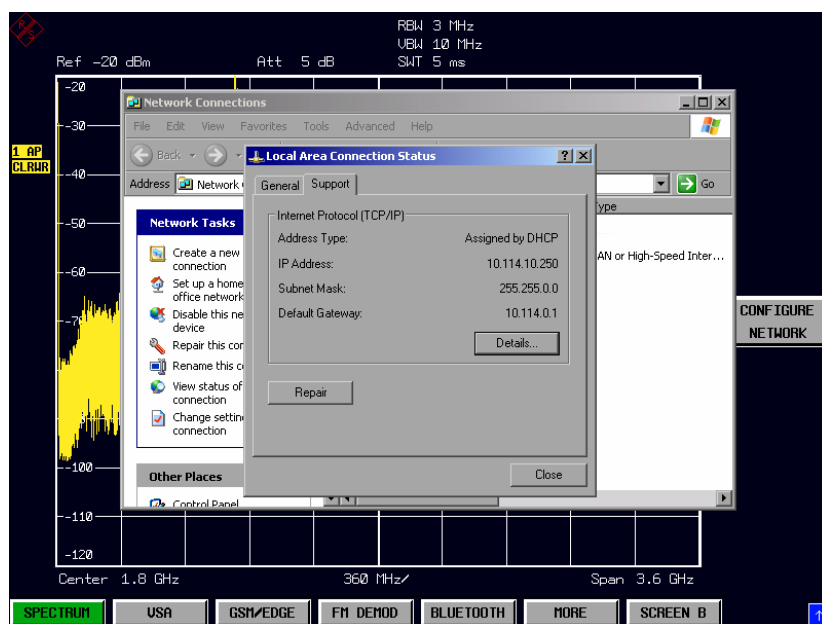


Figure 2-4: Local Area Connection: Support Tab

### 2.2.2.2 How to Obtain the GPIB or LAN Address in the R&S FSV Instrument

In this section it is described how to obtain the GPIB or LAN address of the R&S FSV instrument.

#### GPIB address

1. Press the "SETUP" key.  
The Setup menu opens.
2. Press the "General Setup" softkey

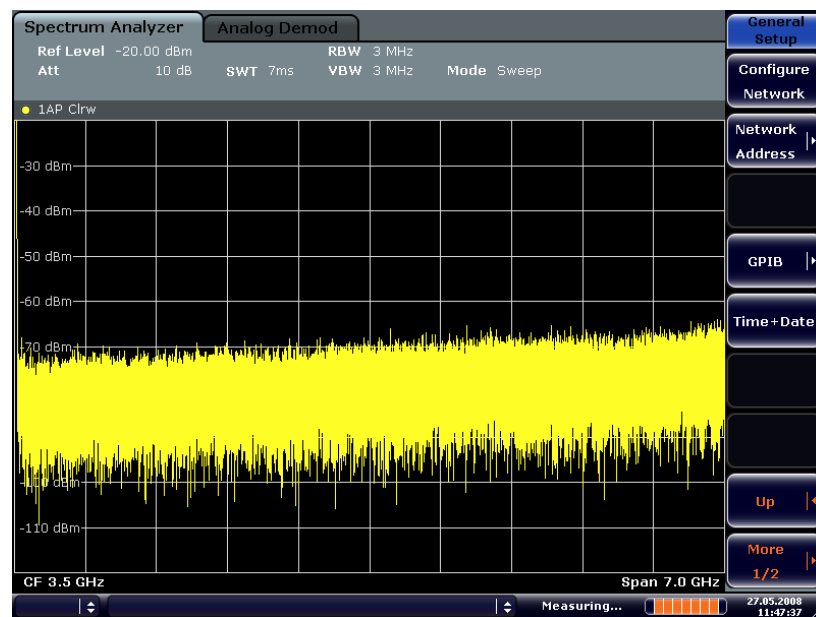


Figure 2-5: General Setup menu

3. Press the "GPIB" softkey.
4. Press the "GPIB" Address softkey.  
The GPIB dialog input box opens. Query or change the GPIB address.

Figure 2-6: Input Dialog Box: GPIB Address



### LAN address

1. Press the "SETUP" key  
The Setup menu opens
2. Press the "General Setup" softkey

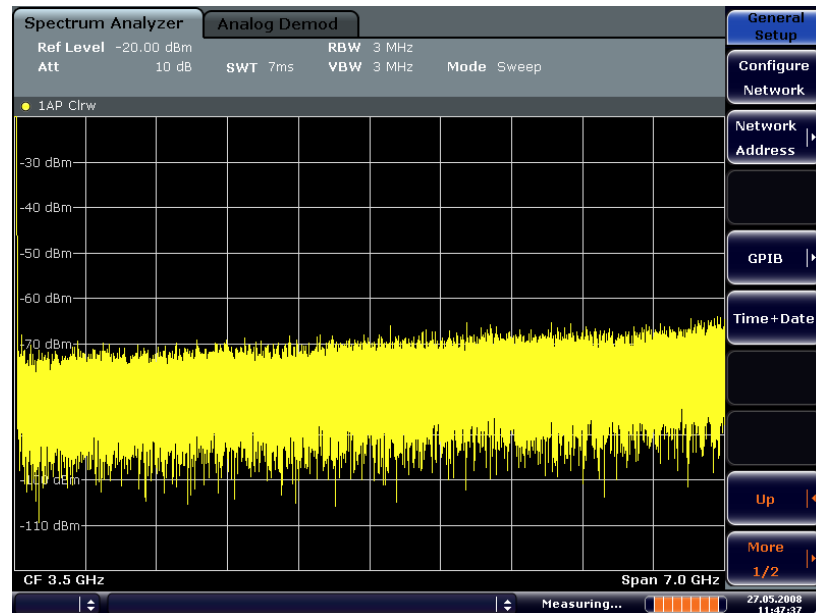


Figure 2-7: The General Setup menu

3. Press the "Network Address" softkey

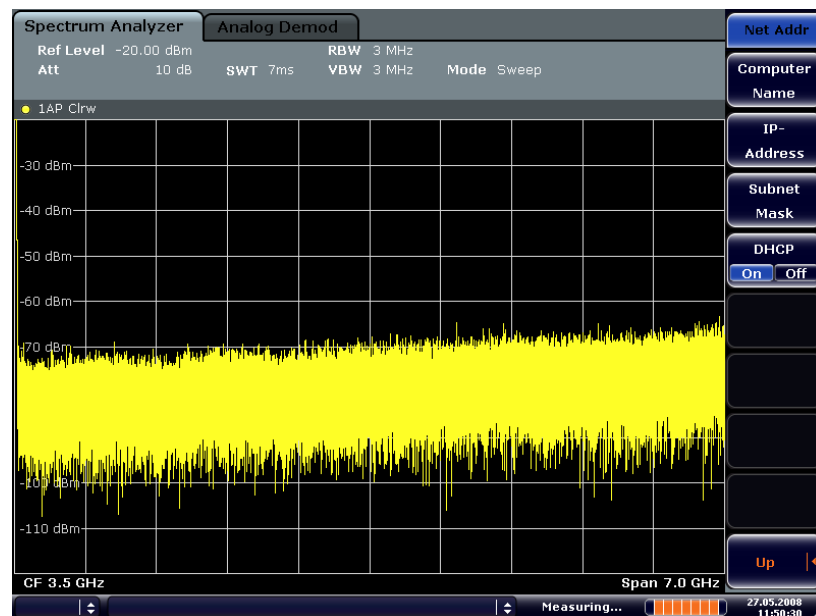


Figure 2-8: The Net Addr menu

4. Press the "IP Address" softkey to query the IP address

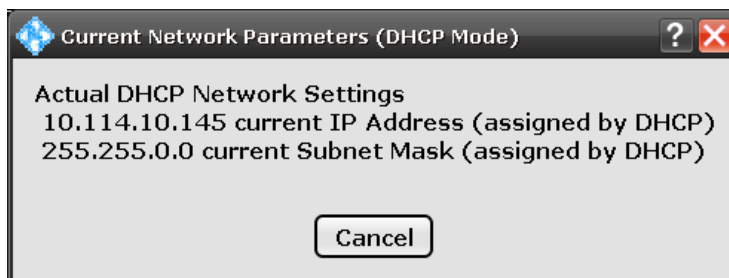


Figure 2-9: Current Network Parameters (DHCP mode)

## 2.3 MIMO Measurement Guide

The R&S FSQ-K102 application is capable of analyzing LTE MIMO signals using two or four R&S FSQ or R&S FSG spectrum analyzers. True MIMO measurements are useful to verify MIMO precoding implementations for setups where it is not possible to decode the transmit data using only one antenna (e.g. applying spatial multiplexing MIMO precoding with more than 1 layer) and to measure the hardware performance of the MIMO transmitter hardware in a true MIMO measurement setup.

### 2.3.1 Hardware Setup

One R&S FSx is defined as the master R&S FSx. The master R&S FSx is the reference oscillator source for all slave R&S FSxs. The REF IN of all slave R&S FSxs must therefore be connected to the REF OUT of the master R&S FSx and all slave R&S FSxs must be set to external reference (if two R&S SMUs are used, the second R&S SMU has to be set to external reference and the REF OUT of the first R&S SMU has to be connected to the REF IN of the second R&S SMU).

To ensure all R&S FSxs capture the data at the same point in time, a trigger signal has to be used. The device under test (DUT) or R&S SMU must therefore provide a trigger signal. This trigger signal has to be connected to all R&S FSxs (if two R&S SMUs are used, the second R&S SMU must be triggered by the first R&S SMU, too).

In Figure 2-10 the MIMO hardware setup with 2 (or optional 4) R&S FSxs and 1 (or optional 2) 2-channel R&S SMUs is given.

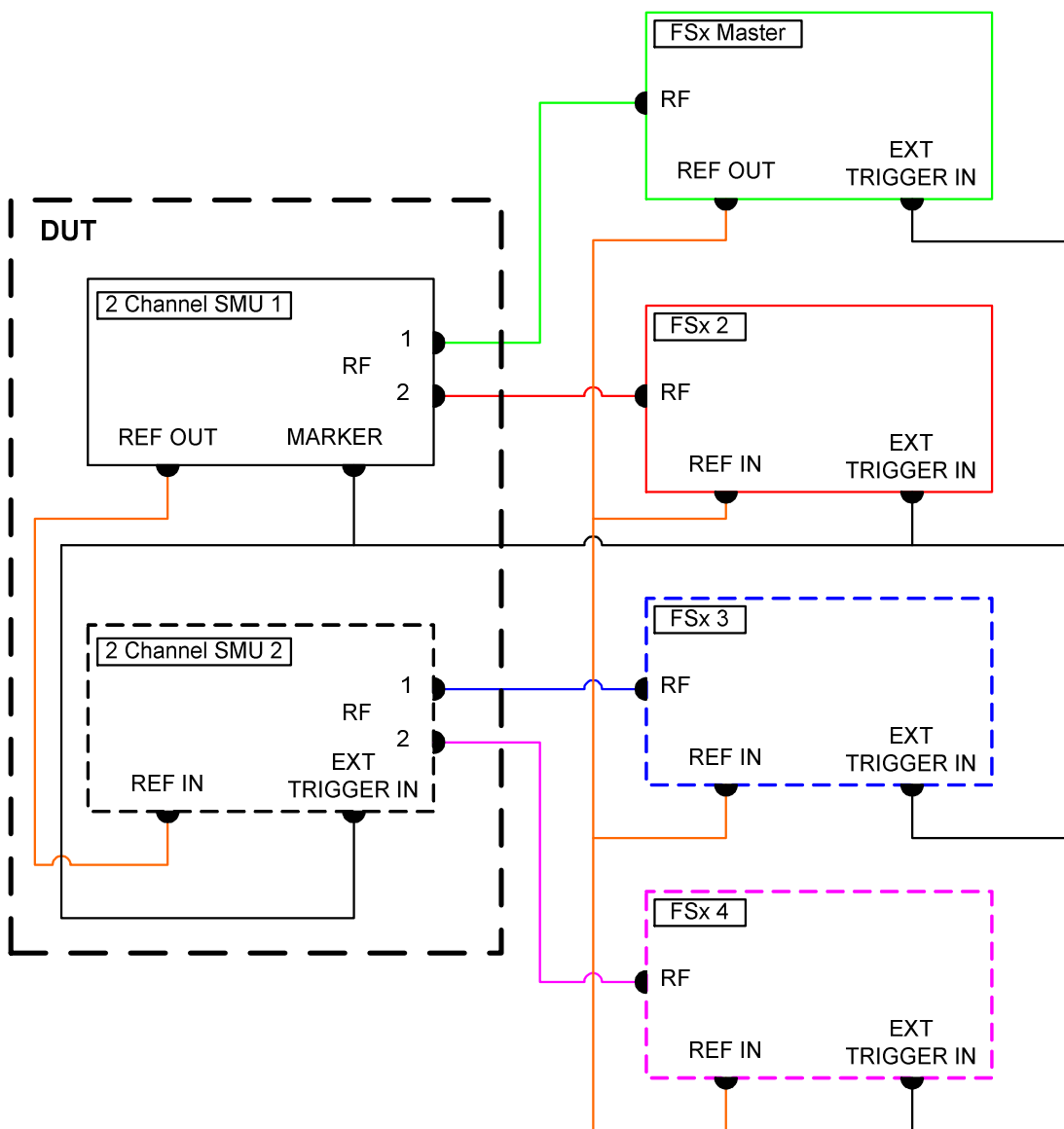


Figure 2-10: MIMO Hardware Setup



## 2.3.2 Performing MIMO Measurements

The following measurement setups are possible without using special additional hardware.

### 2.3.2.1 Delayed trigger signal setup

Generally it is required to start the capturing of all antennas at the same point of time. The R&S FSxs are connected to the R&S FSQ-K102 application via GPIB or LAN connections which have a certain network delay. Since the network delay and tasks like auto-leveling require some time, a certain delay is introduced between the start of the measurement and the point in time when the trigger inputs of all R&S FSxs are armed. To ensure that no trigger event occurs in this time frame, the user has to introduce a delay between starting the measurement (e.g. by pressing the „RUN SGL" button or initiating the measurement via remote control) and sending the trigger signal.

The expected time to arm the trigger of one R&S FSx depends on the GPIB/network conditions and the input settings. To estimate the delay, initiate a single run measurement using only one R&S FSx and measure the time until the „DSP" indicator flashes (note that this estimation also includes the time to transfer the IQ samples from the instrument to the LTE software):



Figure 2-11: R&S FSQ-K102 status indicators

A typical delay to arm the trigger is 2 seconds per instrument.

The minimum delay of the trigger signal must now be greater than the measured time multiplied with the number of measured antennas (number of used R&S FSxs) since the spectrum analyzers are initialized sequentially.

The usage of an LTE frame trigger is not possible for this measurement setup.

### 2.3.2.2 Frame trigger signal setup using identical LTE frames

In the special case that identical LTE frames are transmitted, i.e., all transmitted LTE frames use the same frame configuration and transmit exactly the same data, a special measurement setup is possible. In this case it is possible to use a frame trigger to start the measurement. The different R&S FSxs capture data from different LTE frames but with equal content.

The problem with this measurement setup is that the phase variations of the reference oscillators of the different transmitted signals are not the same since the data are not captured at the same point in time.

As a result we get a phase error which degrades the EVM (see Figure 2-12 and Figure 2-13).

This measurement setup is therefore not recommended for measuring the hardware performance. One application to this measurement setup is, e.g., to check the MIMO precoding implementation.

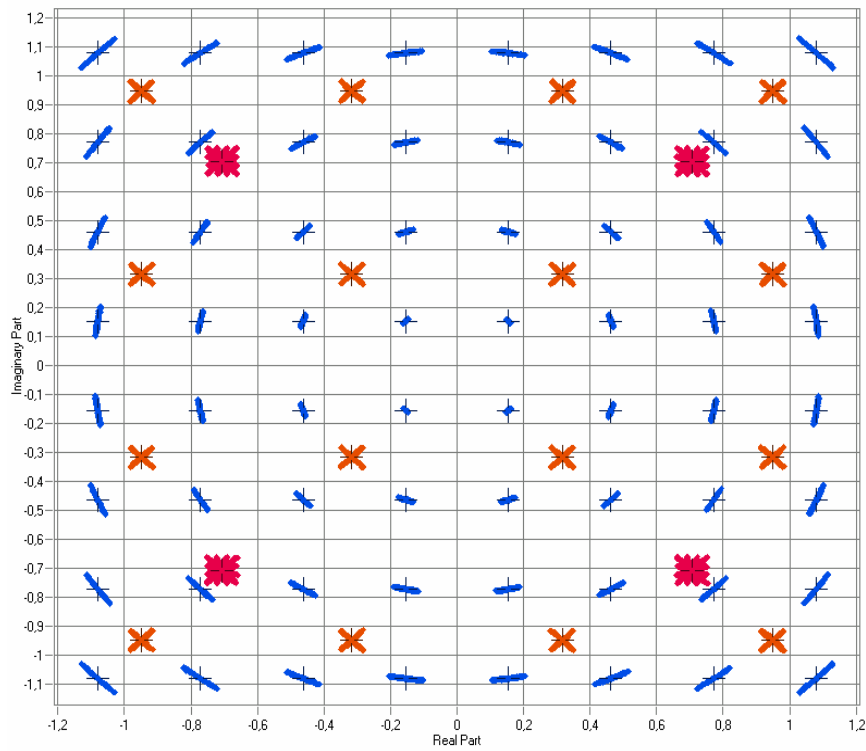


Figure 2-12: Constellation Diagram

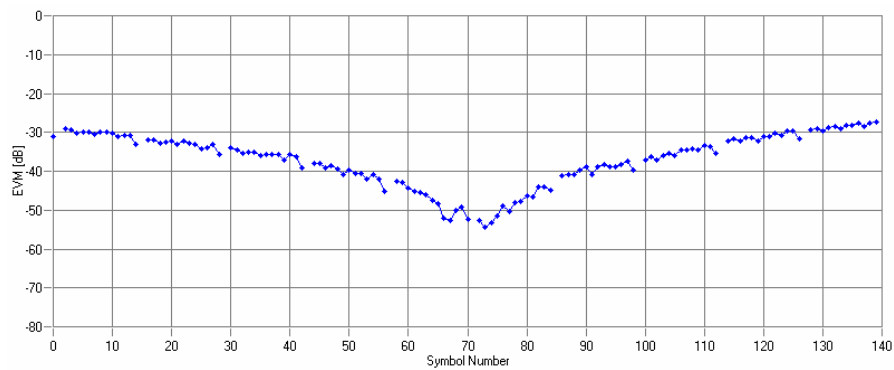


Figure 2-13: Error vector magnitude versus OFDM symbol number

### 2.3.3 Performing Time Alignment Measurements

The R&S FSQ-K102 provides the possibility to perform time alignment measurements between the different antennas for 2 or 4 Tx antenna MIMO configurations. The time alignment error values represent the time offset between the considered antenna and antenna 1 and will be displayed in the result summary (see Figure 2-14 for a schematic description of the result values).

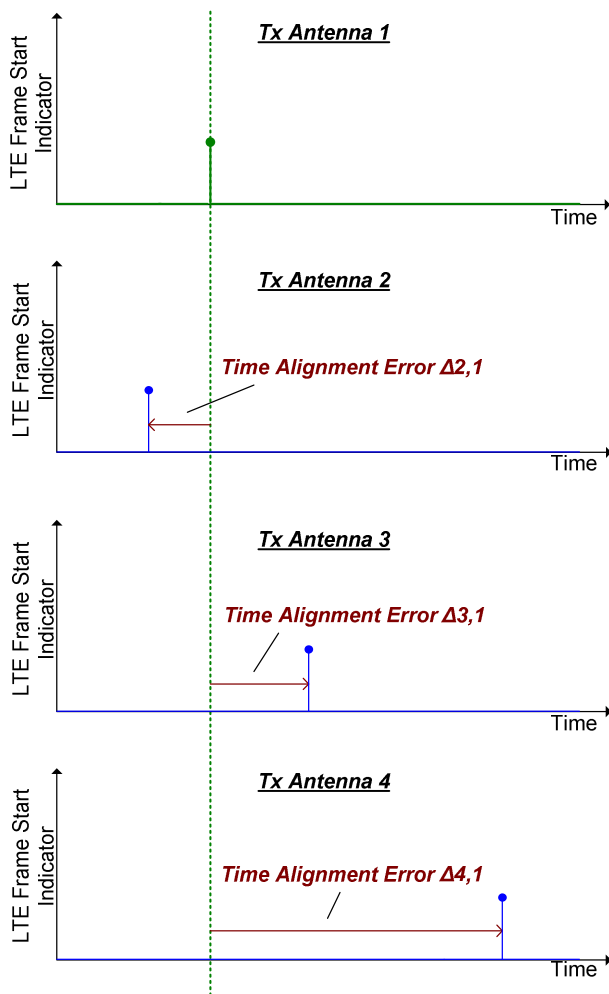


Figure 2-14: Schematic description of the time alignment results.

Figure 2-15 shows the test setup for the time alignment measurement (the dashed connections are only required for 4 Tx antenna MIMO configuration). For best measurement result accuracy it is recommended to use cables of the same length and identical combiners as adders.

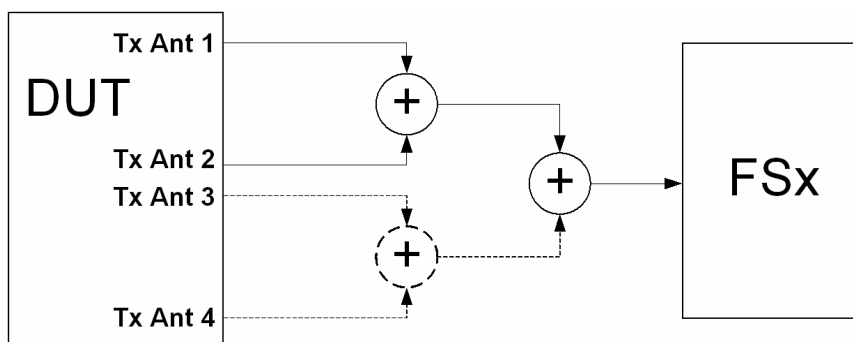
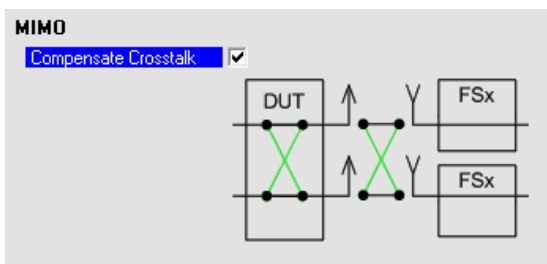


Figure 2-15: Time alignment measurement hardware setup.

For a successful time alignment measurement the following settings have to be used:

- The antenna selection in the general settings menu must not be set to "All"
- The subframe selection in the general settings menu must be set to "All"
- Compensate crosstalk must be enabled in the demodulation settings, see screenshot below:



Note that the time alignment measurement only uses the reference signal and therefore ignores any PDSCH settings (e.g. it does not have an influence on this measurement if the PDSCH MIMO scheme is set to transmit diversity or spatial multiplexing).

The EVM will usually be very high for this measurement. This does not effect the accuracy of the time alignment error measurement result.

## 2.4 TDD Transmit ON/OFF Power Measurement Guide

The technical specification in 3GPP TS 36.141 prescribes the measurement of the transmitter OFF power and the transmitter transient period of an EUTRA/LTE TDD base transceiver station (BTS) operating at its specified maximum output power. A special hardware setup is required for this measurement since the actual measurement is done at very low power during the transmitter OFF periods requiring low attenuation at the analyzer input. The signal power during the transmitter ON periods in this test scenario is usually higher than the specified maximum input power of the FSQ signal analyzer and will cause severe damage to the analyzer if the measurement is not set up appropriately.

### 2.4.1 Hardware Setup

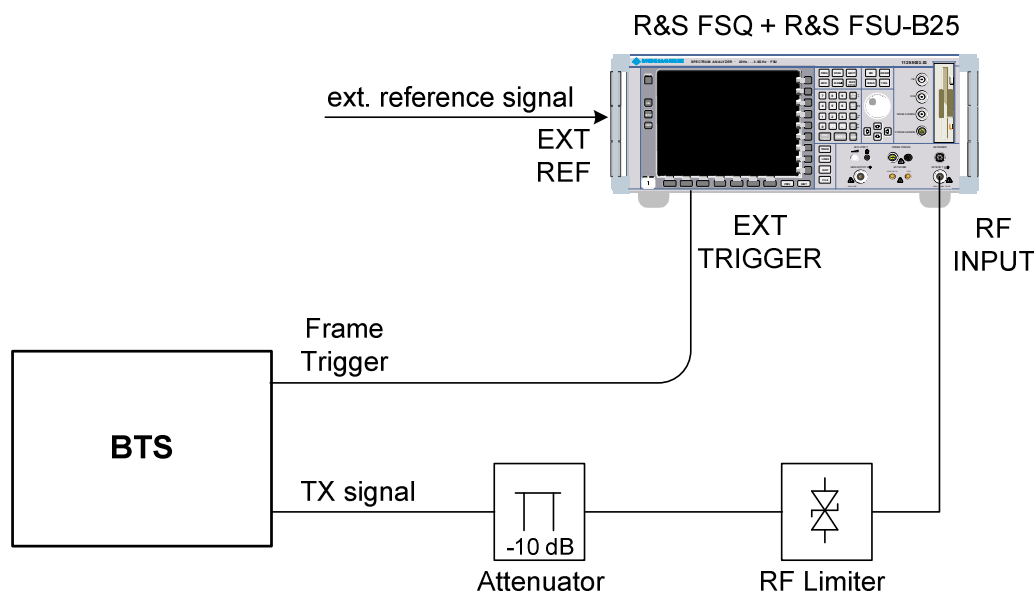


Figure 2-16: Hardware Setup for transmit ON/OFF power measurement

To protect the analyzer input from destruction an RF limiter has to be applied at the analyzer input connector, as can be seen in figure 2-16. Table 1.1 shows the specifications the used limiter has to fulfill.

Table 2-1: RF limiter specifications

Min. acceptable CW input power	BTS output power minus 10 dB
Min. acceptable peak input power	BTS peak output power minus 10 dB
Max. output leakage	20 dBm
Max. response time	1 μs
Max. recovery time	1 μs

An additional 10 dB attenuation must be placed in front of the RF limiter to absorb eventual reflected waves because of the high VSWR of the limiter. The allowed maximum CW input power of the attenuator must be lower than the maximum output power of the BTS.

To ensure correct timing the BTS has to provide a frame trigger signal which is fed to the “EXT TRIGGER” input of the FSQ.

### 2.4.2 Performing Transmitter ON/OFF Power measurements

All settings must be done according to EUTRA/LTE TDD downlink settings described in this manual. This especially incorporates the settings concerning “TDD UL/DL Allocations” and “Special Subframe Configuration” in the “Downlink Signal Characteristics” tab of the “Demodulation Settings” dialog.

Before the actual measurement can be started, the timing must be adjusted by pressing the “Adjust Timing” hotkey. The status display changes from “Timing not adjusted” to “Timing adjusted” and the run hotkeys are released. Relevant setting changes again lead to a “Timing not adjusted” message.

Pressing the “Run Single” hotkey starts the averaging of the traces of the number of frames given in the “General Settings” dialog. After performing all sweeps, the table in the upper half of the screen shows if the measurements pass or fail.

In the lower part of the screen an overview of the EUTRA/LTE frame is shown. Because of the overload during the ON period, only blue rectangles are sketched. The yellow line displays the limit to fulfill, the blue trace shows the transient period and the green trace shows the transmitter OFF power incorporating the filtering prescribed in 3GPP TS 36.141.

### 3 Quick Start Guide

This section will help you to quickly become familiar with R&S FSQ / FSV-K100 / -K102 / -K104 (refer to section "Operating the Software" for detailed operating instructions).

#### 3.1 Setting up the Measurement

Start the R&S FSQ / FSV-K100 / -K102 / -K104 application and press "PRESET".

##### 3.1.1 General Setup (Frequency, Level, etc.)

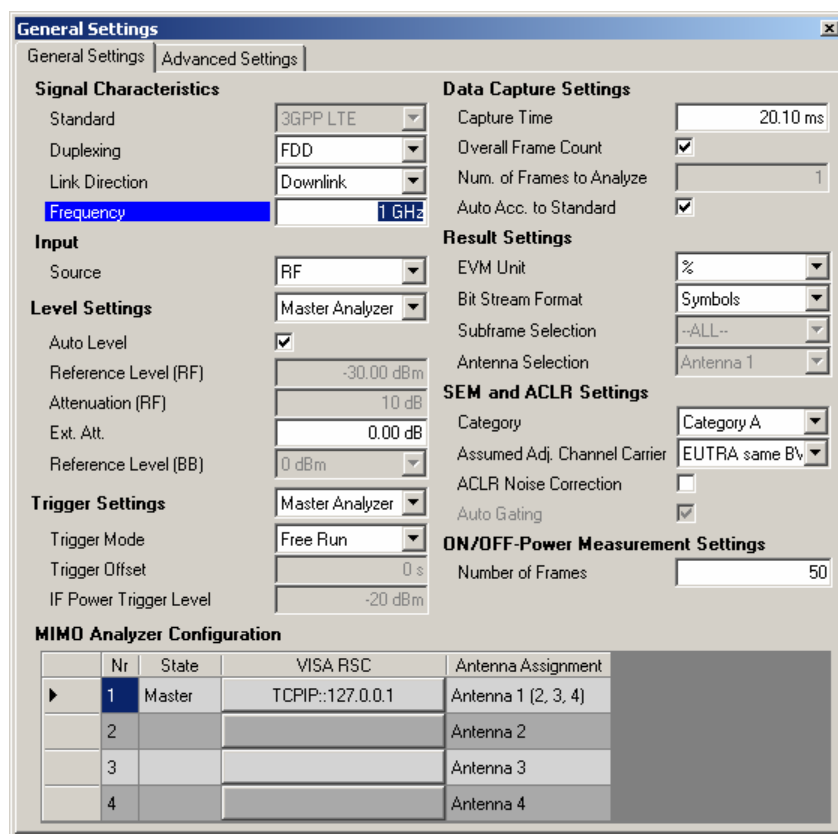


Figure 3-1: General Setup Dialog

1. Press the "General Settings" softkey to open the corresponding dialog box.
2. Enter the frequency you want to measure in the "Frequency" field.
3. Enter the VISA RSC of the R&S FSQ / FSV "MIMO Analyzer Configuration" table.
4. All other settings in this dialog box are sufficient for this example.

### 3.1.2 Demodulation Setup (Tracking Modes, etc.)

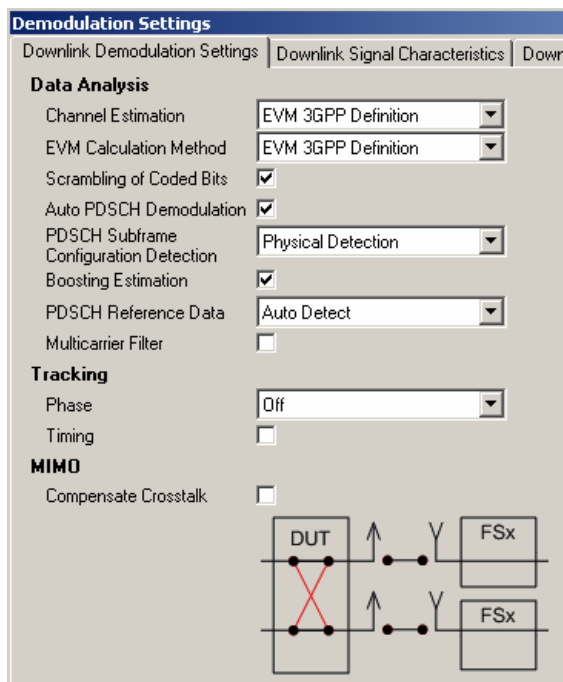


Figure 3-2: Demodulation Setup Dialog

- ▶ Press the "Demod Settings" softkey to open the "Demodulation Settings" dialog box.

Make sure that the "Auto PDSCH Demodulation" feature is enabled. All other settings in this dialog box are sufficient for this example.

## 3.2 Performing the Main Measurement

- ▶ Start the measurement by pressing "RUN SGL".

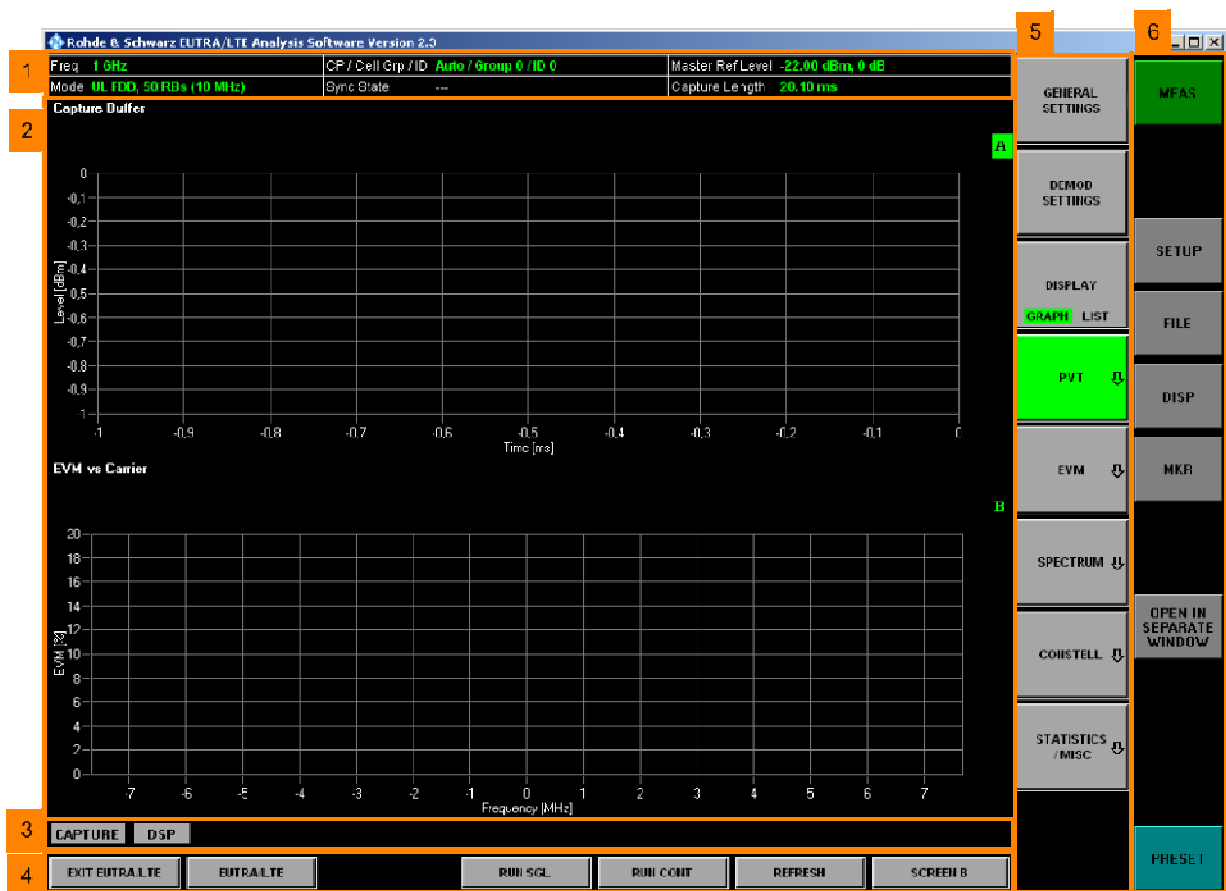
Measurement results are updated once the measurement has been completed. The results are displayed in graphical form. The display can be toggled to a tabular list of measurement points by pressing "DISPLAY".



## 4 Operating the Software

### 4.1 Starting the Software

Use the desktop shortcut or the shortcut from the Start menu to start the R&S FSQ / FSV-K100 / -K102 / -K104 EUTRA/LTE analysis software. The following window opens:



The software user interface consists of six main elements:

- **Header table (1)**

Showing basic information such as measurement frequency or sync state.

- **Hotkeys (4)**

The hotkeys control the measurement process (e.g. running a measurement).

Pressing a hotkey will be referred to as "Hotkey" in this manual, e.g. "RUN SGL".

- **Results display (2)**

Here, all measurement results are displayed in full or split screen style.

Results displays are always separated into

- Header (showing title, etc) and
- Display (showing data) section.

- **Status bar (3)**

The status bar shows "live" information on the measurement progress and displays software messages and errors.

- **Softkeys (5)**

The softkeys are used to open configuration windows and to select the desired measurement result style. The softkeys may change when operating the software (e.g. clicking a hardkey).

Pressing a softkey will be referred to as "Softkey" in this manual, e.g. "Spectrum".

- **Hardkeys (6)**

The hardkeys provide the same functions as those known from the R&S FSQ/FSV (load/store data, configure the display, etc).

Pressing a hardkey will be referred to as "HARDKEY CAPTION" in this manual, e.g. "MEAS".

## 4.2 Loading a Frame Setup

Before starting the measurement, a frame setup, which describes the frame to be analyzed, can be loaded. Use "FILE", "Load Demod Settings" to open a standard file dialog to select the demodulation setup to load.

## 4.3 Loading a Frame Setup

Before starting the measurement, a frame setup, which describes the frame to be analyzed, can be loaded. Use "FILE", "Load Demod Settings" to open a standard file dialog to select the demodulation setup to load.

## 4.4 Preparing for Instrument Connection

In order to be able to communicate with the instruments, the R&S FSQ / FSV must be connected with the PC using either an IEEE bus or LAN connection. The type of connection and the address can be selected inside the software. Refer to section "[Software Installation](#)" for a detailed description.

## 4.5 Performing Measurements

You can either use the R&S FSQ/FSV hardware to capture I/Q data or load the I/Q data from a file. The data source can be switched by using the "SETUP", "Data Source" keys.

Refer to section "[Import and Export of Data](#)" for details on the file format.

### 4.5.1 Running the Measurement

Use the hotkeys of the EUTRA/LTE software displayed at the bottom of the screen to start a single or continuous measurement with newly acquired data or the already captured I/Q data.

	RUN SGL	RUN CONT	REFRESH
<b>RUN SGL</b>	Executes a single measurement with data capturing and signal processing and stops after it has finished. → Remote: INIT		
<b>RUN CONT</b>	Executes subsequent measurements with data capturing and signal processing until you press "Run Cont" again.		
<b>REFRESH</b>	Executes a single measurement as with "RUN SGL", but using already captured I/Q data for processing. This can be used to e.g. observe the changes of different demodulation settings to the results. → Remote: INIT:REFR		

### 4.5.2 Events during a Measurement

While running the measurement, certain events may cause the measurement execution to fail. The corresponding error message is displayed in the status bar and stored in the error log.

### 4.5.3 Measurement Header Table

The tabular section below the title bar shows the overall measurement settings and specific results used to obtain the current measurement results.

Freq	1 GHz	CP / Cell Grp / ID	Ext / Grp 114 / ID 2	Master Ref Level	-30.00 dBm, 10 dB
Mode	DL FDD, 50 RBs (10 MHz)	Sync State	FAIL (C,P,S)	Capture Length	20.00 ms (307200 Sam.)

Figure 4-1: Overall measurement settings summary

The settings summary includes the following information

- **Freq** The analyzer RF frequency.
- **Mode** Link direction, duplexing and maximum number of physical resource blocks (PRBs) / signal bandwidth.
- **CP / Cell Grp / ID** Cyclic prefix length (Normal or Extended), physical layer cell identity group and physical layer identity. If "AUTO" is selected in the "Demodulation Settings" dialog box, (Auto) is shown, otherwise (Manual).
- **Sync State** The following synchronization states may occur:
  - **OK** The synchronization did not generate any errors.
  - **FAIL (C)** The cyclic prefix correlation failed.
  - **FAIL (P)** The P-SYNC correlation failed.
  - **FAIL (S)** The S-SYNC correlation failed.

Any combination of C, P and S may occur.

→ Remote: SENS : SYNC : STAT ?
- **Master Ref Level**

RF input:	RF reference level and RF attenuation settings of the master analyzer.
Baseband (BB) input:	Reference level of the master analyzer.
- **Capture Length** Capture length in ms and samples.

## 4.6 Evaluating the Results – Operating the Graph

### 4.6.1 Context Menu (Marker, Zoom, Pan, Copy Image to Clipboard, Show Data Points)

Using the right mouse button on the graphical displays, you can select several options to perform a more detailed measurement on the displayed graphics.

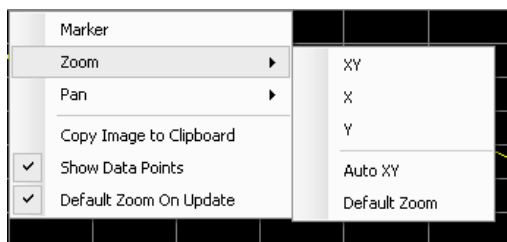


Figure 4-2: Context Menu: Zoom

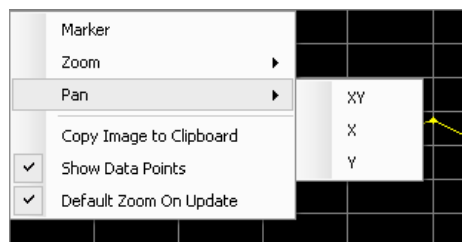


Figure 4-3: Context Menu: Pan

#### 4.6.1.1 Marker

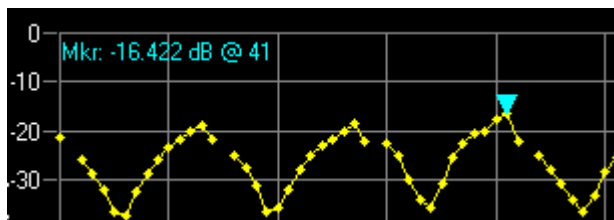


Figure 4-4: Example: Marker

- The marker is activated via the context menu. If activated it is set on the absolute maximum of the trace menu.



#### Setting the marker to the trace maximum

If you have shifted the marker and want to put it back on the absolute maximum, click "Marker" twice in the context menu (deactivates and activates the marker again).

- The text which appears in the upper left corner of the screen consists of: Mkr: [y value] [unit of y axis] @ [x value] [unit of x axis]
- If the marker is moved with the mouse, it jumps to the point closest to the cursor.



Move the mouse above the curve to hop between the local maxima or below the curve to hop between the local minima.

#### 4.6.1.2 Zoom

##### XY

Click and hold the left mouse button in the graph to select an X and Y area to zoom in on.

##### X

Click and hold the left mouse button in the graph to select a range on the X area to zoom in on.

##### Y

Click and hold the left mouse button in the graph to select a range on the Y area to zoom in on.

##### Auto XY

Scales the X and Y axes automatically to display the complete trace data.

Alternatively double-click on the display area.

### Default Zoom

Scales the X and Y axes to the default axis values.

#### 4.6.1.3 Pan

##### XY

Click and hold the left mouse button in the graph to move the graph in the X and Y direction.

##### X

Click and hold the left mouse button in the graph to move the graph in the X direction.

##### Y

Click and hold the left mouse button in the graph to move the graph in the Y direction.

#### 4.6.1.4 Copy Image to Clipboard

Copies the displayed image to the operating system clipboard.

#### 4.6.1.5 Show Data Points

Displays small dots at each data point of the linear interpolated trace.

#### 4.6.1.6 Default Zoom On Update

Resets the Zoom to the default zoom on each display update.

### 4.6.2 Arrows Indicating Data out of Display Range

Parts or all of the data may be out of the display range. For this purpose, arrow indicators on the right side of the graph show a status in each direction (up, down, left, right). The arrow is displayed in yellow if only parts of the data are outside the visual area. If all data is outside the visual area, the arrow turns red.

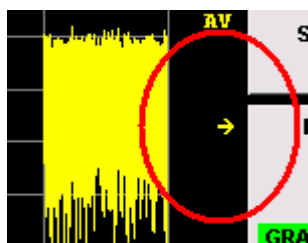


Figure 4-5: "Data out of Display" indication on the screen

The yellow arrow indicates that parts of the data are outside to the right of the visible area (the arrow points to the right).

## 5 Measurements

This section contains a detailed description of all measurement modes, settings and results.

### 5.1 Numerical Results

#### 5.1.1 EVM Measurements

##### EVM PDSCH QPSK/16QAM/64QAM

EVM for all PDSCH channel symbols which are either QPSK, 16QAM or 64QAM modulated for the analyzed frame.

- Remote: FETC:SUMM:EVM:DSQP?
- Remote: FETC:SUMM:EVM:DSST?
- Remote: FETC:SUMM:EVM:DSSF?

##### EVM Physical Channel

EVM for all physical channel symbols for the analyzed frame.

- Remote: FETC:SUMM:EVM:PCH?

##### EVM Physical Signal

EVM for all physical signal symbols for the analyzed frame.

- Remote: FETC:SUMM:EVM:PSIG?

##### EVM All

EVM for all symbols for the analyzed frame.

- Remote: FETC:SUMM:EVM?

#### 5.1.2 I/Q Constellation Measurements

##### Frequency Error

Difference between measured and reference center frequency.

- Remote: FETC:SUMM:FERR?

##### Sampling Error

Difference between measured and reference symbol clock relative to the system sampling rate.

- Remote: FETC:SUMM:SERR?

**I/Q Offset**

Power at spectral line 0 normalized to the total transmitted power.

→ Remote: FETC:SUMM:IQOF?

**I/Q Gain Imbalance**

Logarithm of the 'Q-Channel to I-Channel gain ratio'.

→ Remote: FETC:SUMM:GIMB?

**I/Q Quadrature Error**

Measure of the 'phase angle between Q-Channel and I-Channel' deviating from the ideal 90 degrees.

→ Remote: FETC:SUMM:QUAD?

**5.1.3 MIMO Measurements****Time Alignment Error  $\Delta 2,1$** 

Time Alignment error measuring the timing difference between antenna 2 and antenna 1.

→ Remote: FETC:SUMM:TAE2?

**Time Alignment Error  $\Delta 3,1$** 

Time Alignment error measuring the timing difference between antenna 3 and antenna 1.

→ Remote: FETC:SUMM:TAE3?

**Time Alignment Error  $\Delta 4,1$** 

Time Alignment error measuring the timing difference between antenna 4 and antenna 1.

→ Remote: FETC:SUMM:TAE4?

**5.1.4 Power Measurement****OSTP**

OFDM Symbol Transmit Power as defined in 3GPP TS 36.141.

→ Remote: FETC:SUMM:OSTP?

**Power**

Average time domain power of the analyzed signal.

→ Remote: FETC:SUMM:POW?



**Crest Factor**

Peak-to-average power ratio of captured signal.

→ Remote: FETC:SUMM:CRES?

## 5.2 Graphical Results

### 5.2.1 Power vs. Time Measurements

**Capture Buffer**

Power profile of the capture buffer data being analyzed.

→ Remote: CALC1:FEED 'PVT:CBUF'

**ON/OFF Power**

Transmit OFF power and transmitter transient period measurement.

→ Remote: CALC1:FEED 'PVT:OOP'

**Power vs. Symbol X Carrier**

Power for each analyzed resource element.

→ Remote: Not supported yet.

### 5.2.2 EVM Measurements

**EVM vs. Carrier**

EVM versus the physical carriers of the analyzed frame.

→ Remote: CALC1:FEED 'EVM:EVCA'

**EVM vs. Symbol**

EVM versus the symbols of the analyzed frame.

→ Remote: CALC1:FEED 'EVM:EVSY'

**EVM vs. Symbol X Carrier**

EVM for each analyzed resource element.

→ Remote: Not supported yet.

**Frequency Error vs. Symbol**

Difference between measured and reference center frequency versus the symbols of the analyzed frame.

→ Remote: CALC1:FEED 'EVM:FEVS'

### EVM vs. Subframe

EVM versus the subframes of the analyzed frame.

→ Remote: CALC1:FEED 'EVM:EVSU'

## 5.2.3 Spectrum Measurements

### Spectrum Mask

Spectrum Emission Mask measurement according to the 3GPP standard.

→ Remote: CALC1:FEED 'SPEC:SEM'

### ACLR (Relative)

Relative Adjacent Channel Leakage Ratio measurement according to the 3GPP standard.

→ Remote: CALC1:FEED 'SPEC:ACPR'

### ACLR (Absolute)

Absolute Adjacent Channel Leakage Ratio measurement.

→ Remote: CALC1:FEED 'SPEC:ACPA'

### Power Spectrum

Power density spectrum of the complete capture buffer in dBm/Hz.

→ Remote: CALC1:FEED 'SPEC:PSPE'

### Power Vs RB PDSCH

Power versus PDSCH resource blocks.

→ Remote: CALC1:FEED 'SPEC:PVRP'

### Power Vs RB RS

Power versus reference signal resource blocks.

→ Remote: CALC1:FEED 'SPEC:PVRR'

### Channel Flatness

Amplitude of the channel transfer function.

→ Remote: CALC1:FEED 'SPEC:FLAT'

### Channel Group Delay

Group delay of each single carrier, averaged over all OFDM symbols.

→ Remote: CALC1:FEED 'SPEC:GDEL'

### Channel Flatness Difference

Absolute difference of adjacent carriers.

→ Remote: CALC1:FEED 'SPEC:FDIF'

## 5.2.4 Constellation Measurements

### Constellation Diagram

Complex constellation diagram of the modulation symbols. The different modulation formats are assigned unique colors. With the "Constell Selection" softkey it is possible to suppress unwanted information.

→ Remote: CALC1:FEED 'CONS:CONS'

## 5.2.5 Statistic / Misc. Measurements

### CCDF (Complementary Cumulative Distribution Function)

Complementary cumulative probability distribution for the capture buffer samples relative to the average power.

→ Remote: CALC1:FEED 'STAT:CCDF'

### Signal Flow

Detailed description of the current measurement status.

→ Remote: CALC1:FEED 'STAT:SFLO'

### Allocation Summary

Provides information about the allocations from the analyzed frame, i.e. PRB offset, PRB count and EVM of the allocation.

→ Remote: CALC1:FEED 'STAT:ASUM'

### Bit Stream

Demodulated data stream for each data allocation.

→ Remote: CALC1:FEED 'STAT:BSTR'

### Allocation ID vs. Symbol X Carrier

Allocation ID for each analyzed resource element .

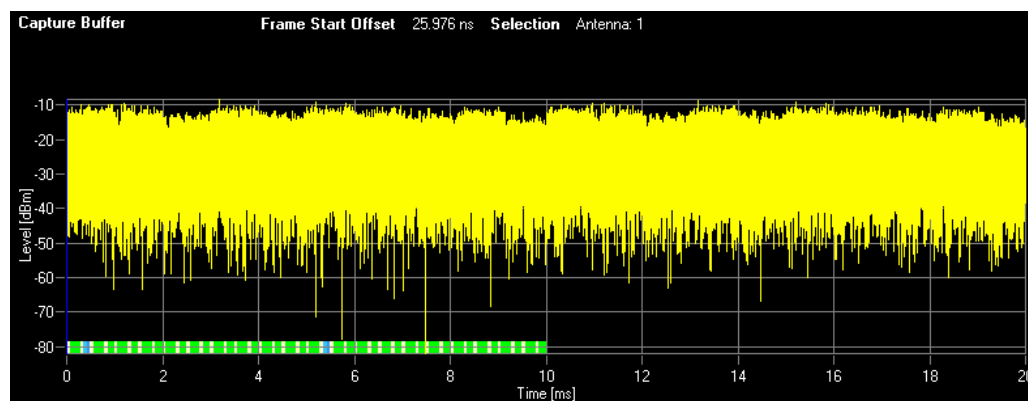
→ Remote: Not supported yet.

## 5.3 I/Q Measurements

This section contains a detailed description of the IQ measurements.

### 5.3.1 Capture Buffer





To display the Capture Buffer PVT (power versus time) results select "PVT", then "Capture Buffer".



**Figure 5-1: Capture Buffer Display**

The Capture Buffer display shows the complete range of captured data for the last sweep. The Capture Buffer display shows the amplitude of the captured I/Q data in dBm.

The analyzed frame is identified with a bar at the bottom of the Capture Buffer display. The useful part of each analyzed OFDM symbol is marked by its own bar; the different colors indicate the OFDM symbol type. The following OFDM symbol types are used:

	Data
	Reference Signal and data
	P-SYNC and data
	S-SYNC and data

A blue vertical line at the beginning of the bar at the bottom of the Capture Buffer display marks the frame start. Additionally, the display header includes the Frame Start Offset value. This value is the time difference between the frame start and capture buffer start.

The following figure shows a zoomed version of the above graph:

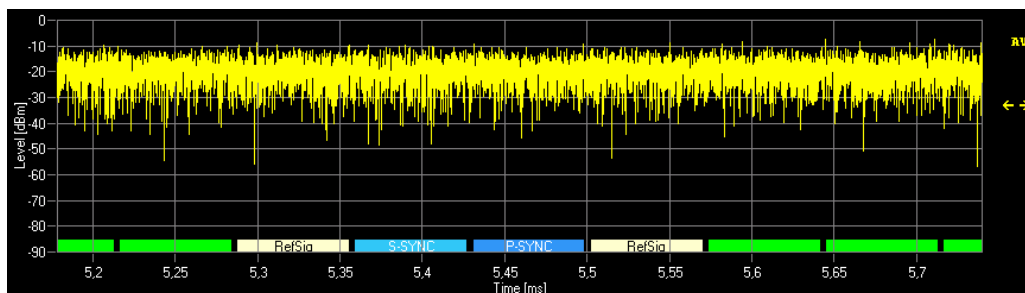


Figure 5-2: Capture Buffer Display (zoom in)

➔ Remote: CALC1:FEED 'PVT:CBUF'

### 5.3.2 ON/OFF Power

To display the ON/OFF Power results select "PVT", then "ON/OFF Power".

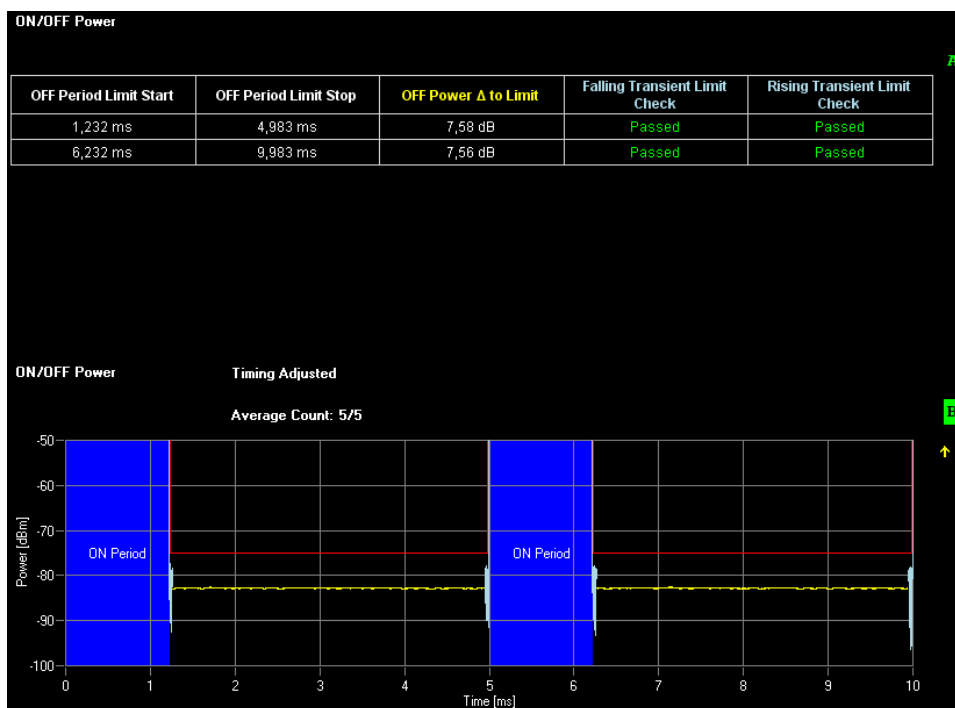


Figure 5-3: ON/OFF Power Display

The ON/OFF power measurement use different signal data to IQ measurements and as such it is not possible to run an IQ measurement and then view the results in the ON/OFF power measurement and vice-versa.

The ON/OFF Power measurement is only available if Duplexing is set to TDD and the input source is set to RF.

For a detailed description of the ON/OFF power measurement see "[TDD Transmit ON/OFF Power Measurement Guide](#)".

➔ Remote: CALC1:FEED 'PVT:OOP'

### 5.3.3 Power vs. Symbol X Carrier

To display the Power vs. Symbol X Carrier results select "PVT", then "POWER VS SYM X CARR".

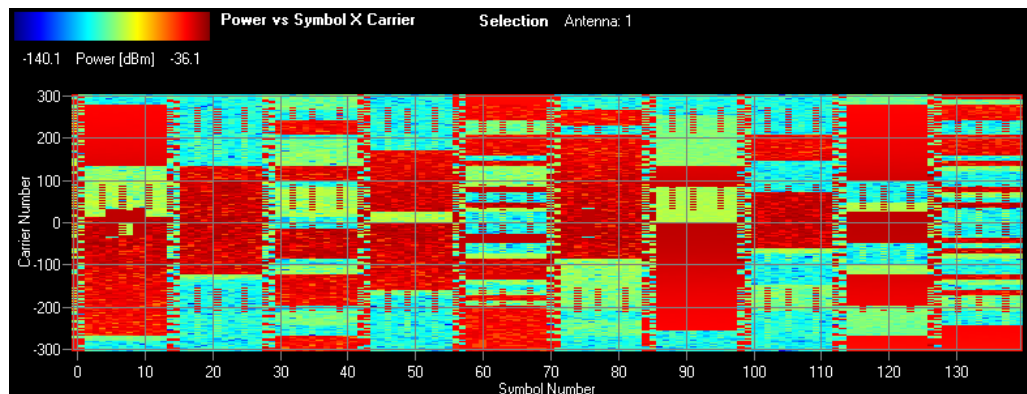


Figure 5-4: Power vs. Symbol X Carrier Display

The Power vs. Symbol X Carrier display shows the power of each carrier in each symbol of the received signal. The values are color-coded using a colormap which is displayed on the top of the measurement window.

➔ Remote: Not supported yet.

### 5.3.4 EVM vs. Carrier

To display the EVM vs. Carrier measurement results select "EVM", then "EVM vs. Carrier".

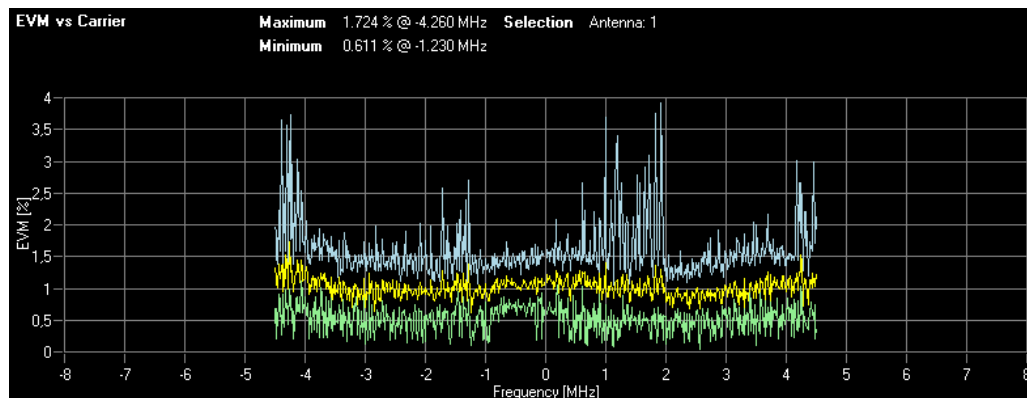


Figure 5-5: EVM vs. Carrier Display

The EVM vs. Carrier display shows the EVM of each carrier, averaged over all available OFDM symbols.

➔ Remote: CALC1:FEED 'EVM:EVCA'

### 5.3.5 EVM vs. Symbol

To display the EVM vs. Symbol measurement results select "EVM", then "EVM vs. Symbol".

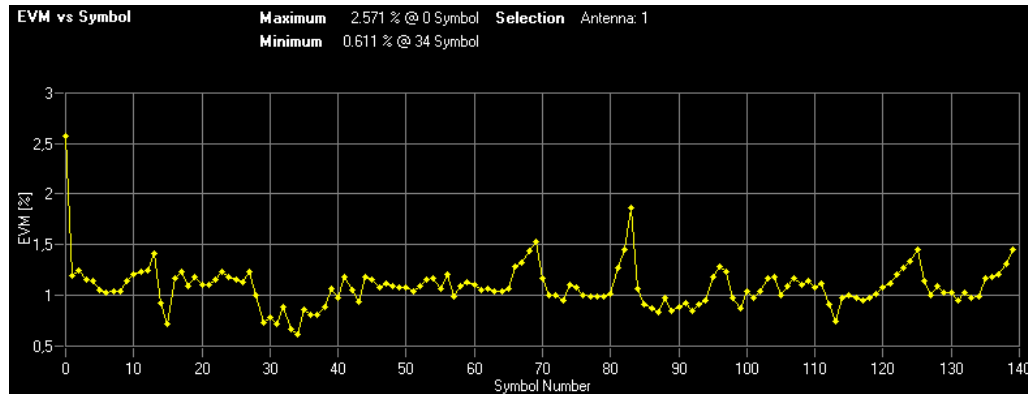


Figure 5-6: EVM vs. Symbol Display

The EVM vs. Symbol display shows the EVM of each symbol, averaged over all OFDM data carriers. The results are displayed on a per-symbol basis.

➔ Remote: CALC1:FEED 'EVM:EVSY'

### 5.3.6 EVM vs. Symbol X Carrier

To display the EVM vs. Symbol X Carrier results select "EVM", then "EVM VS SYM X CARR".

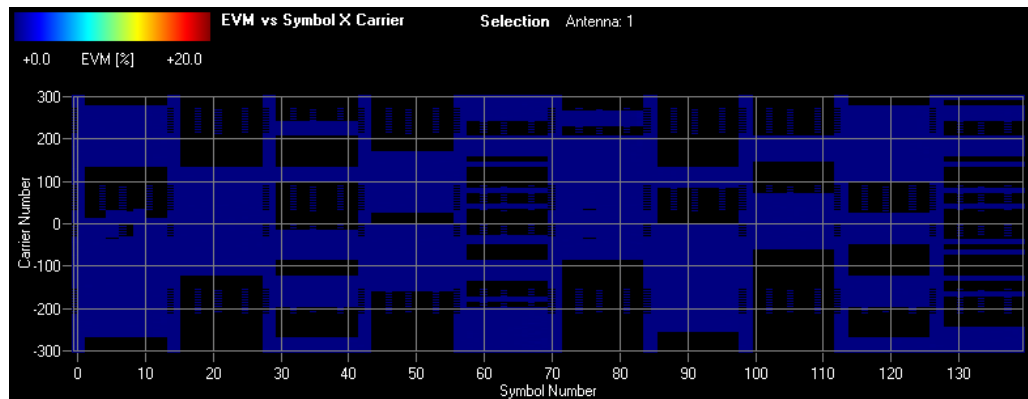


Figure 5-7: EVM vs. Symbol X Carrier Display

The EVM vs. Symbol X Carrier display shows the EVM of each carrier in each symbol of the received signal. The values are color-coded using a colormap which is displayed on the top of the measurement window.

➔ Remote: Not supported yet.

### 5.3.7 Frequency Error vs. Symbol

To display the Frequency Error vs. Symbol measurement results select "EVM", then "Freq Err vs. Symbol".

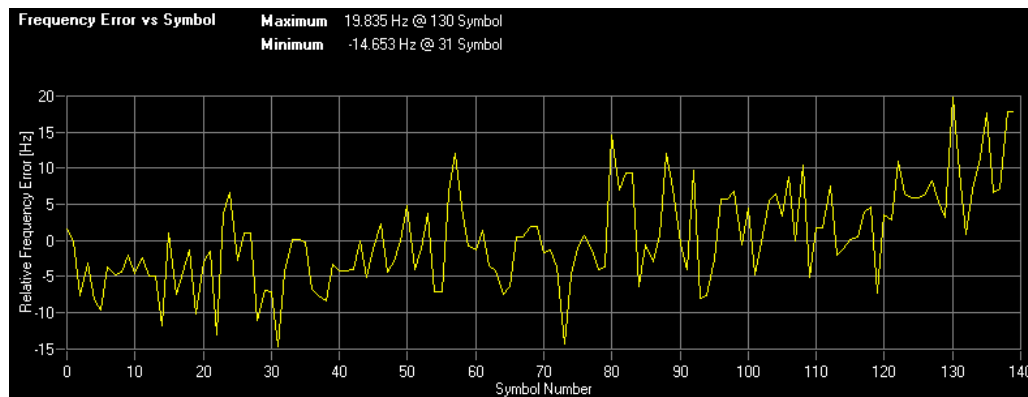


Figure 5-8: Frequency Error vs. Symbol Display

The Frequency Error vs. Symbol results display shows the frequency error values recorded versus the analyzed OFDM symbols.

```
→ Remote: CALC1:FEED 'EVM:FEVS'
```

### 5.3.8 EVM vs. Subframe

To display the EVM vs. Subframe measurement results select "EVM", then "Evm vs. Subframe".

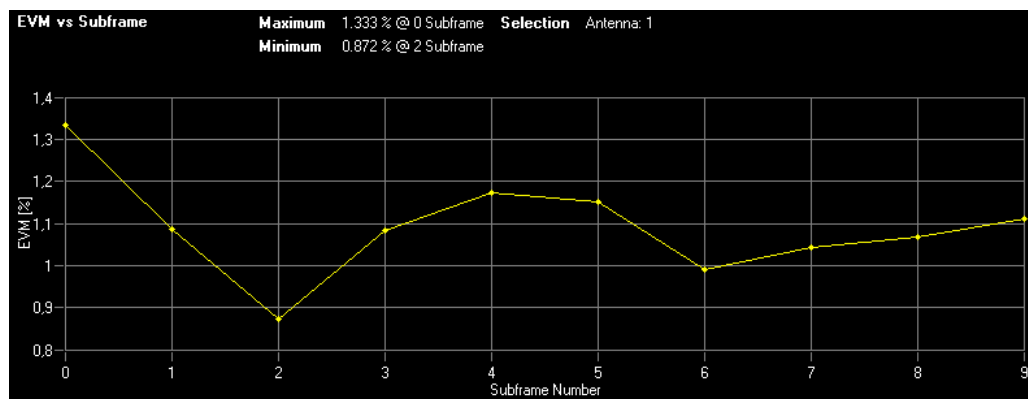


Figure 5-9: EVM vs. Subframe Display

The EVM vs. Subframe display shows the EVM of each subframe. The results are displayed on a per-subframe basis.

```
→ Remote: CALC1:FEED 'EVM:EVSU'
```



### 5.3.9 Power Spectrum

To display the Power Spectrum measurement results select "SPECTRUM", then "Power Spectrum".

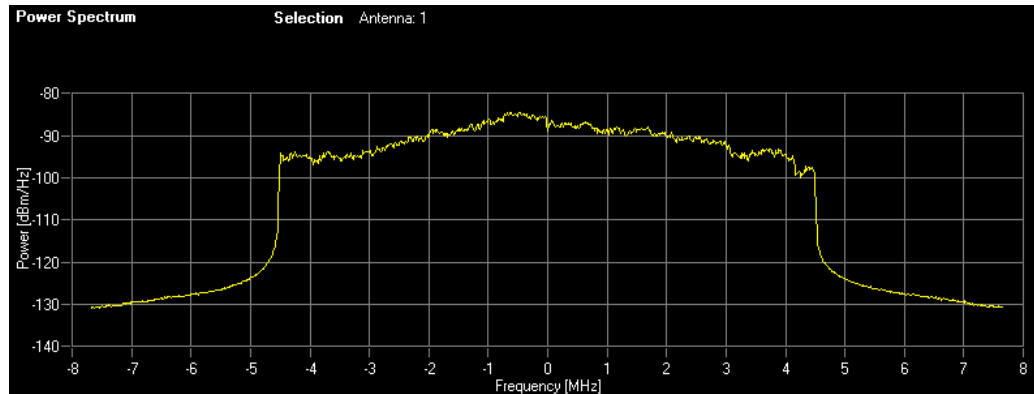


Figure 5-10: Power Spectrum Display

The Power Spectrum display shows the power density spectrum of the complete capture buffer in dBm/Hz.

→ Remote: CALC1:FEED 'SPEC:PSPE'

### 5.3.10 Power vs. RB PDSCH

To display the Power vs. Resource Block measurement results select "SPECTRUM", then "Power vs. RB PDSCH".

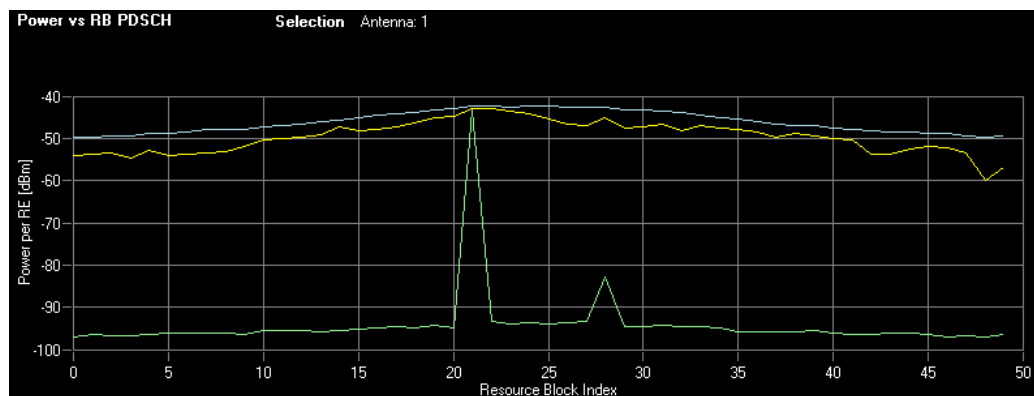


Figure 5-11: Power vs. RB PDSCH display

The Power vs. RB PDSCH display shows the power of the physical downlink shared channel per resource block.

→ Remote: CALC1:FEED 'SPEC:PVRP'

### 5.3.11 Power vs. RB RS

To display the Power vs. Resource Block measurement results select "SPECTRUM", then "Power vs. RB RS".

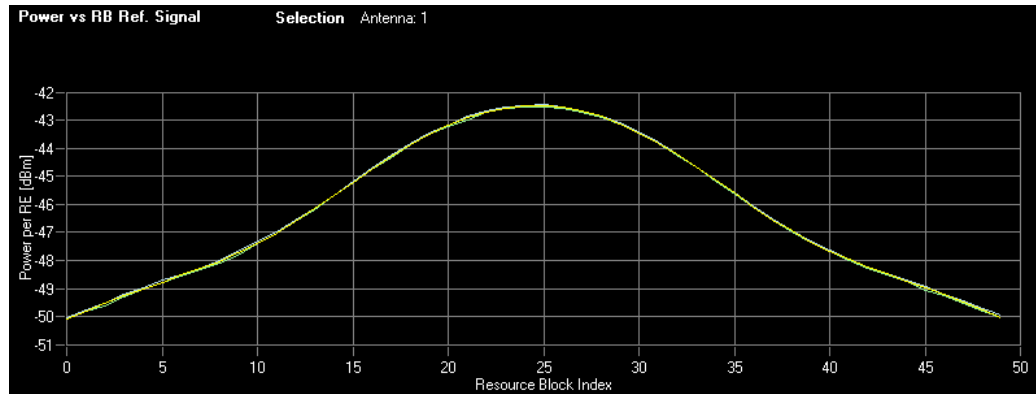


Figure 5-12: Power vs. RB RS display

The Power vs. RB RS display shows the power of the reference signal per resource block.

→ Remote: `CALC1:FEED 'SPEC:PVRR'`

### 5.3.12 Channel Flatness

To display the Channel Flatness measurement results select "SPECTRUM", then "Channel Flatness Flat".

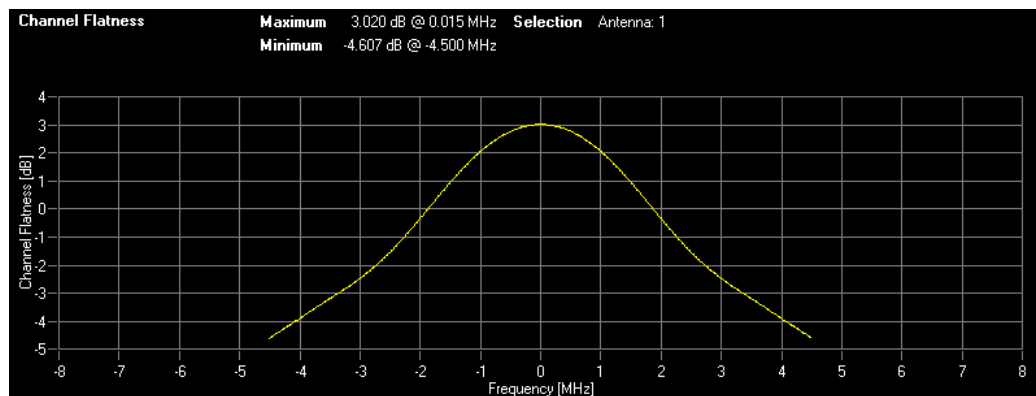


Figure 5-13: Channel Flatness Display

The Channel Flatness display shows the amplitude of the channel transfer function.

→ Remote: `CALC1:FEED 'SPEC:FLAT'`

### 5.3.13 Channel Group Delay

To display the Channel Group Delay measurement results select "SPECTRUM", then "Channel Flatness GRDEL".

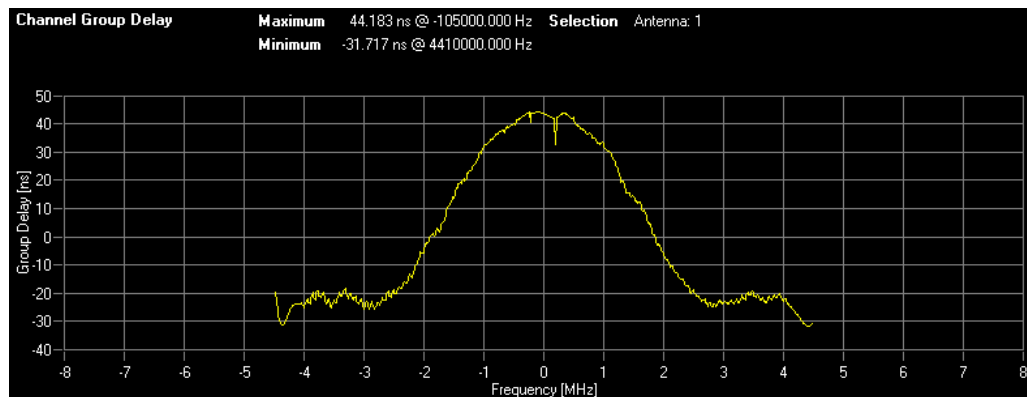


Figure 5-14: Channel Group Delay Display

The Channel Group Delay display shows the group delay of each single subcarrier.

➔ Remote: CALC1:FEED 'SPEC:GDEL'

### 5.3.14 Channel Flatness Difference

To display the Channel Flatness Difference results select "SPECTRUM", then "Channel Flatness Difference".

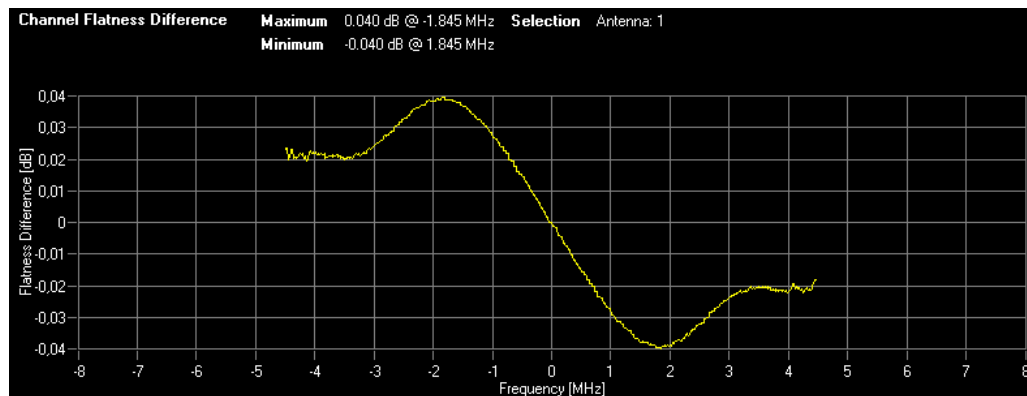


Figure 5-15: Channel Flatness Difference Display

The Channel Flatness Difference display shows the level difference in the spectrum flatness result between two adjacent physical subcarriers.

➔ Remote: CALC1:FEED 'SPEC:FDIF'

### 5.3.15 Constellation Diagram

To display the Constellation Diagram select "CONSTELL", then "Constell".

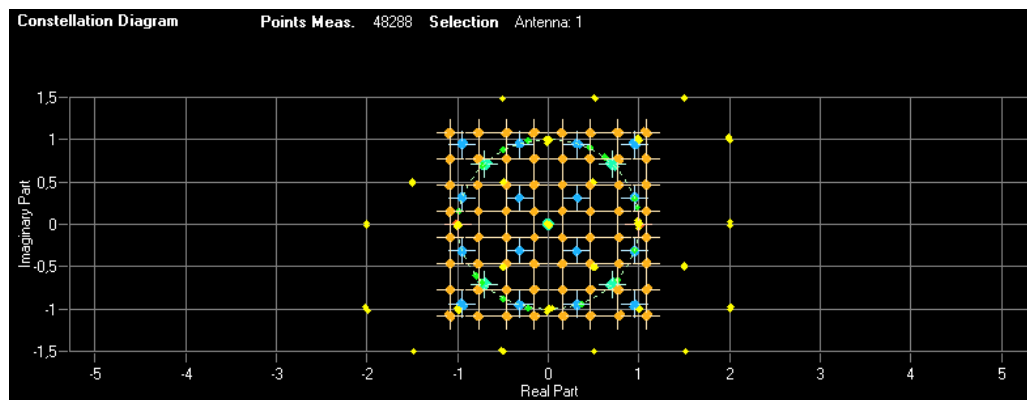


Figure 5-16: Constellation Diagram Display

The Constellation Diagram display shows the inphase and quadrature phase results over the full range of the measured input data. The ideal points for the selected modulation scheme are displayed for reference purposes.

→ Remote: CALC1:FEED 'CONS:CONS'

### 5.3.16 Constellation Selection

The "Constell Selection" softkey displays a pop-up dialog that allows the displayed results to be filtered. The results may be filtered by any combination of modulation, allocation ID, symbol, carrier or location. The results are updated as soon as any change to the constellation selection parameters is made.



Note that if you use a split screen and have the constellation display on each of these screens, it is not possible to have two different filters for the different screens.

#### Location

Choose the location where the constellation diagram is generated, if before or after the MIMO decoder.

If you use Spatial Multiplexing, in the MIMO encoder symbols of different encoding schemes are merged. Thus you get a mix of different modulation alphabets. Filter these symbols in the field "Modulation" with the value "MIXTURE". You get the mixed symbols only if "Location" is set to "Before MIMO decoder".

#### Dependency

- If Location is set to "After MIMO decoder", the filters Symbol and Carrier are not available.

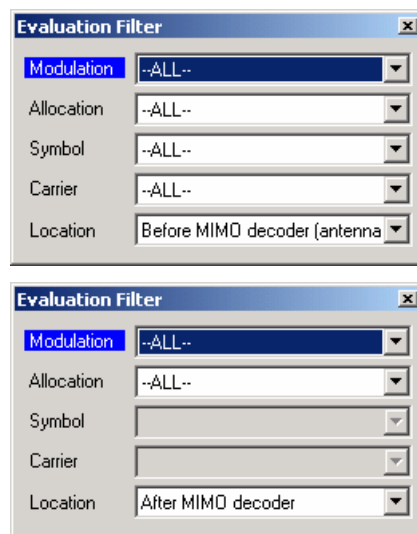


Figure 5-17: Constellation Evaluation Filter Panel

→ Remote: CONF:DL:CONS:LOC AMD

(Only the location setting is supported by remote control yet.)

### 5.3.17 CCDF (Complementary Cumulative Distribution Function)

To display the CCDF measurement results select "STATISTICS/MISC", then "CCDF".

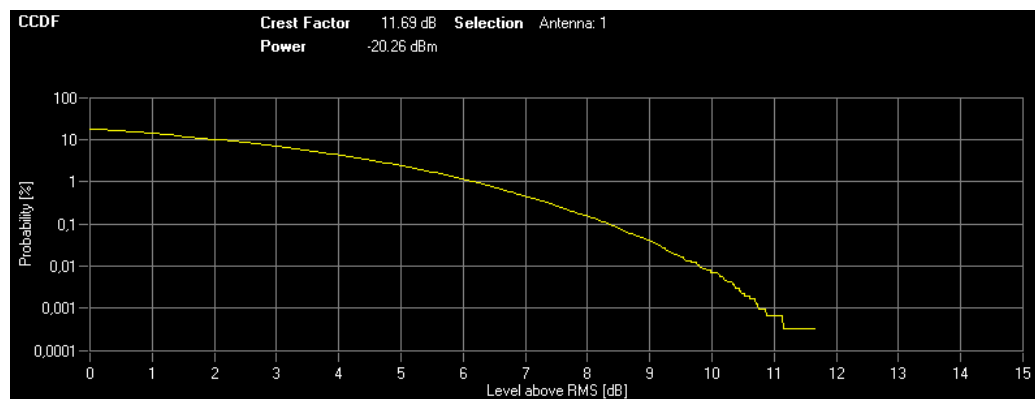


Figure 5-18: CCDF Display

The CCDF results display shows the probability of an amplitude exceeding the mean power. The X axis displays power relative to the measured mean power.

→ Remote: CALC1:FEED 'STAT:CCDF'

### 5.3.18 Signal Flow

To display the Signal Flow display select "STATISTICS/MISC", then "Signal Flow".

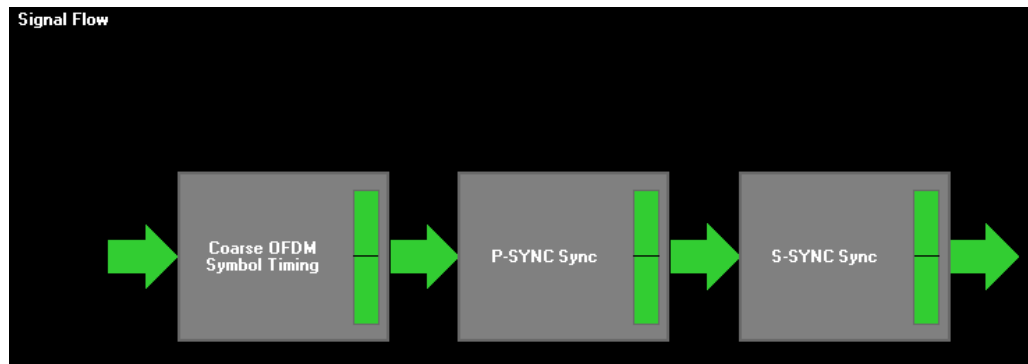


Figure 5-19: Signal Flow Display

The Signal Flow display shows a detailed description of the current measurement status. It provides additional hints on what is going wrong within the signal analysis.

For each synchronization block, a bar is shown giving information about the reliability of the synchronization result. If the level in the bar falls below the threshold indicated by the horizontal line, the synchronization is marked as failed and the color of the bar changes from green to red. When the synchronization of the block fails, the complete block changes its color to red and all succeeding arrows change their color to red, too.

For detailed information about the complete synchronization process, please refer to section "Measurements in Detail".

```
➔ Remote: CALC1:FEED 'STAT:SFLO'
```

### 5.3.19 Allocation Summary

To display the Allocation Summary measurement results select "STATISTICS/MISC", then "Allocation Summary".

Sub-frame	Alloc. ID	Number of RB	Rel. Power/dB	Modulation	Power per RE/dBm	EVM/%
0	RS Ant1		0,000	QPSK	-45,546	1,733
	P-SYNC		-0,007	CAZAC	-42,558	1,254
	S-SYNC		0,005	RBPSK	-42,546	1,251
	PBCH		-0,003	QPSK	-42,579	1,185
	PCFICH		0,000	QPSK	-45,619	2,079
	PHICH		0,000	MIXTURE	-43,984	2,877
	PDCCH		0,001	QPSK	-47,750	1,784
	PDSCH 0	23	-0,001	64QAM	-45,321	1,092
	PDSCH 1	12	0,003	QPSK	-47,871	1,280
	ALL	35				1,333

Figure 5-20: Allocation Summary Display

The Allocation Summary list displays detailed results on the measured allocations.

If a PDSCH allocation uses the Precoding Tx Mode 7 (UE-spec. RS), two entries for this allocation will appear in the Allocation Summary table. The additional entry displays measurement results for the UE specific reference signal.

The EVM unit can be changed in the "General Settings" dialog box.

➔ Remote: CALC:FEED 'STAT:ASUM'

### 5.3.20 Bit Stream

To display the Bit Stream measurement results select "STATISTICS/MISC", then "Bit Stream".

Sub-frame	Allocation ID	Code-word	Modulation	Symbol Index	Bit Stream
0	PBCH	1/1	QPSK	0	01 01 00 02 03 00 01 02 01 02 01 00 03 00 02 02
0	PBCH	1/1	QPSK	16	02 03 02 03 03 03 00 02 00 03 00 02 02 03 01 01
0	PBCH	1/1	QPSK	32	03 02 03 03 03 03 01 03 00 03 00 03 03 00 03 02
0	PBCH	1/1	QPSK	48	00 01 00 01 01 03 01 01 02 03 01 03 01 00 00 03
0	PBCH	1/1	QPSK	64	02 03 02 02 02 00 01 00 02 03 01 03 01 01 02 00
0	PBCH	1/1	QPSK	80	00 01 01 00 02 02 02 01 00 02 03 01 01 01 03 02
0	PBCH	1/1	QPSK	96	02 02 00 02 03 00 03 00 01 03 02 00 03 00 02 03
0	PBCH	1/1	QPSK	112	03 01 01 03 01 01 02 00 03 01 01 01 03 01 03 03
0	PBCH	1/1	QPSK	128	01 03 00 03 02 01 02 03 02 02 02 02 01 02 03 02
0	PBCH	1/1	QPSK	144	03 03 02 02 03 01 02 03 02 02 00 01 02 01 03 00

Figure 5-21: Bit Stream Display

The bit stream results display shows the demodulated data stream for each data allocation.

➔ Remote: CALC:FEED 'STAT:BSTR'

### 5.3.21 Allocation ID vs. Symbol X Carrier

To display the Allocation ID vs. Symbol X Carrier results select "STATISTICS/MISC", then "ALLOC ID VS SYM X CARR".

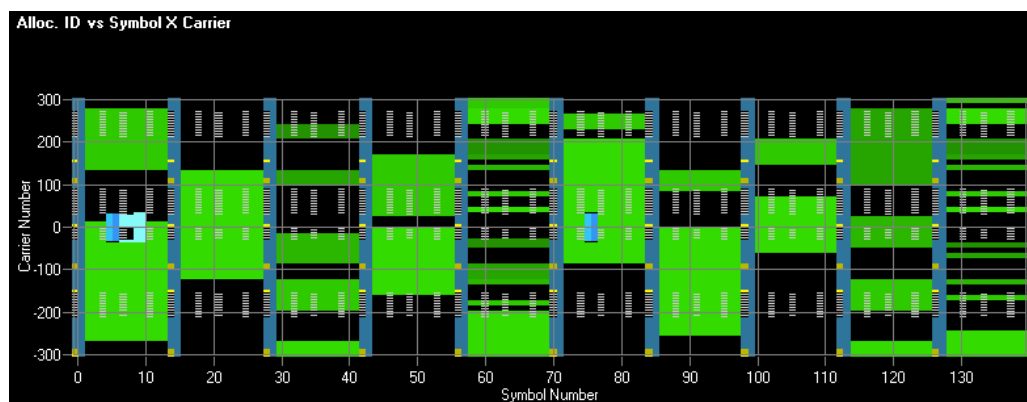


Figure 5-22: Allocation ID vs. Symbol X Carrier Display

The Allocation ID vs. Symbol X Carrier display shows the allocation ID of each carrier in each symbol of the received signal.

→ Remote: Not supported yet.

## 5.4 Frequency Sweep Measurements

The following measurements results are obtained in frequency sweep mode:

- "Spectrum Emission Mask"
- "Spectrum ACLR"

The frequency sweep measurements use different signal data to IQ measurements and as such it is not possible to run an IQ measurement and then view the results in the frequency sweep measurements and vice-versa. Also because each of the frequency sweep measurement use different settings to obtain signal data it is not possible to run a frequency sweep measurement and view the results in another frequency sweep measurement.

Frequency sweep measurements are only available when RF input is selected.

The frequency sweep measurements settings can be found in the "[SEM and ACLR Settings](#)" section of the "General Settings" dialog box.



### 5.4.1 Spectrum Emission Mask

The Spectrum Emission Mask measurement results are selected by pressing the "Spectrum" softkey in the main measurement softkey menu followed by the "Spectrum Mask" softkey.

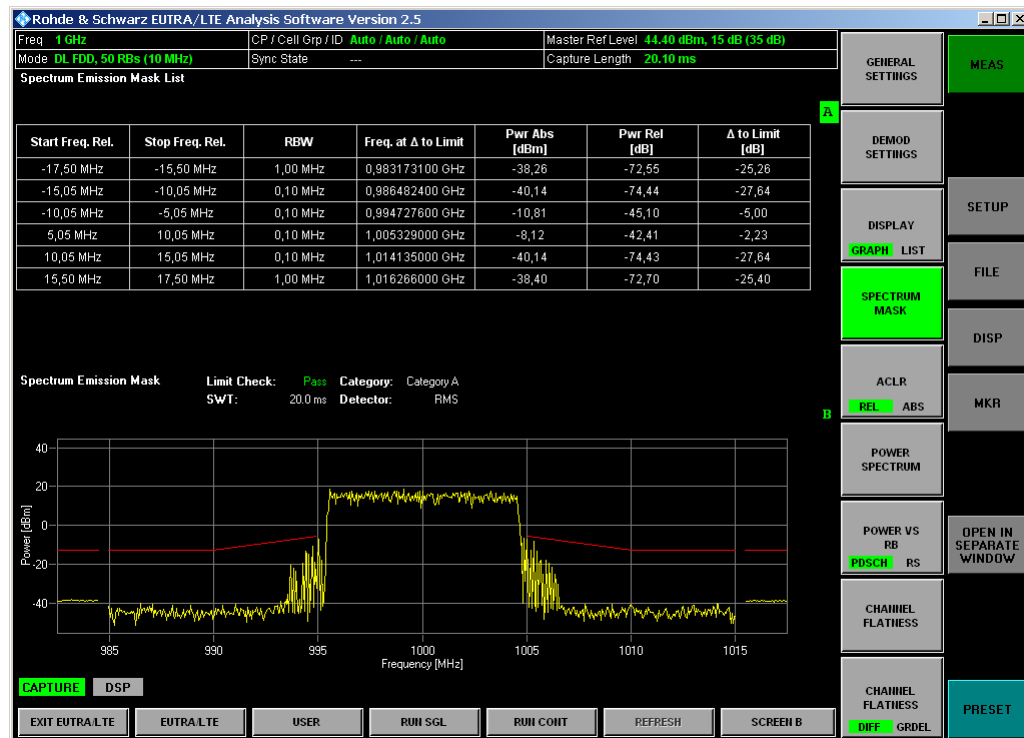


Figure 5-23: Spectrum Emission Mask Results

The Spectrum Mask results display shows power against frequency. The span of the results is related to the specified LTE Channel Bandwidth. A limit line representing the spectrum mask is displayed and an overall pass/fail status is displayed for the obtained results against this limit line.

➔ Remote: CALC1 : FEED 'SPEC : SEM'

### 5.4.2 Spectrum ACLR

The Spectrum ACLR measurement results are selected by pressing the "Spectrum" softkey in the main measurement softkey menu followed by the "ACLR" softkey.

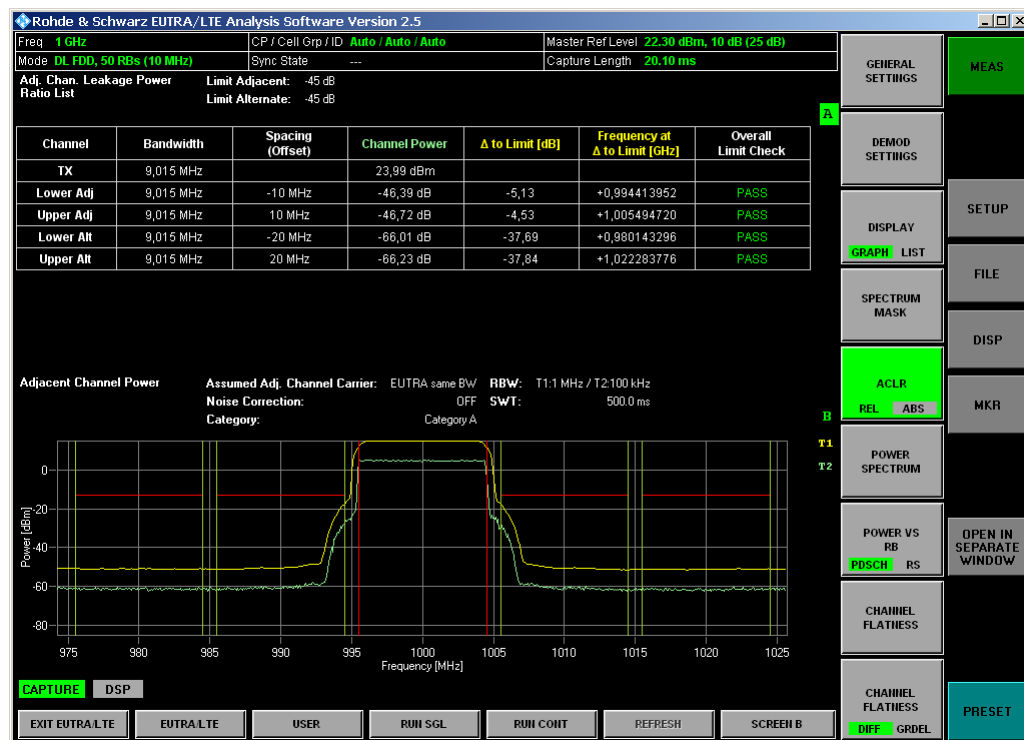


Figure 5-24: Spectrum ACLR Results

The Spectrum ACLR (Adjacent Channel Leakage Ratio) is similar to the Spectrum Mask measurement, and provides information about leakage into adjacent channels. The results show the relative or absolute power measured in the two nearest channels either side of the measured channel. This measurement is the same as the Adjacent Channel Power measurement provided by the Spectrum Analyzer.

Additionally, limit lines in the adjacent and alternate channels representing an absolute limit are displayed. The “Δ to Limit” result in the list shows the minimum distance of the yellow trace to the limit line for the associated channel at the frequency given by the “Frequency at Δ to Limit” result.

The overall limit check combines the limit checks for the adjacent channel power measurement and the absolute limit check measurement by applying the following rule: If any of the two or both measurements pass, the overall limit check is set to pass. For all other cases it is set to fail.

By default the ACLR Settings are derived from the LTE Channel Bandwidth setting of the Demodulation Settings Panel. The assumed adjacent channel carrier type and noise correction setting may be changed in the General Settings menu.

- ➔ Remote: CALC1:FEED 'SPEC:ACPR'
- ➔ Remote: CALC1:FEED 'SPEC:ACPA'

## 5.5 Result Summary

To display the Result Summary results select "Display List".

Result Summary						
		Symbols Meas.	140	Selection	Antenna: 1	
Frame Results 1/1	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK		1.12	17.50			%
EVM PDSCH 16QAM		1.18	12.50			%
EVM PDSCH 64QAM		1.07	8.00			%
Time Alignment Error Δ2,1						ns
Time Alignment Error Δ3,1						ns
Time Alignment Error Δ4,1						ns
Results for Selection	Subframes ALL			Frame 1/1		
EVM All	0.87	1.11		1.33		%
EVM Phys. Channel	0.85	1.10		1.30		%
EVM Phys. Signal	1.00	1.16		1.63		%
Frequency Error	-5247.15	-5242.29		-5233.36		Hz
Sampling Error	0.91	1.02		1.12		ppm
IQ Offset	-30.92	-29.83		-28.28		dB
IQ Gain Imbalance	0.17	0.17		0.18		dB
IQ Quadrature Error	-0.02	0.00		0.01		°
OStP	-22.72	-20.41		-19.34		dBm
Power	-21.96	-20.26		-19.31		dBm
Crest Factor		11.69				dB

Figure 5-25: Result Summary Display

The Result Summary table is displayed for I/Q measurements when the display mode is set to LIST. This table shows the overall measurement results and optionally provides limit checking for result values in accordance with the selected standard.

As the EUTRA/LTE standard currently does not contain all necessary limit values, the limits can be loaded via an XML file. Please refer to section "Import and Export of Data" for details on the import format.

The results are evaluated in the table, and pass or fail verdicts are displayed in green and red, respectively.

In some cases it is not possible to measure the IQ Gain Imbalance and IQ Quadrature Error. Try to step through the subframes by using the subframe selection in general settings to find a subframe where the measurement is available. If subframe selection is set to ---All---, only a measurement result is available if there are valid results in all subframes.

- ➔ Remote: Use the "FETCh Subsystem" to get the results of the Result Summary via remote control.

# 6 Settings

This section describes the "General Settings" dialog box, where all settings related to the overall measurement (i.e. Signal Characteristics, Input, Level, Trigger, Result, SEM and ACLR settings) can be modified.

The "General Settings" softkey opens the "General Settings" dialog box with two tabs: General Settings and Advanced Settings. To see the content of the tabs as shown below click on one of the tabs.



Figure 6-1: Tabs in General Settings Dialog

For a detailed description of the General and Advanced Settings see below.

## 6.1 General Settings

The "General Settings" dialog box opens displaying the "General Settings" tab.

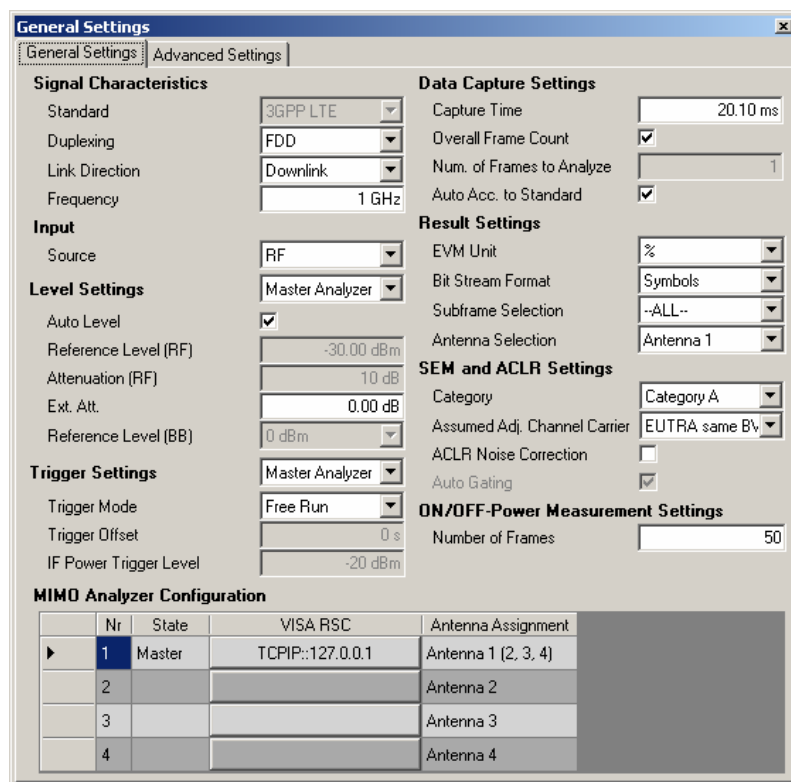


Figure 6-2: General Settings dialog box

### 6.1.1.1 Signal Characteristics

The Signal Characteristics settings are the general settings concerning the physical attributes of the signals to be measured.

#### Standard

Standard

Sets the standard version to use for this measurement.

At the moment, only the preliminary EUTRA/LTE standard version is supported. Therefore, this configuration is disabled.

→ Remote: Not supported yet.

#### Duplexing

Duplexing

Sets the duplexing type to use for this measurement. Frequency Division Duplex (FDD) and Time Division Duplex (TDD) are supported.

→ Remote: CONF:DUPL FDD

#### Link Direction

Link Direction

Sets the link direction to use for this measurement.

Choose Downlink. The downlink option is supported by the R&S K101/K105 software.

→ Remote: CONF:LDIR UL

#### Frequency

Frequency

Specifies the Center Frequency of the signal to be measured.

The maximum frequency depends on the hardware configuration of your R&S FSQ/FSV.

→ Remote: SENS:FREQ:CENT 1GHZ

### 6.1.1.2 Input

The Input settings group contains settings related to the input source of the signal to be measured.

#### Source



Selects whether the RF input, Baseband (BB) input, Digital I/Q or File is used.

The "Source" drop-down combo box is used to specify the I/Q data source. Data can either be captured from the R&S FSQ / FSV instrument (select "RF", "Baseband (BB)" or "Digital IQ") or read from file (select "File"). If "File" is selected, each time the user presses the "RUN SGL" or "RUN CONT" hotkey, a dialog box is shown where the user can specify the full name and path of the I/Q data file to be used. Pressing "ENTER" loads the specified I/Q data file and displays the results.

If the specified file cannot be found or is not a valid I/Q data file, an error message will be displayed indicating that the I/Q data could not be imported.

→ Remote: SENS:INP RF

### 6.1.1.3 Level Settings

The Level settings group contains settings related to the reference level and the RF attenuation.



Chooses to which instrument the Level/Attenuation settings are applied. This concerns the settings

- Auto Level
- Reference Level (RF)
- Attenuation (RF)
- Reference Level (BB)

→ Remote: Not available.

#### Auto level



Selects whether the reference level for measurements is measured automatically (ON) or entered manually by the user (OFF).

When Auto Level is set to ON, the R&S FSQ/FSV-K101/-K105 EUTRA/LTE analysis software will measure the reference level automatically at the start of each measurement sweep. This ensures that the reference level is always set at the optimal level for obtaining accurate results but will lead to slightly increased measurement times.

The Auto Level setting is only available for RF input.

→ Remote: SENS:POW:AUTO2 ON

**Reference level (RF)**

Reference Level (RF)

Specifies the RF Reference Level to use when running measurements, or displays the reference level when Auto Level is enabled.

The Reference Level parameter will only take effect if RF input is selected and Auto Level is disabled.

➔ Remote: CONF:POW:EXP:RF3 -30

**Attenuation (RF)**

Attenuation (RF)

RF Attenuation specifies the mechanical attenuation to be applied to the input RF signal.

The available values depend on the type of measurement hardware. If the current value is not supported by the hardware, the value will be corrected and a warning is shown.

The RF Attenuation parameter will only take effect if RF input is selected and Auto Level is disabled.

➔ Remote: INP:ATT2 10

**Ext Att**

Ext Att

Ext Att specifies the external attenuation or gain applied to the RF signal. A positive value indicates attenuation, a negative value indicates gain. All displayed power level values will be shifted by this value.

➔ Remote: DISP:WIND:TRAC:Y:RLEV:OFFS 10

**Reference level (BB)**

Reference Level (BB)

Specifies the Baseband Reference Level to use when running measurements.

Available values:

-20 dBm to 25 dBm in steps of 5 dBm.

The Reference Level parameter will only take effect if Baseband input is selected.

➔ Remote: CONF:POW:EXP:IQ2 -10

### 6.1.1.4 Trigger Settings

The Trigger settings group contains all the settings related to the triggering of a measurement sweep.

#### Trigger Mode

Trigger Mode

Trigger Mode is the source of the trigger for the measurement sweep.

The possible values for the Trigger Mode are:

Free Run: The measurement sweep starts immediately.

External: The measurement sweep starts when the external trigger signal meets or exceeds the specified external trigger level at the input connector EXT TRIGGER/GATE on the rear panel.

IF Power: The measurement sweep starts when the signal power meets or exceeds the specified power trigger level.

→ Remote: TRIG:MODE IMM

#### Trigger Offset

Trigger Offset

Trigger Offset specifies the time offset between the trigger signal and the start of the sweep. A negative value indicates a pre-trigger.

The Trigger Offset parameter is not editable when Trigger Mode is set to Free Run because this indicates that the measurement sweep should trigger immediately and as such a trigger delay or pre-trigger would not be appropriate.

#### IF Power Trigger Level

IF Power Trigger Level

Trigger Level (RF) Specifies the trigger level when a power trigger is selected.

The IF Power Trigger Level is only available for the trigger mode IF Power.

→ Remote: TRIGger:LEV1:POW -20

### 6.1.1.5 Data Capture Settings

The Data Capture settings specify how much data is to be captured and measured..

#### Capture Time

Capture Time

Capture Time specifies the time (and therefore the amount of data) to be captured in a single measurement sweep.

→ Remote: SENS:SWE:TIME 30MS



**Overall Frame Count**Overall Frame Count 

Overall Frame Count specifies whether a specified number of frames are to be captured and analyzed.

When Overall Frame Count is set to OFF then data analysis shall be performed on a single measurement sweep. When Overall Frame Count is set to ON then data analysis may be performed over a number of consecutive sweeps until the required number of frames has been captured and analyzed.

→ Remote: SENS:LTE:FRAM:COUN:STAT ON

**Num. of Frames to Analyze**Num. of Frames to Analyze 

Number of Frames to Analyze specifies the number of frames to be measured.

If the number of frames of the specified type are not contained in a single measurement sweep then the measurement application will continue to perform measurement sweeps until the requested number of frames have been captured.

The Number of Frames to Analyze parameter is not editable when either Overall Frame Count is set to OFF or Auto Acc. to Standard is set to ON.

→ Remote: SENS:LTE:FRAM:COUN 1

**Auto Acc. to Standard**Auto Acc. to Standard 

If Auto Acc. to Standard is set to ON, the Number of Frames to Analyze parameter will be set in accordance to the EUTRA/LTE standard.

The Auto Acc. to Standard parameter is not editable when Overall Frame Count is set to OFF.

→ Remote: SENS:LTE:FRAM:COUN:AUTO ON

**6.1.1.6 Result Settings**

The Result Settings set parameters for post-processing of the acquired data.

**EVM Unit**EVM Unit 

The EVM Unit setting allows you to display EVM results in the graphs and the numerical results in [dB] or [%].

→ Remote: UNIT:EVM DB

**Bit Stream Format**

Bit Stream Format

The Bit Stream Format setting allows you to display the bit stream as symbols (the bits belonging to one symbol are shown as hexadecimal numbers, always with two digits) or raw bits.

→ Remote: UNIT:BSTR SYM

**Example:**

Bit stream output if Bit Stream Format is set to Symbols:

Sub-frame	Allocation ID	Code-word	Modulation	Symbol Index	Bit Stream
0	PBCH	1/1	QPSK	0	02 00 00 00 01 00 00 02 00 03 00 00 02 01 03 00
0	PBCH	1/1	QPSK	16	02 02 02 03 00 00 03 01 03 02 02 01 02 03 02 01
0	PBCH	1/1	QPSK	32	00 01 01 00 00 02 02 03 01 00 03 03 03 01 02 01
0	PBCH	1/1	QPSK	48	00 02 01 01 02 03 03 03 00 02 01 02 02 02 01 02

Bit stream output if Bit Stream Format is set to Bits:

Sub-frame	Allocation ID	Code-word	Modulation	Bit Index	Bit Stream
0	PBCH	1/1	QPSK	0	100000000100001000110000100111001010101100001101
0	PBCH	1/1	QPSK	48	111010011011100100010100001010110100111111011001
0	PBCH	1/1	QPSK	96	001001011011111100100110101001100110000000110001
0	PBCH	1/1	QPSK	144	100101000110100101111111010001011000111010110010

**Subframe Selection**

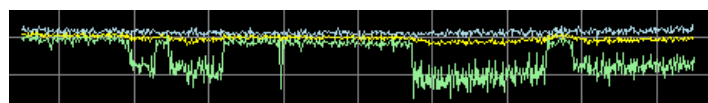
Subframe Selection

With the Subframe Selection, subframe-specific measurement results can be selected. This setting applies to the following measurements: Result Summary, EVM vs. Carrier, EVM vs. Symbol, Channel Flatness, Channel Group Delay, Channel Flatness Difference, Constellation diagram, Allocation Summary list and Bit Stream. If ---All--- is selected, either the results from all subframes are displayed at once or a statistic is calculated over all analyzed subframes.

→ Remote: SENS:SUBF:SEL ALL

**Example:**

Min/mean/max statistic is shown if ---All--- is selected:



where

<b>PK</b>	PK are the peak values,
<b>AV</b>	AV is the average and
<b>MI</b>	MI are the minimum values.

If a specific subframe is selected, only the current results of the selected subframe are shown:



### Antenna selection

Antenna Selection

Selects a specific antenna to display the results for.

→ Remote: SENS:ANT:SEL 1

### 6.1.1.7 SEM and ACLR Settings

The SEM and ACLR Settings are parameters for configuring the Spectrum Emission Mask measurement and the Adjacent Channel Leakage Ratio measurement.

#### Category

Category

Selects the Category (A or B) to be used for the Spectrum Emission Mask measurement.

→ Remote: POW:SEM:CAT A

#### Assumed Adjacent Channel

Assumed Adj. Channel

Selects the assumed adjacent channel carrier for the ACLR measurement. The supported types are EUTRA of same bandwidth, 1.28 Mcps UTRA, 3.84 Mcps UTRA and 7.68 Mcps UTRA.

Note that not all combinations of LTE Channel Bandwidth settings and Assumed Adj. Channel Carrier settings are defined in the 3GPP standard.

→ Remote: SENS:POW:ACH:AACH UTRA384

**ACLR Noise Correction**

ACLR Noise Correction

When selected, ACLR Noise Correction enables noise reduction to be performed on the signal.

➔ Remote: SENS:POW:NCOR ON

**Auto Gating**

Auto Gating

When Auto Gating is enabled, only the on-periods of the LTE signal is used for TDD SEM/ACLR measurements. The location and length of the on-periods are derived from the "TDD UL/DL Allocations" and "Conf. of Special Subframe" settings.

If Trigger Mode is set to External, a LTE frame trigger must be used.

The Auto Gating parameter is only editable when TDD mode is selected and Trigger Mode is set to External or IF Power.

➔ Remote: Not supported yet.

**6.1.1.8 ON/OFF Power Measurement Settings**

The ON/OFF Power Measurement Settings are parameters for configuring the ON/OFF Power measurement.

**Number of Frames**

Number of Frames

The Number of Frames value defines how many frames are averaged to calculate a reliable power trace for the ON/OFF Power measurement.

**6.1.1.9 MIMO Analyzer Configuration**

	Nr	State	VISA RSC	Antenna Assignment
▶	1	Master	TCPIP::myinstrument	Antenna 1 [2, 3, 4]
	2		TCPIP::mysecondinstr	Antenna 2
	3			Antenna 3
	4			Antenna 4

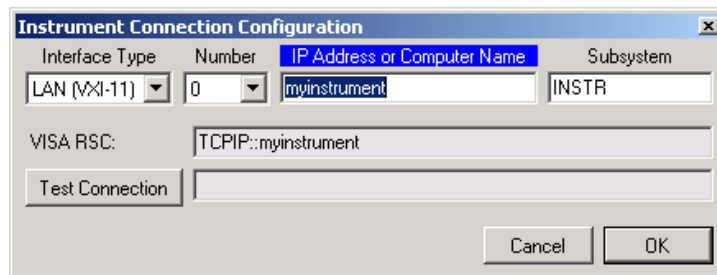
Figure 6-3: MIMO Analyzer Configuration

▶ Clicking on one of the buttons in the VISA RSC column opens the "Instrument Connection Configuration" dialog box.

➔ Remote: CONF:ADDR2 'TCPIP::192.168.0.1::INST0'

**Configure analyzer connection**

In order to be able to communicate with the instruments, the R&S FSQ / FSV must be connected with the PC using either an IEEE bus or LAN connection. For information how to obtain the GPIB or LAN address see section "[How to Obtain the GPIB or LAN Address in the R&S FSQ Instrument](#)" or "[How to Obtain the GPIB or LAN Address in the R&S FSV Instrument](#)".



**Figure 6-4: Instrument Connection Configuration**

If more than one interface is available on the PC (e.g. because two LAN cards are installed), please select the appropriate interface Number. The Subsystem does not need to be changed.

Depending on the Interface Type, different types of addresses must be entered:

Interface	Description	Address equivalent to ...
GPIB Instrument	IEEE bus system using the IEEE 488 protocol	Instrument primary GPIB address (0...31). Default value is 20 for the R&S FSQ/FSV.
LAN VXI-11 protocol	LAN bus system using the VXI-11 protocol (supported with R&S FSQ / FSV firmware version 3.65 or later)	Host address as TC/IP address or computer name. Contact your local IT support if you are not sure what to enter here.
LAN RSIB protocol	LAN bus system using a Rohde & Schwarz-specific protocol (supported with all R&S FSQ / FSV firmware versions)	Host address as TC/IP address or computer name. Contact your local IT support if you are not sure what to enter here.

## 6.1.2 Advanced Settings

In the "General Settings" dialog box click on the "Advanced Settings" tab to display the advanced settings.

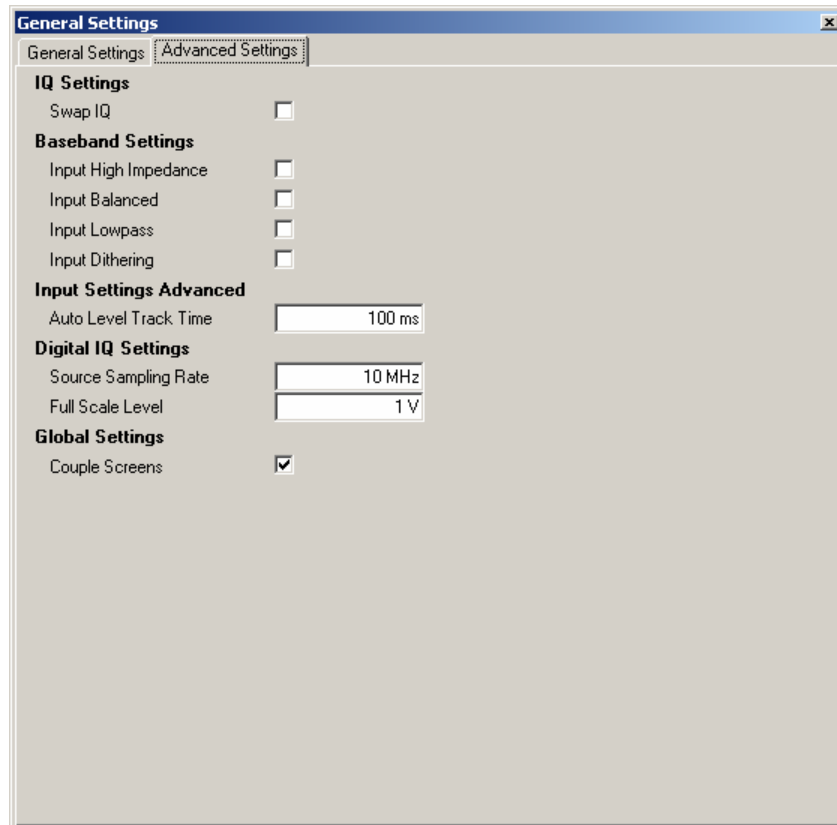


Figure 6-5: Advanced Settings dialog box

### 6.1.2.1 IQ Settings

The IQ Settings are the general settings concerning the signal to be measured.

#### Swap IQ



Swap IQ applies to both hardware I/Q data and file I/Q data.

→ Remote: SENS:SWAP ON

### 6.1.2.2 Baseband Settings

The Baseband Settings group contains settings related to the baseband input source.

#### Input High Impedance

Input High Impedance

Input High Impedance allows the selection of the impedance of the Baseband inputs. If this parameter is not enabled, the impedance is 50  $\Omega$ ; otherwise the impedance is 1 k $\Omega$  or 1 M $\Omega$  (depending on the instrument configuration).

The Input High Impedance parameter is editable only if Baseband input is selected.

→ Remote: INP:IQ:IMP LOW

#### Input Balanced

Input Balanced

Input Balanced switches the Baseband inputs between symmetrical (balanced) and asymmetrical (unbalanced).

The Input Balanced parameter is editable only if Baseband input is selected.

→ Remote: INP:IQ:BAL ON

#### Input Lowpass

Input Lowpass

When enabled, the Lowpass parameter specifies that a filter is applied from 36 MHz for the I/Q inputs.

The Lowpass parameter is editable only if Baseband input is selected.

→ Remote: SENS:IQ:LPAS ON

#### Input Dithering

Input Dithering

When enabled, the Dither parameter specifies that a 2 MHz-wide noise signal at 42.67 MHz is injected into the signal path of the Baseband input. It appears in the spectrum at 38.92 MHz.

The Dither parameter is editable only if Baseband input is selected.

→ Remote: SENS:IQ:DITH ON

### 6.1.2.3 Input Settings Advanced

The Input Settings Advanced group contains settings related to the RF input source.

#### Auto Level Track Time

Auto Level Track Time

Auto Level Track Time specifies the sweep time used for the auto level measurements.

This parameter is editable only if RF input is selected and Auto Level is enabled.

➔ Remote: SENS:POW:AUTO:TIME 0.1

### 6.1.2.4 Digital IQ Settings

The Digital IQ Settings group contains settings related to the Digital IQ input source.

#### Source Sampling Rate

Source Sampling Rate

Specifies the Source Sampling Rate of the digital IQ input signal.

The Source Sampling Rate parameter is editable only if Digital IQ input is selected.

➔ Remote: INP:DIQ:SRAT 10MHz

#### Full Scale Level

Full Scale Level

Specifies the Full Scale Level of the digital IQ input signal.

The Full Scale Level parameter is editable only if Digital IQ input is selected.

➔ Remote: INP:DIQ:RANG 1

### 6.1.2.5 Global Settings

The Global Settings group contains settings related to the settings which apply in a global scope.

#### Couple Screens

Couple Screens

If Couple Screens is enabled, the markers on the top and bottom screen which have the same unit (e.g., frequency or symbol index) are coupled. For the constellation diagram, the constellation selection is coupled with the marker.

➔ Remote: Not supported yet.



## 6.2 Demodulation Settings

This section describes the demodulation settings of the software for running a correct measurement by means of logical channel mapping and demodulation configuration.

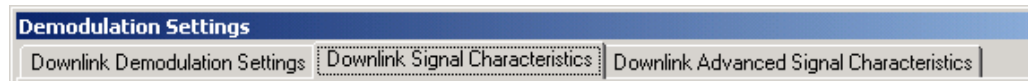


Figure 6-6: Tabs in the Demodulation Settings Dialog

The "Demod Settings" softkey opens the "Demodulation Settings" dialog box with three tabs: "Downlink Demodulation Settings", "Downlink Signal Characteristics" and "Downlink Advanced Signal Characteristics". To see the content of the tabs as shown below click on one of the tabs.

For a detailed description of the Demodulation and Signal Characteristics Settings see the following chapters.

➔ Remote: Not available.

### 6.2.1 Downlink Demodulation Settings

The "Demodulation Settings" dialog box opens displaying the "Downlink Signal Characteristics" tab. Click on the "Downlink Demodulation Settings" tab to display the settings.

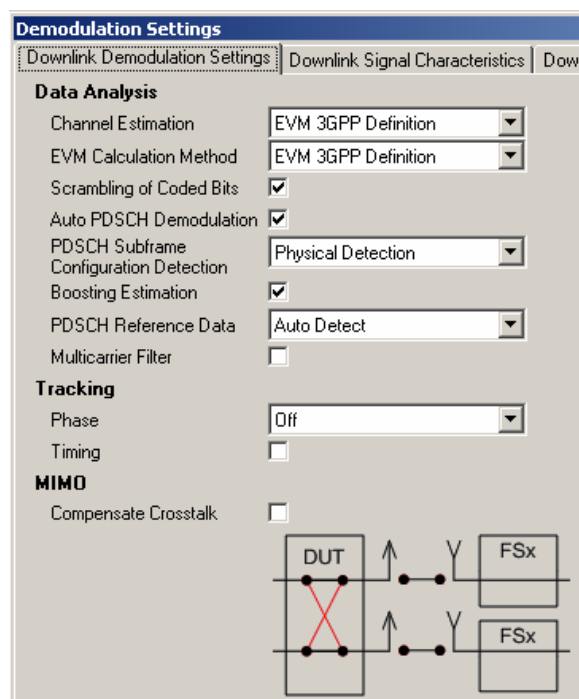


Figure 6-7: Tabs in the Downlink Demodulation Settings Dialog

The Downlink Demodulation Settings tab sets the signal processing configuration with respect to how the signal is to be measured. It does not contain any description of the signal structure.

### 6.2.1.1 Data Analysis

#### Channel Estimation

Channel Estimation

Specifies how channel estimation is performed for the signal.

**EVM 3GPP Definition** Channel estimation method as defined in [7] 3GPP TS 36.104 (averaging in frequency direction and linear interpolation). Only the reference signal resource elements are used.

**Optimal, Pilot only** Optimal channel estimation method, only the reference signal resource elements are used.

**Optimal, Pilot and Payload** Optimal channel estimation method, both reference signal and payload resource elements are used.

→ Remote: SENS:DL:DEM:CEST TGPP

#### EVM Calculation Method

EVM Calculation Method

Specifies the EVM calculation method.

**EVM 3GPP Definition** EVM calculation method as defined in [7] 3GPP TS 36.104. The EVM is evaluated at two trial timing positions and the maximum EVM of these two trials is used.

**At Optimal Timing Position** The EVM is calculated using the optimal timing position

→ Remote: SENS:DL:DEM:EVMC TGPP

#### Scrambling of Coded Bits

Scrambling of Coded Bits

Specifies whether the scrambling for coded bits shall be used or not. This setting applies to all physical channels like PDSCH, PHICH, etc.

→ Remote: SENS:DL:DEM:CBSC ON

#### Auto PDSCH Demodulation

Auto PDSCH Demodulation

Specifies whether or not the auto PDSCH demodulation feature shall be used. If auto PDSCH demodulation is enabled, the resource allocation is automatically detected by analyzing the received signal.

The type of detection is specified by the “[PDSCH Subframe Configuration Detection](#)” setting.

→ Remote: SENS:DL:DEM:AUTO ON

**PDSCH Subframe Configuration Detection**

PDSCH Subframe Configuration Detection

Specifies the type of PDSCH Subframe Configuration Detection.

There are two options available:

- |                    |  |
|--------------------|--|
| Off                | The user PDSCH Subframe Configuration is applied to the current demodulated LTE frame even if the actual subframe configuration of the measured frame is different (a bad EVM will result in case the subframe configuration does not match).  |
| Physical Detection | For manual PDSCH configuration, the current demodulated LTE frame is compared to the user PDSCH Subframe Configuration and will only be analyzed if the actual subframe configuration is the same as the configured one. With this new setting it is possible to measure TDD E-TMs without the requirement of a 20 ms trigger signal.<br><br>For auto PDSCH demodulation, the PDSCH subframe configuration is detected by physical detection of the received signal. |
| PDCCH Protocol     | In this mode, the PDSCH subframe configuration is set according to the data contained in the protocol of the PDCCH DCIs.   |

→ Remote: SENS:LTE:DL:FORM:PSCD

**Boosting Estimation**

Boosting Estimation

Specifies whether or not the boosting estimation feature shall be used. If boosting estimation is enabled, the Rel. Power settings of all physical channels and the P-/S-SYNC are automatically set by analyzing the received signal.

→ Remote: SENS:DL:DEM:BEST ON

**PDSCH Reference Data**

PDSCH Reference Data

Specifies which reference data for PDSCH shall be used.

There are two options available:

- |              |   |
|--------------|---|
| Auto Detect  | The reference data for PDSCH is detected automatically by analyzing the received signal.  |
| All 0 (E-TM) | The PDSCH reference data for the EVM calculation are set to a fixed value of zero in accordance with the test model definition. |

This option is useful if a signal with a high EVM is to be measured, in which case the auto detection does not work reliably.

For this option the device under test must transmit an all-zero data vector on the PDSCH to get correct results.

→ Remote: SENS:DL:DEM:PRD ALL0

### Multicarrier Filter

Multicarrier Filter

The Multicarrier Filter suppresses interference from adjacent LTE/WDCMA/GSM/etc. carriers.

→ Remote: SENS:DL:DEM:MCF ON

## 6.2.1.2 Tracking Settings

### Phase Tracking

Phase Tracking

Specifies whether or not the measurement results should be compensated for common phase error. When phase compensation is used, the measurement results will be compensated for phase error on a per-symbol basis.

Off Common phase tracking is not applied.

Pilot only Only the pilot carriers are used.

Pilot and Payload Both pilot and payload carriers are used.

→ Remote: SENS:DL:TRAC:PHAS OFF

### Timing Tracking

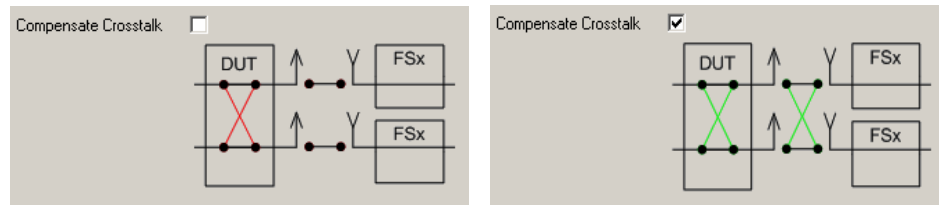
Timing Tracking

Specifies whether or not the measurement results should be compensated for timing error. When timing compensation is used, the measurement results will be compensated for timing error on a per-symbol basis.

→ Remote: SENS:DL:TRAC:TIME ON

### 6.2.1.3 MIMO Settings

#### Compensate Crosstalk



Specifies if crosstalk produced by the device under test will be compensated or not. The crosstalk compensation must be activated for Time Alignment Error measurements.

➔ Remote: CONF:DL:MIMO:CROS ON

### 6.2.2 Downlink Signal Characteristics

The "Downlink Signal Characteristics" tab describes the structure of the signal to be analyzed.

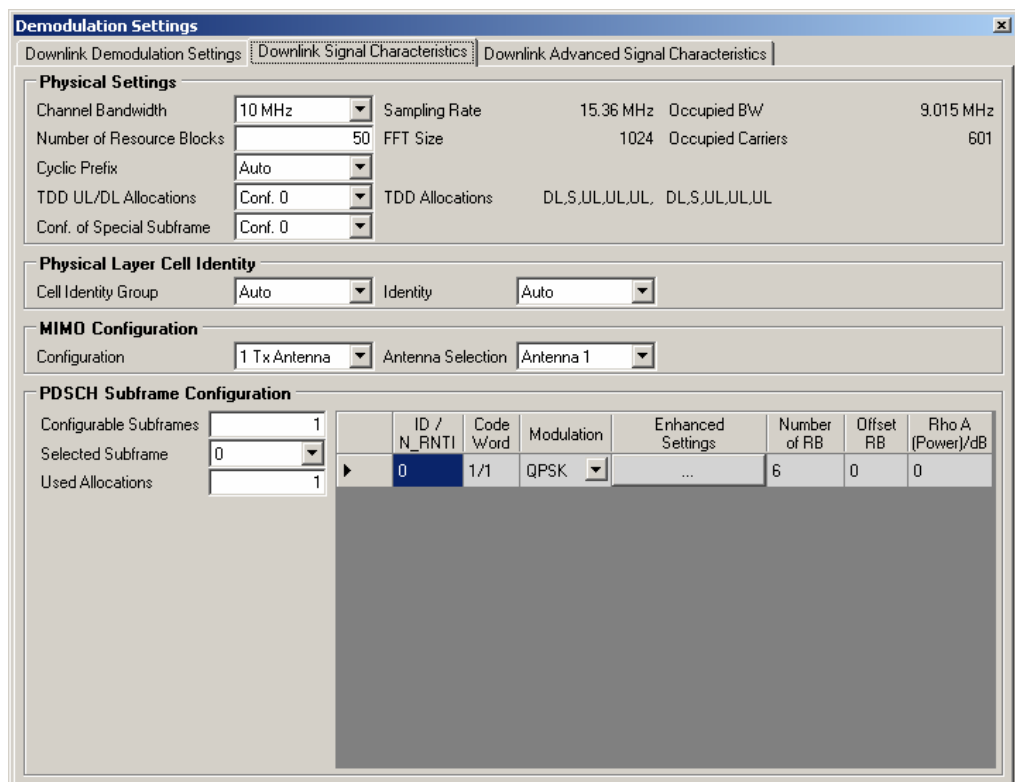


Figure 6-8: Downlink Signal Characteristics dialog box

### 6.2.2.1 Physical Settings

The physical settings are the general settings concerning the physical attributes of the signal to be measured.

#### Channel Bandwidth

Channel Bandwidth	10 MHz
Number of Resource Blocks	50
Sampling Rate	15.36 MHz
FFT Size	1024
Occupied BW	9.015 MHz
Occupied Carriers	601

Channel Bandwidth or alternatively the Number of Resource Blocks specify the bandwidth of the channel to be measured. If a channel bandwidth is selected, the number of resource blocks is automatically set according to the definitions in the standard.

→ Remote: CONF:DL:BW BW10\_00

→ Remote: CONF:DL:NORB 50

The Sampling Rate, FFT Size, Occupied BW and Occupied Carriers are read-only parameters which depend on the Channel Bandwidth / Number of Resource Blocks setting.

#### Cyclic Prefix

Cyclic Prefix	Auto
---------------	------

Cyclic Prefix specifies the cyclic prefix type. The types Normal and Extended are supported. If Auto is selected, the cyclic prefix type is detected automatically.

→ Remote: CONF:DL:CYCP AUTO

#### TDD UL/DL Allocations

TDD UL/DL Allocations	Conf. 0
TDD Allocations	DL,S,UL,UL,UL, DL,S,UL,UL,UL

TDD UL/DL Allocations specifies the uplink-downlink allocation configuration.

The details of the current selected configuration is shown as a comma separated list of a complete LTE frame containing the following elements:

- DL: downlink subframe
- UL: uplink subframe
- S: special subframe with the three fields DwPTS, GP UqPTS

The TDD UL/DL Allocations setting is available only if Duplexing is set to TDD.

→ Remote: CONF:DL:TDD:UDC 2

**Conf. of Special Subframe**

Conf. of Special Subframe

Configuration of Special Subframe specifies the type of TDD special subframe.

The special subframe configurations Conf. 7 and Conf. 8 are only defined for Normal Cyclic Prefix. Therefore an error message will result if Cyclic Prefix is set to Auto or Extended.

Configuration of Special Subframe setting is available only if Duplexing is set to TDD.

→ Remote: CONF:LTE:DL:TDD:SPSC 2

**6.2.2.2 Physical Layer Cell Identity**

There are 504 unique physical-layer cell identities. The physical-layer cell identities are grouped into 168 unique physical-layer cell-identity groups, each group containing three unique identities. A physical-layer cell identity  $N_{ID}^{cell} = 3N_{ID}^{(1)} + N_{ID}^{(2)}$  is uniquely defined by a number  $N_{ID}^{(1)}$  in the range of 0 to 167, representing the physical-layer cell-identity group, and a number  $N_{ID}^{(2)}$  in the range of 0 to 2, representing the physical-layer identity within the physical-layer cell-identity group.

**Cell Identity Group**

Cell Identity Group

Cell Identity Group specifies the physical-layer cell-identity group. If set to Auto, the physical-layer cell-identity group is detected automatically.

→ Remote: CONF:DL:PLC:CIDG AUTO

**Identity**

Identity

Identity specifies the physical-layer identity. If set to Auto, the physical-layer identity is detected automatically.

→ Remote: CONF:DL:PLC:PLID AUTO

**6.2.2.3 MIMO Configuration**

The MIMO configuration sets essential antenna configuration parameters.

**Configuration**

Configuration

Configuration specifies the number of transmit antennas. One-, two- and four-antenna configuration is supported.

→ Remote: CONF:DL:MIMO:CONF TX1

### Antenna Selection

Antenna Selection selects the antenna to be analyzed.

If the MIMO configuration is set to two or four antennas, the Antenna Selection can be set to All. In this case the signals from all antennas are captured by more than one R&S FSQ / FSV. Please refer to section "[MIMO Measurement Guide](#)" for setting up the hardware for this type of measurement.

→ Remote: CONF:DL:MIMO:ASEL ANT1

### 6.2.2.4 Subframe Configuration

The Resource Allocation settings allow you to configure the OFDMA resource allocations. If Auto Demodulation is enabled, these settings are automatically detected from the received signal.

### Configurable Subframes

Configurable Subframes specifies the number of subframes which can be configured in the subframe configuration frame.

→ Remote: CONF:DL:CSUB 10

### Selected Subframe

Selected Subframe specifies the subframe to be displayed in the allocation settings table.

→ Remote: Not available.

### Used Allocations

The Used Allocations setting specifies the number of allocations used in this subframe. This setting defines the number of rows in the allocation settings table.

→ Remote: CONF:DL:SUBF3:ALC 4



6.2.2.5 Allocation Settings Table

	ID / N_RNTI	Code Word	Modulation	Enhanced Settings	Number of RB	Offset RB	Rho A (Power)/dB
▶	0	1/1	QPSK	...	21	0	0
	1	1/1	16QAM	...	15	21	0
	2	1/1	64QAM	...	10	36	0
	3	1/1	16QAM	...	4	46	0

The Allocation Settings Table specifies the properties of each allocation used. For each allocation, the following settings are provided:

- Allocation ID/N\_RNTI: Each allocation can be assigned an individual N\_RNTI or allocations can be combined by using the same N\_RNTI value. In this case, the allocation measurement results are the combined results from all allocations with the same N\_RNTI. This makes it possible to configure users which use distributed allocations and get the correct descrambled bit stream for this user.  
 Note: If allocations have the same ID, only the Modulation, Enhanced Settings and Power of the first allocation in the table can be edited. For all other allocations with the same ID, only the Number of RB and Offset RB can be set.
- ➔ Remote: CONF:DL:SUBF4:ALL33:UEID 2
- Code Word: See description below
- Modulation: Modulation type
- ➔ Remote: CONF:DL:SUBF4:ALL33:CW2:MOD QAM64
- Enhanced Settings: Accesses precoding and spatial multiplexing settings. Pressing a button in the Enhanced Settings column opens the Enhanced Settings dialog, see below.
- Number of RB: Sets the size of the selected allocation in resource blocks
- ➔ Remote: CONF:DL:SUBF2:ALL34:RBC 25
- Offset RB: Sets the start resource block of the selected allocation
- ➔ Remote: CONF:DL:SUBF2:ALL34:RBO 3
- Power [dB]: Sets the power in dB
- ➔ Remote: CONF:DL:SUBF8:ALL5:POW -1.3

Code Word

If 2 or 4 TX antennas are used and in the Enhanced Settings dialog Spatial Multiplexing is selected as the Precoding value, then the number of layers can be changed. If 2 or more layers are selected (in the Enhanced Settings dialog), then two code words are assigned and hence two rows for the same allocation are visible in the Allocation Settings table. For the second code word the columns Number of RB, Offset RB and Power are not accessible, the settings are the same as for the first code word. In the Code Word column 1/2 and 2/2 is shown to distinguish the two code words.

**Conflict detection**

For the table, a conflict detection is integrated. If two or more resource allocations overlap with others, a red circle containing an exclamation mark is shown in the upper left corner to indicate a conflict. The same icon is displayed in the row of the allocation causing the conflict. The tool tip (shown by moving the mouse pointer over the red circle) provides additional information about the conflict. If only the exclamation mark in the upper left corner is visible, you have to change the number of the selected subframe to find the location of the conflict.

	ID / N_RNTI	Code Word	Modulation	Enhanced Settings	Number of RB	Offset RB	Rho A (Power)/dB
	0	1/1	QPSK	...	22	0	0
	Collision with allocation ID/N_RNTI 0			...	15	21	0
	2	1/1	64QAM	...	10	36	0
	3	1/1	16QAM	...	4	46	0

	ID / N_RNTI	Code Word	Modulation	Enhanced Settings	Number of RB	Offset RB	Rho A (Power)/dB
	Error(s) in the following subframe(s): 0						
	0	1/1	QPSK	...	22	0	0
	1	1/1	16QAM	...	15	21	0
	2	1/1	64QAM	...	10	36	0
	3	1/1	16QAM	...	4	46	0

Conflicts must be resolved before a measurement can be started.

**Enhanced Settings**

With the Enhanced Settings dialog the precoding for a physical channel is defined.

The precoding types None, Transmit Diversity, Spatial Multiplexing and Tx Mode 7 (UE-specific reference signal) can be selected with the Precoding setting.

In case Spatial Multiplexing is used, the Number of Layers and the Codebook Index can be selected. Additionally, the Cyclic Delay Diversity (CDD) can be enabled or disabled. If CDD is enabled, the Codebook Index will be selected automatically and is not editable. The maximum number of layers and the maximum codebook index depends on the MIMO configuration.

- ➔ Remote: CONF:DL:SUBF2:ALL44:PREC:SCH SPM
- ➔ Remote: CONF:DL:SUBF1:ALL40:PREC:NOL 2
- ➔ Remote: CONF:DL:SUBF1:ALL40:PREC:CBIN 1
- ➔ Remote: CONF:DL:SUBF0:ALL99:PREC:CDD OFF

### 6.2.3 Downlink Advanced Signal Characteristics

The "Downlink Signal Characteristics" tab describes the structure of the signal to be analyzed.

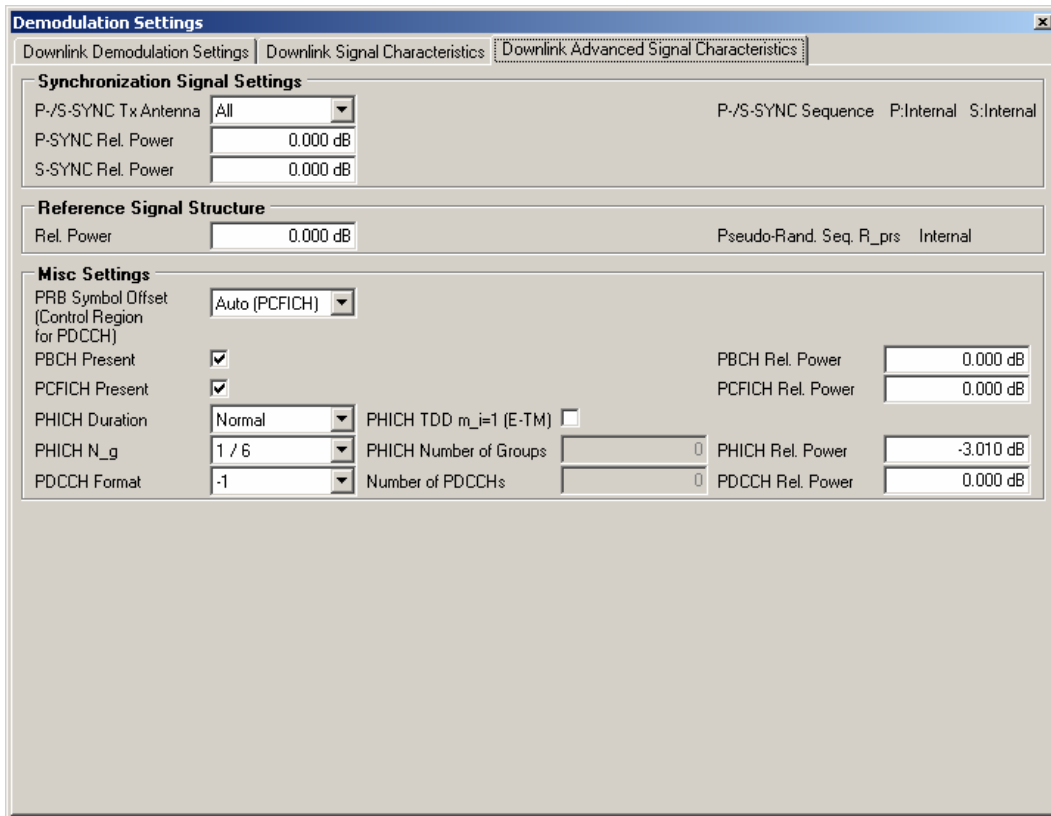


Figure 6-9: Downlink Advanced Signal Characteristics

#### 6.2.3.1 Synchronization Signal Settings

The Synchronization Signal Settings are the general settings concerning the physical attributes of the synchronization signals P-SYNC (primary synchronization signal) and S-SYNC (secondary synchronization signal).

##### P-/S-SYNC Tx Antenna

P-/S-SYNC Tx Antenna

P-/S-SYNC Tx Antenna specifies on which Tx antenna the P-/S-SYNC is transmitted.

With the P-/S-SYNC Tx Antenna setting the synchronization method is implicitly selected. If there is no synchronization signal available, the Reference Signal is used for synchronization. NOTE: For the Reference Signal based synchronization, no auto Cell ID detection is supported.

➔ Remote: CONF:LTE:DL:SYNC:ANT ALL

**P-SYNC Relative Power**

P-SYNC Rel. Power

Relative power of the P-SYNC signals.

→ Remote: CONF:DL:SYNC:PPOW 0.5

**S-SYNC Relative Power**

S-SYNC Rel. Power

Relative power of the S-SYNC signals.

→ Remote: CONF:DL:SYNC:SPOW 0.5

**6.2.3.2 Reference Signal Structure**

The Reference Signal Structure settings are the general settings concerning the physical attributes of the reference signal.

**Relative Power**

Rel. Power

Relative power of the reference signal.

→ Remote: CONF:DL:REFS:POW -1.2

**Pseudo-Random Sequence R\_prs**

Pseudo-Random Sequence R\_prs

**IQW**

Indicates whether the internal reference symbol sequence or a user-defined reference symbol sequence is used.

If an external symbol definition file is used, the font color changes to red and the type of input file (txt or iqw format) is indicated.

**6.2.3.3 Misc Settings**

The Miscellaneous Settings are the general settings concerning the physical resource blocks (PRBs), physical broadcast channel (PBCH), physical control format indicator channel (PCFICH), physical hybrid-ARQ indicator channel (PHICH) and physical downlink control channel (PDCCH) symbols.

**PRB Symbol Offset (Control Region for PDCCH)**

PRB Symbol Offset  
(Control Region  
for PDCCH)

PRB Symbol Offset (Control Region for PDCCH) specifies the symbol offset of the data allocations relative to the subframe start. This setting applies to all subframes in a frame.

With this settings, the number of OFDM symbols used for control channels is defined, too. For example, if this parameter is set to 2 and the PDCCH is enabled, the number of OFDM symbols actually used by the PDCCH is 2.

Special control channels like the PCFICH or PHICH require a minimum number of control channel OFDM symbols at the beginning of each subframe. If PRB Symbol Offset is lower than the required value, the control channel data then overwrite some symbols of the PDSCH.

If Auto is selected, the Control Region for PDCCH (PRB Symbol Offset) value is detected from the PCFICH. For correct Demodulation of a 3GPP conform PCFICH signal, the Scrambling of Coded Bits has to be enabled.

→ Remote: CONF:DL:PSOF 2

#### PBCH Present

PBCH Present

PBCH Present specifies whether the physical broadcast channel is present or not.

→ Remote: CONF:DL:PBCH:STAT ON

#### PBCH Relative Power

PBCH Rel. Power

Relative Power of the PBCH.

→ Remote: CONF:DL:PBCH:POW -1.1

#### PCFICH Present

PCFICH Present

PCFICH Present specifies whether the physical control format channel is present or not.

→ Remote: CONF:DL:PCF:STAT ON

#### PCFICH Relative Power

PCFICH Rel. Power

Relative Power of the PCFICH.

→ Remote: CONF:DL:PCF:POW 0

**PHICH Duration**

PHICH Duration

PHICH Duration specifies the duration of the PHICH. Normal and Extended duration are supported.

→ Remote: CONF:DL:PHIC:DUR NORM

**PHICH TDD m<sub>i</sub>=1 (E-TM)**

PHICH TDD m<sub>i</sub>=1 (E-TM)

PHICH TDD m<sub>i</sub>=1 (E-TM) specifies if the special setting for PHICH for the enhanced test models is used.

The definition in 36.141 V9.0.0, 6.1.2.6 is as follows: "For frame structure type 2 the factor m<sub>i</sub> shall not be set as per TS36.211, Table 6.9-1, but instead shall be set to m<sub>i</sub>=1 for all transmitted subframes."

PHICH TDD m<sub>i</sub>=1 (E-TM) setting is available only if Duplexing is set to TDD.

→ Remote: CONF:LTE:DL:PHIC:MITM OFF

**PHICH N<sub>g</sub>**

PHICH N<sub>g</sub>

PHICH N<sub>g</sub> specifies the N<sub>g</sub> parameter for PHICH. This parameter defines how many PHICH groups are transmitted in a subframe. If Custom is selected, a custom number of PHICH groups can be chosen.

→ Remote: CONF:LTE:DL:PHIC:NGP NGCUSTOM

**PHICH Number Of Groups**

PHICH Number of Groups

PHICH Number of Groups specifies the number of PHICH groups.

PHICH Number of Groups setting is available only if PHICH N<sub>g</sub> is set to Custom.

→ Remote: CONF:DL:PHIC:NOGR 5

**PHICH Relative Power**

PHICH Rel. Power

Relative Power of the PHICH.

→ Remote: CONF:DL:PHIC:POW -1.3

### PDCCH Format

PDCCH Format

PDCCH Format specifies the format for the physical downlink control channel. PDCCH format -1 is not defined in the LTE standard. This format corresponds to the transmission of one PDCCH on all available resource element groups (as a special case for this PDCCH format, the center of the constellation diagram is treated as a valid constellation point).

→ Remote: CONF:DL:PDCC:FORM 2

### Number of PDCCHs

Number of PDCCHs

Number of PDCCHs specifies the number of physical downlink control channels.

Number of PDCCHs setting is available only if PDCCH Format is not set to -1.

→ Remote: CONF:DL:PDCC:NOVD 5

### PDCCH Relative Power

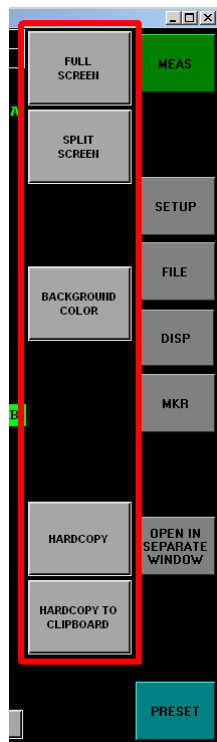
PDCCH Rel. Power

Relative Power of the PDCCH.

→ Remote: CONF:DL:PDCC:POW -1.2

## 6.3 Display Settings

The layout of the display can be controlled using the display menu.



**Figure 6-10: Display Menu**

The "DISP" hardkey opens the display softkey menu.

The display menu allows the display to be changed between split and full screen mode.

→ Remote: Not available.

The active screen can be selected by pressing the "Screen A / Screen B" hotkey. In full screen mode the "Screen A / Screen B" hotkey also toggles which screen is displayed.

→ Remote: `DISP:WIND2:SEL`

The background color of the software can be changed by pressing the "Background Color" softkey and selecting a color in the "Color Selection" dialog box.

→ Remote: Not available.

With the "Hardcopy" softkey a screenshot of the application window can be saved in the following formats:

- BMP Uncompressed pixel format
- GIF: Color compressed pixel format with 256 colors (platform independent)
- JPEG: Compressed pixel format
- PNG: Lossless compressed pixel format
- TIFF: Format for high color depth images



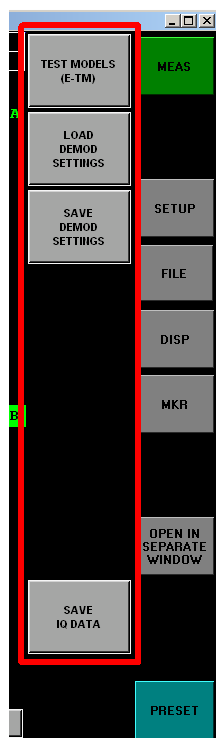
The "Hardcopy To Clipboard" softkey sends a screenshot of the application window to the operating system clipboard.

→ Remote: Not supported yet.

## 6.4 File Management

This section describes the file management of demodulation settings, global settings and I/Q data.

The "FILE" hardkey opens the file management softkey menu.



**Figure 6-11: File Management Menu**

Use "Test Models (E-TM)" to open a dialog to select which downlink test model will be loaded.

→ Remote: `MMEM:LOAD:TMOD:DL 'E-TM1_1__10MHz'`

Use "Load Demod Settings" to open a standard file dialog to select which demodulation setup will be loaded.

→ Remote: `MMEM:LOAD:DEM 'D:\USER\Settingsfile.allocation'`

Use "Save Demod Settings" to open a standard file dialog to save the current demodulation setup to a file.

→ Remote: `MMEM:STOR:DEM 'D:\USER\Settingsfile.allocation'`

Use "Save IQ Data" to open a standard file dialog to save the current I/Q data in the capture buffer.

→ Remote: Not supported yet.

Please refer to section "[Import and Export of Data](#)" for details on the file format.

## 6.5 Software Setup

This section describes the software setup of the demodulation settings, global settings and I/Q data.

The "SETUP" hardkey opens the software setup softkey menu. It also closes any settings dialogs that are open.

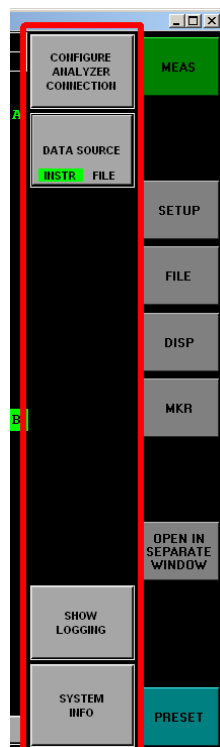


Figure 6-12: Software Setup menu

### 6.5.1 Configure Analyzer Connection

This softkey opens the "General Settings" dialog box. For more information how to change the analyzer connection see "[MIMO Analyzer Configuration](#)".

→ Remote: Not available.

## 6.5.2 Data Source (Instrument or File)

This softkey changes the data source from instrument to file. It is advisable to change this setting only in the combo box "Source" under Input in the "General Settings" dialog box.

→ Remote: Not available.

## 6.5.3 Show Logging

The "Show Logging" softkey is used to display an error messages history.

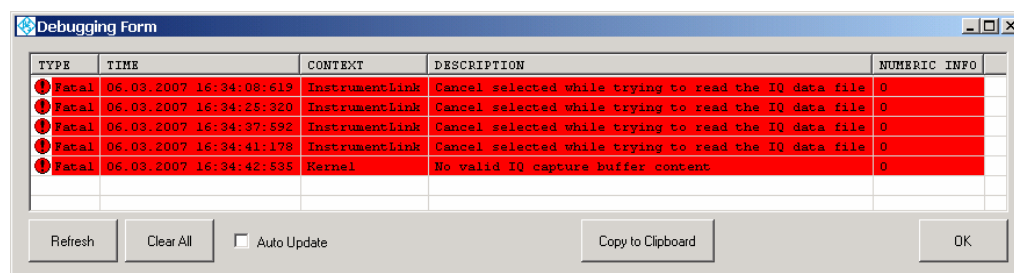


Figure 6-13: Debugging Form dialog box

The message history can be refreshed and cleared, and the contents can be copied to the operating system clipboard.

→ Remote: Not supported yet.

## 6.5.4 System Info

The "System Info" softkey opens a dialog containing system information about the version numbers of used drivers and utility software. This information can be useful in case the analyzer software does not work properly.

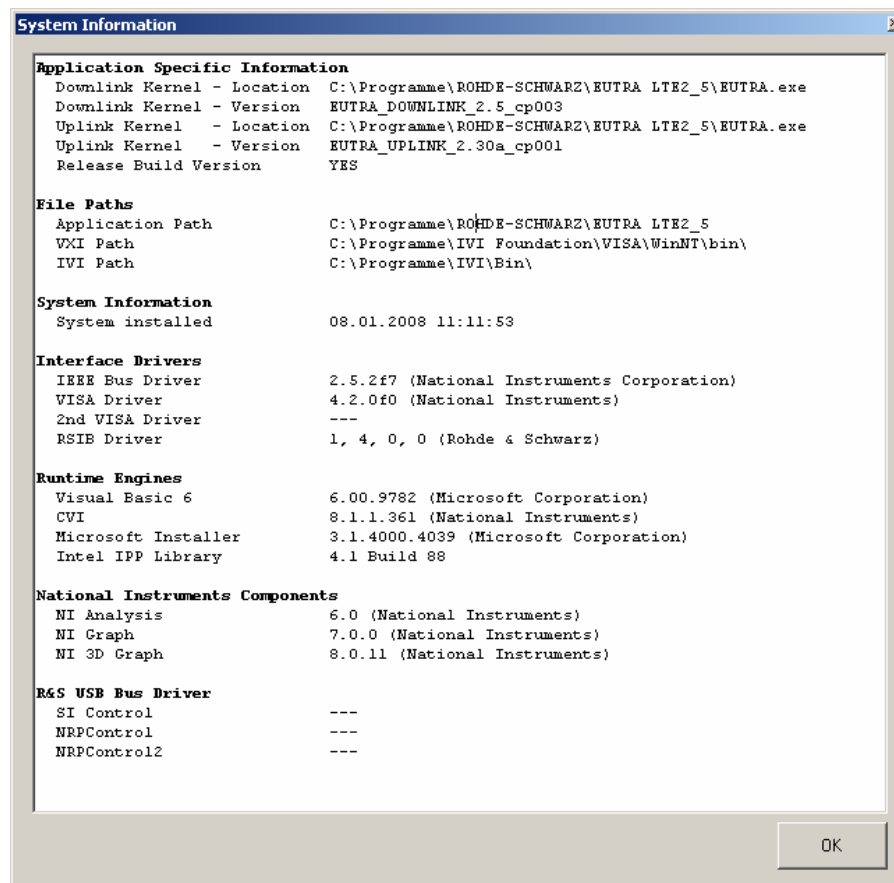


Figure 6-14: System information

→ Remote: Not supported.

## 6.6 Marker

The "MARKER" hardkey has the same functionality as the "Marker" entry in the context menu of the graph display. For an explanation how to use the "MARKER" hardkey, see section "[Evaluating the Results – Operating the Graph](#)".



### Note on Marker behaviour

The "MARKER" hardkey acts on the actual selected graph. If the graph contains more than one trace, nothing happens, see section "[Evaluating the Results – Operating the Graph](#)".

---

→ Remote: Not supported yet.

## 6.7 Open in separate window

The "OPEN IN SEPARATE WINDOW" hardkey creates a copy of the currently selected screen and displays it in additional windows. This functionality makes it possible to watch more than two results simultaneously.



The "OPEN IN SEPARATE WINDOW" hardkey is not available if the software is running directly on an analyzer.

---

→ Remote: Not supported yet.

## 6.8 Preset

When the PRESET hardkey is pressed the LTE software is preset. If the input source is not set to File and a valid R&S FSQ / FSV address is configured, this instrument is also preset.

If the LTE software is installed on a R&S FSQ / FSV, the LTE software is exited and a preset will be performed after pressing the PRESET hardkey.

→ Remote: \*RST

## 7 Remote Control

### 7.1 Description of commands

This section specifies all the remote control commands specific to the R&S FSQ / FSV-K100 / -K102 / -K104 option. Only those commands provided for this option are specified. For details of remote control commands provided by the host analyzer please refer to the analyzer user manual.

#### 7.1.1 Notation

In the following sections, all commands implemented in the software are first listed in tables and then described in detail, arranged according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

##### 7.1.1.1 Table of Commands

**Command:**

In the command column, the table provides an overview of the commands and their hierarchical arrangement (see indentations).

**Parameter:**

The parameter column indicates the requested parameters together with their specified range.

**Unit:**

The unit column indicates the basic unit of the physical parameters.

**Comment:**

In the comment column an indication is made on:

- whether the command does not have a query form,
- whether the command has only one query form
- whether the command is implemented only with a certain option of the instrument

**Indentations:**

The different levels of the SCPI command hierarchy are represented in the table by means of indentations to the right. The lower the level, the further the indentation to the right. Please note that the complete notation of the command always includes the higher levels as well.

Example: SENSE:FREQUENCY:CENTER is represented in the table as follows:

SENSe	first level
:FREQuency	second level
:CENTer	third level

### Individual description

The individual description contains the complete notation of the command. An example for each command, the \*RST value and the SCPI information are included as well.

### Upper/lower case notation

Upper/lower case letters are used to mark the long or short form of the key words of a command in the description. The instrument itself does not distinguish between upper and lower case letters.

### Special characters

| A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.

Example: SENSE:FREQUENCY:CW|:FIXed

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:

SENSe:FREQuency:CW 1E3 = SENSe:FREQuency:FIXed 1E3

A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command is different, depending on which parameter is used.

Example: Selection of the parameters for the command

DISPlay:FORMat FULL | SPLit

If parameter FULL is selected, full screen is displayed, in the case of SPLit, split screen is displayed.

[ ] Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards. Parameters in square brackets can be incorporated optionally in the command or omitted as well.

{ } Parameters in braces can be incorporated optionally in the command, either not at all, once or several times.

### Description of parameters

Due to the standardisation, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<...>) and will be briefly explained in the following.

#### <Boolean>

This keyword refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword OFF or by the numeric value 0, the "on" state is indicated by ON or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

#### <numeric value>,<num>

These keywords mark parameters which may be entered as numeric values or are set using specific keywords (character data). The following keywords given below are permitted:

MINimum	This keyword sets the parameter to the smallest possible value.
MAXimum	This keyword sets the parameter to the largest possible value.
DEFault	This keyword is used to reset the parameter to its default value.
UP	This keyword increments the parameter value.
DOWN	This keyword decrements the parameter value.

The numeric values associated to MAXimum/ MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example: `SENSe:FREQuency:CENTer? MAXimum`

returns the maximum possible numeric value of the center frequency as result.

#### <arbitrary block program data>

This keyword is provided for commands the parameters of which consist of a binary data block.



## 7.2 CALCulate Subsystem

### List of commands

- CALCulate<1|2>:FEED[?]
- CALCulate<1|2>:LIMit<1>:ACPower:ACHannel:RESult?
- CALCulate<1|2>:LIMit<1>:ACPower:ALternate:RESult?
- CALCulate<1|2>:LIMit<1>:OOPower:OFFPower?
- CALCulate<1|2>:LIMit<1>:OOPower:TRANsient?
- CALCulate<1|2>:MARKer<1>:FUNCTion:POWER:RESult[:CURRent]?

### CALCulate<1|2>:FEED[?]

---

Select display type for screen A and B.

The suffix is used to select screen A (=1) or B (=2).

#### Example

```
"CALC2:FEED 'PVT:CBUF'"
```

Select Capture-Buffer to be displayed on screen B.

#### Parameters

PVT:CBUF	Capture Buffer
PVT:OOP	ON/OFF Power
EVM:EVCA	EVM versus Carrier
EVM:EVSY	EVM versus Symbol
EVM:FEVS	Frequency Error versus Symbol
EVM:EVSU	EVM versus Subframe
SPEC:SEM	Spectrum Mask
SPEC:ACPR	ACLR (Relative)
SPEC:ACPA	ACLR (Absolute)
SPEC:PSPE	Power Spectrum
SPEC:PVRP	Power versus RB PDSCH
SPEC:PVRR	Power versus RB RS
SPEC:FLAT	Channel Flatness
SPEC:GDEL	Channel Group Delay
SPEC:FDIF	Channel Flatness Difference
CONS:CONS	Constellation Diagram
STAT:CCDF	CCDF

STAT:SFLO	Signal Flow
STAT:ASUM	Allocation Summary
STAT:BSTR	Bit stream

**Characteristics**

SCPI: device-specific

**Mode**

UL, DL (some measurements are only available in either UL or DL)

**CALCulate<1|2>:LIMit<1>:ACPowEr:ACHannel:RESult?**

This command queries the limit check results of the Adjacent Channels in the relative ACLR measurement. The two values for the lower and upper adjacent channels are returned.

**Example**

```
"CALC:LIMI:ACPO:ACHA:RESU? ALL"
```

Queries the overall limit check result.

**Parameter**

ALL	Overall Limit Check
REL	Channel Power limit check
ABS	$\Delta$ to Limit limit check

**Characteristics**

SCPI: device-specific

**Mode**

UL, DL

**CALCulate<1|2>:LIMit<1>:ACPowEr:ALTErnate:RESult?**

This command queries the limit check results of the Alternate Channels in the relative ACLR measurement. The two values for the lower and upper alternate channels are returned.

**Example**

```
"CALC:LIMI:ACPO:ALTE:RESU? ALL"
```

Queries the overall limit check result.

**Parameter**

ALL	Overall Limit Check
REL	Channel Power limit check
ABS	$\Delta$ to Limit limit check

**Characteristics**

SCPI: device-specific

**Mode**

UL, DL

**CALCulate<1|2>:LIMit<1>:OOPower:OFFPower?**

---

This command queries the limit check result of the OFF periods in the ON/OFF Power measurement.

**Example**

```
"CALC:LIMI:OOPO:OFFP?"
```

Queries the OFF period limit check results.

**Characteristics**

SCPI: device-specific

**Mode**

DL

**CALCulate<1|2>:LIMit<1>:OOPower:TRANSient?**

---

This command queries the limit check result of the transient periods in the ON/OFF Power measurement.

**Example**

```
"CALC:LIMI:OOPO:TRAN? ALL"
```

Queries the overall transient limit check results.

**Parameter**

ALL	Overall Limit Check
FALLing	Falling Transient Limit Check
RISing	Rising Transient Limit Check

**Characteristics**

SCPI: device-specific

**Mode**

DL

**CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult[:CURRent]?**

This command queries the current result values of the ACLR measurement. An ACPR (Adjacent channel power relative) measurement must have previously been run for there to be summary data available.

Results are output separated by commas in the following order:

1.	Power of main channel in dBm
2.	Rel. Power of lower adjacent channel in dB
3.	Rel. Power of upper adjacent channel in dB
4.	Rel. Power of lower alternate adjacent channel 1 in dB
5.	Rel. Power of upper alternate adjacent channel 1 in dB

Adjacent channel power values are output in dB. The returned list is variable length depending on the number of channels to be measured, i.e. if the number of channels is 2 then the list will contain 5 results (main channel plus two results each for each adjacent channel specified).

**Example**

```
"CALC1:MARK:FUNC:POW:RES?"
```

Returns the current ACLR measurement results.

**Characteristics**

SCPI: device-specific

**Mode**

UL, DL

## 7.3 CONFigure Subsystem

The CONFigure subsystem contains commands for configuring complex measurement tasks. The CONFigure subsystem is closely linked to the functions of the FETCH subsystem, where the measurement results of the measurements are queried.

### List of commands

- CONFigure[:LTE]:LDIRection[?]
- CONFigure[:LTE]:DL:BW[?]
- CONFigure[:LTE]:DL:PLCI:CIDGroup[?]
- CONFigure[:LTE]:DL:PLCI:PLID[?]
- CONFigure[:LTE]:DL:MIMO:CONF[?]
- CONFigure[:LTE]:DL:MIMO:ASElection[?]
- CONFigure[:LTE]:DL:MIMO:CROStalk[?]
- CONFigure[:LTE]:DL:NORB[?]
- CONFigure[:LTE]:DL:CYCPrefix[?]
- CONFigure[:LTE]:DL:CSUBframes[?]
- CONFigure[:LTE]:DL:CONS:LOCation[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALCount[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:RBCount[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:RBOffset[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:UEID[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:POWer[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>[:CW<[1]2>]:MODulation[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:PRECoding:[SCHeme][?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:PRECoding:NOLayers[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:PRECoding:CBINdex[?]
- CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:PRECoding:CDD[?]
- CONFigure[:LTE]:DL:SYNC:ANTenna
- CONFigure[:LTE]:DL:SYNC:SPOWer[?]
- CONFigure[:LTE]:DL:SYNC:PPOWer[?]
- CONFigure[:LTE]:DL:REFSig:POWer[?]
- CONFigure[:LTE]:DL:TDD:SPSC
- CONFigure[:LTE]:DL:TDD:UDConf[?]
- CONFigure[:LTE]:DL:PSOffset[?]
- CONFigure[:LTE]:DL:PCFich:STAT[?]
- CONFigure[:LTE]:DL:PCFich:POWer[?]
- CONFigure[:LTE]:DL:PHICH:MITM
- CONFigure[:LTE]:DL:PHICH:NGP
- CONFigure[:LTE]:DL:PHICH:NOGRoups[?]
- CONFigure[:LTE]:DL:PHICH:DURation[?]
- CONFigure[:LTE]:DL:PHICH:POWer[?]
- CONFigure[:LTE]:DL:PDCCh:STAT[?]
- CONFigure[:LTE]:DL:PDCCh:POWer[?]
- CONFigure[:LTE]:DL:PDCCh:NOPD[?]
- CONFigure[:LTE]:DL:PDCCh:FORMat[?]
- CONFigure[:LTE]:DL:PBCH:POWer[?]
- CONFigure[:LTE]:DL:PBCH:STAT[?]

- [CONFigure\[:LTE\]:DUPLexing\[?\]](#)
- [CONFigure\[:LTE\]:OOPower:NFRames\[?\]](#)
- [CONFigure:POWER:EXpected:RF<1..4>\[?\]](#)
- [CONFigure:POWER:EXpected:IQ<1..4>\[?\]](#)
- [CONFigure:PRESet](#)
- [CONFigure:ADDRes<1..4>\[?\]](#)

### CONFigure[:LTE]:LDIRrection[?]

---

Configures the current link direction.

#### Example

```
"CONF:LDIR DL"
```

EUTRA/LTE option is configured to analyze downlink data.

#### Parameters

DL Downlink

UL Uplink

#### Characteristics

\*RST value: -

SCPI: device-specific

#### Mode

UL, DL

### CONFigure[:LTE]:DL:BW[?]

---

Configures the bandwidth of the LTE downlink signal.

#### Example

```
"CONF:DL:BW BW1_40"
```

Sets a signal bandwidth of 1.4 MHz in downlink.

#### Parameters

BW1\_40 | BW2\_50 | BW3\_00 | BW5\_00 | BW10\_00 | BW15\_00 | BW20\_00

#### Characteristics

\*RST value: BW10\_00

SCPI: device-specific

#### Mode

DL

**CONFigure[:LTE]:DL:PLCI:CIDGroup[?]**

---

Configures the current cell identity group for DL.

**Example**

```
"CONF:DL:PLCI:CIDG 134"
```

Cell identity group number 134 is selected

```
"CONF:DL:PLCI:CIDG AUTO"
```

Automatic cell identity group detection is selected

**Parameters:**

AUTO     Automatic selection

0...167     Manual selection

**Characteristics**

\*RST value: AUTO

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PLCI:PLID[?]**

---

Configures the current cell identity for DL.

**Example**

```
"CONF:DL:PLCI:PLID 2"
```

Sets the physical layer identity to 2.

```
"CONF:DL:PLCI:PLID AUTO"
```

Physical layer ID is selected automatically.

**Parameters**

AUTO             Automatic selection

0...2             Manual selection

**Characteristics**

\*RST value: AUTO

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:MIMO:CONF[?]**

---

Configures the current MIMO antenna configuration.

**Example**

```
"CONF:DL:MIMO:CONF TX2"
```

Tx configuration with two antennas is selected.

**Parameters**

TX1    Use one Tx-antenna  
TX2    Use two TX-antennas  
TX4    Use four TX-antennas

**Characteristics**

\*RST value: TX1

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:MIMO:ASElection[?]**

---

Configures the antenna selection.

**Example**

```
"CONF:DL:MIMO:ASEL ANT3"
```

Selects antenna 3 to be analyzed.

```
"CONF:DL:MIMO:ASEL ALL"
```

Selects all antennas to be analyzed.

**Parameters**

ANT1|ANT2|ANT3|ANT4    Select a single antenna to be analyzed  
ALL                      Select all antennas to be analyzed

**Characteristics**

\*RST value: ANT1

SCPI: device-specific

**Mode**

DL



**CONFigure[:LTE]:DL:MIMO:CROStalk[?]**

---

Activates or deactivates the MIMO crosstalk compensation in the demodulation settings menu.

**Example**

```
"CONF:DL:MIMO:CROS ON"
```

Activates the MIMO crosstalk compensation.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:NORB[?]**

---

Configures the number of resource blocks used for DL.

**Example**

```
"CONF:DL:NORB 25"
```

Sets the number of resource blocks to 25.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 50

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:CYCPrefix[?]**

---

Configures the cyclic prefix type for DL.

**Example**

```
"CONF:DL:CYCP EXT"
```

Sets cyclic prefix type to extended.

**Parameters**

NORM	Normal cyclic prefix length
EXT	Extended cyclic prefix length
AUTO	Automatic cyclic prefix length detection

**Characteristics**

\*RST value: AUTO  
 SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:CSUBframes[?]**

---

Sets the number of configurable subframes for DL.

**Example**

```
"CONF:DL:CSUB 5"
```

Sets the number of configurable subframes to 5.

**Parameters**

1...10

**Characteristics**

\*RST value: 1  
 SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:CONS:LOCation[?]**

---

Defines if the constellation diagram shall use data before or after the MIMO decoder.

**Example**

```
"CONF:DL:CONS:LOC AMD"
```

Use data from after the MIMO decoder.

**Parameters**

AMD	After the MIMO decoder
BMD	Before the MIMO decoder

**Characteristics**

\*RST value: AMD

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SUBFrame<0...9>:ALCount[?]**

---

Configures the number of used allocations for a specific DL subframe. The suffix stands for the corresponding subframe number.

**Example**

```
"CONF:DL:SUBF3:ALC 5"
```

Sets the number of used allocations in subframe number 3 to 5.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 1

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:RBCCount[?]**

---

Configures the number of resource blocks for an allocation in a specific DL subframe. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number.

**Example**

```
"CONF:DL:SUBF2:ALL34:RBC 25"
```

Sets the number of resource blocks used in allocation 34 in subframe number 2 to 25.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 6

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLOc<0...99>:RBOFFset[?]**

---

Configures the resource block offset for an allocation in a specific DL subframe. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number.

**Example**

```
"CONF:DL:SUBF2:ALL34:RBOF 3"
```

Sets the resource block offset used in allocation 34 in subframe number 2 to 3.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLOc<0...99>:UEID[?]**

---

Configures the allocation ID for an allocation in a specific DL subframe. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number.

**Example**

```
"CONF:DL:SUBF2:ALL34:UEID 3"
```

Sets the allocation ID used in allocation 34 in subframe number 2 to 3.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLOc<0...99>:POWER[?]**

Configures the relative power of an allocation in a specific DL subframe. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number.

**Example**

```
"CONF:DL:SUBF8:ALL5:POW -1.3"
```

Sets the allocation power for allocation 5 in subframe number 8 to -1.3 dB.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLOc<0...99>[:CW<[1]|2>]:MODulation[?]**

Configures the modulation type for an allocation in a specific DL subframe. In case of MIMO there might be more than one codewords which can be configured separately. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number. The third suffix stands for the codeword index.

**Example**

```
"CONF:DL:SUBF4:ALL33:CW2:MOD QAM64"
```

Sets modulation type of codeword 2 in allocation 33 of subframe number 4 to QAM64.

**Parameters**

QPSK QPSK modulation

QAM16 16QAM modulation

QAM64 64QAM modulation

**Characteristics**

\*RST value: QPSK

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLOc<0...99>:PRECoding:[SCHeme][?]**

Configures the precoding type of an allocation in a specific DL subframe. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number.

**Example**

```
"CONF:DL:SUBF2:ALL4:PREC: SCH NONE"
```

Configures allocation 4 of subframe number 2 to use no precoding scheme.

**Parameters**

NONE Do not use a precoding scheme  
 SPM Use spatial multiplexing scheme  
 TXD Use transmit diversity scheme  
 TXMS Use Tx mode 7 (UE-spec. RS)

**Characteristics**

\*RST value: NONE  
 SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLOc<0...99>:PRECoding:NOLayers[?]**

Configures the number of layers for an allocation in a specific DL subframe. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number. This setting is only valid if the precoding is set to spatial multiplexing.

**Example**

```
"CONF:DL:SUBF1:ALL4:PREC:NOL 3"
```

Sets the number of layers for allocation 4 in subframe 1 to 3.

**Parameters**

1...4

**Characteristics**

\*RST value: 1  
 SCPI: device-specific

**Mode**

DL

**CONFigure[LTE]:DL:SUBFrame<0...9>:ALLOc<0...99>:PRECoding:CBINdex[?]**

Configures the codebook index of an allocation in a specific DL subframe. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number. This setting is only valid if the precoding is set to spatial multiplexing.

**Example**

```
"CONF:DL:SUBF1:ALL4:PREC:CBIN 3"
```

Sets the codebook index of allocation 4 in subframe number 1 to 3.

**Parameters**

0...15

**Characteristics**

\*RST value: 1

SCPI: device-specific

**Mode**

DL

**CONFigure[LTE]:DL:SUBFrame<0...9>:ALLOc<0...99>:PRECoding:CDD[?]**

Activates or deactivates cyclic delay diversity of an allocation in a specific DL subframe. The first suffix stands for the corresponding subframe number and the second one stands for the corresponding allocation number. This setting is only valid if the precoding is set to spatial multiplexing.

**Example**

```
"CONF:DL:SUBF0:ALL9:PREC:CDD ON"
```

Activates cyclic delay diversity for allocation 9 in subframe 0.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SYNC:ANTenna**

---

Specifies on which Tx antenna the P-/S-SYNC is transmitted.

**Example**

```
"CONF:DL:SYNC:ANT ANT1"
```

Sets antenna 1 as the P-/S-SYNC antenna.

**Parameters**

ANT1 | ANT2 | ANT3 | ANT4 | ALL | NONE

**Characteristics**

\*RST value: ALL

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SYNC:SPOWer[?]**

---

Configures the S-SYNC relative power for DL.

**Example**

```
"CONF:DL:SYNC:SPOW 0.5"
```

Sets a relative power of 0.5 dB.

**Parameters**

Numeric value.

**Characteristics**

\*RST value: 0 dB

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:SYNC:PPOWer[?]**

---

Configures the P-SYNC relative power for DL.

**Example**

```
"CONF:DL:SYNC:PPOWer 0.5"
```

Sets a relative power of 0.5 dB.

**Parameters**

Numeric value



**Characteristics**

\*RST value: 0 dB

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:REFSig:POWer[?]**

---

Configures the relative power of the reference signal for DL.

**Example**

```
"CONF:DL:REFS:POW -1.2"
```

Sets a relative power of -1.2 dB.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0 dB

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:TDD:SPSC[?]**

---

Specifies the type of TDD special subframe.

The special subframe configurations Conf. 7 and Conf. 8 are only defined for Normal Cyclic Prefix. Therefore an error message will result if Cyclic Prefix is set to Auto or Extended.

**Example**

```
"CONF:DL:TDD:SPSC 2"
```

Sets special subframe configuration 2.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:TDD:UDConf[?]**

---

Configures the TDD UL/DL Allocations for DL.

**Example**

```
"CONF:DL:TDD:UDC 2"
```

Selects allocation configuration number 2.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PSOffset[?]**

---

Specifies the PRB Symbol Offset (Control Region for PDCCH).

**Example**

```
"CONF:DL:PSOF AUTO"
```

Sets the PRB symbol offset to auto.

**Parameters:**

AUTO     Automatic selection

0...4     Manual selection

**Characteristics**

\*RST value: AUTO

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PCFich:STAT[?]**

---

Activates or deactivates the PCFICH for DL.

**Example**

```
"CONF:DL:PCF:STAT ON"
```

Activates the PCFICH.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PCFich:POWer[?]**

---

Configures the PCFICH relative power for DL.

**Example**

```
"CONF:DL:PCF:POW 0"
```

Sets the relative power to 0 dB.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PHICH:MITM**

---

Specifies if the special setting for PHICH for the enhanced test models is used.

**Example**

```
"CONF:DL:PHIC:NOGR 5"
```

Activates PHICH TDD m<sub>i</sub>=1 (E-TM)

**Parameters**

ON | OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PHICH:NOGRoups[?]**

---

Configures the number of PHICH groups for DL.

**Example**

```
"CONF:DL:PHICH:NOGR 5"
```

Sets number of PHICH groups to 5.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PHICH:NGP**

---

Specifies the N<sub>g</sub> parameter for PHICH.

**Example**

```
"CONF:DL:PHICH:NGP NG1_6"
```

Sets N<sub>g</sub> parameter 1\_6.

**Parameters**

NG1\_6|NG1\_2|NG1|NG2|NGCUSTOM

**Characteristics**

\*RST value: NGCUSTOM

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PHICH:DURation[?]**

---

Configure the PHICH duration for DL.

**Example**

```
"CONF:DL:PHICH:DUR NORM"
```

Selects normal PHICH duration.

**Parameters**

NORM Normal

EXT Extended

**Characteristics**

\*RST value: NORM

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PHICH:POWER[?]**

---

Configures the PHICH relative power for DL.

**Example**

```
"CONF:DL:PHICH:POW -1.3"
```

Sets the relative power to -1.3 dB.

**Parameters**

Numeric value

**Characteristics**

\*RST value: -3.01

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PDCCh:STAT[?]**

---

Activates or deactivates the PDCCH for DL.

**Example**

```
"CONF:DL:PDCC:STAT ON"
```

Activates the PDCCH.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PDCCh:POWer[?]**

---

Configures the PDCCH relative power for DL.

**Example**

```
"CONF:DL:PDCCH:POW -1.2"
```

Sets the relative power to -1.2 dB.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PDCCh:NOPD[?]**

---

Configures the number of physical downlink control channels.

**Example**

```
"CONF:DL:PDCCH:NOPD 3"
```

Sets the number of DPCCHs to 3.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PDCCh:FORMat[?]**

---

Configures the physical downlink control channel format.

**Example**

```
"CONF:DL:PDCCH:FORM 0"
```

Sets the PDDCH format to 0.

**Parameters**

-1 | 0 | 1 | 2 | 3

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PBCH:POWER[?]**

---

Configures the PBCH relative power for DL.

**Example**

```
"CONF:DL:PBCH:POW -1.1"
```

Sets the relative power to -1.1 dB.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DL:PBCH:STAT[?]**

---

Activates or deactivates the physical broadcast channel.

**Example**

```
"CONF:DL:PBCH:STAT ON"
```

Activates the PBCH.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: ON

SCPI: device-specific

**Mode**

DL

**CONFigure[:LTE]:DUPLexing[?]**

---

Configures the duplexing mode.

**Example**

```
"CONF:DUPL TDD"
```

Activates time division duplex.

**Parameters**

TDD Time division duplex

FDD Frequency division duplex

**Characteristics**

\*RST value: FDD

SCPI: device-specific

**Mode**

UL,DL

**CONFigure[:LTE]:OOPower:NFRames[?]**

---

Configures the Number of Frames for the ON/OFF power measurement..

**Example**

```
"CONF:OOP:NFR 3"
```

Sets the number of frames to 3.

**Characteristics**

\*RST value: 50

SCPI: device-specific

**Mode**

DL

**CONFigure:POWer:EXPEcted:RF<1..4>[?]**

---

Configures the reference level of the analyzers used in RF mode. The suffix <1..4> specifies to which analyzer the setting applies to.

**Example**

```
"CONF:POW:EXP:RF3 -20"
```

Sets the radio frequency reference level used by analyzer 3 to -20 dBm.

**Parameters**

Numeric value in dBm



**Characteristics:**

\*RST value: -30 dBm

SCPI: device-specific

**Mode**

RF, UL and DL

**CONFigure:POWer:EXPEcted:IQ<1..4>[?]**

---

Configures the reference level of the analyzers used in BB-mode. The suffix <1..4> specifies to which analyzer the setting applies to.

**Example**

```
"CONF:POW:EXP:IQ2 -10"
```

Sets the baseband-reference level used by analyzer 2 to -10 dBm.

**Parameters**

Numeric value in dBm. Values from -25 to +20 in steps of 5 are supported.

**Characteristics**

\*RST value: 0 dBm

SCPI: device-specific

**Mode**

BB, UL and DL

**CONFigure:PRESet**

---

Presets the software. In contrast to the \*RST or the SYST:PRES command, this command will not close the LTE software after the preset even if it is running on an analyzer.

**Example**

```
"CONF:PRESet"
```

Presets the LTE software.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**CONFigure:ADDRess<1..4>[?]**

---

Specifies the addresses and the connection type of the instruments to be used as string.

**Example**

```
"CONF:ADDR2 'TCPIP::192.168.0.1::INSTR0'"
```

Configures the connection used for instrument 2 as type TCPIP with an address of 192.168.0.1

**Parameters**

String containing information about connection type and address.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

## 7.4 DISPlay Subsystem

### List of commands

- [DISPlay\[:WINDow<1|2>\]:SElect](#)
- [DISPlay\[:WINDow\]:TRACe:Y:RLEVel:OFFSet](#)

### DISPlay[:WINDow<1|2>]:SElect

---

Selects the active measurement window. WINDow1 corresponds to SCREEN A, WINDow2 to SCREEN B.

#### Example

```
"DISP:WIND2:SEL"
```

Selects SCREEN B.

#### Characteristics

\*RST value: SCREEN A active

#### Mode

UL and DL

This command is an event and therefore has no query.

### DISPlay[:WINDow]:TRACe:Y:RLEVel:OFFSet

---

Sets the external attenuation.

#### Example

```
"DISP:TRAC:Y:RLEV:OFFS 5 DB"
```

Sets an external attenuation of 5 dB.

#### Characteristics

\*RST value:

#### Mode

UL, DL

This command is an event and therefore has no query.

## 7.5 FETCh Subsystem

### List of commands

- FETCh:SUMMary:EVM:DSQP[:AVERage]
- FETCh:SUMMary:EVM:DSST[:AVERage]
- FETCh:SUMMary:EVM:DSSF[:AVERage]
- FETCh:SUMMary:EVM:PCHannel[:AVERage]?
- FETCh:SUMMary:EVM:PCHannel:MAXimum?
- FETCh:SUMMary:EVM:PCHannel:MINimum?
- FETCh:SUMMary:EVM:PSIGnal[:AVERage]?
- FETCh:SUMMary:EVM:PSIGnal:MAXimum?
- FETCh:SUMMary:EVM:PSIGnal:MINimum?
- FETCh:SUMMary:EVM[:ALL][:AVERage]?
- FETCh:SUMMary:EVM[:ALL]:MAXimum?
- FETCh:SUMMary:EVM[:ALL]:MINimum?
- FETCh:SUMMary:FERRor[:AVERage]?
- FETCh:SUMMary:FERRor:MAXimum?
- FETCh:SUMMary:FERRor:MINimum?
- FETCh:SUMMary:GIMBalance[:AVERage]?
- FETCh:SUMMary:GIMBalance:MAXimum?
- FETCh:SUMMary:GIMBalance:MINimum?
- FETCh:SUMMary:IQOFfset[:AVERage]?
- FETCh:SUMMary:IQOFfset:MAXimum?
- FETCh:SUMMary:IQOFfset:MINimum?
- FETCh:SUMMary:POWer[:AVERage]?
- FETCh:SUMMary:POWer:MAXimum?
- FETCh:SUMMary:POWer:MINimum?
- FETCh:SUMMary:QUADerror[:AVERage]?
- FETCh:SUMMary:QUADerror:MAXimum?
- FETCh:SUMMary:QUADerror:MINimum?
- FETCh:SUMMary:SERRor[:AVERage]?
- FETCh:SUMMary:SERRor:MAXimum?
- FETCh:SUMMary:SERRor:MINimum?
- FETCh:SUMMary:CRESt?
- FETCh:SUMMary:TFRame?
- FETCh:SUMMary:TAE<2...4>?
- FETCh:SUMMary:OSTP?
- FETCh:PLCI:CIDGroup?
- FETCh:PLCI:PLID?
- FETCh:CYCPrefix?

**FETCh:SUMMary:EVM:DSQP[:AVERage]**

---

Returns the "EVM PDSCH QPSK" value from the result summary list. Depending on the EVM unit selected in the "General Settings" menu the value will be either in dB or in percent.

**Example**

```
"FETC : SUMM : EVM : DSQP?"
```

Returns the mean value.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL only

**FETCh:SUMMary:EVM:DSST[:AVERage]**

---

Returns the "EVM PDSCH 16QAM" value from the result summary list. Depending on the EVM unit selected in the "General Settings" menu the value will be either in dB or in percent.

**Example**

```
"FETC : SUMM : EVM : DSST?"
```

Returns the mean value.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL only

**FETCh:SUMMary:EVM:DSSF[:AVERage]**

---

Returns the "EVM PDSCH 64QAM" value from the result summary list. Depending on the EVM unit selected in the "General Settings" menu the value will be either in dB or in percent.

**Example**

```
"FETC : SUMM : EVM : DSSF?"
```

Returns the mean value.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL only

**FETCh:SUMMary:EVM:PCHannel[:AVERAge]?****FETCh:SUMMary:EVM:PCHannel:MAXimum?****FETCh:SUMMary:EVM:PCHannel:MINimum?**


---

Returns the "EVM Physical Channel" value from the result summary list. Depending on the EVM unit selected in the "General Settings" menu the value will be either in dB or in percent.

**Example**`"FETC : SUMM : EVM : PCH : MAX?"`

Returns the maximum value.

`"FETC : SUMM : EVM : PCH : MIN?"`

Returns the minimum value.

`"FETC : SUMM : EVM : PCH?"`

Returns the mean value.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:SUMMary:EVM:PSIGnal[:AVERAge]?****FETCh:SUMMary:EVM:PSIGnal:MAXimum?****FETCh:SUMMary:EVM:PSIGnal:MINimum?**


---

Returns the "EVM Physical Signal" value from the result summary list. Depending on the EVM unit selected in the "General Settings" menu the value will be either in dB or in percent.

**Example**`"FETC : SUMM : EVM : PSIG : MAX?"`

Returns the maximum value.

`"FETC : SUMM : EVM : PSIG : MIN?"`

Returns the minimum value.

`"FETC : SUMM : EVM : PSIG?"`

Returns the mean value.

**Characteristics**

\*RST value: –

SCPI: device-specific

**Mode**

DL only

**FETCh:SUMMary:EVM[:ALL][:AVERAge]?**

**FETCh:SUMMary:EVM[:ALL]:MAXimum?**

**FETCh:SUMMary:EVM[:ALL]:MINimum?**

---

Returns the "EVM All" value from the result summary list. Depending on the EVM unit selected in the "General Settings" menu the value will be either in dB or in percent.

**Example**

"FETC:SUMM:EVM:MAX?"

Returns the maximum value.

"FETC:SUMM:EVM:MIN?"

Returns the minimum value.

"FETC:SUMM:EVM?"

Returns the mean value.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL only

**FETCh:SUMMary:FERRor[:AVERAge]?**

**FETCh:SUMMary:FERRor:MAXimum?**

**FETCh:SUMMary:FERRor:MINimum?**

---

Returns the average "Frequency Error" value from the result summary list in Hz.

**Example**

"FETC:SUMM:FERR?"

Returns the average frequency error in Hz.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:SUMMary:GIMBalance[:AVERage]?**  
**FETCh:SUMMary:GIMBalance:MAXimum?**  
**FETCh:SUMMary:GIMBalance:MINimum?**

---

Returns the IQ gain imbalance from the result summary list in dB.

**Example**

```
"FETC : SUMM : GIMB ?"
```

Returns the current gain imbalance in dB.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:SUMMary:IQOffset[:AVERage]?**  
**FETCh:SUMMary:IQOffset:MAXimum?**  
**FETCh:SUMMary:IQOffset:MINimum?**

---

Returns the IQ offset from the result summary list in dB.

**Example**

```
"FETC : SUMM : IQOF ?"
```

Returns the current IQ-offset in dB

Characteristics:

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:SUMMary:POWER[:AVERage]?**  
**FETCh:SUMMary:POWER:MAXimum?**  
**FETCh:SUMMary:POWER:MINimum?**

---

Returns the "Frame Power" from the result summary list in dBm.

**Example**

```
"FETC : SUMM : POW ?"
```

Returns the Current Frame Power in dBm



**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL only

**FETCh:SUMMary:QUADerror[:AVERage]?**

**FETCh:SUMMary:QUADerror:MAXimum?**

**FETCh:SUMMary:QUADerror:MINimum?**

---

Returns the mean "Quadrature Error" from the result summary list in degrees.

**Example**

"FETC:SUMM:QUAD?"

Returns the current mean Quadrature Error in degrees.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:SUMMary:SERRor[:AVERage]?**

**FETCh:SUMMary:SERRor:MAXimum?**

**FETCh:SUMMary:SERRor:MINimum?**

---

Returns the "Sampling Error" from the result summary list in ppm.

**Example**

"FETC:SUMM:SERR?"

Returns the current mean Sampling Error in ppm.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:SUMMary:CRESt?**

---

Returns the crest factor from the result summary list in dB.

**Example**

```
"FETC : SUMM : CRES ?"
```

Returns the current crest factor in dB.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:SUMMary:TFRame?**

---

Returns the trigger to frame value.

**Example**

```
"FETC : SUMM : TFR ?"
```

Returns the trigger to frame value

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL, UL

**FETCh:SUMMary:TAE<2...4>?**

---

Returns the time alignment error from the result list in ns. The suffix indicates which antenna to be used for the comparison to antenna 1.

**Example**

```
"FETC : SUMM : TAE2 ?"
```

Returns the time alignment error between antenna 3 and antenna 1 (Time Alignment Error  $\Delta 3,1$ ).

```
"FETC : SUMM : TAE4 ?"
```

Returns the time alignment error between antenna 4 and antenna 1 (Time Alignment Error  $\Delta 4,1$ ).

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL

**FETCh:SUMM:OSTP?**

---

Returns the OSTP value from the result list in dBm.

**Example**

```
"FETC:SUMM:OSTP?"
```

Returns the current OSTP value.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL

**FETCh:PLCI:CIDGroup?**

---

Returns the cell identity group detected by the DSP kernel. If no valid value has been detected yet, the command will return -1.

**Example**

```
"FETC:PLCI:CIDG?"
```

Returns the current detected CID group.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:PLCI:PLID?**

---

Returns the cell identity detected by the DSP kernel. If no valid value has been detected yet the command will return -1.

**Example**

```
"FETC:PLCI:PLID?"
```

Returns the current detected cell identity.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

**FETCh:CYCPrefix?**

---

Returns the cyclic prefix type detected by the DSP kernel. If no valid value has been detected yet the command will return -1.

**Example**

```
"FETCh:CYCP?"
```

Returns the current cyclic prefix length type.

**Parameters**

Parameter string	Measurement data type
NORM	Normal cyclic prefix length detected
EXT	Extended cyclic prefix length detected

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

UL, DL

## 7.6 FORMat Subsystem

### List of commands

- [FORMat\[:DATA\] \[?\]](#)

### FORMat[:DATA] [?]

---

Specifies the data format for the data transmission between the LTE software and the remote client. Supported formats are ASCII, PACKED or REAL32.

#### Example

```
"FORM REAL"
```

The software will send binary data in Real32 data format.

#### Parameters

ASCII | PACKED | REAL

#### Characteristics

\*RST value: ASCII

SCPI: conforming

#### Mode

UL, DL

## 7.7 INITiate Subsystem

### List of commands

- [INITiate\[:IMMediate\]](#)
- [INITiate:REFResh](#)

#### INITiate[:IMMediate]

---

Starts a new measurement sequence. If a measurement sequence is already in progress the command will have no effect.

##### Example

```
"INIT"
```

Attempts to start a new measurement.

##### Characteristics

\*RST value: -

SCPI: device-specific

##### Mode

UL, DL

#### INITiate:REFResh

---

This command updates the current IQ measurement results to reflect the current measurement settings. Note no new IQ data is captured. I.e. the measurement settings apply to the IQ data being currently in the capture buffer. The command applies exclusively to IQ measurements. It requires available IQ data.

##### Example

```
"INIT:REFR"
```

The R&S FSQ / FSV-K100 / -K102 / -K104 updates the IQ results

##### Characteristics

\*RST value: -

SCPI:device-specific

##### Mode

UL, DL

## 7.8 INPut Subsystem

### List of commands

- INPut:IQ:BALanced[:STATe][?]
- INPut:IQ:IMPedance[?]
- INPut:ATT<1..4>[?]
- INPut:DIQ:SRATe[?]
- INPut:DIQ:RANGe[:UPPer][?]

### INPut:IQ:BALanced[:STATe][?]

---

Specifies whether the IQ inputs are symmetrical (balanced) or asymmetrical (unbalanced). Note that this command requires option B71.

#### Example

```
"INP:IQ:BAL ON"
```

Specifies symmetrical (balanced) IQ inputs.

#### Parameters

ON|OFF

#### Characteristics

\*RST value: OFF

SCPI: device-specific

#### Mode

UL, DL

### INPut:IQ:IMPedance[?]

---

Specifies the input impedance for the IQ inputs. Note that this command requires option B71.

#### Example

```
"INP:IQ:IMP LOW"
```

Specifies low input impedance for IQ inputs.

#### Parameters

LOW | HIGH

#### Characteristics

\*RST value: LOW

SCPI: device-specific

**Mode**

UL, DL

**INPut:ATT<1..4>[?]**

---

Configures the RF attenuation used by the analyzer specified via the suffix <1..4>.

**Example**

```
"INP:ATT2 10 dB"
```

Sets the mechanical attenuation of analyzer 2 to 10 dB.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 10 dB

SCPI: conforming

**Mode**

RF, UL, DL

**INPut:DIQ:SRATe[?]**

---

Configures the digital IQ source sampling rate in Hz.

**Example**

```
"INP:DIQ:SRAT 5MHz"
```

Sets the source sampling rate to 5 MHz.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 10 MHz

SCPI: device-specific

**Mode**

DigIQ, UL, DL



**INPut:DIQ:RANGe[:UPPer][?]**

---

Configures the full scale level used for digital IQ mode in Volt.

**Example**

```
"INP:DIQ:RANG 0.7"
```

Sets the full scale level to 0.7 V.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 1 V

SCPI: device-specific

**Mode**

DigIQ, UL, DL

## 7.9 MMEMory Subsystem

### List of commands

- [MMEMory:LOAD:DEM](#)
- [MMEMory:STORe:DEM](#)
- [MMEMory:LOAD:TMOD:DL](#)

### MMEMory:LOAD:DEM

---

Restores previously saved demodulation settings. The input file must be of type "\*.allocation" and depends on the link direction that was currently selected when the file was saved. Only files with correct link directions can get loaded.

#### Example

```
"MMEM:LOAD:DEM 'D:\USER\Settingsfile.allocation'"
```

#### Characteristics

\*RST value: -

SCPI: device-specific

#### Mode

UL, DL

### MMEMory:STORe:DEM

---

Stores the current demodulation settings to a file. The resulting file type is "\*.allocation". Existing files will be overwritten.

#### Example

```
"MMEM:STOR:DEM 'D:\USER\Settingsfile.allocation'"
```

#### Characteristics

\*RST value: -

SCPI: device-specific

#### Mode

UL, DL

**MMEMory:LOAD:TMOD:DL**

---

Selects a EUTRA Test Model (E-TM) in accordance with the 3GPP standard TS 36.141.

The following test models are available (each test model is defined for the bandwidths 1.4/3/5/10/15/20MHz):

EUTRA Test Models 1.1 (E-TM1.1): 'E-TM1\_1\_\_10MHz'

EUTRA Test Model 1.2 (E-TM1.2): 'E-TM1\_2\_\_10MHz'

EUTRA Test Model 2 (E-TM2): 'E-TM2\_\_10MHz'

EUTRA Test Model 3.1 (E-TM3.1): 'E-TM3\_1\_\_10MHz'

EUTRA Test Model 3.2 (E-TM3.2): 'E-TM3\_2\_\_10MHz'

EUTRA Test Model 3.3 (E-TM3.3): 'E-TM3\_3\_\_10MHz'

**Example**

```
"MMEM:LOAD:TMOD:DL 'E-TM1_1__10MHz'"
```

Loads the test model 1.1 for 10 MHz LTE bandwidth.

**Characteristics**

\*RST value: -

SCPI: device-specific

**Mode**

DL

## 7.10 SENSe Subsystem

### List of commands

- [SENSe][:LTE]:DL:DEMod:AUTO[?]
- [SENSe][:LTE]:DL:DEMod:BEStimation[?]
- [SENSe][:LTE]:DL:DEMod:CEStimation[?]
- [SENSe][:LTE]:DL:DEMod:EVMCalc[?]
- [SENSe][:LTE]:DL:DEMod:MCFilter[?]
- [SENSe][:LTE]:DL:DEMod:PRData[?]
- [SENSe][:LTE]:DL:DEMod:CBSCrambling[?]
- [SENSe][:LTE]:DL:FORMat:PSCD[?]
- [SENSe][:LTE]:DL:TRACking:PHASe[?]
- [SENSe][:LTE]:DL:TRACking:TIME[?]
- [SENSe][:LTE]:FRAMe:COUNt:STATe[?]
- [SENSe][:LTE]:FRAMe:COUNt[?]
- [SENSe][:LTE]:FRAMe:COUNt:AUTO[?]
- [SENSe][:LTE]:SUBFrame:SElect[?]
- [SENSe][:LTE]:ANTenna:SElect[?]
- [SENSe]:FREQuency:CENTer[?]
- [SENSe]:IQ:DITHer[:STATe][?]
- [SENSe]:IQ:LPASs[:STATe][?]
- [SENSe]:POWer:AUTO:TIME[?]
- [SENSe]:POWer:AUTO<1..4>[?]
- [SENSe]:POWer:SEM:CATegory[?]
- [SENSe]:POWer:ACHannel:AACHannel[?]
- [SENSe]:POWer:NCORrection[?]
- [SENSe]:SWAPiq[?]
- [SENSe]:SWEep:TIME[?]
- [SENSe]:SYNC:STATe?
- [SENSe]:OOPower:ATIMing
- SENSe:INPut[?]

### [SENSe][:LTE]:DL:DEMod:AUTO[?]

Activates or deactivates automatic demodulation for DL.

#### Example

```
"SENS:DL:DEM:AUTO ON"
```

Activates the auto-demodulation for DL.

#### Parameters

ON|OFF

#### Characteristics

\*RST value: ON

SCPI: device-specific

**Mode**

DL

**[SENSe][:LTE]:DL:DEMod:BEStimation[?]**

---

Activates or deactivates boosting estimation for DL.

**Example**

```
"SENS:DL:DEM:BESt ON"
```

Activates the boosting estimation for DL.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: ON

SCPI: device-specific

**Mode**

DL

**[SENSe][:LTE]:DL:DEMod:CEStimation[?]**

---

Configures the channel estimation type for DL.

**Example**

```
"SENS:DL:DEM:CESt TGPP"
```

Use 3GPP EVM definition for channel estimation.

**Parameters**

TGPP	3GPP EVM definition
------	---------------------

PIL	Optimal, pilot only
-----	---------------------

PILPAY	Optimal, pilot and payload
--------	----------------------------

**Characteristics**

\*RST value: TGPP

SCPI: device-specific

**Mode**

DL

**[SENSe][:LTE]:DL:DEMod:EVMCalc[?]**

---

Sets the EVM calculation method for DL.

**Example**

```
"SENS:DL:DEM:EVMC TGPP"
```

Use 3GPP method.

**Parameters**

TGPP	3GPP definition
OTP	Optimal timing position

**Characteristics**

\*RST value: TGPP

SCPI: device-specific

**Mode**

DL

**[SENSe][:LTE]:DL:DEMod:MCFilter[?]**

---

Activates or deactivates the multicarrier filter for DL.

**Example**

```
"SENS:DL:DEM:MCF ON"
```

Activate the multicarrier filter for DL.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

DL

**[SENSe][:LTE]:DL:DEMod:PRData[?]**

---

Sets the PDSCH Reference Data.

**Example**

```
"SENS:DL:DEM:PRD ALL0"
```

Use the all zero data as the reference data.

**Parameters**

AUTO	Auto Detect
ALL0	All 0 (E-TM)

**Characteristics**

\*RST value: AUTO  
 SCPI: device-specific

**Mode**

DL

**[SENSe][:LTE]:DL:DEMod:CBSCrambling[?]**

Activates or deactivates scrambling of coded bits for DL.

**Example**

```
"SENS:DL:DEM:CBSC ON"
```

Activate scrambling of coded bits.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: ON  
 SCPI: device-specific

**Mode**

DL

**[SENSe][:LTE]:DL:FORMat:PSCD[?]**

Specifies the type of PDSCH Subframe Configuration Detection.

**Example**

```
"DL:FORM:PSCD PHYDET"
```

Sets subframe configuration detection to physical detection.

**Parameters**

OFF | PHYDET | PDCCH

OFF      The user PDSCH Subframe Configuration is applied to the current demodulated LTE frame even if the actual subframe configuration of the measured frame is different (a bad EVM will result in case the subframe configuration does not match)

**PHYDET** For manual PDSCH configuration, the current demodulated LTE frame is compared to the user PDSCH Subframe Configuration and will only be analyzed if the actual subframe configuration is the same as the configured one. With this new setting it is possible to measure TDD E-TMs without the requirement of a 20 ms trigger signal.

For auto PDSCH demodulation, the PDSCH subframe configuration is detected by physical detection of the received signal.

**PDCCH** In this mode, the PDSCH subframe configuration is set according to the data contained in the protocol of the PDCCH DCIs.

### Characteristics

\*RST value: OFF

SCPI: device-specific

### Mode

DL

## [SENSe][:LTE]:DL:TRACking:PHASe[?]

---

Configures the phase tracking type for DL.

### Example

```
"SENS:DL:TRAC:PHAS PILPAY"
```

Use pilots and payload for channel estimation.

### Parameters

Parameter string	Measurement data type
OFF	Deactivate phase tracking
PIL	Pilot only
PILPay	Pilot and payload

### Characteristics

\*RST value: OFF

SCPI: device-specific

### Mode

DL



**[SENSe][:LTE]:DL:TRACking:TIME[?]**

---

Activates or deactivates timing tracking for DL.

**Example**

```
"SENS:DL:TRAC:TIME ON"
```

Activates timing tracking.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

DL

**[SENSe][:LTE]:FRAMe:COUNT:STATe[?]**

---

Activates or deactivates overall frame count.

Overall Frame Count specifies whether a specified number of frames are to be captured and analyzed.

**Example**

```
"FRAM:COUN:STAT ON"
```

Activates overall frame count.

**Parameters**

ON | OFF

**Characteristics**

\*RST value: ON

SCPI: device-specific

**Mode**

UL, DL

**[SENSe][:LTE]:FRAME:COUNT[?]**

---

Sets the number of frames to analyze.

**Example**

```
"FRAM:COUN 10"
```

Sets 10 frames to analyze.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 1

SCPI: device-specific

**Mode**

UL, DL

**[SENSe][:LTE]:FRAME:COUNT:AUTO[?]**

---

Sets the number of frames to analyze in accordance to the EUTRA/LTE standard.

**Example**

```
"FRAM:COUN:AUTO ON"
```

Activates automatic setting of number of frames to analyze.

**Parameters**

ON | OFF

**Characteristics**

\*RST value: ON

SCPI: device-specific

**Mode**

UL, DL

**[SENSe][:LTE]:SUBFrame:SElect[?]**

---

Configures the subframe to be analyzed.

**Example**

```
"SENS:SUBF:SEL ALL"
```

Select all subframes for analysis.

**Parameters**

ALL Select all subframes

0...9 Select a single subframe

**Characteristics**

\*RST value: ALL

SCPI: Device specific

**Mode**

UL, DL

**[SENSe][:LTE]:ANTenna:SElect[?]**

---

Configures which antenna shall be used for analysis.

**Example**

```
"SENS:ANT:SEL 2"
```

Select antenna 2 for analysis.

**Parameters**

numeric value

**Characteristics**

\*RST value: 1

SCPI: Device specific

**Mode**

DL

**[SENSe]:FREQuency:CENTer[?]**

---

Configures the current center frequency for RF-mode in Hz. Modifiers like MHz or GHz may also be used.

**Example**

```
"SENS:FREQ:CENT 2GHZ"
```

Set the center frequency to 2 GHz.

**Characteristics**

\*RST value: 1GHz

SCPI: conforming

**Mode**

UL, DL

**[SENSe]:IQ:DITHer[:STATe][?]**

---

Activates or deactivates input dithering.

**Example**

```
"SENS:IQ:DITH ON"
```

Activate input dithering

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

UL, DL

**[SENSe]:IQ:LPASs[:STATe][?]**

---

Activates or deactivates the baseband input lowpass.

**Example**

```
"SENS:IQ:LPAS ON"
```

Activate the input lowpass.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

UL, DL

**[SENSe]:POWer:AUTO:TIME[?]**

---

Configures the auto level track time.

**Example**

```
"SENS:POW:AUTO:TIME 200ms"
```

An auto level track time of 200 ms gets set.

**Characteristics**

\*RST value: 100 ms

SCPI: device-specific

**Mode**

UL, DL

**[SENSe]:POWer:AUTO<1..4>[?]**

---

Activates or deactivates auto level. The suffix defines for which analyzer the setting shall take effect.

**Example**

```
"SENS:POW:AUTO2 ON"
```

Activate auto level for analyzer number 2.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: ON

SCPI: device-specific

**Mode**

UL, DL

**[SENSe]:POWer:SEM:CATegory[?]**

---

Specifies the SEM category defined in 3GPP TS 36.101 for Uplink.

**Example**

```
"SENS:POW:SEM:CAT B"
```

Selects category B for all SEM measurements.

**Parameters**

A|B

**Characteristics**

\*RST value: A

SCPI: device-specific

**Mode**

UL

**[SENSe]:POWer:ACHannel:AACHannel[?]**


---

Selects the ACLR Assumed Adj. Channel Carrier in the general settings menu.

**Example**

```
"SENS:POW:ACH:AACH UTRA384"
```

Selects an UTRA signal with a bandwidth of 3.84MHz as assumed adjacent channel carrier.

**Parameters**

EUTRA	Selects an EUTRA signal of the same bandwidth like the TX channel as assumed adjacent channel carrier.
UTRA128	Selects an UTRA signal with a bandwidth of 1.28MHz as assumed adjacent channel carrier.
UTRA384	Selects an UTRA signal with a bandwidth of 3.84MHz as assumed adjacent channel carrier.
UTRA768	Selects an UTRA signal with a bandwidth of 7.68MHz as assumed adjacent channel carrier.

**Characteristics**

\*RST value: EUTRA

SCPI: device-specific

**Mode**

UL, DL

**[SENSe]:POWer:NCORrection[?]**


---

Activates or deactivates ACLR Noise Correction for ACLR measurements.

**Example**

```
"SENS:POW:NCOR ON"
```

Activates ACLR noise correction.

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

UL, DL

**[SENSe]:SWAPiq[?]**

---

Specifies if the IQ data shall be swapped.

**Example**

```
"SENS:SWAP ON"
```

Activate IQ-swapping

**Parameters**

ON|OFF

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Mode**

UL, DL

**[SENSe]:SWEep:TIME[?]**

---

Specifies the time of a single sweep. The capture time therefore defines the amount of data that is recorded during a single sweep.

**Example**

```
"SWEep:TIME 30"
```

Sets the capture time to 30 ms.

**Parameters**

Numeric value

**Characteristics**

\*RST value: 20.1 ms

SCPI: device-specific

**Mode**

UL, DL

**[SENSe]:SYNC:STATe?**

---

Returns the current sync state as comma separated list containing three values. A zero represents a failure and a one represents a successful operation. The first value stands for the coarse OFDM symbol timing, the second value stands for the P-SYNC synchronization and the third value stands for the S-SYNC synchronization.

**Example**

```
"SENS:SYNC:STAT?"
```

Returns "1,1,0" if coarse timing and P-SYNC were successful but S-SYNC failed.

**Characteristics**

\*RST value: -

SCPI: device specific

**Mode**

DL

**[SENSe]:OOPower:ATIMing**

---

Starts an ON/OFF power timing adjustment.

**Example**

```
"SENS:OOP:ATIM"
```

Starts the timing adjustment.

**Characteristics**

\*RST value: -

SCPI: device specific

**Mode**

DL

**SENSe:INPut[?]**

---

Configures the current signal source. Signal sources can be baseband, digital IQ and Radio Frequency. (Remark: In the current remote control version "File" is not supported as signal source)

**Example**

```
"SENS:INP DIQ"
```

Select digital IQ as signal source.



**Parameters**

- RF     Select radio frequency input as signal source.
- AIQ    Select analog IQ input (baseband) as signal source.
- DIQ    Select digital IQ input as signal source
- FILE   <Not supported yet>

**Characteristics**

- \*RST value: -
- SCPI: device-specific

**Mode**

- UL, DL

## 7.11 TRACe Subsystem

### List of commands

- [TRACe\[:DATA\]?](#)

### TRACe[:DATA]?

---

Returns all the measured data that relates to the currently selected measurement type. The data format returned is particular to the currently selected measurement type and is specified below.

- [Capture Buffer](#)
- [EVM vs. Carrier](#)
- [EVM vs. Symbol](#)
- [EVM vs. Subframe](#)
- [Spectrum Emission Mask](#)
- [Adjacent Channel Leakage Ratio](#)
- [Power Spectrum](#)
- [Power vs. RB PDSCH](#)
- [Power vs. RB Reference Signal](#)
- [Channel Flatness](#)
- [Channel Group Delay](#)
- [Channel Flatness Difference](#)
- [Constellation Diagram](#)
- [CCDF](#)
- [Allocation Summary](#)
- [Bitstream](#)

### Parameter

TRACE1 | TRACE2 | TRACE3 | LIST

### Return values

The returned values are scaled in the current measurement unit. For some measurements the unit may change depending on the unit-settings specified in the General Setup menu (or set by the UNIT:EVM-command).

### ASCII format (FORMat ASCII):

In ASCII format, a list of values separated by commas is returned (Comma Separated Values = CSV). Empty fields will return NaN.

### Binary format (FORMat REAL,32):

If the transmission takes place using the binary format (REAL,32), the data are transferred in block format (Definite Length Block Data according to IEEE 488.2). They are arranged in succeeding lists of I and Q data of 32 Bit IEEE 754 floating point numbers.

### Capture Buffer

<Not implemented yet (returns nothing)>

### **EVM vs. Carrier**

Returns the EVM-vs.-Carrier-values as list over all carriers. Depends on the Subframe selection that can be made in the General Settings.

Trace1: Mean values (averaged over all subframes) [dB | Percent]

Trace2: Minimum values (nothing if a single subframe is selected) [dB | Percent]

Trace3: Maximum values (nothing if a single subframe is selected) [dB | Percent]

### **EVM vs. Symbol**

Returns the EVM-vs.-Symbol-values as list over all symbols. If a single subframe is selected in the General Settings, only the symbols of the selected subframe will be returned.

Trace1: Mean values [dB | Percent]

### **Frequency Error vs. Symbol**

Returns the Frequency Error vs. Symbol values as list over all symbols in increasing order. If a single subframe is selected in the "General Settings", only the symbols of the selected subframe are returned.

Trace1: Mean values [Hz]

### **EVM vs. Subframe**

Returns the EVM-vs.-Symbol-values as list over all subframes.

Trace1: Mean values [dB | Percent]

### **Spectrum Emission Mask**

Returns the spectrum emission mask results as follows.

Trace1: Clear power values [dBm]

Trace2: Nothing

Trace3: Nothing

List: Spectrum Emission Mask (SEM) summary results.  
Result data will be returned as a fixed number of 625 trace points in floating point format in groups of 9 comma separated values as follows:

- 1st Value -Index in the table of results
- 2nd Value -Start frequency band (Hz)
- 3rd Value -Stop frequency band (Hz)
- 4th Value -RBW (Hz)
- 5th Value -limit fail frequency (Hz)
- 6th Value -Power absolute (dBm)

- 7th Value -Power relative (dBc)
- 8th Value -Limit distance (dB)
- 9th Value -Failure flag (1 = fail, 0 = pass)

### Adjacent Channel Leakage Ratio

Returns the ACLR power values as vector.

Trace1: Clear power values [dBm]

Trace2: Nothing

Trace3: Nothing

List: Nothing

### Power Spectrum

Returns the signal power in dBm/Hz as list over the considered frequency span.

Trace1: Mean values [dB]

### Power vs. RB Reference Signal

Returns the reference signal power per RB in dBm as list over the currently available RBs.

Trace1: Mean values (averaged over all subframes) [dBm]

Trace2: Minimum values (nothing if a single subframe is selected) [dBm]

Trace3: Maximum values (nothing if a single subframe is selected) [dBm]

### Power vs. RB PDSCH

Returns the PDSCH signal power per RB in dBm as list over the currently available RBs.

Trace1: Mean values (averaged over all subframes) [dBm]

Trace2: Minimum values (nothing if a single subframe is selected) [dBm]

Trace3: Maximum values (nothing if a single subframe is selected) [dBm]

### Channel Flatness

Returns the spectrum flatness in dB as list over the considered frequency span. Depends on the subframe selection that can be made in the General Settings.

Trace1: Mean values (averaged over all subframes) [dB]

Trace2: Minimum values (nothing if a single subframe is selected) [dB]

Trace3: Maximum values (nothing if a single subframe is selected) [dB]

**Channel Group Delay**

Returns the channel group delay in ns as list over the considered frequency span. Depends on the Subframe selection that can be made in the General Settings.

Trace1: Mean values (averaged over all subframes) [ns]

Trace2: Minimum values (nothing if a single subframe is selected) [ns]

Trace3: Maximum values (nothing if a single subframe is selected) [ns]

**Channel Flatness Difference**

Returns the channel flatness difference in dB as list over the considered frequency span. Depends on the Subframe selection that can be made in the General Settings.

Trace1: Mean values (averaged over all subframes) [dB]

Trace2: Minimum values (nothing if a single subframe is selected) [dB]

Trace3: Maximum values (nothing if a single subframe is selected) [dB]

**Constellation Diagram**

This measurement represents I and Q data. Data will be returned as an array of interleaved I and Q data until all data is exhausted. By default all detected data-points will be returned. The amount of data can be narrowed by changing settings in the "Constellation Selection" menu. Only data points that meet the requirements specified in the "Constellation Selection" menu will be returned.

The the constellation data will be swept and returned in the following order:

Subframe0 ⇒ Symbol0 ⇒ First Carrier to last Carrier of Symbol 0

Subframe0 ⇒ Symbol1 ⇒ First Carrier0 to last Carrier of Symbol 1

Subframe0 ⇒ ...

Subframe0 ⇒ Last Symbol of Subframe0 ⇒ First Carrier to last Carrier

Subframe1 ⇒ Symbol0 ⇒ First Carrier to last Carrier of Symbol 0

Subframe1 ⇒ Symbol1 ⇒ First Carrier to last Carrier of Symbol 1

Subframe1 ⇒ ...

Subframe1 ⇒ Last Symbol of Subframe0 ⇒ First Carrier to last Carrier

...

Last Subframe

**CCDF**

Returns the complementary cumulative distribution function results in percent as list over the power level in dB. The first value returned represents the number of following values. Trace1 will return the probability-values (Y-Axis) while Trace2 will return the corresponding power-level-steps (X-Axis).

Trace1: Probability values (Y-Axis) [Percent]

Trace2: Corresponding power steps (X-Axis) [dB]

### Allocation Summary

The Allocation Summary will be returned line by line. The result-data has to be interpreted differently for downlink and uplink.

In case of downlink, the data will be returned in groups of 7 comma separated values as follows:

- 1st value – Subframe Number
- 2nd value – Allocation ID where:
  - 1 = INVALID
  - 2 = ALL
  - 3 = P-SYNC
  - 4 = S-SYNC
  - 5 = PILOTS\_ANT1
  - 6 = PILOTS\_ANT2
  - 7 = PILOTS\_ANT3
  - 8 = PILOTS\_ANT4
  - 9 = PCFICH
  - 10 = PHICH
  - 11 = PDCCH
  - 12 = PBCH
  - 13 = PMCH
- 3rd value – Number of RB
- 4th value – Offset RB
- 5th value – Modulation
  - 0 = Unrecognized
  - 1 = RBPSK (both constellation points are located on the X-axis)
  - 2 = QPSK
  - 3 = 16QAM
  - 4 = 64QAM
  - 5 = 8PSK
  - 6 = PSK
  - 7 = Modulation Mixture
  - 8 = BPSK
- 6th value – Power in dBm
- 7th value – EVM in dB or percent

Each transmitted group represents one line of the summary table.



This command is not available for Real32 data format and will therefore always return ASCII formatted data

---

## Example

Subframe	Allocation ID	Number of RB	Offset RB	Modulation	Power [dBm]	EVM [%]
0	RefSig Ant1				-17,093	0,000
	P-SYNC				-17,742	0,000
	S-SYNC				-17,742	0,000
	PBCH			QPSK	-17,093	0,000
	0	3	0	64QAM	-17,177	0,000
	1	1	3	16QAM	-17,169	0,000
	2	11	4	64QAM	-17,119	0,000
	3	2	15	QPSK	-17,093	0,000
	4	27	17	64QAM	-17,113	0,000
	5	6	44	16QAM	-17,105	0,000
	ALL	50			0,000	
1	RefSig Ant1				-17,093	0,000
	0	41	0	16QAM	-17,073	0,000
	1	9	41	QPSK	-17,093	0,000
	ALL	50				0,000
2	RefSig Ant1				-17,093	0,000

SCPI would return the following:

```

S|A I|R|R|M|P           | E
u|l D|B|B|o|o         | V
b|l | | |d|w          | M
f|o |N|O|u|e          |
r|c |u|f|l|r          |
a|a |m|f|a|           |
m|t |b|s|t|           |
e|I |e|e|i|           |
 |o |r|t|o|           |

0,-5,,,0,-17.0926996097583,8.44728660354122E-06,
0,-3,,,0,-17.742108013101,8.49192574037261E-06,
0,-4,,,0,-17.7421077124897,8.50963104426228E-06,
0,-12,,,2,-17.092699868618,7.81896929424875E-06,
0,0,3,0,4,-17.1774446884892,8.54281765327869E-06,
0,1,1,3,3,-17.1688944558343,9.53971195372105E-06,
0,2,11,4,4,-17.1194836675011,8.1122671247158E-06,
0,3,2,15,2,-17.0926996097583,8.03053410436405E-06,
0,4,27,17,4,-17.1130321527746,8.12566085528488E-06,
0,5,6,44,3,-17.105305197162,9.96321958268709E-06,
0,-2,50,,,,8.4165201030828E-06,
1,-5,,,0,-17.0926996097583,8.8521098007277E-06,
1,0,41,0,3,-17.0730933763501,1.00923926993346E-05,
1,1,9,41,2,-17.0926996097583,8.2804383794155E-06,
1,-2,50,,,,9.74191536329272E-06,
2,-5,,,0,-17.0926996097583,8.73975167792196E-06,
2,0,18,0,4,-17.1170893880663,8.48596712899052E-
06,2,1,13,18,2,-17.0926996097583,8.37752480720155E-06,
2,2,6,31,3,-17.1306290208122,9.84026229389201E-
06,2,3,13,37,2,-
<continues like this till end of data reached>

```

### Bitstream

Just like the allocation summary, the bitstream data will be returned in groups where each group represents one line of the table. The result data has to be interpreted differently for downlink and uplink and additionally it is important to distinguish between bitstream and hexadecimal data format.

In case of downlink, the data will be returned in groups of 6 comma separated values as follows:

- 1st value – Subframe Number
- 2nd value – Allocation ID where:
  - 1 = INVALID
  - 2 = ALL
  - 3 = P-SYNC
  - 4 = S-SYNC
  - 5 = PILOTS\_ANT1



-6 = PILOTS\_ANT2  
 -7 = PILOTS\_ANT3  
 -8 = PILOTS\_ANT4  
 -9 = PCFICH  
 -10 = PHICH  
 -11 = PDCCH  
 -12 = PBCH  
 -13 = PMCH

- 3rd value – Codeword where:

0 = '1/1'  
 1 = '1/2'  
 2 = '2/2'

- 4th value – Modulation where:

0 = Unrecognized  
 1 = RBPSK (both constellation points are located on the X-axis)  
 2 = QPSK  
 3 = 16QAM  
 4 = 64QAM  
 5 = 8PSK  
 6 = PSK  
 7 = Modulation Mixture  
 8 = BPSK

- 5th value –

Hexmode: Number of Symbols to be transmitted  
 Binary Mode: Number of bits to be transmitted

- 6th value –

Hexmode: Comma-separated stream of two-digit hexadecimal numbers  
 Binary Mode: Comma-separated stream of binary numbers



This command is not available for Real32 data format and will therefore always return ASCII formatted data

---

Bit Stream					
Subfr.	Alloc. ID	Codeword	Modulation	Symbol Index	Bit Stream
0	PBCH	1/1	QPSK	0	01 00 02 01 01 00 00 00 00 00 01 01 01 00 00 00
0	PBCH	1/1	QPSK	16	03 00 01 01 01 02 01 00 03 03 00 01 01 02 02 03
0	PBCH	1/1	QPSK	32	00 01 01 02 01 02 02 01 02 01 03 00 03 02 02 00
0	PBCH	1/1	QPSK	48	03 00 00 02 01 03 01 02 03 00 03 03 00 00 02 00
0	PBCH	1/1	QPSK	64	02 00 02 02 01 01 03 01 02 03 01 03 02 03 03 00
0	PBCH	1/1	QPSK	80	02 02 02 01 01 02 01 02 02 02 03 03 00 02 01 01
0	PBCH	1/1	QPSK	96	02 03 03 01 03 02 03 01 02 02 00 01 03 03 00 01
0	PBCH	1/1	QPSK	112	03 03 01 02 03 02 02 00 02 00 01 03 02 00 01 00
0	PBCH	1/1	QPSK	128	00 02 03 01 03 00 00 00 03 02 02 02 01 01 02 00
0	PBCH	1/1	QPSK	144	00 00 02 03 00 00 01 03 01 02 03 03 02 03 00 01
0	PBCH	1/1	QPSK	160	00 00 03 00 00 00 02 00 01 00 01 02 02 00 03 00
0	PBCH	1/1	QPSK	176	01 01 01 00 01 02 00 01 00 03 00 02 03 02 03 02
0	PBCH	1/1	QPSK	192	01 03 00 01 03 03 00 01 01 02 02 02 02 02 00 03
0	PBCH	1/1	QPSK	208	01 02 00 02 02 01 02 01 01 02 02 03 02 00 00 00
0	PBCH	1/1	QPSK	224	01 03 00 03 01 00 00 00 00 02 00 03 02 00 01 03
0	0	1/1	64QAM	0	1D 2B 27 03 24 07 35 05 1F 22 20 15 17 0C 21 34
0	0	1/1	64QAM	16	10 2C 09 32 19 03 11 36 19 2A 05 0A 0F 0F 04 15
0	0	1/1	64QAM	32	32 2D 3D 11 3B 1D 04 0D 1E 23 19 00 28 33 17 25

SCPI would return the following:

```

S|A I|C|M|N S| B           i
u|l D|o|o|u y| i           n
b|l |d|d|m m| t           |
f|o |e|u|b b|           H
r|c |w|l|e o| S           e
a|a |o|a|r l| t           x
m|t |r|t| s| r           |
e|I |d|i|o | e           |
 |o | |o|f | a           |
 |n | |n| | m           |

0, -12, 0, 2, 239, 01, 00, 02, 01, 01, 00, 00, 00, 00, 00, 01, 01, 01, 00, 00,
00, 03, 00, 01, 01, 01, 02, 01, 00, 03, 03, 00, 01, 01, 02, 02, 03, 00, 01, 01,
02, 01, 02, 02, 01, 02, 01, 03, 00, 03, 02, 02, 00, 03, 00, 00, 02, 01, 03, 01,
02, 03, 00, 03, 03, 00, 00, 02, 00, 02, 00, 02, 01, 01, 03, 01, 02, 03, 01,
03, 02, 03, 03, 00, 02, 02, 02, 01, 01, 02, 01, 02, 02, 02, 03, 03, 00, 02, 01,
01, 02, 03, 03, 01, 03, 02, 03, 01, 02, 02, 00, 01, 03, 03, 00, 01, 03, 03, 01,
02, 03, 02, 02, 00, 02, 00, 01, 03, 02, 00, 01, 00, 00, 02, 03, 01, 03, 00, 00,
00, 03, 02, 02, 02, 01, 01, 02, 04, 32, 0B, 18, 17, 3A, 0B, 32, 33, 21, 1B, 3D,
01, 12, 39, 05, 29, 28, 28, 0A, 06, 0F, 2D, 18, 24, 3C, 0D, 26, 18, 0B, 17, 0D,
3E, 05, 01, 08, 3D, 19, 0F, 1F, 2D, 10, 36, 31, 27, 38, 2F, 17, 17, 2E, 2B, 2C,
19, 07, 13, ...
<continues like this till next datablock starts or end of data reached>

..., 0, 0, 0, 4, 413, 1D, 2B, 27, 03, 24, 07, 35, 05, 1F, 22, 20, 15, 17, 0C, 21, 3
4, 10, 2C, 09, 32, 19, 03, 11, 36, 19, 2A, 05, 0A, 0F, 0F, 04, 15, 32, 2D, 3D, 1
1, 3B, 1D, 04, 0D, 1E, 23, 19, 00, 28, 33, 17, 25, 35, 2F, 35, 31, 37, 25, 3A, 0
F, 08, 35, 2D, 3B, 1B, 1D, 32, 27, 1E, 32, 29, 04, 32, 0B, 18, 17, 3A, 0B, 32, 3
3, 21, 1B, 3D, 01, 12, 39, 05, 29, 28, 28, 0A, 06, 0F, 2D, 18, 24, 3C, 0D, 26, 1
8, ...
<continues like this till next datablock starts or end of data reached>

```

## 7.12 TRIGger Subsystem

The trigger subsystem is used to synchronize device action(s) with events.

### List of commands

- TRIGger[:SEQuence]:MODE[?]
- TRIGger[:SEQuence]:HOLDoff[?]
- TRIGger[:SEQuence]:LEVel<1..4>:POWer[?]

### TRIGger[:SEQuence]:MODE[?]

---

Configures the trigger mode used.

#### Example

```
"TRIG:MODE IMM"
```

Free trigger will be used for measurements.

#### Parameter

EXTernal	Use an external trigger during measurement
IMMediate	Run measurement in "free trigger"-mode
POWer	Use an IF power trigger during measurement

#### Characteristics

\*RST value: IMMediate

SCPI: device-specific

#### Mode

UL, DL

### TRIGger[:SEQuence]:HOLDoff[?]

---

Configures the trigger offset.

#### Example

```
"TRIG:HOLD 5MS"
```

Sets the trigger offset to 5 ms.

#### Parameter

numeric value in seconds

#### Characteristics

\*RST value 0 s

SCPI: conforming

**Mode**

UL, DL

**TRIGger[:SEquence]:LEVel<1..4>:POWer[?]**

---

Configures the IF Power Trigger Level of the analyzers used in RF mode. The suffix <1..4> specifies to which analyzer the setting applies to.

**Example**

```
"TRIG:LEV1:POW -10"
```

Sets the IF power trigger level used by analyzer 1 to -10 dBm.

**Parameters**

Numeric value in dBm

**Characteristics:**

\*RST value: -20 dBm

SCPI: device-specific

**Mode**

UL, DL

## 7.13 UNIT Subsystem

### List of commands

- [UNIT:EVM\[?\]](#)
- [UNIT:BSTR\[?\]](#)

#### UNIT:EVM[?]

---

Specifies the units for EVM results.

##### Example

```
"UNIT:EVM PCT"
```

EVM results to be returned in %.

##### Parameter

DB EVM results returned in dB

PCT EVM results returned in %

##### Characteristics

\*RST value: DB

SCPI: device-specific

##### Mode

UL, DL

#### UNIT:BSTR[?]

---

Specifies if the bit stream gets displayed using bits or using symbols.

##### Example

```
"UNIT:BSTR BIT"
```

Bit stream gets displayed using Bits.

##### Parameter

SYMBOLS Bit stream gets displayed using Symbols

BITS Bit stream gets displayed using Bits

##### Characteristics

\*RST value: SYMBOLS

SCPI: device-specific

##### Mode

UL, DL

## 7.14 Table of Softkeys with Assignment of Remote Commands

GENERAL SETTINGS		
General Settings	Standard	Not supported yet.
	Duplexing	CONFigure[:LTe]:DUPLexing <TDD   FDD>
	Link direction	CONFigure[:LTe]:LDIRection <DL   UL>
	Frequency	[SENSe]:FREQuency:CENTer <value>
	Source	[SENSe]:INPut <RF   AIQ   DIQ   FILE>
	Level Settings	Not available.
	Auto Level	[SENSe]:POWer:AUTO<1..4> <ON   OFF>
	Reference Level (RF)	CONFigure:POWer:EXPEcted:RF<1..4> <value>
	Attenuation	INPut:ATT<1..4> <value>
	Ext Att	DISPlay[:WINDow]:TRACe:Y:RLEVel:OFFSet <value>
	Reference level (BB)	CONFigure:POWer:EXPEcted:IQ<1..4> <value>
	Trigger Mode	TRIGger[:SEQuence]:MODE <EXT   IMM>
	Trigger Offset	TRIGger[:SEQuence]:HOLDoff <value>
	IF Power Trigger Level	TRIGger[:SEQuence]:LEVel<1..4>:POWer <value>
	Capture Time	[SENSe]:SWEp:TIME <value>
	Overall Frame Count	[SENSe][:LTe]:FRAME:COUNT:STATE <ON   OFF>
	Num. of Frames to Analyze	[SENSe][:LTe]:FRAME:COUNT <value>
	Auto Acc. to Standard	[SENSe][:LTe]:FRAME:COUNT:AUTO <ON   OFF>
	EVM Unit	UNIT:EVM <DB   PCT>
	Bit Stream Format	UNIT:BSTR <SYM   BIT>
	Subframe Selection	[SENSe][:LTe]:SUBFrame:SELEct <ALL   0..9>
	Antenna Selection	[SENSe][:LTe]:ANTenna:SELEct <value>
	Category	[SENSe]:POWer:SEM:CATegory <A   B>
	Assumed Adj. Channel Carrier	[SENSe]:POWer:ACHannel:AACHannel <EUTRA UTRA128 UTRA384 UTRA768>
	ACLR Noise Correction	[SENSe]:POWer:NCORrection <ON   OFF>
	Auto Gating	Not supported yet.
	MIMO Analyzer Configuration	CONFigure:ADDRes<1..4>

Table of Softkeys with Assignment of Remote Commands

Advanced Settings	Swap IQ	[SENSe]:SWAPiQ <ON   OFF>
	Input high impedance	INPut:IQ:IMPedance <LOW   HIGH>
	Input balanced	INPut:IQ:BALanced[:STATe] <ON   OFF>
	Input lowpass	[SENSe]:IQ:LPASs[:STATe] <ON   OFF>
	Input dithering	[SENSe]:IQ:DITHer[:STATe] <ON   OFF>
	Auto level track time	[SENSe]:POWer:AUTO:TIME <value>
	Source sampling rate	INPut:DIQ:SRATE <value>
	Full scale level	INPut:DIQ:RANGE[:UPPer] <value>
	Couple Screens	Not supported yet.
<div style="border: 1px solid black; padding: 2px; display: inline-block;">           DEMOD SETTINGS         </div>		
Downlink Demodulation Settings	Channel Estimation	[SENSe][:LTE]:DL:DEMod:CEStimation <TGPP   PIL   PILPAY>
	EVM Calculation Method	[SENSe][:LTE]:DL:DEMod:EVMCalc <TGPP   OTP>
	Scrambling of Coded Bits	[SENSe][:LTE]:DL:DEMod:CBScrambling <ON   OFF>
	Auto PDSCH Demodulation	[SENSe][:LTE]:DL:DEMod:AUTO <ON   OFF>
	PDSCH Subframe Configuration Detection	[SENSe][:LTE]:DL:FORMat:PSCD <value>
	Boosting Estimation	[SENSe][:LTE]:DL:DEMod:BEStimation <ON   OFF>
	PDSCH Reference Data	[SENSe][:LTE]:DL:DEMod:PRData <value>
	Multicarrier Filter	[SENSe][:LTE]:DL:DEMod:MCFilter <ON   OFF>
	Phase Tracking	[SENSe][:LTE]:DL:TRACking:PHASe <OFF   PIL   PILPAY>
	Timing Tracking	[SENSe][:LTE]:DL:TRACking:TIME <ON   OFF>
	Compensate Crosstalk	CONFigure[:LTE]:DL:MIMO:CROStalk <ON   OFF>
Downlink Signal Characteristics	Channel Bandwidth	CONFigure[:LTE]:DL:BW <BW1_40   BW2_50   BW3_00   BW5_00   BW10_00   BW15_00   BW20_00>
	Number of Resource Blocks	CONFigure[:LTE]:DL:NORB <value>
	Cyclic Prefix	CONFigure[:LTE]:DL:CYCPrefix <NORM   EXT   AUTO>
	TDD UL/DL Allocations	CONFigure[:LTE]:DL:TDD:UDConf <0..6>
	Conf. of Special Subframe	CONFigure[:LTE]:DL:TDD:SPSC <value>
	Cell Identity Group	CONFigure[:LTE]:DL:PLCi :CIDGroup <AUTO   0..167>
	Identity	CONFigure[:LTE]:DL:PLCi:PLID <AUTO   0..2>
	Configuration	CONFigure[:LTE]:DL:MIMO:CONF <TX1   TX2   TX4>
	Antenna selection	CONFigure[:LTE]:DL:MIMO:ASElection <ANT1   ANT2   ANT3   ANT4   ALL>
	Configurable Subframes	CONFigure[:LTE]:DL:CSUBframes <1..10>

Table of Softkeys with Assignment of Remote Commands

	Selected Subframe	Not available.
	Used Allocations	CONFigure[:LTE]:DL:SUBFrame<0...9>:ALCount <value>
	Allocation Settings Table	ID/N_RNTI: CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:UEID <value>
		Modulation: CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>[:CW<[1]   2>]:MODulation <QPSK   QAM16   QAM64>
		Enhanced Settings: CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:PRECoding[:SCHEME] <NONE   SPM   TXD   TXMS> CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:PRECoding:NOLayers <1..4> CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:PRECoding:CBIndex <0..15> CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:PRECoding:CDD <ON   OFF>
		Number of RB: CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:RBCount <value>
		Offset RB: CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:RBOffset <value>
		Power (dB): CONFigure[:LTE]:DL:SUBFrame<0...9>:ALLoc<0...99>:POWER <value>
DL Adv Signal Settings	P-/S-SYNC Tx Antenna	CONFigure[:LTE]:DL:SYNC:ANTenna <antenna>
	P-SYNC Relative Power	CONFigure[:LTE]:DL:SYNC:PPOwer <value>
	S-SYNC relative Power	CONFigure[:LTE]:DL:SYNC:SPOwer <value>
	Relative Power	CONFigure[:LTE]:DL:REFSig:POWER <value>
	PRB Symbol Offset	CONFigure[:LTE]:DL:PSOffset <value>
	PBCH Present	CONFigure[:LTE]:DL:PBCH:STAT <ON   OFF>
	PBCH Rel Power	CONFigure[:LTE]:DL:PBCH:POW <value>
	PCFICH Present	CONFigure[:LTE]:DL:PCFich:STAT <ON   OFF>
	PCFICH Rel Power	CONFigure[:LTE]:DL:PCFich:POWER <value>
	PHICH Duration	CONFigure[:LTE]:DL:PHICH:DURATION <NORM   EXT>
	PHICH TDD m <sub>i</sub> =1	CONFigure[:LTE]:DL:PHICH:MITM <ON   OFF>
	PHICH N <sub>g</sub>	CONFigure[:LTE]:DL:PHICH:NG <NG1_6>   NG1_2   NG1   NG2   NGCUSTOM>
	PHICH Number of Groups	CONFigure[:LTE]:DL:PHICH:NOGRoups <value>
	PHICH Relative Power	CONFigure[:LTE]:DL:PHICH:POWER <value>



Table of Softkeys with Assignment of Remote Commands

	PDCCH Format	CONFigure[:LTE]:DL:PDCCh:FORMat <value>
	Number of PDCCHs	CONFigure[:LTE]:DL:PDCCh:NOPD <value>
	PDCCH Relative Power	CONFigure[:LTE]:DL:PDCCh:POWer <value>
DISPLAY GRAPH LIST		
PVT ↓	CAPTURE BUFFER	CALCulate<1 2>:FEED 'PVT:CBUF'
	ON/OFF POWER	CALCulate<1 2>:FEED 'PVT:OOP'
	POWER VS SYM X CARR	Not supported yet.
EVM ↓	EVM VS CARRIER	CALCulate<1 2>:FEED 'EVM:EVCA'
	EVM VS SYMBOL	CALCulate<1 2>:FEED 'EVM:EVSY'
	EVM S SYM X CARR	Not supported yet.
	FREQ ERR VS SYMBOL	CALCulate<1 2>:FEED 'EVM:FEVS'
	EVM VS SUBFRAME	CALCulate<1 2>:FEED 'EVM:EVSU'
SPECTRUM ↓	SPECTRUM MASK	CALCulate<1 2>:FEED 'SPEC:SEM'
	ACLR	CALCulate<1 2>:FEED 'SPEC:ACP'
	POWER SPECTRUM	CALCulate<1 2>:FEED 'SPEC:PSPE'
	POWER VS RB PDSCH RS	CALCulate<1 2>:FEED 'SPEC:PVRP' CALCulate<1 2>:FEED 'SPEC:PVRP'
	CHANNEL FLATNESS FLAT GRDEL	CALCulate<1 2>:FEED 'SPEC:FLAT' CALCulate<1 2>:FEED 'SPEC:GDEL'
	CHANNEL FLATNESS DIFFERENCE	CALCulate<1 2>:FEED 'SPEC:FDIF'
CONSTELL ↓	CONSTELL	CALCulate<1 2>:FEED 'CONS:CONS'
	CONSTELL SELECTION	Not available.
STATISTICS / MISC ↓	CCDF	CALCulate<1 2>:FEED 'STAT:CCDF'
	SIGNAL FLOW	CALCulate<1 2>:FEED 'STAT:SFLO'

Table of Softkeys with Assignment of Remote Commands

	ALLOCATION SUMMARY	CALCulate<1 2>:FEED 'STAT:ASUM'
	BIT STREAM	CALCulate<1 2>:FEED 'STAT:BSTR'
	ALLOC ID VS SYM X CARR	Not supported yet.

**Softkey of the SETUP menu:**

CONFIG ANALYZER CONNECTION	Not available.
DATA SOURCE INST FILE	Not available.
SHOW LOGGING	Not supported yet.
SYSTEM INFO	Not supported yet.

**Softkey of the FILE menu:**

TEST MODELS (E-TM)	MMEM:LOAD:TMOD:DL [filename]
LOAD DEMOD SETTINGS	MMEMemory:LOAD:DEM [filename]
SAVE DEMOD SETTINGS	MMEMemory:STORE:DEM [filename]
SAVE IQ DATA	Not supported yet.

**Softkey of the DISP menu:**

FULL SCREEN	Not available.
SPLIT SCREEN	Not available.
BACKGROUND COLOR	Not available.
HARDCOPY	Not supported yet.

# Appendix

## A Import and Export of Data

This section describes how to import and export data from and to the EUTRA/LTE software.

The software will process the following types of data files the user may manipulate:

- I/Q data
- Frame description
- User-defined P-SYNC, S-SYNC and reference symbols
- Screenshots
- Limit line definitions

### A.1 IQ Data

The EUTRA/LTE software is able to process I/Q data from a file rather than from the R&S FSQ / FSV instrument hardware. Captured I/Q data can also be stored in various formats for e.g. processing with other external tools or for support purposes.

#### Format

I/Q data can be formatted either in binary form or as ASCII files. The data is linearly scaled using the unit Volt (if a correct display of e.g. Capture Buffer power is required).

For **binary format**, data is expected as 32-bit floating point data, Little Endian format (also known as LSB Order or Intel format).

(EXAMPLE: 0x1D86E7BB in hexadecimal notation will be decoded to -7.0655481E-3.)

The data order can be either IQIQIQ or II..IQQ..Q.

For **MIMO I/Q data**, first the I and Q are interleaved and then the antennas, e.g., for a 2 Tx MIMO signal and [I/Q][antenna index]([symbol index]) we get the following order:

I0(0), Q0(0), I1(0), Q1(0), I0(1), Q0(1), I1(1), Q1(1), I0(2), ...

For **ASCII format**, data is expected as I and Q values in alternating rows, separated by new lines:

```
<I value 1>
<Q value 1>
<I value 2>
<Q value 2>
...
```

### Usage – IMPORT

To use externally stored data, switch to input source File in the "General Settings" dialog box. Each time you start a new measurement, you will be prompted for the file name.

### Usage – EXPORT

To export captured I/Q data, select "FILE", "Save IQ Data".

## A.2 Frame Description

### Purpose

The frame description is used to describe the complete modulation structure of the signal, such as bandwidth, modulation, etc.

### Format

The frame setup is stored as an XML file. XML files are very commonly used to describe hierarchical structures in an easy-to-read format for both humans and PC. A typical frame setup file is shown below:

```
<FrameDefinition LinkDirection="downlink" TDDULDLAllocationConfiguration="0"
TDDSpecialSubframeConfiguration="0" ResourceBlocks="50" CP="auto" PSYNCRBoostingdB="0"
SSYNCRBoostingdB="0" PSSYNCRtxAntenna="All" ReferenceSignalBoostingdB="0"
PBCHIsPresent="true" PBCHBoostingdB="0" PCFICHIsPresent="true" PCFICHBoostingdB="0"
PHICH_Ng="1" PHICHNumGroups="0" PHICHDuration="Normal" PHICHBoostingdB="-3.01"
PHICHTDDSetMiAccToETMs="false" NumberOfPDCCHs="0" PDCCHFormat="-1"
PDCCHBoostingdB="0" PSSYNCRRepetitionPeriod="10" DataSymbolOffsetSubFrame="-1"
MIMOConfiguration="1 Tx Antenna" MIMOAntennaSelection="Antenna 1" PhysLayCellIDGrp="Auto"
PhysLayID="Auto" RefSignal3GPPVersion="3" N_c_fastforward="1600">
  <Frame>
    <Subframe>
      <PRBs>
        <PRB Start="0" Length="6" Boosting="0" Modulation="QPSK" Precoding="None" Layers="1"
Codebook="0" CDD="0" N_RNTI="0" />
      </PRBs>
    </Subframe>
  </Frame>
  <stControl PhaseTracking="1" TimingTracking="0" ChannelEstimation="1"
EVMCalculationMethod="1" CompensateCrosstalk="0" EnableScrambling="1"
AutoDemodulation="1" AutoBoostingEstimation="1" SubframeConfDetect="2" RefDataSource="1"
MulticarrierFilter="0"/>
</FrameDefinition>
```

All settings which can be entered via "Demod Settings" can also be found in the frame setup file.

Additional allocations can be entered by adding additional PRB entries in the PRBs list.

The following restrictions apply to the frame setup content:

- At least one PRB must exist.
- Only one frame can be allocated in this software version.

**Usage – IMPORT**

To load a stored frame setup, select "FILE", then "Load Demod Setup".

**Usage – EXPORT**

To save a frame setup, select "FILE", then "Save Demod Setup".

**A.3 User-Defined P-SYNC, S-SYNC and Reference Symbols****Purpose**

To offer maximum flexibility, it is possible to load user-defined **bit** or **iq sequences** for the P-SYNC, S-SYNCH and reference signal. The modulation of the bit sequences is QPSK.

**Format**

To create user-defined bit sequences, create a text file (ASCII format) with the numbers 0 and 1, with one number per line. A "0" corresponds to a 0 bit and a "1" corresponds to a 1 bit:

```
<QPSK symbol 1, I bit >
<QPSK symbol 1, Q bit >
<QPSK symbol 2, I bit >
<QPSK symbol 2, Q bit >
<QPSK symbol 3, I bit >
...
```

The length of the P-SYNC bit definition vector must be 144 (bits per symbol \* carriers = 2 \* 72). For S-SYNC and reference symbols, if not enough bits are available for the mapping, the bits are repeated. The length of the reference symbols bit definition vectors must be a multiple of 2.

To create user-defined **iq sequences**, create a binary file containing the complex valued iq symbols. Data is expected as 32-bit floating point data, Little Endian format (also known as LSB Order or Intel format, EXAMPLE: 0x1D86E7BB in hexadecimal notation will be decoded to -7.0655481E-3). The data order is IQIQIQ.

To generate iqw-files of the correct format, the following Matlab code can be used, assuming that x is the complex valued I/Q-symbol column 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);
```

The length of the P-SYNC iq symbol definition vector must be 144 (inphase/quadrature component \* carriers = 2 \* 72). For S-SYNC and reference symbols, if not enough iqw symbols are available for the mapping, the iqw symbols are repeated.

The pseudo-random sequence  $r^{\text{PRS}}$  of [3] can be uploaded from a text or IQW file. The maximum length of rPRS may vary from slot to slot. Hence, the maximum composite length of all 20 sequences (20 slots per radio frame) rPRS is given by  $340 * 2 * 20 = 13600$  symbols (i.e. 27200 Bits in case of QPSK text file). The data file is read out as follows:

- For QPSK, the first 680 bits are read out for the primary reference signal of the first slot. For I/Q file, the first 340 symbols are read out for the primary reference signal of the first slot.
- Then the next 680 bits (340 symbols for I/Q file) are read out for the secondary reference signal of the first slot.
- Then the next 680 bits (340 symbols for I/Q file) are read out for the primary reference signal of the second slot.
- ...
- If secondary reference signals are not used, then the corresponding data in the text file is 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  $27200 \text{ bits} / 20 = 1360$  bits.

Note that this approach also reflects the possibility to use a complex scrambling code as defined in [6] as sequence  $r^{\text{PRS}}$ .

#### Usage – IMPORT

The bit/iq definition file must be placed in the same folder as the EUTRA/LTE application binary ("Program folder\Rohde-Schwarz\EUTRA LTE" by default).

- The name of the **P-SYNC bit** definition file must be *PSCHBitsQPSKUser.txt*.
- The name of the **P-SYNC iq** definition file must be *PSCHSymbolsUser.iqw*.
- The name of the **S-SYNC bit** definition file must be *SSCHBitsQPSKUser.txt*.
- The name of the **S-SYNC iq** definition file must be *SSCHSymbolsUser.iqw*.
- The name of the **Reference Pilots bit** definition file must be *PilotBitsQPSKUser.txt*.
- The name of the **Reference Pilots iq** definition file must be *PilotSymbolsUser.iqw*.

## A.4 Limits

### Purpose

The limit definition is used to specify user-defined limits, as the EUTRA/LTE standard does not describe explicit limits at the moment.

Currently, limits are only used in the Result Table ("MAIN", then "Display List").

### Format

The limit definition can be provided as XML. An example, including comments on how to use the definition, can be found in the following paragraph:

```

<Limits>
  <DL>
    <EVM>
      <PDSCHQPSK Mean="0.175"/><!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
      <PDSCH16QAM Mean="0.125"/><!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
      <PDSCH64QAM Mean="0.08"/><!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
      <PhysicalChannel/><!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
      <PhysicalSignal/><!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
      <All/><!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
    </EVM>
    <FrequencyError/><!--Unit: [Hz]-->
    <SamplingClockError/><!--Unit [ppm]-->
    <TimeAlignmentError/><!--Unit [ns]-->
    <IQOffset/><!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
    <IQGainImbalance/><!--Unit: linear (1 = 0 dB, 0.1 = -20 dB)-->
    <IQQuadraturError/><!--Unit: [°]-->
    <OSTP/><!--Unit: [W]-->
    <PowerTotal/><!--Unit: [W]-->
    <CrestFactor/><!--Unit: linear (1 = 0 dB, 10 = 10 dB)-->
    <OffPowSpectralDensity Limit="-85"/><!--Unit: [dBm/MHz]-->
  </DL>
</Limits>

```

Limit definitions which are not required may be skipped by making no entries or by deleting the complete tag.

### Usage – IMPORT

The bit definition file must be placed in the same folder as the EUTRA/LTE application binary ("%Program folder%\Rohde-Schwarz\EUTRA LTE" by default). The file name must be *Default.eutra\_limits*. The file is read once during the start-up process of the software.

## B Measurements in Detail

This section provides a detailed explanation of the measurements provided by R&S FSQ / FSV-K100 / -K102 / -K104 and provides help for using R&S FSQ / FSV-K100 / -K102 / -K104 to measure the characteristics of specific types of DUT.

In the following table the symbols are defined.

$a_{l,k}, \hat{a}_{l,k}$	data symbol (actual, decided)
$b_{l,k}$	boosting factor
$\Delta f, \hat{\Delta f}_{\text{coarse}}$	carrier frequency offset between transmitter and receiver (actual, coarse estimate)
$\Delta f_{\text{res}}$	residual carrier frequency offset
$\zeta$	relative sampling frequency offset
$H_{l,k}, \hat{H}_{l,k}$	channel transfer function (actual, estimate)
$i$	time index
$\hat{i}_{\text{coarse}}, \hat{i}_{\text{fine}}$	timing estimate (coarse, fine)
$k$	subcarrier index
$l$	OFDM symbol index
$N_{\text{FFT}}$	length of FFT
$N_{\text{g}}$	number of samples in cyclic prefix (guard interval)
$N_{\text{s}}$	number of Nyquist samples
$N_{\text{RE}}$	number of resource elements
$n$	subchannel index, subframe index
$n_{l,k}$	noise sample
$\Phi_l$	common phase error
$r(i)$	received sample in the time domain
$r'_{l,k}, r''_{l,k}, r'''_{l,k}$	received sample (uncompensated, partially compensated, equalized) in the frequency domain
$T$	useful symbol time
$T_{\text{g}}$	guard time
$T_{\text{s}}$	symbol time



### B.1 Introduction

The following description provides a brief overview of the digital signal processing used in the R&S FSQ / FSV's EUTRA/LTE downlink measurement application.

Between the received IF signal as the point of origin to the actual analysis results such as EVM, the digital signal processing can be divided into four major groups:

- Data capture
  - Synchronization
  - Channel estimation / equalization
  - Analysis
- } EUTRA / LTE downlink signal processing

The remainder of this description is structured accordingly.

### B.2 Signal Processing

#### Data Capturing

The block diagram in Figure 7-1 shows the R&S FSQ hardware from the IF section to the processor running the EUTRA/LTE downlink measurement application. The selectable IF filter bandwidth ranges from 300 kHz to 50 MHz. The A/D converter samples the IF signal at a rate of 81.6 MHz. The digital signal is converted down to the complex baseband, is low pass-filtered, and is resampled to the nearest multiple of the target sampling rate. The decimation filters suppress the aliasing frequencies arising from the subsequent downsampling to the target rate. Up to 16 M samples of the now available I/Q data can be stored in the capture buffer.

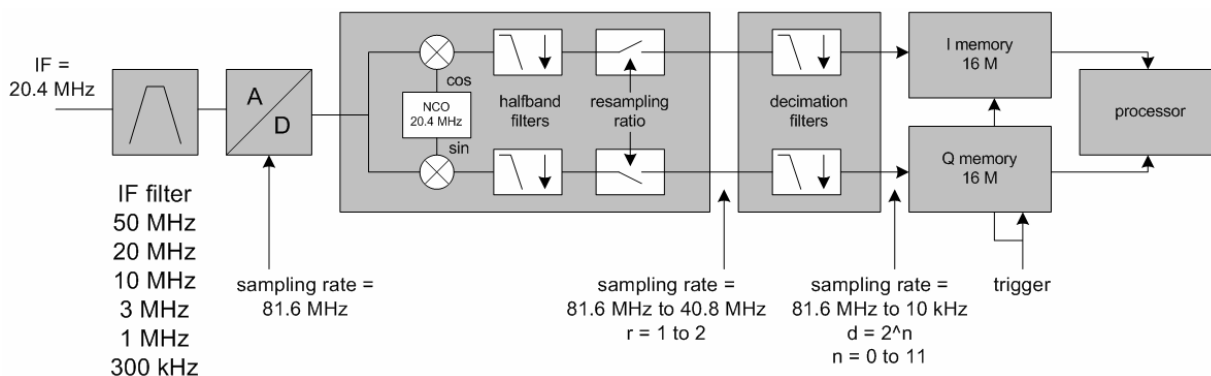


Figure 7-1: Data Capturing Mechanism of the R&S FSQ

### B.3 UTRA/LTE Downlink Measurement Application

The block diagram in Figure 7-2 shows the EUTRA/LTE downlink measurement application from the capture buffer containing the I/Q data to the actual analysis block. The outcome of the fully compensated reference path (green) are the estimates  $\hat{a}_{l,k}$  of the transmitted data symbols  $a_{l,k}$ . Depending on the user-defined compensation, the received samples  $r'_{l,k}$  of the measurement path (yellow) still contain the transmitted signal impairments of interest. The analysis block reveals these impairments by comparing the reference and the measurement path. Prior to the analysis, diverse synchronization and channel estimation tasks have to be accomplished.

#### Synchronization

The first of the synchronization tasks is to estimate the OFDM symbol timing, which coarsely estimates both timing and carrier frequency offset. The frame synchronization block determines the position of the P-/S-Sync symbols in time and frequency by using the coarse fractional frequency offset compensated capture buffer and the timing estimate  $\hat{i}_{coarse}$  to position the window of the FFT. If no P-/S-Sync is available in the signal, the reference signal is used for synchronization. The fine timing block prior to the FFT allows a timing improvement and makes sure that the EVM window is centered on the measured cyclic prefix of the considered OFDM symbol. For the 3GPP EVM calculation according to [3], the block "window" produces three signals taken at the timing offsets  $\Delta\tilde{c}$ ,  $\Delta\tilde{t}_l$  and  $\Delta\tilde{t}_h$ . For the reference path, only the signal taken at the timing offset  $\Delta\tilde{c}$  is used.

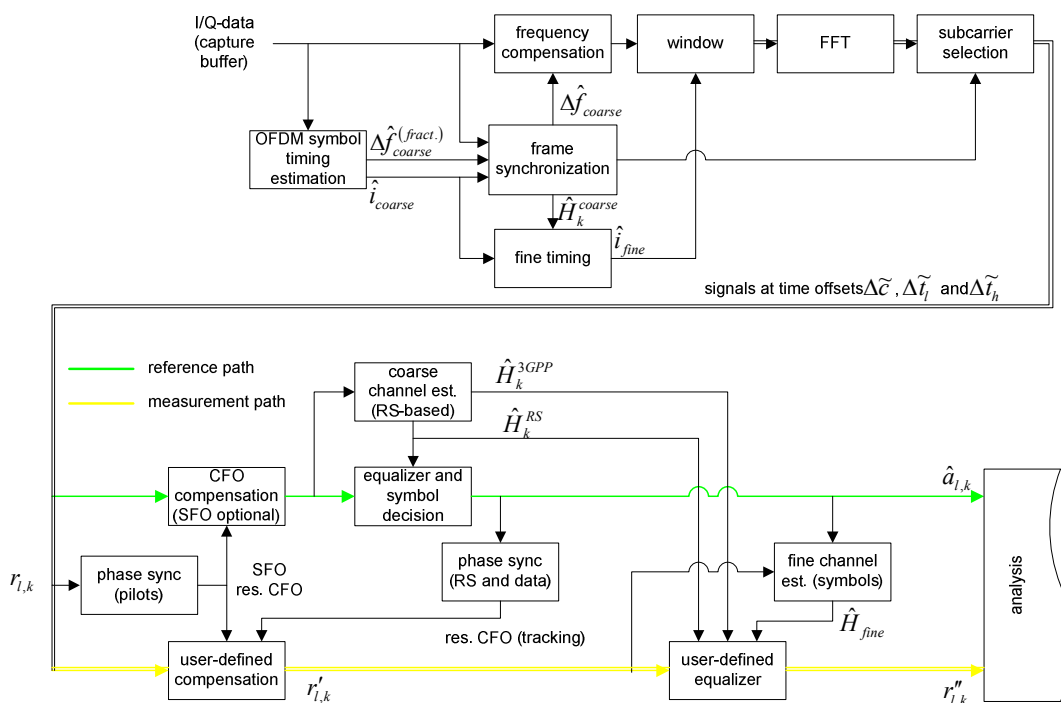


Figure 7-2: EUTRA/LTE Downlink Measurement Application

After the time to frequency transformation by an FFT of length  $N_{\text{FFT}}$ , the phase synchronization block is used to estimate the following:

- the relative sampling frequency offset  $\zeta$  (SFO)
- the residual carrier frequency offset  $\Delta f_{\text{res}}$  (CFO)
- the common phase error  $\Phi_l$  (CPE)

According to references [1] and [2], the uncompensated samples can be expressed as

$$r_{l,k} = a_{l,k} \cdot H_{l,k} \cdot \underbrace{e^{j\Phi_l}}_{\text{CPE}} \cdot \underbrace{e^{j2\pi \cdot N_s / N_{\text{FFT}} \cdot \zeta \cdot k \cdot l}}_{\text{SFO}} \cdot \underbrace{e^{j2\pi \cdot N_s / N_{\text{FFT}} \cdot \Delta f_{\text{res}} \cdot T \cdot l}}_{\text{res. CFO}} + n_{l,k} \quad (1)$$

where

- the data symbol is  $a_{l,k}$  on subcarrier  $k$  at OFDM symbol  $l$ ,
- the channel transfer function is  $H_{l,k}$ ,
- the number of Nyquist samples is  $N_s$  within the symbol time  $T_s$ ,
- the useful symbol time  $T = T_s - T_g$ ,
- the independent and Gaussian distributed noise sample is  $n_{l,k}$ .

Within one OFDM symbol, both the CPE and the residual CFO cause the same phase rotation for each subcarrier, while the rotation due to the SFO depends linearly on the subcarrier index. A linear phase increase in symbol direction can be observed for the residual CFO as well as for the SFO.

The results of the tracking estimation block are used to compensate the samples  $r_{l,k}$ .

Whereas a full compensation is performed in the reference path, the signal impairments that are of interest to the user are left uncompensated in the measurement path.

After having decided the data symbols in the reference path, an additional phase tracking can be utilized to refine the CPE estimation.

### Channel Estimation/Equalization

As shown in Figure 7-2, there is one coarse and one fine channel estimation block. The reference signal-based coarse estimation is tapped behind the CFO compensation block (SFO compensation can optionally be enabled) of the reference path. The coarse estimation block uses the reference signal symbols to determine estimates of the channel transfer function by interpolation in both time and frequency direction. A special channel estimation  $\hat{H}_k^{3GPP}$  as defined in [3] is additionally generated. The coarse estimation results are used to equalize the samples of the reference path prior to symbol decision. Based on the decided data symbols, a fine channel estimation is optimally performed and then used to equalize the partially compensated samples of the measurement path.

### Analysis

The analysis block of the EUTRA/LTE downlink measurement application allows to compute a variety of measurement variables.

- **EVM**

The error vector magnitude (EVM) measurement results “EVM PDSCH QPSK/16-QAM/64-QAM” are calculated according to the specification in [3].

All other EVM measurement results are calculated according to

$$EVM_{l,k} = \frac{|r_{l,k}'' - \hat{a}_{l,k}|}{b_{l,k} \sqrt{\mathbb{E} \left\{ \left| \frac{a_{l,k}}{b_{l,k}} \right|^2 \right\}}} \quad (2)$$

on subcarrier  $k$  at OFDM symbol  $l$ , where  $b_{l,k}$  is the boosting factor. Since the average power of all possible constellations is 1 when no boosting is applied, (2) can be rewritten as

$$EVM_{l,k} = \frac{|r_{l,k}'' - \hat{a}_{l,k}|}{b_{l,k}} \quad (3)$$

The average EVM of all data subcarriers is then

$$EVM_{\text{data}} = \sqrt{\frac{1}{N_{\text{RE data}}} \sum_l \sum_{k_{\text{data}}} EVM_{l,k_{\text{data}}}^2} \quad (4)$$

The number of subcarriers taken into account is denoted by  $N_{\text{sc}}$ .

- **I/Q Imbalance**

The I/Q imbalance can be written as

$$r(t) = I \Re\{s(t)\} + jQ \Im\{s(t)\} \quad (5)$$

where  $s(t)$  is the transmit signal,  $r(t)$  is the received signal, and  $I$  and  $Q$  are the weighting factors. We define that  $I := 1$  and  $Q := 1 + \Delta Q$ .

The I/Q imbalance estimation makes it possible to evaluate the

$$\text{modulator gain balance} = |1 + \Delta \hat{Q}| \quad (6)$$

and the

$$\text{quadrature mismatch} = \arg\{1 + \Delta \hat{Q}\} \quad (7)$$

based on the complex-valued estimate  $\Delta \hat{Q}$ .

- **Other measurement variables**

Without going into detail, the EUTRA/LTE downlink measurement application additionally provides the following results:

- Total power
- Constellation diagram
- Group delay
- I/Q offset
- Crest factor
- Spectral flatness

## B.4 References

[1] Speth, M., Fechtel, S., Fock, G., and Meyr, H.: Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM – Part I. IEEE Trans. on Commun. Vol. 47 (1999) No. 11, pp. 1668-1677.

[2] Speth, M., Fechtel, S., Fock, G., and Meyr, H.: Optimum Receiver Design for OFDM-Based Broadband Transmission – Part II: A Case Study. IEEE Trans. on Commun. Vol. 49 (2001) No. 4, pp. 571-578.

[3] 3GPP TS 36.104: Base Station (BS) radio transmission and reception (Release 8)

## C Common Errors and Remedies

This section shows the most common problems that occur when using the R&S FSQ / FSV-K100 / -K102 / -K104 EUTRA/LTE analysis software.

Error	Remedy
The software does not start up – only an error message occurs.	The graphical display component may not be installed correctly. Check if the file cwui.ocx is present in the System Root folder. If yes, re-register the component by opening a command prompt in the System Root folder and typing in "regsvr32 cwui.ocx".
The software shows the start-up screen but crashes during that state.	Delete the folder "EUTRA_mcr" from the Application Path and restart the software.
When trying to run a measurement with the R&S FSQ / FSV, the error message "Instrument not found @ ..." occurs.	The software cannot connect to the measurement instrument. Check the connection setup ("SETUP", then "Configure Analyzer Connection"). Make sure the instrument is connected to the specified bus and has the stated address assigned. If you are using a firewall, make sure that the firewall does not block the connection to the instrument.
When trying to run a measurement with the R&S FSQ / FSV, the warning message "Auto level FAILED: NO SIGNAL" occurs.	The measured signal level during the auto-level process is too low. Increase the signal level at the R&S FSQ / FSV input.

## D References

- [1] 3GPP TS 25.913: Requirements for E-UTRA and E-UTRAN (Release 7)
- [2] 3GPP TR 25.892: Feasibility Study for Orthogonal Frequency Division Multiplexing (OFDM) for UTRAN enhancement (Release 6)
- [3] 3GPP TS 36.211 v8.9.0: Physical Channels and Modulation (Release 8)
- [4] 3GPP TS 36.300: E-UTRA and E-UTRAN; Overall Description; Stage 2 (Release 8)
- [5] 3GPP TS 22.978: All-IP Network (AIPN) feasibility study (Release 7)
- [6] 3GPP TS 25.213: Spreading and modulation (FDD)
- [7] 3GPP TS 36.104: Base Station (BS) radio transmission and reception

## Glossary

3GPP	3rd Generation Partnership Project
Application path	The path where the setup software installed the R&S FSQ/FSV-K100/-K102/-K104 EUTRA/LTE analysis software ("Program folder\Rohde-Schwarz\EUTRA LTE" by default)
ARQ	Automatic Repeat Request
BB	Baseband
BW	Bandwidth
CAPEX	Capital Expenditure
CCDF	Complementary Cumulative Distribution Function
CCPCH	Common Control Physical Channel
CFO	Carrier Frequency Offset
CIR	Channel Impulse Response
CP	Cyclic Prefix (Guard Interval)
CPE	Common Phase Error
CQI	Channel Quality Indicator
CTF	Channel Transfer Function
DL	Downlink
DUT	Device under Test
DVB	Digital Video Broadcast
EUTRA	Evolved Universal Terrestrial Radio Access
EUTRAN	Evolved Universal Terrestrial Radio Access Network
EVM	Error Vector Magnitude
FDD	Frequency Division Duplex
FFT	Fast Fourier Transform
GERAN	GSM EDGE Radio Access Network
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
IF	Intermediate Frequency
IFFT	Inverse Fast Fourier Transformation
LAN	Local Area Network
LTE	Long Term Evolution
MBMS	Multimedia Broadcast Multicast Services

MIMO	Multiple Input Multiple Output
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
OPEX	Operational Expenditures
PBCH	Physical Broadcast Channel
PCFICH	Physical Control Format Indicator
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PHICH	Physical Hybrid-ARQ Indicator Channel
PRB	Physical Resource Block
Program folder	The path where programs are installed; by default, this is C:\Program Files
PS	Packet switched
PSCH	Primary Synchronization Channel (no longer used, now replaced by P-SYNC)
P-SYNC	Primary Synchronization Signal
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
QPSK	Quadrature Phase Shift Keying
RAT	Radio Access Technology
RB	Resource Block
RF	Radio Frequency
R&S FSQ/FSV	Rohde & Schwarz Signal Analyzer
SAE	System Architecture Evolution
SC-FDMA	Single Carrier Frequency Division Multiple Access
SFO	Sampling Frequency Offset
SSCH	Secondary Synchronization Channel (no longer used, now replaced by S-SYNC)
S-SYNC	Secondary Synchronization Signal
System root	The path where Microsoft Windows is installed; by default, this is C:\WINNT
TDD	Time Division Duplex
UE	User Equipment
UL	Uplink



UMTS	Universal Mobile Telecommunications System
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network
WCDMA	Wideband Code Division Multiple Access
WLAN	Wireless Local Area Network
WiMAX	Worldwide Interoperability for Microwave Access

# Index

ACLR Settings		
ACLR Noise Correction.....	68, 72	
Assumed Adj. Channel .....	67	
Allocation Settings Table		
Code Word .....	82	
Enhanced Settings.....	82	
Baseband Settings		
Input Balance.....	71	
Input Dithering .....	71	
Input High Impedance.....	71	
Input Lowpass .....	71	
Conventions.....	7	
Data Analysis Settings		
Auto Demodulation .....	74, 75, 76	
Channel Estimation.....	74	
EVM Calculation Method .....	74	
PDSCH Subframe Configuration Detection.....	75	
Scrambling of Coded Bits .....	74	
Data Capture		
Auto Acc to Standard.....	65	
Capture Time.....	64	
No of Frames to Analyze .....	65	
Overall Frame Count .....	65	
Digital IQ Settings		
Full Scale Level .....	72	
Source Sampling Rate .....	72	
GPIO (R&S FSQ).....	18	
GPIO (R&S FSV) .....	21	
Hardkey		
DISP.....	88	
FILE.....	89	
MARKER.....	93	
OPEN IN SEPARATE WINDOW.....	93	
SETUP .....	90	
Input		
Source.....	62	
Input Settings		
Auto Level Track Time .....	72	
Installation .....	18	
Interface.....	33	
IQ Settings		
Swap IQ.....	70	
LAN Address (R&S FSQ).....	18	
LAN Address (R&S FSV) .....	21	
Level		
Attenuation (RF) .....	63	
Auto Level .....	62	
Reference Level (BB).....	63	
Reference Level (RF).....	63	
Measurements		
Allocation ID vs Symbol X Carrier .....	55	
Allocation Summary.....	54	
Bit Stream.....	55	
Capture Buffer .....	44	
CCDF .....	53	
Channel Flatness.....	50	
Channel Flatness Difference.....	51	
Channel Group Delay .....	51	
Constellation Diagram .....	52	
Constellation Selection .....	52	
EVM vs Carrier .....	46	
EVM vs Subframe.....	48	
EVM vs Symbol .....	47	
EVM vs Symbol X Carrier .....	47	
Frequency Error vs Symbol .....	48	
Frequency Sweep.....	56	
ON/OFF Power.....	45	
Overview .....	39	
Power Spectrum .....	49	
Power vs RB PDSCH .....	49	
Power vs RB RS.....	50	
Power vs Symbol X Carrier.....	46	
Result Summary .....	59	
Signal Flow.....	54	
Spectrum ACLR.....	58	
Spectrum Emission Mask .....	57	
MIMO Analyzer Configuration .....	68	
MIMO Configuration		
Antenna Selection.....	80	
Configuration .....	79	
MIMO Settings		
Compensate Crosstalk.....	77	
Misc Settings		
Number Of PDCCHs.....	87	
PBCH Present .....	85	
PBCH Relative Power.....	85	
PCFICH Present .....	85	
PCFICH Relative Power .....	85	
PDCCH Format .....	87	
PDCCH Relative Power.....	87	
PHICH Duration.....	86	
PHICH Number Of Groups .....	86	
PHICH Relative Power.....	86	
PHICH TDD m <sub>i</sub> =1 (E-TM) .....	86	
PRB Symbol Offset.....	85	
Operating the Software .....	33	
Physical Layer Cell Identity		
Cell Identity Group.....	79	
Identity.....	79	
Physical Settings		
Channel Bandwidth.....	78	
Conf. of Special Subframe .....	79	
Cyclic Prefix.....	78	
TDD UL/DL Allocations .....	78	
Reference Signal Structure		
Pseudo Random Sequence R <sub>pr</sub> s.....	84	
Relative Power .....	84	
Result Display		
Allocation ID vs Symbol X Carrier .....	55	
Allocation Summary.....	54	
Bit Stream.....	55	
Capture Buffer .....	44	

CCDF .....	53	Downlink Demodulation Settings .....	73
Channel Flatness .....	50	Downlink Signal Characteristics .....	77
Channel Flatness Difference .....	51	Duplexing .....	61
Channel Group Delay .....	51	EVM Calculation Method .....	74
Constellation Diagram .....	52	EVM Unit .....	65
Constellation Selection .....	52	Frequency .....	61
EVM vs Carrier .....	46	Full Scale Level .....	72
EVM vs Subframe .....	48	General Settings .....	60
EVM vs Symbol .....	47	Header Table .....	35
EVM vs Symbol X Carrier .....	47	Identity .....	79
Frequency Error vs Symbol .....	48	Input Balance .....	71
ON/OFF Power .....	45	Input Dithering .....	71
Power Spectrum .....	49	Input High Impedance .....	71
Power vs RB PDSCH .....	49	Input Lowpass .....	71
Power vs RB RS .....	50	Input Settings .....	62
Power vs Symbol X Carrier .....	46	Input Settings Advanced .....	72
Result Summary .....	59	IQ Settings .....	70
Signal Flow .....	54	Level Settings .....	62
Spectrum ACLR .....	58	Link Direction .....	61
Spectrum Emission Mask .....	57	MIMO Analyzer Configuration .....	68
Result Settings		MIMO Configuration .....	79
Antenna Selection .....	67	MIMO Settings .....	77
Bitstream Format .....	66	Misc Settings .....	84
EVM Unit .....	65	Number Of PDCCHs .....	87
Subframe Selection .....	66	ON/OFF Power Measurement Settings .....	68
Screen		Overall Frame Count .....	65
full .....	88	P-/S-SYNC Tx Antenna .....	83
split .....	88	PBCH Present .....	85
Screen Layout .....	33	PBCH Relative Power .....	85
SEM Settings		PCFICH Present .....	85
Category .....	67	PCFICH Relative Power .....	85
Settings		PDCCH Format .....	87
ACLR Noise Correction .....	68, 72	PDCCH Relative Power .....	87
Advanced Settings .....	70	PDSCH Subframe Configuration Detection .....	75
Allocation Settings Table .....	81	Phase Tracking .....	76
Antenna Selection .....	67, 80	PHICH Duration .....	86
Assumed Adj. Channel .....	67	PHICH Number Of Groups .....	86
Attenuation (RF) .....	63	PHICH Relative Power .....	86
Auto Acc to Standard .....	65	PHICH TDD m <sub>i</sub> =1 (E-TM) .....	86
Auto Demodulation .....	74, 75, 76	Physical Layer Cell Identity .....	79
Auto Level .....	62	Physical Settings .....	78
Auto Level Track Time .....	72	PRB Symbol Offset .....	85
Baseband Settings .....	71	Pseudo Random Sequence R <sub>prs</sub> .....	84
Bitstream Format .....	66	P-SYNC Relative Power .....	84
Capture Time .....	64	Reference Level (BB) .....	63
Category .....	67	reference Level (RF) .....	63
Cell Identity Group .....	79	Reference Signal Structure .....	84
Channel Bandwidth .....	78	Relative Power .....	84
Channel Estimation .....	74	Result Settings .....	65
Compensate Crosstalk .....	77	Scrambling of Coded Bits .....	74
Conf. of Special Subframe .....	79	Selected Subframe .....	80
Configurable Subframes .....	80	SEM and ACLR Settings .....	67
Configuration .....	79	Signal Characteristics .....	61
Cyclic Prefix .....	78	Source .....	62
Data Analysis .....	74	Source Sampling Rate .....	72
Data Capture Settings .....	64	S-SYNC Relative Power .....	84
Demodulation Settings .....	73	Standard .....	61
Digital IQ Settings .....	72	Subframe Configuration .....	80
Display Settings .....	88	Subframe Selection .....	66
Downlink Advanced Signal Characteristics .....	83	Swap IQ .....	70

Synchronization Signal Settings.....	83	EVM vs Subframe.....	48
TDD UL/DL Allocations.....	78	EVM vs Symbol.....	47
Timing Tracking.....	76	EVM vs Symbol X Carrier.....	47
Tracking Settings.....	76	Frequency Error vs Symbol.....	48
Trigger Mode.....	64	General Settings.....	31, 60
Trigger Offset.....	64	Hardcopy.....	88
Trigger Settings.....	64	Hardcopy To Clipboard.....	89
Used Allocations.....	80	Load Demod Settings.....	89
SettingsNo of Frames to Analyze.....	65	Power Spectrum.....	49
Signal Characteristics		Power vs RB PDSCH.....	49
duplexing.....	61	Power vs RB RS.....	50
frequency.....	61	Power vs Symbol X Carrier.....	46
link direction.....	61	Save Demod Settings.....	89
standard.....	61	Save IQ Data.....	90
Softkey		Show Logging.....	91
ACLR.....	58	Signal Flow.....	54
Allocation ID vs Symbol X Carrier.....	55	Spectrum Mask.....	57
Allocation Summary.....	54	System Info.....	92
Background Color.....	88	Subframe Configuration	
Bit Stream.....	55	Configurable Subframes.....	80
Capture Buffer.....	44, 45	Selected Subframe.....	80
CCDF.....	53	Used Allocations.....	80
Channel Flatness.....	50	Synchronization Signal Settings	
Channel Flatness Difference.....	51	P-/S-SYNC Tx Antenna.....	83
Channel Group Delay.....	51	P-SYNC Relative Power.....	84
Configure Analyzer Connection.....	90	S-SYNC Relative Power.....	84
Configure Network.....	19	Tracking Settings	
Constellation Diagram.....	52	Phase Tracking.....	76
Constellation Selection.....	52	Timing Tracking.....	76
Data Source.....	91	Trigger	
Demod Settings.....	32	Trigger Mode.....	64
Display.....	59	Trigger Offset.....	64
EVM vs Carrier.....	46		