

# R&S® FSV-K93

## Firmware Option WiMAX, WiBro

### Measurements

# Operating Manual



1173.0789.02 – 06

This manual describes the following R&S®FSV options:

R&S FSV-K93 (1310.8955.02)

This manual is applicable for the following analyzer models with firmware version 1.61 and higher:

- R&S®FSV 3 (1307.9002K03)
- R&S®FSV 7 (1307.9002K07)
- R&S®FSV 13 (1307.9002K13)
- R&S®FSV 30 (1307.9002K30)
- R&S®FSV 40 (1307.9002K40)

The firmware of the instrument makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgement" on the user documentation CD-ROM (included in delivery).

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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The following abbreviations are used throughout this manual: R&S®FSV is abbreviated as R&S FSV.

# 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.

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 (polveros 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.

### Europe, Africa, Middle East

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

### North America

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

### Latin America

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

### Asia/Pacific

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





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

**75** Years of  
Driving  
Innovation



**ROHDE & SCHWARZ**





# Contents

<b>1</b>	<b>Preface</b> .....	<b>5</b>
1.1	Documentation Overview.....	5
1.2	Conventions Used in the Documentation.....	7
1.3	How to Use the Help System.....	8
<b>2</b>	<b>Introduction</b> .....	<b>11</b>
<b>3</b>	<b>WiMAX, WiBro Measurements (R&amp;S FSV-K93)</b> .....	<b>13</b>
3.1	Basic Measurement Examples.....	14
3.2	Signal Processing of the IEEE 802.16-2004 OFDM measurement application .....	17
3.3	Signal Processing of the IEEE802.16-2005 OFDMA/WiBro Measurement Applica- tion.....	29
<b>4</b>	<b>Instrument Functions WiMAX, WiBro Measurements (R&amp;S FSV- K93)</b> .....	<b>37</b>
4.1	Menu and Softkey Description.....	38
4.2	Further Information.....	38
4.3	Softkeys of the WiMAX, WiBro Menu (R&S FSV-K93).....	47
4.4	Softkeys of the Sweep Menu – SWEEP Key (R&S FSV-K93).....	107
4.5	Softkeys of the Marker Menu – MKR Key (R&S FSV-K93).....	108
4.6	Softkeys of the Marker to Menu – MKR-> Key (R&S FSV-K93).....	109
4.7	Softkeys of the Lines Menu – LINES Key (R&S FSV-K93).....	110
4.8	Softkeys of the Trace Menu – TRAC Key (R&S FSV-K93).....	110
4.9	Softkeys of the Input/Output Menu for WiMAX Measurements.....	111
<b>5</b>	<b>Remote Commands of the WiMAX/WiBro Measurements (R&amp;S FSV- K93)</b> .....	<b>115</b>
5.1	Notation.....	117
5.2	ASCII Formats for Returned Values.....	119
5.3	ABORt subsystem.....	121
5.4	CALCulate:BURSt Subsystem (WiMAX/WiBro, K93).....	121
5.5	CALCulate:LIMit Subsystem (WiMAX/WiBro, K93).....	121
5.6	CALCulate:MARKer Subsystem (WiMAX / WiBro, K93).....	139
5.7	CONFigure Subsystem (WiMAX / WiBro, K93).....	150

5.8	DISPlay Subsystem (WiMAX / WiBro, K93).....	180
5.9	FETCh Subsystem (WiMAX / WiBro, K93).....	185
5.10	FORMat Subsystem (WiMAX / WiBro, K93).....	195
5.11	INITiate Subsystem (WiMAX / WiBro, K93).....	195
5.12	INPUt subsystem.....	197
5.13	INSTrument Subsystem (WiMAX / WiBro, K93).....	200
5.14	MMEMory Subsystem (WiMAX / WiBro, K93).....	200
5.15	SENSE Subsystem (WiMAX / WiBro, K93).....	202
5.16	STATus Subsystem (OFDMA/WiBro, K93).....	220
5.17	SYSTEM Subsystem (WiMAX, K93).....	224
5.18	TRACe Subsystem (WiMAX, K93).....	224
5.19	TRIGger Subsystem (WiMAX, K93).....	233
5.20	UNIT Subsystem (WiMAX, K93).....	237
5.21	Status Reporting System (Option R&S FSV-K93).....	238
	List of Commands.....	245
	Index.....	252

# 1 Preface

## 1.1 Documentation Overview

The user documentation for the R&S FSV is divided as follows:

- Quick Start Guide
- Operating Manuals for base unit and options
- Service Manual
- Online Help
- Release Notes

### Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the CD. It provides the information needed to set up and start working with the instrument. Basic operations and basic measurements are described. Also a brief introduction to remote control is given. The manual includes general information (e.g. Safety Instructions) and the following chapters:

Chapter 1	Introduction, General information
Chapter 2	Front and Rear Panel
Chapter 3	Preparing for Use
Chapter 4	Firmware Update and Installation of Firmware Options
Chapter 5	Basic Operations
Chapter 6	Basic Measurement Examples
Chapter 7	Brief Introduction to Remote Control
Appendix 1	Printer Interface
Appendix 2	LAN Interface

### Operating Manuals

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

The Operating Manual for the base unit provides basic information on operating the R&S FSV in general, and the "Spectrum" mode in particular. Furthermore, the software options that enhance the basic functionality for various measurement modes are described here. The set of measurement examples in the Quick Start Guide is expanded by more advanced measurement examples. In addition to the brief introduction to remote control in the Quick Start Guide, a description of the basic analyzer commands and programming examples is given. Information on maintenance, instrument interfaces and error messages is also provided.

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

The following Operating Manuals are available for the R&S FSV:

- R&S FSV base unit; in addition:
  - R&S FSV-K9 Power Sensor Support
  - R&S FSV-K14 Spectrogram Measurement
- R&S FSV-K7 Analog Demodulation and R&S FSV-K7S FM Stereo Measurements
- R&S FSV-K10 GSM/EDGE Measurement
- R&S FSV-K30 Noise Figure Measurement
- R&S FSV-K40 Phase Noise Measurement
- R&S FSV-K70 Vector Signal Analysis Operating Manual  
R&S FSV-K70 Vector Signal Analysis Getting Started (First measurements)
- R&S FSV-K72 3GPP FDD BTS Analysis
- R&S FSV-K73 3GPP FDD UE Analysis
- R&S FSV-K76/77 3GPP TD-SCDMA BTS/UE Measurement
- R&S FSV-K82/83 CDMA2000 BTS/MS Analysis
- R&S FSV-K84/85 1xEV-DO BTS/MS Analysis
- R&S FSV-K91 WLAN IEEE 802.11a/b/g/j/n
- R&S FSV-K93 WiMAX IEEE 802.16 OFDM/OFDMA Analysis
- R&S FSV-K100/K104 EUTRA / LTE Downlink Measurement Application
- R&S FSV-K101/K105 EUTRA / LTE Uplink Measurement Application

These manuals are available in PDF format on the CD delivered with the instrument. The printed manual can be ordered from Rohde & Schwarz GmbH & Co. KG.

### Service Manual

This manual is available in PDF format on the CD delivered with the instrument. It describes how to check compliance with rated specifications, instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S FSV by replacing modules. The manual includes the following chapters:

Chapter 1	Performance Test
Chapter 2	Adjustment
Chapter 3	Repair
Chapter 4	Software Update / Installing Options
Chapter 5	Documents

### Online Help

The online help contains context-specific help on operating the R&S FSV and all available options. It describes both manual and remote operation. The online help is installed on

the R&S FSV by default, and is also available as an executable .chm file on the CD delivered with the instrument.

### Release Notes

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

## 1.2 Conventions Used in the Documentation

### 1.2.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

### 1.2.2 Conventions for Procedure Descriptions

When describing how to operate the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touch screen is described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the instrument or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" 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 instrument or on a keyboard.

## 1.3 How to Use the Help System

### Calling context-sensitive and general help

- ▶ To display the general help dialog box, press the HELP key on the front panel.  
The help dialog box "View" tab is displayed. A topic containing information about the current menu or the currently opened dialog box and its function is displayed.



For standard Windows dialog boxes (e.g. File Properties, Print dialog etc.), no context-sensitive help is available.

---

- ▶ If the help is already displayed, press the softkey for which you want to display help.  
A topic containing information about the softkey and its function is displayed.



If a softkey opens a submenu and you press the softkey a second time, the submenu of the softkey is displayed.

---

### Contents of the help dialog box

The help dialog box contains four tabs:

- "Contents" - contains a table of help contents
- "View" - contains a specific help topic
- "Index" - contains index entries to search for help topics
- "Zoom" - contains zoom functions for the help display

To change between these tabs, press the tab on the touchscreen.

### Navigating in the table of contents

- To move through the displayed contents entries, use the UP ARROW and DOWN ARROW keys. Entries that contain further entries are marked with a plus sign.
- To display a help topic, press the ENTER key. The "View" tab with the corresponding help topic is displayed.
- To change to the next tab, press the tab on the touchscreen.

### Navigating in the help topics

- To scroll through a page, use the rotary knob or the UP ARROW and DOWN ARROW keys.
- To jump to the linked topic, press the link text on the touchscreen.

### Searching for a topic

1. Change to the "Index" tab.

2. Enter the first characters of the topic you are interested in. The entries starting with these characters are displayed.
3. Change the focus by pressing the ENTER key.
4. Select the suitable keyword by using the UP ARROW or DOWN ARROW keys or the rotary knob.
5. Press the ENTER key to display the help topic.  
The "View" tab with the corresponding help topic is displayed.

### **Changing the zoom**

1. Change to the "Zoom" tab.
2. Set the zoom using the rotary knob. Four settings are available: 1-4. The smallest size is selected by number 1, the largest size is selected by number 4.

### **Closing the help window**

- ▶ Press the ESC key or a function key on the front panel.





## 2 Introduction

This document contains all information required for operation of an R&S FSV equipped with Application Firmware R&S FSV-K93. It covers operation via menus and the remote control commands for WiMAX, WiBro measurements.



This option is not available for R&S FSV 40 model 1307.9002K39.

---

This document consists of the following chapters:

- [chapter 3.1, "Basic Measurement Examples"](#), on page 14  
Describes the measurement setup for WiMAX, WiBro measurements.
- [chapter 4, "Instrument Functions WiMAX, WiBro Measurements \(R&S FSV-K93\)"](#), on page 37  
Describes the overall instrument functions and provides further information.
- [chapter 4.3, "Softkeys of the WiMAX, WiBro Menu \(R&S FSV-K93\)"](#), on page 47  
Shows all softkeys available in the "WiMAX, WiBro" menu. This chapter also refers to the remote control commands associated with each softkey function.
- [chapter 5, "Remote Commands of the WiMAX/WiBro Measurements \(R&S FSV-K93\)"](#), on page 115  
Describes all remote control commands defined for the WiMAX, WiBro measurement.

This document includes only functions of the Application Firmware R&S FSV-K93. For all other descriptions, please refer to the description of the base unit.



## 3 WiMAX, WiBro Measurements (R&S FSV-K93)

The R&S FSV-K93 application extends the functionality of the R&S FSV Signal and Spectrum analyzer to enable WiMAX and WiBro TX-measurements according to the following standards:

- IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode.  
The short form 'IEEE 802.16-2004 OFDM' is used in this document, to reference this standard.
- IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode.  
The short form 'IEEE 802.16e-2005 OFDMA' is used in this document, to reference this standard.
- IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro.  
The short form 'WiBro' is used in this document, to reference this standard.

The following measurements are described in this section:

<b>3.1 Basic Measurement Examples</b> .....	<b>14</b>
3.1.1 Setting Up the Measurement.....	14
3.1.2 Performing the Level Detection.....	16
3.1.3 Performing the Main Measurement.....	17
<b>3.2 Signal Processing of the IEEE 802.16-2004 OFDM measurement application</b> .....	<b>17</b>
3.2.1 Understanding Signal Processing of the IEEE 802.16-2004 OFDM Measurement Application.....	18
3.2.2 Analysis Steps.....	23
3.2.3 Subchannelization.....	24
3.2.4 Synchronization.....	24
3.2.5 Channel Results.....	24
3.2.6 Frequency and Clock Offset.....	25
3.2.7 EVM.....	26
3.2.8 IQ Impairments.....	26
3.2.9 RSSI.....	27
3.2.10 CINR.....	28
3.2.11 OFDM Literature.....	28
<b>3.3 Signal Processing of the IEEE802.16-2005 OFDMA/WiBro Measurement Application</b> .....	<b>29</b>
3.3.1 Signal Processing Block Diagram.....	31
3.3.2 Synchronisation.....	32

3.3.3	Channel Estimation/Equalization.....	33
3.3.4	Analysis.....	33
3.3.5	OFDMA/WiBro Literature.....	36

## 3.1 Basic Measurement Examples

This section provides step-by-step instruction for working through an ordinary measurement. The following steps are described:

1. [chapter 3.1.1, "Setting Up the Measurement"](#), on page 14
2. [chapter 3.1.2, "Performing the Level Detection"](#), on page 16
3. [chapter 3.1.3, "Performing the Main Measurement"](#), on page 17

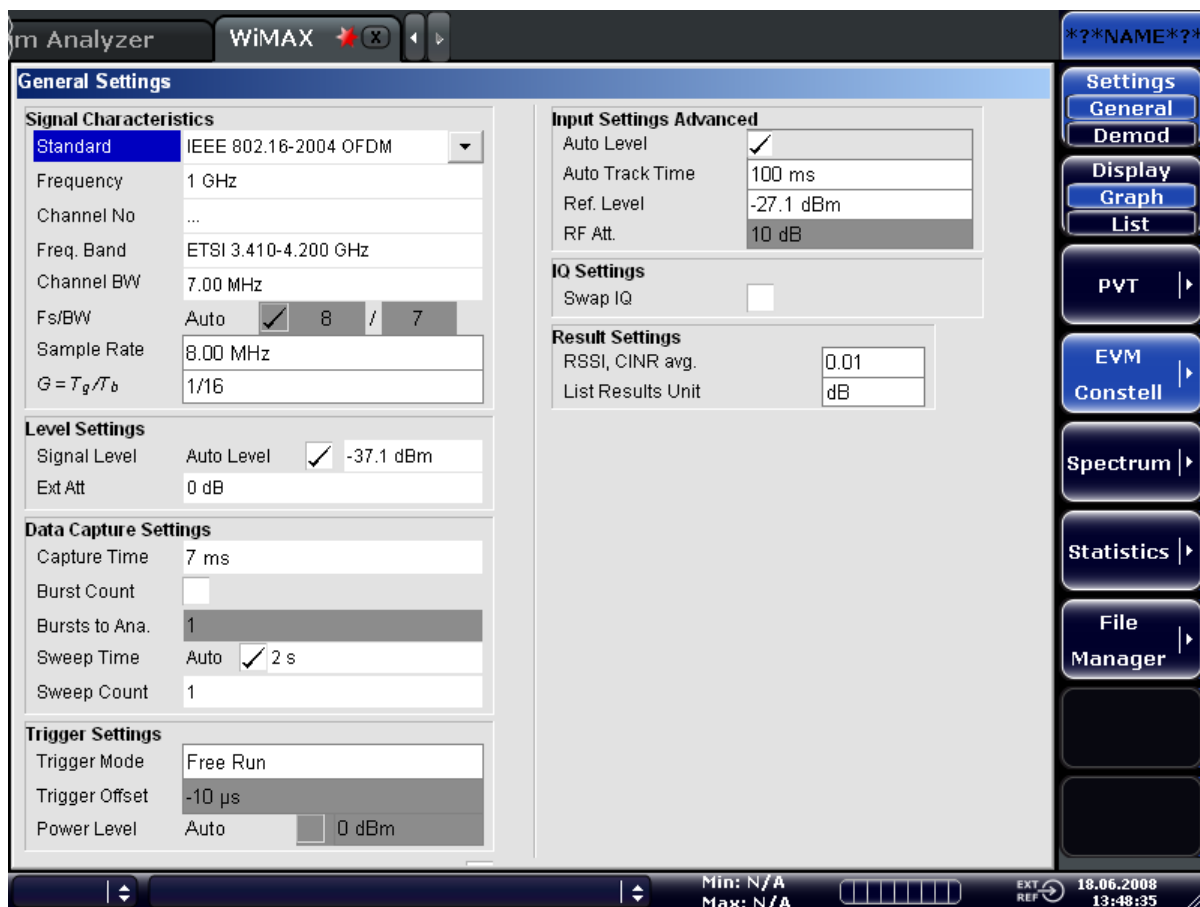
### Test setup

In this example, a DUT using IEEE 802.16-2004 is be used.

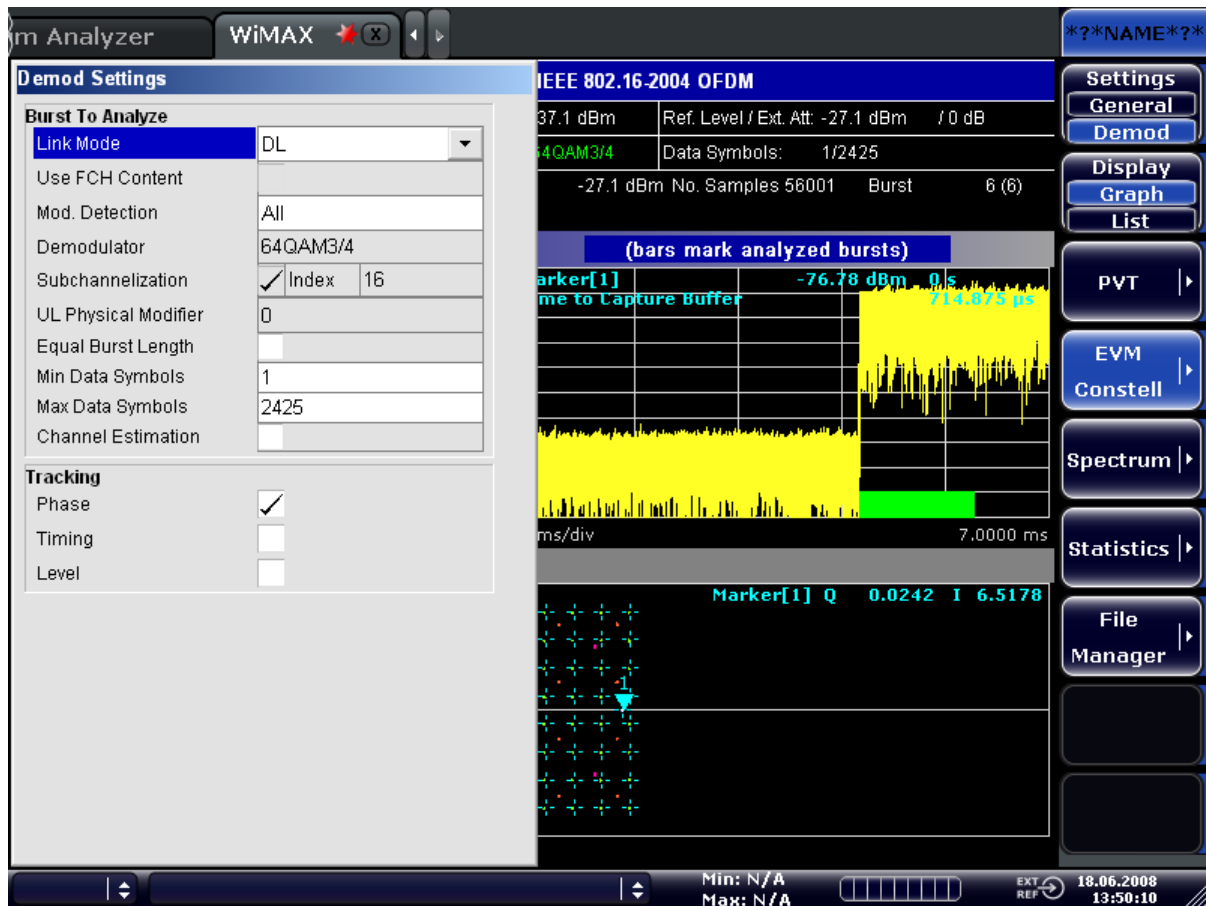
Connect the DUT to the R&S FSV using the RF input of the R&S FSV. The DUT generates a signal modulated using 16QAM 2/3.

### 3.1.1 Setting Up the Measurement

1. Activate the "WiMAX" mode.
2. Press the [Settings General/Demod](#) softkey once to select and open the [chapter 4.3.2, "General Settings Dialog Box"](#), on page 86 dialog box.



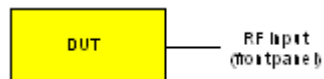
- a) In the "Frequency" on page 87 field, enter the desired frequency to measure. If a frequency is entered, which maps to a specific channel, the "Channel No" field updates.
  - b) In the "Frequency Band" on page 88 field, select the signal to be analyzed. The target band is either one of the bands given as example in the IEEE 802.16-2004 standard or an unspecified band.
  - c) In the "Channel BW" on page 88 or "Sample Rate" on page 88 field depending on the characteristics of the signal to be analyzed, select a value. The second parameter is derived from the first according to the standard.
  - d) In the " $G = T_g/T_b$ " on page 88 field, select a useful time ratio according to the characteristics of the signal to be analyzed.
  - e) Under "Level Settings", deactivate the "Auto Level" on page 88 option. In this example, the level detection measurement is executed manually (for details see Performing the level detection).
3. Press the "Settings General"/"Demod" softkey twice to select and open the [chapter 4.3.3, "Demod Settings Dialog Box"](#), on page 94 dialog box.



- In the "Link Mode (IEEE 802.16-2004 OFDM)" on page 96 field, select the link mode of the bursts to be analyzed.
- In the "Demodulator" field, select the used modulation scheme.

### 3.1.2 Performing the Level Detection

1. Connect the DUT to the RF input of the R&S FSV.



2. Start the level detection measurement by pressing the [chapter 4.4, "Softkeys of the Sweep Menu – SWEEP Key \(R&S FSV-K93\)"](#), on page 107 and then the "Auto Level" on page 107 softkey.

During the level detection measurement the text "Running" is displayed in the status bar at the bottom of the screen.

After successful level detection, the status message "Measurement Complete" is displayed, the signal level field for the selected input displays the detected signal level and the Magnitude Capture Buffer (screen A) displays the zero span trace obtained during the measurement sequence.

An automatic level detection can be performed in two ways:

- Once by pressing the "Auto Level" on page 107 softkey in the "Sweep" menu.
- At the start of each measurement sweep by activating the "Auto Level" on page 88 option in the [chapter 4.3.2, "General Settings Dialog Box"](#), on page 86 dialog box under "Level Settings".

### 3.1.3 Performing the Main Measurement

1. Select single sweep measurements by pressing the SWEEP key and then the [Run Single/Cont](#) softkey to select "Single".
2. Start the measurement by pressing the RUN key.

During the measurement, the status message "Running" is displayed.

Measurement results are updated once the measurement has completed. The results are displayed in graphical form. The display can be toggled to a tabular list of measurement points by pressing the [Display Graph/List](#) softkey (in the "WiMAX/WiBro" menu or "Trace" menu).

## 3.2 Signal Processing of the IEEE 802.16-2004 OFDM measurement application

This description gives a rough view of the IEEE 802.16-2004 OFDM measurement application signal processing. Details are disregarded in order to get a concept overview.

### Abbreviations:

Abbreviation	Description
$N_{\text{FFT}} = 256$	FFT length
$a_{lk}$	symbol from the alphabet at symbol-index $l$ of sub carrier $k$
$\text{EVM}_k$	error vector magnitude of sub carrier $k$
$\text{EVM}$	error vector magnitude of current packet
$g$	signal gain
$\Delta f$	frequency deviation between Tx and Rx
$l$	symbol index $l = [1, \text{nof\_Symbols}]$
$\text{nof\_symbols}$	number of symbols of payload



Abbreviation	Description
$H_k$	channel transfer function of sub carrier $k$
$k$	channel index $k = [-128, 127]$
$K_{\text{mod}}$	modulation dependent normalization factor
$\xi$	relative clock error of reference oscillator
$r_{lk}$	received symbol at symbol-index $l$ of sub carrier $k$
	<b>Pilots = {-88, -63, -38, -13, 13, 38, 63, 88}</b>

3.2.1	Understanding Signal Processing of the IEEE 802.16-2004 OFDM Measurement Application.....	18
3.2.2	Analysis Steps.....	23
3.2.3	Subchannelization.....	24
3.2.4	Synchronization.....	24
3.2.5	Channel Results.....	24
3.2.6	Frequency and Clock Offset.....	25
3.2.7	EVM.....	26
3.2.8	IQ Impairments.....	26
3.2.9	RSSI.....	27
3.2.10	CINR.....	28
3.2.11	OFDM Literature.....	28

### 3.2.1 Understanding Signal Processing of the IEEE 802.16-2004 OFDM Measurement Application

A diagram of the relevant blocks is shown in [figure 3-1](#). First the RF signal is down-converted to the IF frequency  $f_{IF} = 20.4$  MHz. The resulting IF signal  $r_{IF}(t)$  is shown on the left-hand side of the figure. After bandpass filtering, the signal is sampled by an Analog to Digital Converter (ADC) at a sampling rate of  $f_{s1} = 81.6$  MHz. This digital sequence is resampled to the new sampling frequency of  $f_{s2} = 80$  MHz which is a multiple of the Nyquist rate (20 MHz).

The subsequent digital down-converter shifts the IF signal to the complex base band. In the next step the base band signal is filtered by an FIR filter. To get an idea, the rough transfer function is plotted in the figure. This filter fulfils two tasks: first it suppresses the IF image frequency, secondly it attenuates the aliasing frequency bands caused by the subsequent down-sampling. After filtering, the sequence is sampled down by the factor of 4. Thus the sampling rate of the down-sampled sequence  $r(i)$  is the Nyquist rate of  $f_{s3} = 20$  MHz. Up to this point the digital part is implemented in an ASIC.

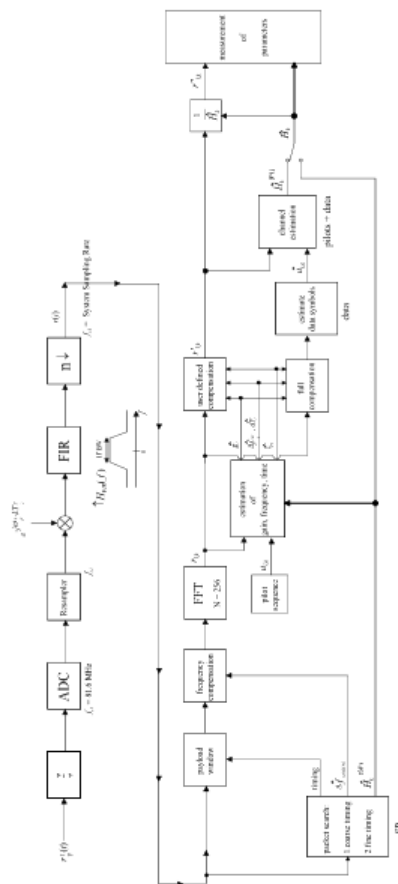


Fig. 3-1: Signal processing of the IEEE 802.16 OFDM measurement application

In the lower part of the figure the subsequent digital signal processing is shown. In the first block the packet search is performed. This block detects the Short Preamble (SP) and recovers the timing. The coarse timing is detected first. This search is implemented in the time domain. The algorithm is based on cyclic repetition within the SP after  $N = N_{FFT} / 2 = 128$  samples. Note this cyclic repetition occurs also in the Long Preamble (LP). Numerous treatises exist on this subject, e.g. [1] to [3].

Furthermore, a coarse estimate  $\Delta \hat{f}_{course}$  of the Rx-Tx frequency offset  $\Delta f$  is derived from the metric in [6].



In this documentation, the  $\hat{\phantom{x}}$  generally describes an estimate. Example:  $\hat{H}$  is the estimate of H.

This can easily be understood because the phase of  $\mathbf{r}(i) \mathbf{r}^*(i + N)$  is determined by the mod  $2\pi$  frequency offset. As the frequency deviation  $\Delta f$  can exceed several bins (distance between neighboring sub-carriers) the SP is further used to solve this  $n2\pi$  [offset over several bins] ambiguity.

After the coarse timing calculation the time estimate is improved by the fine timing calculation. This is achieved by first estimating the coarse frequency response  $\hat{H}^{(SP)}_k$ , with  $\mathbf{k} = [-100, 100]$  denoting the channel index of the occupied sub-carriers. First the FFT of the SP is calculated. After the FFT calculation the known symbol information of the SP

sub-carriers is removed by dividing by the symbols. The result is a coarse estimate  $\hat{H}_k$  of the channel transfer function.

In the next step the complex channel impulse response is computed by an IFFT. Next the energy of the windowed impulse response (the window size is equal to the guard period) is calculated for each trial time. Afterwards the trial time of the maximum energy is detected. This trial time is used to adjust the timing.

Now the position of the SP is known and the starting point of the useful part of the first payload symbol can be derived. In the next block this calculated time instant is used to position the payload window. Only the payload part is windowed. This is sufficient because the payload is the only subject of the subsequent measurements.

In the next block the windowed sequence is compensated by the coarse frequency estimate  $\Delta \hat{f}_{\text{course}}$ . This is necessary because otherwise inter channel interference (ICI) would occur in the frequency domain.

The transition to the frequency domain is achieved by an FFT of length 256. The FFT is performed symbol-wise for each of the **nof \_symbols** symbols of the payload. The calculated FFTs are described by  $r_{l,k}$  with

- $l = [ 1 , \text{nof\_symbols} ]$  as the symbol index
- $k = [ -128 , 127 ]$  as the channel index

In case of an additive white Gaussian noise (AWGN) channel the FFT is described by [4], [5]

$$r_{l,k} = K_{\text{mod}} \times a_{l,k} \times g_l \times H_k \times e^{j(\text{phase}_l^{(\text{common})} + \text{phase}_{l,k}^{(\text{timing})})} + n_{l,k}$$

Equation (3 - 1)

with

- $K_{\text{mod}}$ : the modulation-dependant normalization factor
- $a_{l,k}$ : the symbol of sub-carrier k at symbol l
- $g_l$ : the gain at the symbol l in relation to the reference gain  $g = 1$  at the Short Preamble (SP)
- $H_k$ : the channel frequency response at the Short Preamble (SP)
- $\text{phase}_l^{(\text{common})}$ : the common phase drift of all sub-carriers at symbol l (see [Equation](#))
- $\text{phase}_{l,k}^{(\text{timing})}$ : the phase of sub-carrier k at symbol l caused by the timing drift (see [Equation](#))
- $n_{l,k}$ : the independent Gaussian distributed noise samples

The common phase drift in [Equation](#) is given by:

$$\text{phase}_l^{(\text{common})} = 2\pi \times N_s / N \times \Delta f_{\text{rest}} T \times l + d\gamma_l$$

Equation (3 - 2)

with:

- $N_s = N_g + N_b$ : the number of Nyquist samples of the symbol period

- $\mathbf{N} = \mathbf{N}_b = 256$ : the number of Nyquist samples of the useful part of the symbol
- $\Delta f_{\text{rest}}$ : the (not yet compensated) frequency deviation
- $d\Upsilon_l$ : the phase jitter at the symbol  $l$

In general, the coarse frequency estimate  $\Delta \hat{f}_{\text{coarse}}$  (see [figure 3-1](#)) is not error-free. Therefore, the remaining frequency error  $\Delta f_{\text{rest}}$  represents the frequency deviation in  $r_{l,k}$  not yet compensated. Consequently, the overall frequency deviation of the device under test (DUT) is calculated by:

$$\Delta f = \Delta \hat{f}_{\text{coarse}} + \Delta f_{\text{rest}}$$



The only motivation for dividing the common phase drift in [Equation](#) into two parts is to be able to calculate the overall frequency deviation of the DUT.

The reason for the phase jitter  $d\Upsilon_l$  in [Equation](#) may be different. The nonlinear part of the phase jitter may be caused by the phase noise of the DUT oscillator. Another reason for nonlinear phase jitter may be the increase of the DUT amplifier temperature at the beginning of the burst. Note that besides the nonlinear part the phase jitter  $d\Upsilon_l$  also contains a constant part. This constant part is caused by the frequency deviation  $\Delta f_{\text{rest}}$  not yet compensated. To understand this, keep in mind that the measurement of the phase starts at the first symbol  $l = 1$  of the payload. In contrast, the channel frequency response  $\mathbf{H}_k$  in [Equation](#) represents the channel at the Short Preamble of the preamble.

Consequently, the frequency deviation  $\Delta f_{\text{rest}}$  not yet compensated produces a phase drift between the Short Preamble and the first symbol of the payload. Therefore, this phase drift appears as a constant value ("DC value") in  $d\Upsilon_l$ .

Referring to the IEEE 802.16-2004 measurement standard Chapter 8.3.10.1.2 "Transmitter constellation error and test method" [6], the common phase drift  $\text{phase}_l^{(\text{common})}$  must be estimated and compensated from the pilots. Therefore the "symbol-wise phase tracking" (Tracking Phase) is activated as the default setting of the R&S FSV-K93.

Furthermore, the timing drift in [Equation](#) is given by:

$$\text{phase}_{l,k}^{(\text{timing})} = 2\pi \times N_s / N \times \xi \times k \times l$$

Equation (3 - 3)

with  $\xi$ : the relative clock deviation of the reference oscillator.

Normally a symbol-wise timing jitter is negligible and thus not modeled in [Equation](#). There may be situations where the timing drift has to be taken into account. This is illustrated by an example: In accordance to [6], the allowed clock deviation of the DUT is up to  $\xi_{\text{max}} = \pm 8$  ppm. Furthermore, the maximal length of a frame **nof\_symbols** = 2420 symbols is assumed.



Assuming the maximum system sampling rate  $F_s = 32$  MHz.

From [equation 3-1](#) and [Equation](#), it results that the phase drift of the highest sub-carrier  $k = 100$  in the last symbol  $l = \text{nof\_symbols}$  is degrees. Even in the noise-free case, this would lead to symbol errors. The example shows that it is actually necessary to estimate and compensate the clock deviation, which is accomplished in the next block.

Referring to the IEEE 802.16-2004 measurement standard [6], the timing drift phase $_{l,k}^{(\text{timing})}$  is not part of the requirements. Therefore the "time tracking" (Tracking Time) is not activated as the default setting of the R&S FSV-K93. The time tracking option should rather be seen as a powerful analyzing option.

In addition the tracking of the gain  $g_l$  in [Equation](#) is supported for each symbol in relation to the reference gain  $g = 1$  at the time instant of the Short Preamble (SP). At this time the coarse channel transfer function  $\hat{H}^{(\text{SP})}_k$  is calculated.

This makes sense since the sequence  $r'_{l,k}$  is compensated by the coarse channel transfer function  $\hat{H}^{(\text{SP})}_k$  before estimating the symbols. Consequently, a potential change of the gain at the symbol  $l$  (caused, for example, by the increase of the DUT amplifier temperature) may lead to symbol errors especially for a large symbol alphabet  $M$  of the MQAM transmission. In this case the estimation and the subsequent compensation of the gain are useful.

Referring to the IEEE 802.16-2004 measurement standard [6], the compensation of the gain  $g_l$  is not part of the requirements. Therefore the "gain tracking" (Tracking Gain) is not activated as the default setting of the R&S FSV-K93.

The unknown deviations of gain, frequency and time are calculated by an optimal maximum likelihood procedure, which works well even at low signal to noise ratios with the Cramer Rao Bound being reached. After estimation of these parameters, the received signal is fully compensated to determine the ideal reference signal  $\hat{a}_{l,k}$  and compensated according to the user settings to get the measurement signal  $r''_{l,k}$ . Then the measurement signal is equalized by the inverse channel transfer function. According to the chosen setting, either the preamble estimation of the channel transfer function or a data aided estimation using the ideal reference signal is used. According to the IEEE 802.16-2004 measurement standard [6], the coarse channel estimation  $\hat{H}^{(\text{SP})}_k$  (from the short preamble) has to be used for equalization. Therefore the default setting of the R&S FSV-K93 is equalization from the coarse channel estimate derived from the short preamble.

In the last block the measurement variables are calculated. The most important variable is the error vector magnitude of the sub-carrier  $k$  of the current packet.

$$EVM_k = \sqrt{\frac{1}{\text{nof\_Symbols}} \cdot \sum_{l=1}^{\text{nof\_Symbols}} |r''_{l,k} - K_{\text{mod}} \cdot a_{l,k}|^2}$$

Equation (3 - 4)

Furthermore, the packet error vector magnitude is derived by averaging the squared  $EVM_k$  versus  $k$ .

$$EVM = \sqrt{\frac{1}{200} \cdot \sum_{\substack{k=-100 \\ (k \neq 0)}}^{100} EVM_k^2}$$

Equation (3 - 5)

Finally, the average error vector magnitude is calculated by averaging the packet EVM of all **nof\_packets** detected packets.

$$\overline{EVM} = \sqrt{\frac{1}{\text{nof\_packets}} \sum_{\text{counter}=1}^{\text{nof\_packets}} EVM^2(\text{counter})}$$

Equation (3 - 6)

This parameter is equivalent to the so-called "RMS average of all errors" ( $\text{Error}_{\text{RMS}}$ ) of the IEEE 802.16-2004 measurement commandment (see [6], Chapter 8.3.10.1.2).

### 3.2.2 Analysis Steps

Preamble related result	Remark
Rough frequency estimation	In case of subchannelization, a rough frequency estimation is obtained by exploiting the cyclic prefix of the OFDM symbols.
Preamble power	
Preamble EVM	Uses payload channel estimation for equalization.
Frequency error vs. preamble	
Phase error vs. preamble	
Channel estimation	Used for equalizing

Payload related result	Remark
Fine frequency estimation	Estimation on pilots used for phase correction if 'Phase Tracking' is selected. Phase tracking needs at least one pilot. In case of subchannelization, the value shown in the result summary table is estimated on pilots and data.
Clock offset estimation	Estimation on pilots used for timing correction if 'Timing Tracking' is selected. Timing tracking needs at least two pilots. In case of subchannelization, the value shown in the result summary table is estimated on pilots and data.
IQ Offset	Power at spectral line 0 normalized to the total transmitted power.
Gain Imbalance	Estimation not available in case of subchannelization.
Quadrature Error	Estimation not available in case of subchannelization.

Payload related result	Remark
Payload channel estimation	Combined with the preamble channel estimation.

Burst related result	Remark
EVM All carriers EVM Data carriers EVM Pilot carriers	According to standard normalized to the average power of all 200 used carriers.
Burst Power	
Crest Factor	

### 3.2.3 Subchannelization

Subchannelization can be used in uplink bursts to allocate only a subset of the available OFDM sub carriers. The measurement software can distinguish between downlink bursts, uplink bursts without subchannelization and uplink bursts with a selectable sub-channel index. Thus it is possible to analyze the complete WirelessMAN traffic with one capture buffer shot.

### 3.2.4 Synchronization

The synchronization of uplink bursts using subchannelization is performed after the synchronization on standard downlink and uplink preambles:

1. Synchronization of downlink and uplink bursts without subchannelization.
2. Pre-analysis of the bursts without subchannelization to determine their length.
3. Extraction of TX power areas without already detected bursts.
4. Synchronization of uplink bursts with the selected subchannel index.

In the following sections, the influence of subchannelization on results is discussed.

### 3.2.5 Channel Results

The standard requires an interpolation of order 0 for the channel estimation on unallocated sub carriers, i.e. the estimated channel coefficient of the nearest allocated sub carrier shall be used for those sub carriers not part of the allocated subchannels.

For the derived channel results like group delay or flatness difference, the unallocated carriers are not taken into account.

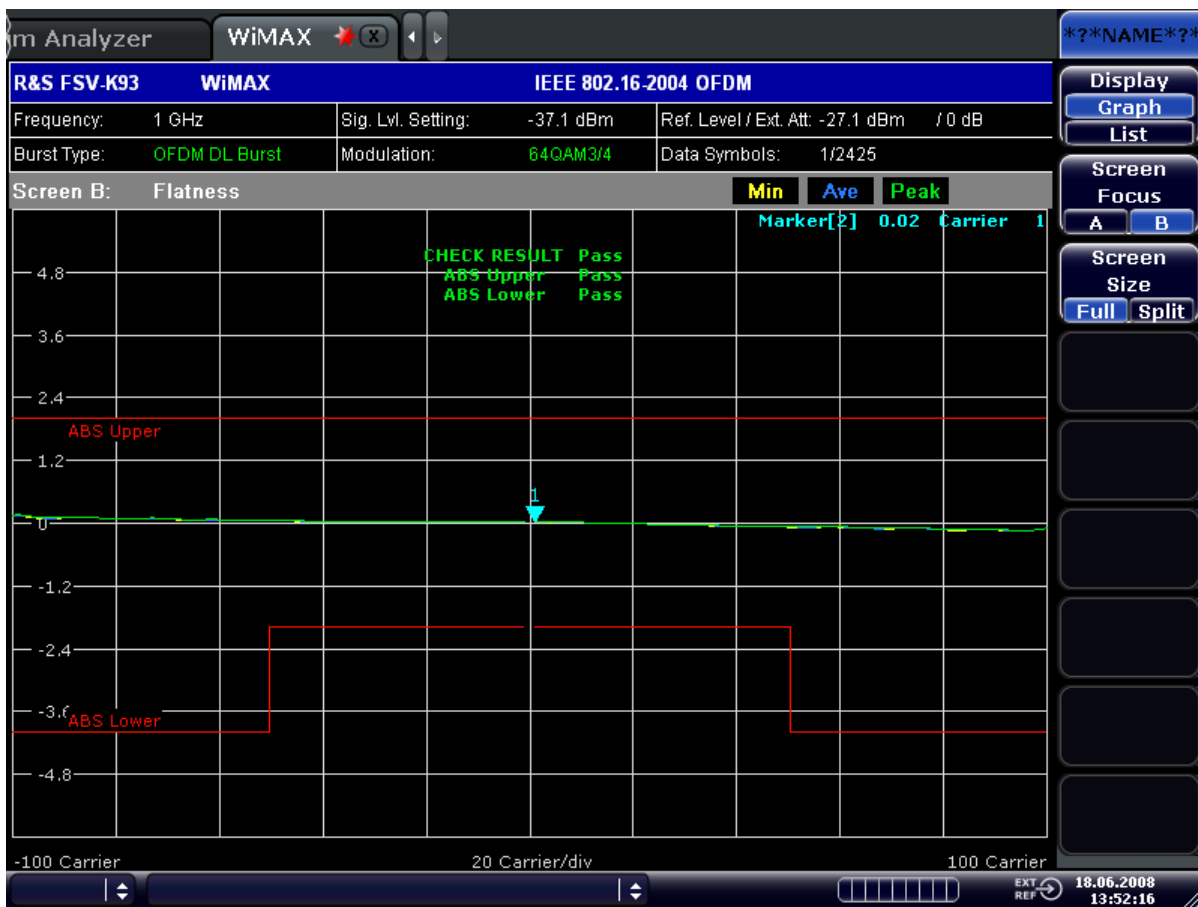


Fig. 3-2: Spectrum Flatness

### 3.2.6 Frequency and Clock Offset

The measurement software allows selectable compensation of phase, timing and gain errors based on pilot estimations. However, in case of subchannelization the number of pilots is decreased. Bursts with odd subchannel indices do not provide pilots at all.

The following table lists the restrictions on the tracking ability for subchannelization:

Tracking	Subchannel Index		
	16 (8 Pilots) 8, 24 (4 Pilots) 4, 12, 20, 28 (2 Pilots)	2, 6, 10, 14, 18, 22, 26, 30 (1 Pilot)	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31 (No Pilot)
Phase	Available	Available	Available, but uses rough frequency offset estimation from the synchronization step only
Timing	Available	Not available	Not available
Gain	Available	Available	Not available



While the tracking functionality has to use pilot based estimates, the actual results for frequency and clock offset in the result summary can be data aided. In case of subchannelization the final estimation of frequency and clock offset is done using the already decided data sequence, which gives stable results even without pilots.

### 3.2.7 EVM

The error vector magnitude of a single constellation point is defined by

$$\text{EVM}(\mathbf{l}, \mathbf{k}) = \sqrt{\frac{|r(\mathbf{l}, \mathbf{k}) - a(\mathbf{l}, \mathbf{k})|^2}{\frac{1}{N_{\text{used}}} \sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2} |a(\mathbf{l}, \mathbf{k})|^2}}$$

where  $\mathbf{r}(\mathbf{l}, \mathbf{k})$  is the received constellation point and  $\mathbf{a}(\mathbf{l}, \mathbf{k})$  is the transmitted constellation point at the  $\mathbf{l}^{\text{th}}$  symbol and carrier number  $\mathbf{k}$ .

In case of subchannelization, it is required by the standard to include the unallocated carriers  $\mathbf{k}_{\text{unalloc}}$  by assuming  $\mathbf{a}(\mathbf{l}, \mathbf{k}_{\text{unalloc}}) = 0$  in the denominator of the EVM calculation.

Thus the EVM All Carriers result for one burst in the result summary equals

$$\text{EVM\_All\_Carr} = \sqrt{\frac{\frac{1}{L} \sum_{l=1}^L \frac{1}{N_{\text{used}}} \sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2} |r(\mathbf{l}, \mathbf{k}) - a(\mathbf{l}, \mathbf{k})|^2}{\frac{1}{L} \sum_{l=1}^L \frac{1}{N_{\text{used}}} \sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2} |a(\mathbf{l}, \mathbf{k})|^2}}$$

where  $L$  is the number of symbols in the burst.

This definition is according to the relative constellation error defined in the IEEE 802.16-2004 standard.

Using the equations above, the error power is normalized by the average transmitted power in all 200 carriers. Please notify that by this definition the same absolute error power leads to different EVM results depending on the number of allocated carriers in case of subchannelization.

### 3.2.8 IQ Impairments

IQ imbalance in an OFDM transmitter or receiver leads to an interference of the symbols  $\mathbf{a}_{\mathbf{l}, \mathbf{k}}$  with the symbols  $\mathbf{a}_{\mathbf{l}, \mathbf{k}}$ . In case of subchannelization, the used sub carriers are always situated in such a way, that  $\mathbf{a}_{\mathbf{l}, \mathbf{k}} = 0$ , if  $\mathbf{a}_{\mathbf{l}, \mathbf{k}} \neq 0$ . There is no impact of IQ imbalance on the actually allocated carriers of a subchannelization transmission. The effect can only be

seen on the unallocated carriers and yields a pattern around the origin of the constellation diagram.

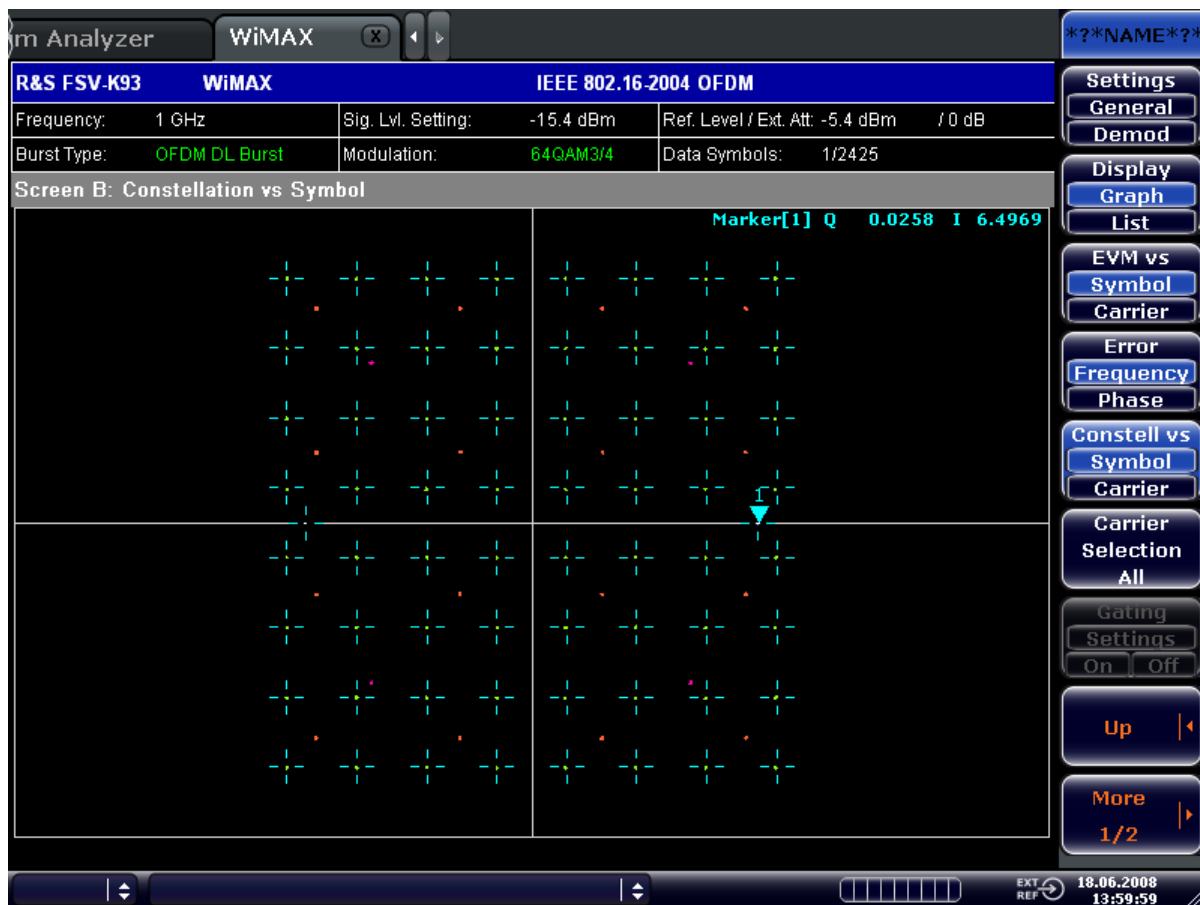


Fig. 3-3: Constellation vs Symbol

The unsymmetrical allocation of the sub carriers prevents a measurement of gain imbalance and quadrature error in case of subchannelization. The influence of the occupied carriers  $a_{i,k}$  on the unoccupied carriers  $a_{i,k}$  could be measured, but there is no possibility to distinguish them from an unknown channel coefficient.

### 3.2.9 RSSI

See IEEE Std 802.16-2004 [6] section "8.3.9.2 RSSI mean and standard deviation". The Received Signal Strength Indication [RSSI] is basically the preamble power. The result summary provides the RSSI statistics according to the standard. A possible method to compute  $RSSI[k]$  at the antenna connector is given in [6] equation (87).  $RSSI[k]$  is the RSSI measurement based on the k-th signal/preamble.

The RSSI statistics of the "result summary" is calculated as follows:

1. RSSI row:
2. Statistic {min, mean, max} of the  $R[k]=RSSI[k]$ .

3. The mean value is  $\hat{\mu}_{RSSI,AB}[k]$  according to [6] formula (89).
4. RSSI Standard Deviation row:
5.  $\hat{\sigma}_{RSSI,AB}$  according to [6] formula (91).

### 3.2.10 CINR

See IEEE Std 802.16-2004 [6] section "8.3.9.3 CINR mean and standard deviation". The result summary provides the Carrier Interference Noise Ratio [CINR] statistics according to the standard. One possible method to estimate the CINR of a single message is to compute the ratio of the sum of signal power and the sum of residual error for each data sample, using equation (92).

$$CINR[k] = \frac{\sum_{n=0}^{N-1} |s[k, n]|^2}{\sum_{n=0}^{N-1} |r[k, n] - s[k, n]|^2}$$

with

r[k,n]	received/measured sample n within message k
s[k,n]	corresponding detected/reference sample (with channel state weighting)
	corresponding to received symbol n

The CINR statistics of the "result summary" is calculated as follows:

1. CINR row:
2. Statistic {min, mean, max} of the CINR[k].
3. The mean value is  $\hat{\mu}_{CINR,AB}[k]$  according to [6] formula (94).
4. CINR Standard Deviation row
5.  $\hat{\sigma}_{CINR,AB}$  according to [6] formula (96).

### 3.2.11 OFDM Literature

[1]	Speth, Classen, Meyer: "Frame synchronization of OFDM systems in frequency selective fading channels", VTC '97, pp. 1807-1811
[2]	Schmidl, Cox: "Robust Frequency and Timing Synchronization of OFDM", IEEE Trans. on Comm., Dec. 1997, pp. 1613-621
[3]	Minn, Zeng, Bhargava: "On Timing Offset Estimation for OFDM", IEEE Communication Letters, July 2000, pp. 242-244

[4]	Speth, Fechtel, Fock, Meyr: "Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM – Part I", IEEE Trans. On Comm. VOL. 47, NO 11, Nov. 1999
[5]	Speth, Fechtel, Fock, Meyr: "Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM – Part II", IEEE Trans. On Comm. VOL. 49, NO 4, April. 2001
[6]	IEEE 802.16-2004, Part 16: Air Interface for Fixed Broadband Wireless Access Systems; 1 October 2004; Medium Access Control (MAC) and Physical Layer (PHY) specifications

### 3.3 Signal Processing of the IEEE802.16-2005 OFDMA/WiBro Measurement Application

The following description provides a brief overview of the digital signal processing used in the IEEE 802.16 OFDMA measurement application.

From the received IF signal as the point of origin to the actual analysis results like EVM or CINR, the digital signal processing can be divided into four major groups:

<ul style="list-style-type: none"> <li>Data capturing</li> </ul>	
<ul style="list-style-type: none"> <li><a href="#">chapter 3.3.2, "Synchronisation"</a>, on page 32</li> <li><a href="#">chapter 3.3.3, "Channel Estimation/Equalization"</a>, on page 33</li> <li><a href="#">chapter 3.3.4, "Analysis"</a>, on page 33</li> </ul>	(OFDMA measurement application) (OFDMA measurement application) (OFDMA measurement application)

The description of the IEEE802.16-2005 OFDMA/WiBro measurement signal processing is structured accordingly:

- [chapter 3.3.1, "Signal Processing Block Diagram"](#), on page 31
- [chapter 3.3.2, "Synchronisation"](#), on page 32
- [chapter 3.3.3, "Channel Estimation/Equalization"](#), on page 33
- [chapter 3.3.4, "Analysis"](#), on page 33
- [chapter 3.3.5, "OFDMA/WiBro Literature"](#), on page 36

#### Abbreviations and Symbols:

Symbol	Description
$a_{i,k}, \hat{a}_{i,k}$	data symbol (actual, decided)
$\Delta f_{res}$	residual carrier frequency offset
$\Delta f, \Delta \hat{f}_{course}$	carrier frequency offset between transmitter and receiver (actual, coarse estimate)
$\xi$	relative sampling frequency offset
$g_i$	gain
$H_{i,k}, \hat{H}_{i,k}$	channel transfer function (actual, estimate)
$i$	time index
$\hat{t}_{coarse}, \hat{t}_{fine}$	timing estimate (coarse, fine)

Symbol	Description
$k, k_p, k_d, k_{ch\ n}$	subcarrier index (general, pilot, data, subchannel $n$ )
$l$	OFDM symbol index
$N_{FFT}$	length of FFT
$N_g$	number of samples in cyclic prefix (guard interval)
$N_s$	number of Nyquist samples
$N_{sc}$	number of subcarriers
$n$	subchannel index, subframe index
$n_{l,k}$	noise sample
$\Phi_l$	common phase error
$\Delta Q, \Delta \hat{Q}$	I/Q imbalance (actual, estimate)
$r(i)$	received sample in the time domain
$r_{l,k}, \hat{r}_{l,k}, \tilde{r}_{l,k}, \tilde{\tilde{r}}_{l,k}$	received sample (uncompensated, fully compensated, partially compensated, equalized) in the frequency domain
$T$	useful symbol time
$T_g$	guard time
$T_s$	symbol time

Abbreviation	Description
AWGN	additive white Gaussian noise
BER	bit error rate
CFO	carrier frequency offset
CINR	carrier to interference and noise ratio
CIR	channel impulse response
CP	cyclic prefix (guard interval)
CPE	common phase error
CTF	channel transfer function
DL	downlink
EVM	error vector magnitude
FFT	fast Fourier transformation
IF	intermediate frequency
ISI	intersymbol interference
OFDM	orthogonal frequency division multiplexing
OFDMA	orthogonal frequency division multiple access

PAPR	peak to average power ratio
RSSI	received signal strength indicator
SFO	sampling frequency offset
UL	uplink

### 3.3.1 Signal Processing Block Diagram

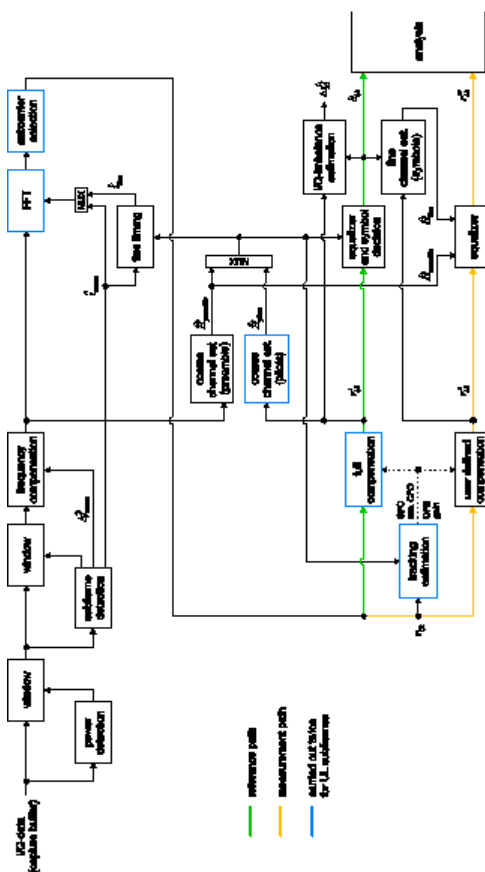


Fig. 3-4: Signal processing of the IEEE 802.16 OFDMA measurement application

The block diagram in figure 3-4 shows the OFDMA measurement application from the capture buffer containing the I/Q data to the actual analysis block. Outcome of the fully compensated reference path (green) are the estimates  $\hat{a}_{i,k}$  of the transmitted data symbols  $a_{i,k}$ . Depending on the user defined compensation, the received samples  $r''_{i,k}$  of the measurement path (orange) 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.

### 3.3.2 Synchronisation

The first of the synchronization tasks is to detect areas of sufficient power within the captured I/Q data stream. The subframe detection block determines the beginning and end of each subframe and coarsely estimates both timing and carrier frequency offset. The fine timing block prior to the FFT allows a timing improvement using a level-based search for the beginning and end of the coarsely estimated channel impulse response. In the DL the coarse estimate of the CIR can be directly obtained from the preamble. Other than that the UL consists only of payload information with scattered pilots in the subcarrier-symbol plane, thus several OFDM symbols have to be observed to get a reliable estimate of the CIR. Since the OFDM symbols need to be phase synchronized prior to the channel estimation, the blue blocks in the figure above [figure 3-4](#) have to be carried out twice. In the first iteration the timing estimate  $\hat{t}_{\text{coarse}}$  is used to position the window of the FFT. Having found the pilot-based estimate of the CIR, the fine timing estimate  $\hat{t}_{\text{fine}}$  is used in the second iteration.

After the time to frequency transformation by an FFT of length  $N_{\text{FFT}}$ , the tracking estimation block is used to estimate the following:

relative sampling frequency offset  $\xi$

residual carrier frequency offset  $\Delta f_{\text{res}}$

common phase error  $\Phi_l$

gain  $g_l$

Corresponding to [3] and [4], the uncompensated samples  $r_{l,k}$  can be expressed as

$$r_{l,k} = g_l \cdot a_{l,k} \cdot H_{l,k} \cdot \underbrace{e^{j\Phi_l}}_{\text{CPE}} \cdot \underbrace{e^{j2\pi \cdot N_s / N_{\text{FFT}} \cdot \xi \cdot k \cdot l}}_{\text{SFO}} \cdot \underbrace{e^{j2\pi \cdot N_s / N_{\text{FFT}} \cdot \Delta f_{\text{res}} \cdot T \cdot l}}_{\text{res. CFO}} + n_{l,k}$$

Equation (36) (3 - 7)

with

data symbol  $a_{l,k}$  on subcarrier  $k$  at OFDM symbol  $l$

channel transfer function  $H_{l,k}$

number of Nyquist samples  $N_s$  within the symbol time  $T_s$

useful symbol time  $T = T_s - T_g$

independent and Gaussian distributed noise sample  $n_{l,k}$

Within one OFDM symbol both the CPE and the residual CFO respectively cause the same phase rotation for each subcarrier, while the rotation due to the SFO linearly depends on the subcarrier index. A linear phase increase in symbol direction can be observed for the residual CFO as well as the SFO.

The results of the tracking estimation block are used to compensate the samples  $r_{l,k}$ . While 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.

### 3.3.3 Channel Estimation/Equalization

According to [figure 3-4](#), there are two coarse and one fine channel estimation blocks. Which of the two coarse estimation blocks is used depends on the link direction. For DL subframes the coarse channel estimation is based on the preamble and directly follows the coarse frequency compensation block. The pilot-based estimation for UL subframes is tapped behind the full compensation block of the reference path. Both of the coarse estimation blocks use available training symbols to determine initial estimates  $\hat{H}_{l,k}$  of the channel transfer function at fixed positions in the subcarrier-symbol plane. Based on these nodes, the missing CTF values are obtained by interpolation in both time and frequency direction. The coarse estimation results are used for the above mentioned fine timing and to equalize the samples  $r'_{l,k}$  of the reference path prior to symbol decision. Based on the decided data symbols, a fine channel estimation is performed and then used to equalize the partially compensated samples of the measurement path.

### 3.3.4 Analysis

The analysis block of the OFDMA measurement application allows to calculate a variety of measurement variables.

- EVM
- CINR
- RSSI
- I/Q Imbalance
- Other Measurement Variables

#### EVM

The most important variable is the error vector magnitude (EVM).

$$EVM_{l,k} = \left| \frac{r_{l,k}''' - \hat{a}_{l,k}}{\hat{a}_{l,k}} \right|$$

Equation (3 - 8)

on subcarrier **k** at OFDM symbol **l**. The subsequent average values can be derived from (37).

EVM of subchannel **n** at OFDM symbol **l**:

$$EVM_{l,\text{subchannel } n} = \sqrt{\frac{1}{N_{sc}} \sum_{k_{ch,n}} EVM_{l,k_{ch,n}}^2}$$

Equation (3 - 9)

EVM of all pilot subcarriers:



$$EVM_{\text{pilots}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_l \sum_{k_p} EVM_{l,k_p}^2}$$

Equation (3 - 10)

EVM of all data subcarriers:

$$EVM_{\text{data}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_l \sum_{k_d} EVM_{l,k_d}^2}$$

Equation (3 - 11)

EVM of all used subcarriers:

$$EVM_{\text{all}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_l \left[ \sum_{k_p} EVM_{l,k_p}^2 + \sum_{k_d} EVM_{l,k_d}^2 \right]}$$

Equation (3 - 12)

The number of subcarriers respectively taken into account is denoted by  $N_{\text{sc}}$ .**CINR**

The carrier to interference and noise ratio is determined for each subframe  $n$ . The computation is based on the partially compensated samples  $r'_{l,k}$ , the decided symbols  $\hat{a}_{l,k}$ , and the channel estimates  $\hat{H}_k$  (DL: preamble and fine; UL: fine).

$$CINR(n) = \frac{\sum_l \sum_k |\hat{a}_{l,k} \cdot \hat{H}_k|^2}{\sum_l \sum_k |r'_{l,k} - \hat{a}_{l,k} \cdot \hat{H}_k|^2}$$

Equation (3 - 13)

Further CINR statistics are defined in the standards [5], [6].

$$\hat{\mu}_{\text{CINR}}(n) = \begin{cases} \text{CINR}(0) & n = 0 \\ (1 - \alpha_{\text{avg}}) \cdot \hat{\mu}_{\text{CINR}}(n-1) + \alpha_{\text{avg}} \cdot \text{CINR}(n) & n > 0 \end{cases}$$

$$\hat{\mu}_{\text{CINR}}^{(\text{dB})}(n) = 10 \cdot \log \hat{\mu}_{\text{CINR}}(n) \text{ dB}$$

$$\hat{x}_{\text{CINR}}^2(n) = \begin{cases} \text{CINR}^2(0) & n = 0 \\ (1 - \alpha_{\text{avg}}) \cdot \hat{x}_{\text{CINR}}^2(n-1) + \alpha_{\text{avg}} \cdot \text{CINR}^2(n) & n > 0 \end{cases}$$

$$\hat{\sigma}_{\text{CINR}}^{(\text{dB})}(n) = 5 \cdot \log(\hat{x}_{\text{CINR}}^2(n) - \hat{\mu}_{\text{CINR}}^2(n)) \text{ dB}$$

Equation (3 - 14)

**RSSI**

The received signal strength indicator is determined for each subframe **n**. The computation is based on the time domain samples **r(i)** extracted by the subframe detection block.

$$\text{RSSI}(n) \sim \overline{|r(i)|^2}$$

Equation (3 - 15)

Further RSSI statistics are defined in the standard [5], [6].

$$\hat{\mu}_{\text{RSSI}}(n) = \begin{cases} \text{RSSI}(0) & n = 0 \\ (1 - \alpha_{\text{avg}}) \cdot \hat{\mu}_{\text{RSSI}}(n-1) + \alpha_{\text{avg}} \cdot \text{RSSI}(n) & n > 0 \end{cases}$$

$$\hat{\mu}_{\text{RSSI}}^{(\text{dB})}(n) = 10 \cdot \log \hat{\mu}_{\text{RSSI}}(n) \text{ dB}$$

$$\hat{x}_{\text{RSSI}}^2(n) = \begin{cases} \text{RSSI}^2(0) & n = 0 \\ (1 - \alpha_{\text{avg}}) \cdot \hat{x}_{\text{RSSI}}^2(n-1) + \alpha_{\text{avg}} \cdot \text{RSSI}^2(n) & n > 0 \end{cases}$$

$$\hat{\sigma}_{\text{RSSI}}^{(\text{dB})}(n) = 5 \cdot \log(\hat{x}_{\text{RSSI}}^2(n) - \hat{\mu}_{\text{RSSI}}^2(n)) \text{ dB}$$

Equation (3 - 16)

**I/Q Imbalance**

The I/Q imbalance estimation block allows to evaluate the modulator gain balance and the quadrature mismatch based on the block's estimate  $\Delta\hat{\theta}$ .

modulator gain balance =  $|1 + \Delta Q|$

quadrature mismatch =  $\arg\{1 + Q\}$

### Other Measurement Variables

Without going into detail, the OFDMA measurement application additionally provides the following results:

- Burst power
- Constellation diagram
- Group delay
- I/Q offset
- PAPR
- Pilot BER
- Spectral flatness

### 3.3.5 OFDMA/WiBro Literature

[1]	Speth, M., Classen, F., and Meyr, H.: Frame Synchronization of OFDM Systems in Frequency Selective Fading Channels. IEEE VTC'97, May 1997, pp. 1807-1811.
[2]	Schmidl, T. M. and Cox, D. C.: Robust Frequency and Timing Synchronization of OFDM. IEEE Trans. on Commun. Vol. 45 (1997) No. 12, pp. 1613-1621.
[3]	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.
[4]	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.
[5]	IEEE 802.16-2004™: Air Interface for Fixed Broadband Wireless Access Systems (2004).
[6]	IEEE Std 802.16e™-2005 and IEEE Std 802.16™-2004/Cor1-2005: Air Interface for Fixed and Mobile Broadband Wireless Access Systems (2006)

## 4 Instrument Functions WiMAX, WiBro Measurements (R&S FSV-K93)

The WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93) extends the functionality of the R&S FSV to enable WiMAX IEEE 802.16e, WiBro Measurements according to the IEEE standards listed below. It includes the functionality of the WiMAX 802.16 OFDM Measurements option (R&S FSV-K93). Accordingly both options are described together in this section, differentiated by the corresponding standards:

- WiMAX 802.16 OFDM Measurements (R&S FSV-K93)
  - IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode  
The short form IEEE 802.16-2004 OFDM is used in this section to reference this standard. The corresponding remote control mode is OFDM.
- WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93)
  - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode  
The short form IEEE 802.16e-2005 OFDMA is used in this section to reference this standard. The corresponding remote control mode is OFDMA.
  - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro  
The short form IEEE 802.16e-2005 WiBro is used in this section to reference this standard. The corresponding remote control mode is WiBro.

TX measurements of a WiMAX Device Under Test (DUT) according to the standards specified for the device are performed:

- Modulation formats
  - IEEE 802.16-2004: BPSK (IEEE 802.16-2004 OFDM), QPSK, 16QAM, 64QAM
- Modulation measurements
  - Constellation diagram
  - Constellation diagram per OFDM carrier
  - I/Q offset and I/Q imbalance
  - Carrier and symbol frequency errors
  - Modulation error (EVM) per OFDM carrier or symbol
  - Amplitude response and group-delay distortion (spectral flatness)
- Amplitude statistics (CCDF) and crest factor
- Frequency and Phase error vs Symbol
- Transmit spectrum mask
- Adjacent Channel Power (absolute and relative)
- FFT, also over a selected part of the signal, e.g. preamble
- Payload bit information
- Capture time selectable up to 50 ms, multiple sweeps possible for large number of bursts

### To open the measurement menu

- If the "WiMAX" mode is not the active measurement mode, press the MODE key and activate the "WiMAX" option.

- If the "WiMAX" mode is already active, press the HOME or MEAS key. The measurement menu is displayed. To exit the "WiMAX" measurement mode, select another option.

## 4.1 Menu and Softkey Description

For WiMAX measurements, the following menus and softkeys are available.

- [chapter 4.3, "Softkeys of the WiMAX, WiBro Menu \(R&S FSV-K93\)", on page 47](#)
- [chapter 4.4, "Softkeys of the Sweep Menu – SWEEP Key \(R&S FSV-K93\)", on page 107](#)
- [chapter 4.5, "Softkeys of the Marker Menu – MKR Key \(R&S FSV-K93\)", on page 108](#)
- [chapter 4.6, "Softkeys of the Marker to Menu – MKR-> Key \(R&S FSV-K93\)", on page 109](#)
- [chapter 4.7, "Softkeys of the Lines Menu – LINES Key \(R&S FSV-K93\)", on page 110](#)
- [chapter 4.8, "Softkeys of the Trace Menu – TRAC Key \(R&S FSV-K93\)", on page 110](#)
- [chapter 4.9, "Softkeys of the Input/Output Menu for WiMAX Measurements", on page 111](#)

The "File", "Setup", and "Print" menus are provided as described for the base unit. For details refer to the corresponding menu descriptions. The "Span" and "Bandwidth" menus are not available in the "WiMAX" mode.

The FREQ, AMPT and TRIG keys open the "General Settings" or the "Demod Settings" dialog box. For details refer to ["Settings General/Demod"](#) on page 48.

## 4.2 Further Information

This chapter provides further information about the measurements and result displays for R&S FSV-K93 application.

- [chapter 4.2.1, "Measurement and Result Displays", on page 39](#)
- [chapter 4.2.2, "Measurement Settings", on page 40](#)
- [chapter 4.2.3, "Result Summary List", on page 41](#)
- [chapter 4.2.4, "Result Display Graph", on page 44](#)
- [chapter 4.2.5, "Transferring the Current R&S SMU WiMAX Settings via LAN", on page 46](#)
- [chapter 4.2.6, "Title Bar Information", on page 46](#)
- [chapter 4.2.7, "Status Bar Information", on page 46](#)

## 4.2.1 Measurement and Result Displays

The WiMAX IEEE 802.16 OFDM, OFDMA Measurements option provides two main measurement types:

- IQ measurements (based on captured IQ data)
  - Power vs Time (see ["PVT"](#) on page 48 softkey)
  - EVM vs Symbol, EVM vs Carrier (see ["EVM vs Symbol/Carrier"](#) on page 54 softkey)
  - Phase vs Preamble, Frequency vs Preamble (see ["Error Frequency/Phase \(IEEE 802.16-2004 OFDM\)"](#) on page 57 softkey)
  - Spectrum Flatness (see ["Spectrum Flat./Diff./Group Delay \(IEEE 802.16-2004 OFDM, WiBro\)"](#) on page 63 softkey)
  - Spectrum Flatness Adjacent Carrier Power Difference (see ["Spectrum Flat./Diff./Group Delay \(IEEE 802.16-2004 OFDM, WiBro\)"](#) on page 63 softkey)
  - Spectrum Group Delay (see ["Spectrum Flat./Diff./Group Delay \(IEEE 802.16-2004 OFDM, WiBro\)"](#) on page 63 softkey)
  - Preamble Channel Frequency Response: Phase (see ["Channel Phase/Group Delay \(IEEE 802.16e-2005 OFDMA\)"](#) on page 68 softkey)
  - Spectrum FFT (see ["Spectrum FFT"](#) on page 74 softkey)
  - Constellation vs Symbol (see ["Constell vs Symbol/Carrier"](#) on page 59 softkey)
  - Constellation vs Carrier (IEEE 802.16-2004 OFDM only, see ["Constell vs Symbol/Carrier"](#) on page 59 softkey)
  - Conditional Cumulative Distribution Function (see ["CCDF"](#) on page 79 softkey)
  - Bit Stream (see ["Bitstream"](#) on page 81 softkey)
- frequency sweep measurements
  - Spectrum Mask (see ["SEM Settings"](#) on page 77 softkey)
  - Spectrum ACP/ACPR (see ["ACPR Abs/Rel"](#) on page 75 softkey)

For current restrictions refer to "Current restrictions to the IEEE 802.16e-2005 OFDMA/WiBro signal to be analyzed."

### Result display

The measurement result display is divided into two parts:

- [chapter 4.2.2, "Measurement Settings"](#), on page 40
- Result display

The results can be displayed in form of a list or a graph (see also [Display Graph/List](#) softkey).

- [chapter 4.2.3, "Result Summary List"](#), on page 41
- [chapter 4.2.4, "Result Display Graph"](#), on page 44

When a graph is displayed, the result area can be split into 2 screens (see [Screen Size Full/Split](#) softkey):

- Screen A: capture buffer display
- Screen B: measurement result display

### Saving results

The measurement results (trace and result summary) can be stored at any time using the SAVE/RCL key (see the base unit description). Note that the originally measured values are always stored. The values are not updated after changes to the Demod Settings.

## 4.2.2 Measurement Settings

The overall measurement settings used to obtain the current measurement results are displayed below the title bar (see [figure 4-1](#)). The following settings are listed:

Setting	Description	Restrictions
Frequency	The frequency of the measured input signal.	
Burst Type	The type of burst being analyzed.	IEEE 802.16-2004 OFDM only
Zone/Seg	The zone and segment being analyzed	IEEE 802.16e-2005 OFDMA/WiBro only
Signal Level	The expected mean signal level for the input signal.	
Modulation	Shows the active setting selected in the "Demod Settings" dialog box, "Demodulator" list. If the "Mod". "Detection" field is set to "ALL", "ALL" is displayed.	IEEE 802.16-2004 OFDM only
	Shows the active setting selected in the "Demod Settings" dialog box, "Demodulator" list. If the "Modulation Analysis Scope" field is set to "ALL", "ALL" is displayed.	IEEE 802.16e-2005 OFDMA/WiBro only
External Att	The attenuation (positive values) or gain (negative values) applied to the signal externally (i.e. before the RF or IQ connector of the spectrum analyzer), e.g.: External Att = 10 dB means that before the RF connector of the R&S FSV a 10 dB attenuator is used External Att = -20 dB means that before the RF connector of the R&S FSV a amplifier with 20 dB gain is used.	
Data Symbols	Shows the minimum and maximum number of data symbols that a burst may have to be considered in results analysis.	IEEE 802.16-2004 OFDM only
Zone Offset/Length	A combined display of the offset and length of the analyzed zone	IEEE 802.16e-2005 OFDMA/WiBro only

R&S FSV-K93	WiMAX	IEEE 802.16-2004 OFDM	
Frequency:	1 GHz	Sig. Lvl. Setting:	-15.4 dBm / Ref. Level / Ext. Att: -5.4 dBm / 0 dB
Burst Type:	OFDM DL Burst	Modulation:	64QAM3/4 / Data Symbols: 1/2425

Fig. 4-1: Measurement settings for IEEE 802.16-2004 OFDM (example)

R&S FSV-K93	WiMAX	IEEE 802.16e-2005 OFDMA			
Frequency:	1 GHz	Sig. Lvl Set:	-14.8 dBm	Ref. Level / Ext. Att:	-4.81 dBm / 0 dB
Zone / Seg:	DL-PUSC, ID=A, Seg=0	Modulation:	ALL	Zone Offset / Len:	1 / 26 Symbols

Fig. 4-2: Measurement settings for IEEE 802.16e-2005 OFDMA/WiBro (example)

### 4.2.3 Result Summary List

If the results are displayed in tabular form ([Display Graph/List](#) softkey), the result summary list is displayed. It shows the overall measurement results and provides limit checking for result values in accordance with the selected standard. Result values which are within the limit as specified by the standard are displayed in green. Result values which are outside of the limits specified by the standard are displayed in red with a '\*' to the left. Results which have no limits specified by the standard are displayed in white. Limit values are displayed in white (not bold) and can be modified, when focused, via the keypad. Limits are modified for the currently selected modulation scheme. Each modulation scheme may have its own set of user defined limits. To reset the limit values to the values specified in the standard, use the "Lines" menu (LINES key).

- IEEE 802.16-2004 OFDM  
The results displayed in this list are for the entire measurement. If a specific number of bursts have been requested which requires more than one sweep, the result summary list is updated at the end of each sweep. The number of bursts measured and the number of bursts requested are displayed to show the progress through the measurement. The Min/Mean/Max columns show the minimum, mean or maximum values of the burst results.



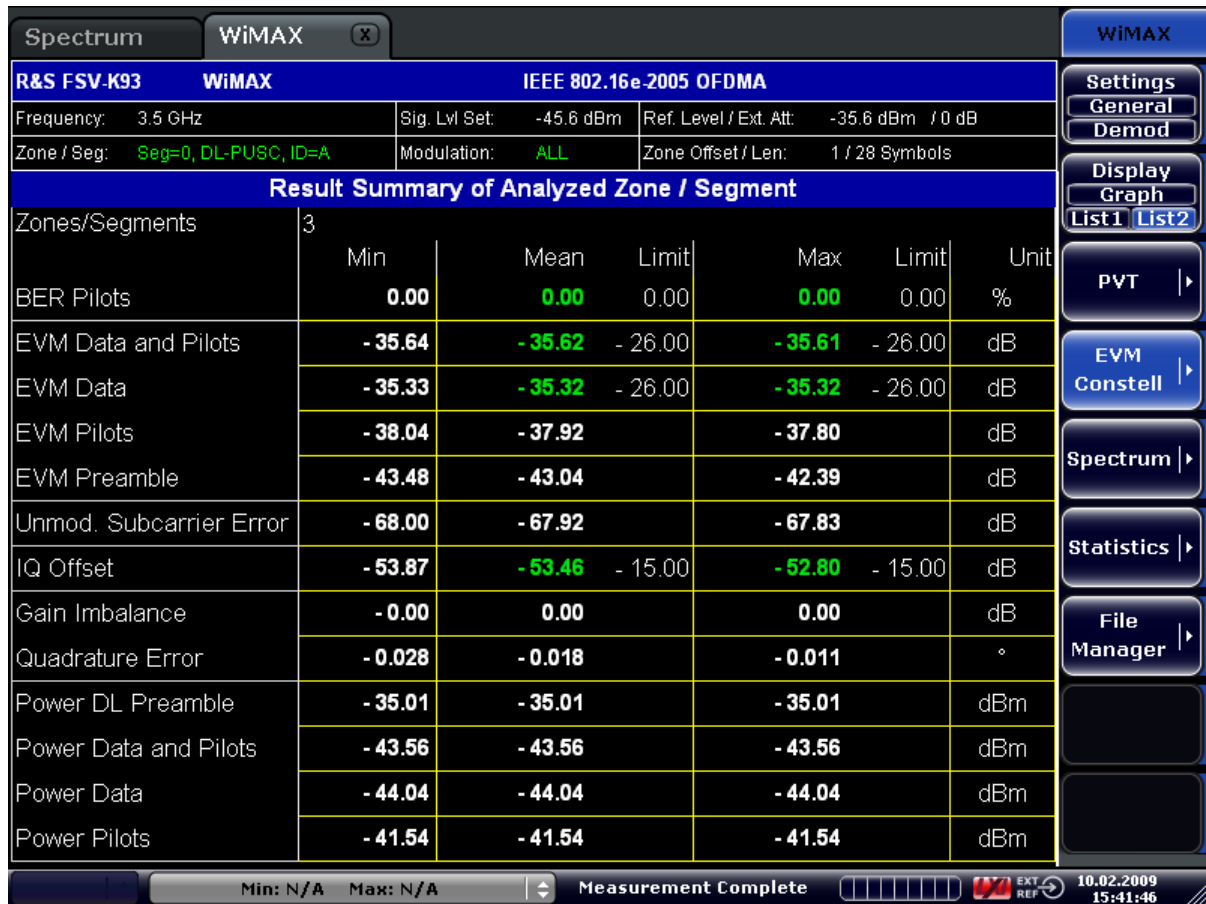


Fig. 4-3: Result summary list for IEEE 802.16-2004 OFDM (example)

- IEEE 802.16e-2005 OFDMA, WiBro

For these measurement results, the minimum, mean, and maximum is taken over the analyzed zones of the current capture buffer content.

Two lists are available:

- Result Summary of Analyzed Subframes (list 1)
- Result Summary of Analyzed Zone/Segment (list 2)

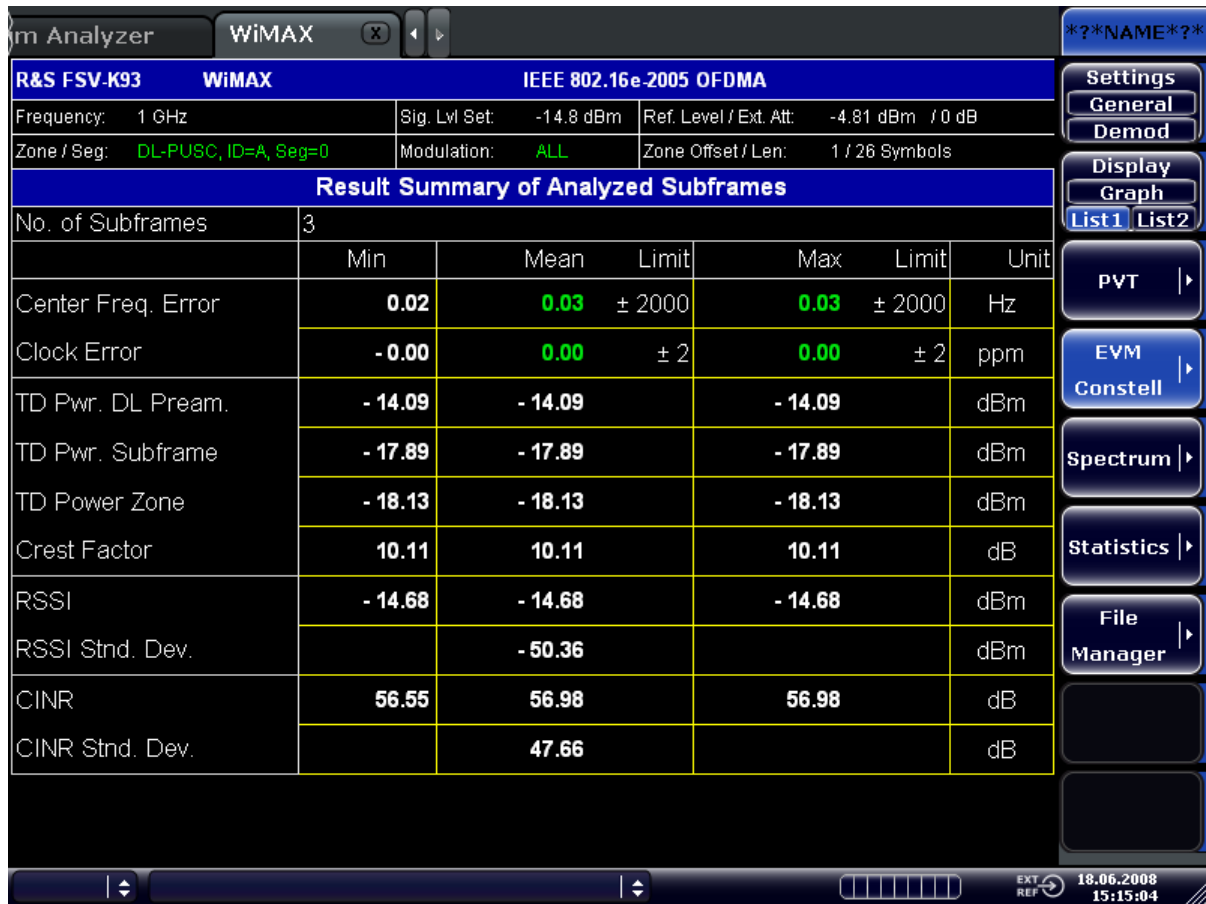


Fig. 4-4: Result summary list for IEEE 802.16e-2005 OFDMA/WiBro (example)



Fig. 4-5: Result summary list 2 for IEEE 802.16e-2005 OFDMA/WiBro (example)

#### 4.2.4 Result Display Graph

- IQ measurements

If the results are displayed in graphical form ([Display Graph/List](#) softkey), additionally to the selected graphical result display, the Magnitude Capture Buffer (power profile) display is provided for all IQ measurements. The different result displays are described with the corresponding softkey.

The Magnitude Capture Buffer display shows the complete range of captured data for the last sweep. All analyzed bursts are identified with a green bar at the bottom of the Magnitude Capture Buffer display. Only those bursts match the required criteria. The gate delay line ("GD") and gate length line ("GL") are displayed in red color.

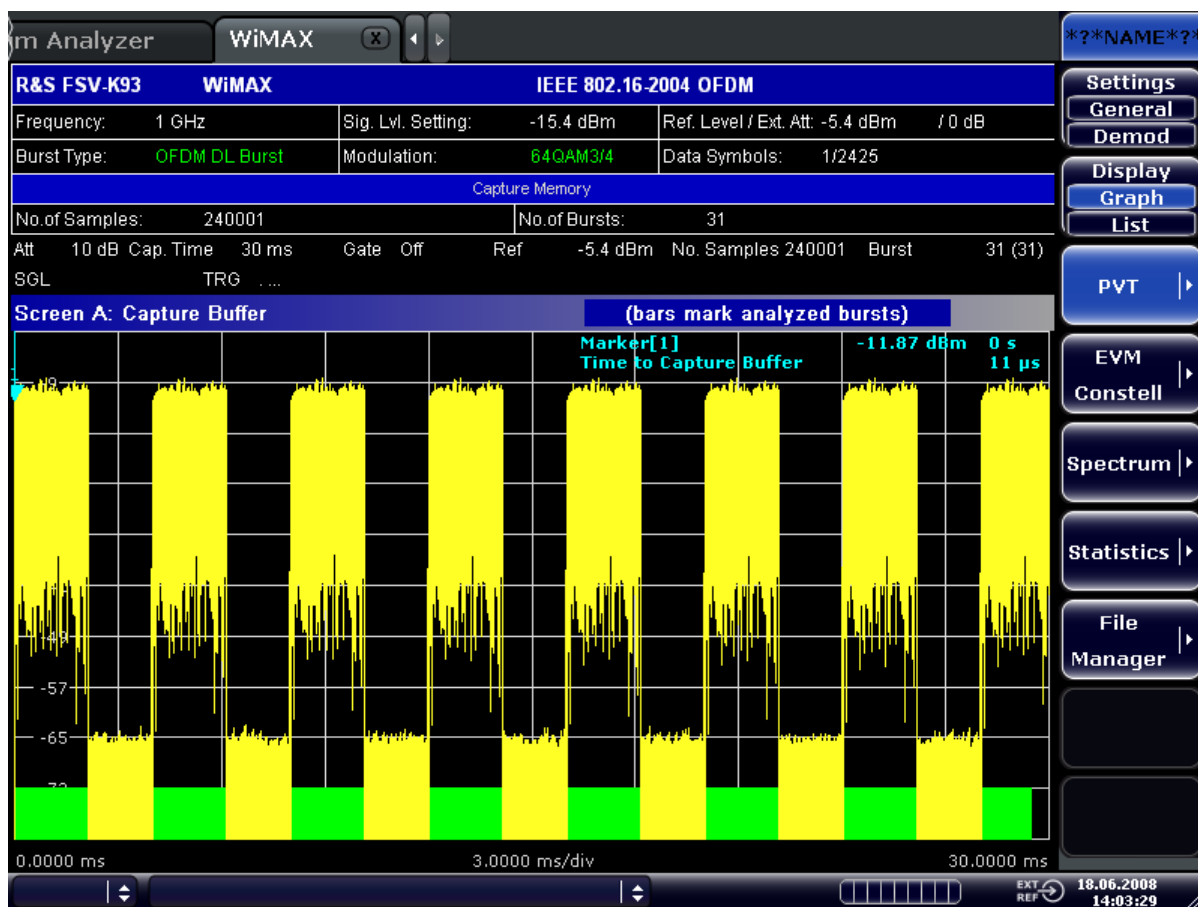


Fig. 4-6: Magnitude capture buffer results (example)

All IQ measurements process the same signal data and as such all IQ measurement results are available after a single IQ measurement execution.

IQ measurements can be run in split screen mode (allowing both the Magnitude Capture Buffer display and the selected IQ measurement results to be displayed simultaneously) or in full screen mode (with either the Magnitude Capture Buffer display or the selected IQ measurement results displayed).

If measuring OFDMA or WiBro measurements, the time from the start of the capture buffer to the start of the first frame is also displayed in the Magnitude Capture buffer. This time is marked with a vertical blue line, with the result displayed at the top of the graph.

- Frequency sweep measurements
  - 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 measurements uses different settings to obtain signal data it is not possible to run a frequency sweep measurement and view the results of another frequency sweep measurement.
  - All frequency sweep measurements are run in full screen mode.

#### 4.2.5 Transferring the Current R&S SMU WiMAX Settings via LAN

Prerequisite: The Windows Firewall of the R&S SMU is switched off.

1. Press the Settings General/Demod softkey to open the "General Settings" dialog box.
2. Under "Signal Characteristics" in the Standard list, select the "IEEE 802"."16e"-"2005 OFDMA" or "IEEE 802"."16e"-"2005 WiBro" standard.
3. Open the "Advanced Settings" dialog box
4. Under SETUP in the SMU Address field specify the TCP/IP address of the R&S SMU.
5. Press the "More >" softkey to change into the side menu.
6. Press the File Manager softkey to open the File Manager.
7. Under "Folders", select the "SMU" entry.
8. Under "Files", select the "Current SMU WiMAX Settings" entry using the "RIGHT-ARRROW" key.
9. Press the "Recall" softkey.
10. The selected WiMAX setting file is transferred from the R&S SMU to the R&S FSV.

#### 4.2.6 Title Bar Information

The title bar displays the following information:

- standard applicable to the current measurement

#### 4.2.7 Status Bar Information

The status bar displays the following information:

- parameter values  
If a parameter in a settings dialog box is selected, the minimum and maximum values for the selected parameter are displayed.  
If a Boolean parameter in a dialog box is selected, the minimum and maximum values are displayed as N/A for not applicable.
- measurement status  
During the measurement, the current measurement status along with detailed information about the progress is displayed.
- error messages (with red background)
- warning messages (with yellow background)

## 4.3 Softkeys of the WiMAX, WiBro Menu (R&S FSV-K93)

The following table shows all softkeys available in the "WiMAX" menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

### 4.3.1 Description of the softkeys of the WiMAX, WiBro Menu

Settings General/Demod.....	48
Display Graph/List.....	48
PVT.....	48
L Full Burst (IEEE 802.16-2004 OFDM).....	48
L Start End (IEEE 802.16-2004 OFDM).....	49
L Burst Selection (IEEE 802.16-2004 OFDM).....	50
L Full Subframe (IEEE 802.16e-2005 OFDMA/WiBro).....	50
L Rising/Falling (IEEE 802.16e-2005 OFDMA/WiBro).....	51
L Gating Settings On/Off.....	52
L Import.....	53
L Export.....	53
L R&S Support.....	53
EVM Constell.....	54
L EVM vs Symbol/Carrier.....	54
L Error Frequency/Phase (IEEE 802.16-2004 OFDM).....	57
L Constell vs Symbol/Carrier.....	59
L Carrier Selection All (IEEE 802.16-2004 OFDM).....	62
L Constell Selection (IEEE 802.16e-2005 OFDMA/WiBro).....	62
L Y-Axis/Div .....	62
Spectrum.....	63
L Spectrum Flat./Diff./Group Delay (IEEE 802.16-2004 OFDM, WiBro).....	63
L Spectrum Flatness/Difference (IEEE 802.16e-2005 OFDMA).....	66
L Channel Phase/Group Delay (IEEE 802.16e-2005 OFDMA).....	68
L Spectrum.....	70
L Spectrum FFT.....	74
L ACPR Abs/Rel.....	75
L SEM Settings.....	77
L SEM according to.....	77
L File Name.....	78
L Link Direction.....	78
L Power Class.....	78
L SEM Configuration.....	78
L ACP Settings.....	78
Statistics.....	79
L CCDF.....	79
L Bitstream.....	81
L Burst Summary.....	83
L Bit Selection (IEEE 802.16e-2005 OFDMA/WiBro).....	85
File Manager (IEEE 802.16e-2005 OFDMA/WiBro).....	85

**Settings General/Demod**

Opens the [chapter 4.3.2, "General Settings Dialog Box"](#), on page 86 or the [chapter 4.3.3, "Demod Settings Dialog Box"](#), on page 94 dialog box. Screenshots of the dialog boxes are provided in [chapter 3.1, "Basic Measurement Examples"](#), on page 14.

Alternatively, the "General Settings" dialog box is opened as follows:

- **FREQ** key, with focus on the "Frequency" field
- **AMPT** key, with focus on the "Signal Level" ("RF") field
- **TRIG** key, with focus on the "Trigger Mode" field

**Display Graph/List**

Configures the result display. The measurement results are displayed either in form of a list of measurement points or as a graphical trace.

For details on the result displays refer to [chapter 4.2.3, "Result Summary List"](#), on page 41 and [chapter 4.2.4, "Result Display Graph"](#), on page 44.

SCPI command:

`DISPlay[:WINDow<n>]:TABLE` on page 181

**PVT**

Opens the PVT submenu to select the "Power vs Time" measurement results.

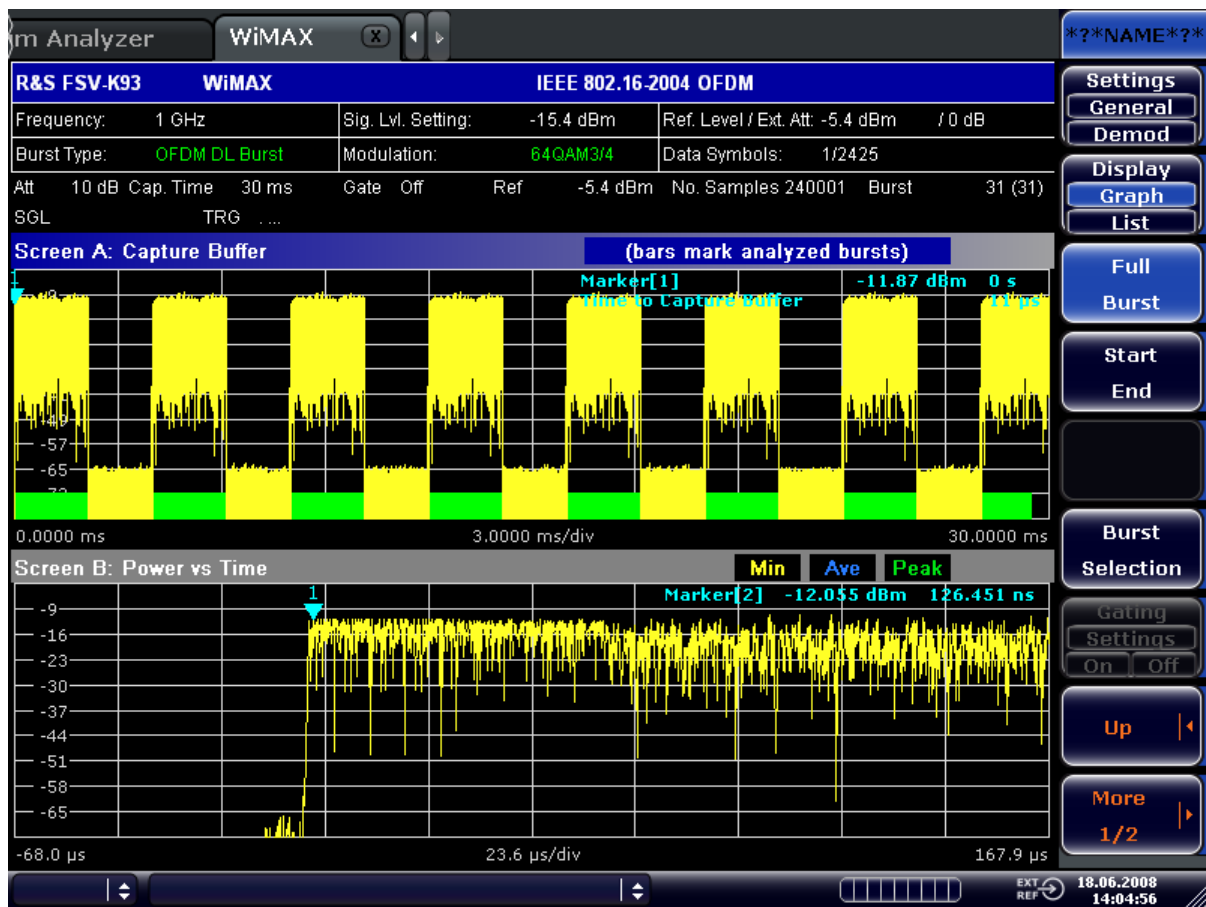
The PVT result displays show the measured input data over the full range or over complete bursts, displayed within the gating lines if gating is switched on. The results are displayed as a single burst. If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the [Refresh](#) softkey in the "Sweep" menu.

SCPI command:

`CONFigure:BURSt:PVT[:IMMediate]` on page 156

**Full Burst (IEEE 802.16-2004 OFDM) ← PVT**

Displays the PVT results in a single graph with all burst data being displayed ("Display Graph" selected), or in a list ("Display List" selected).



For further details refer to the [Display Graph/List](#) softkey.

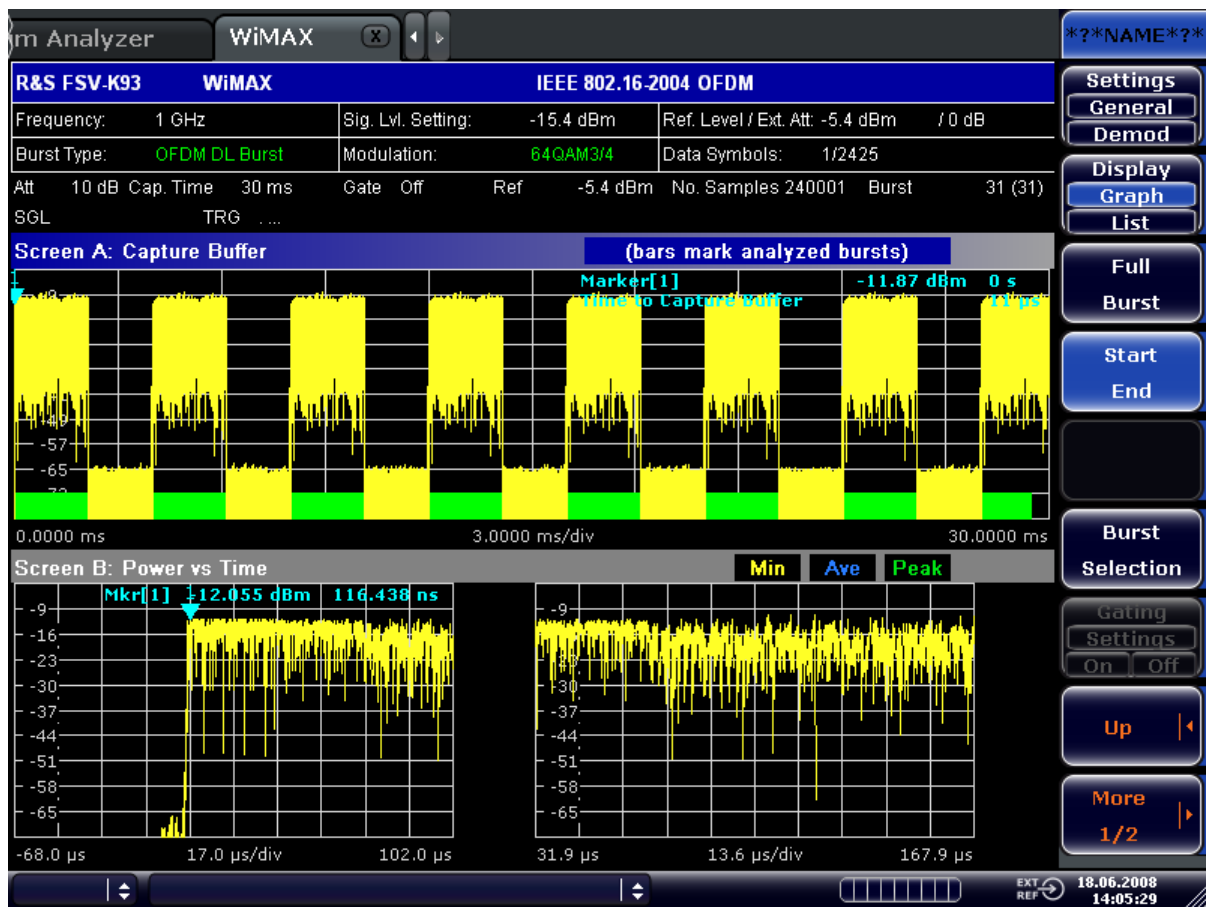
SCPI command:

[CONFigure: BURSt: PVT: SElect](#) on page 157

#### **Start End (IEEE 802.16-2004 OFDM) ← PVT**

Displays the results in two separate graphs, the left hand side showing the start and the right hand side showing the end of a burst ("Display Graph" selected), or in a list ("Display List" selected).





SCPI command:

CONF:BURS:PVT:SEL EDGE, see [CONFigure:BURSt:PVT:SELEct](#) on page 157

#### **Burst Selection (IEEE 802.16-2004 OFDM) ← PVT**

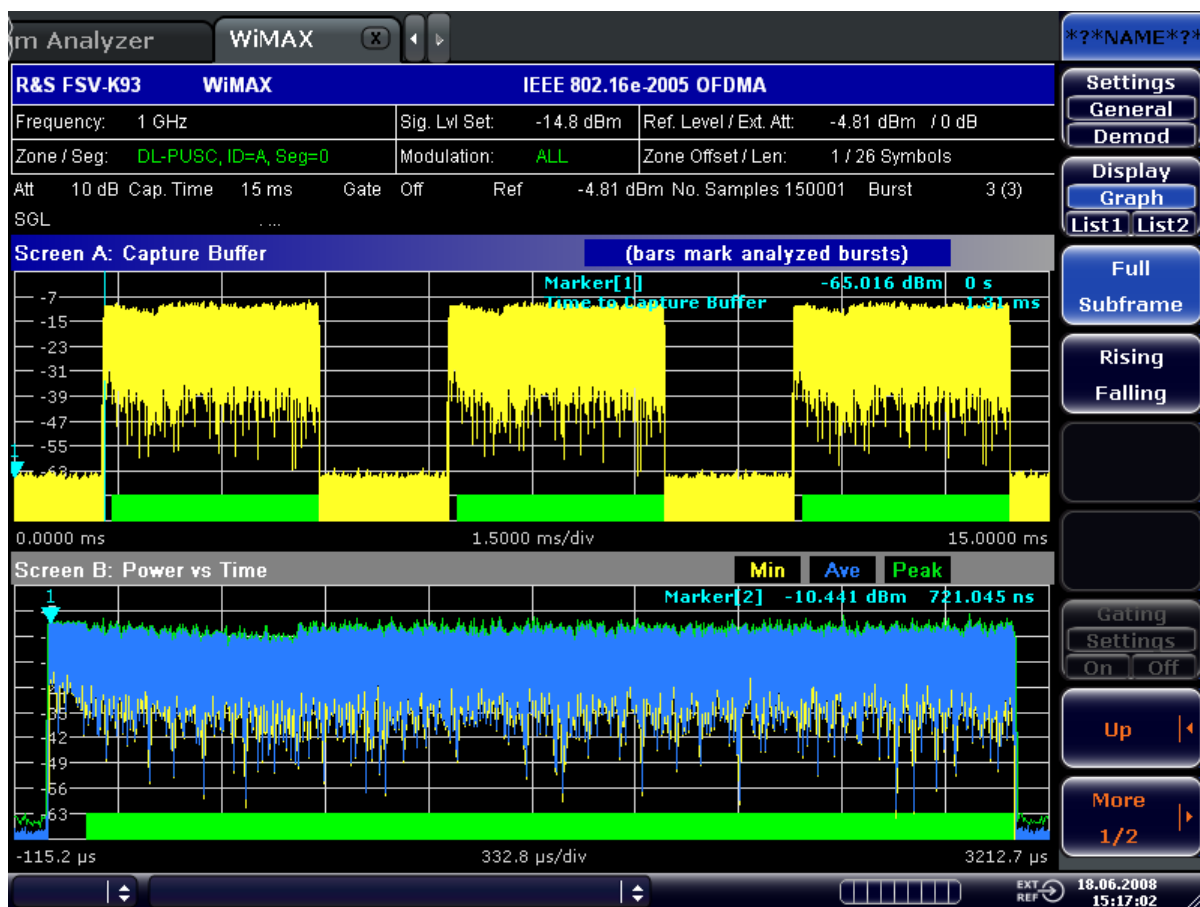
Opens an edit dialog box to select a burst by entering its number.

SCPI command:

[CONFigure:BURSt:PVT:BURSt](#) on page 156

#### **Full Subframe (IEEE 802.16e-2005 OFDMA/WiBro) ← PVT**

Displays the results in a single graph with the minimum, mean, and maximum power profile of the subframe that contains the zone selected to be analyzed ("Display Graph" selected), or in two lists ("Display List 1/2" selected).

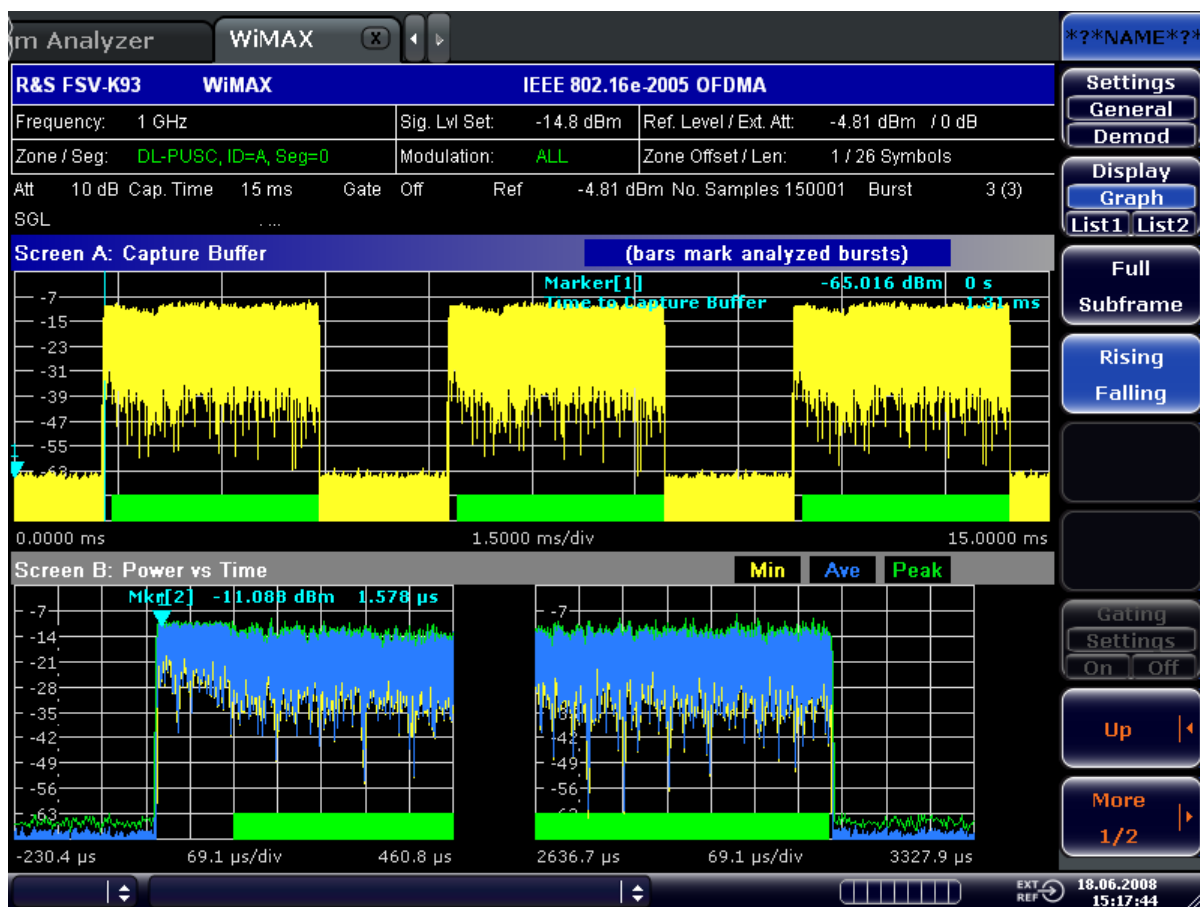


SCPI command:

CONF:BURS:PVT:SEL FULL, see [CONFigure:BURSt:PVT:SELEct](#) on page 157

#### Rising/Falling (IEEE 802.16e-2005 OFDMA/WiBro) ← PVT

Displays the results in two separate graphs: the minimum, mean, and maximum power profile of rising (on the left hand) or falling (on the right hand) edge of the subframe that contains the zone selected to be analyzed ("Display Graph" selected), or in two lists ("Display List 1/2" selected).



SCPI command:

CONF:BURS:PVT:SEL EDGE, see [CONFigure:BURSt:PVT:SElect](#) on page 157

#### Gating Settings On/Off ← PVT

Activates or deactivates gating, or opens the "Gate Settings" dialog box to specify range of captured data used in results calculation (available for Spectrum Mask, Spectrum FFT, Spectrum ACPR, CCDF).

Gate Settings		
	Time	Samples
Delay	129 $\mu$ s	2579
Length	196 $\mu$ s	3920
Link Gate and Marker	<input type="checkbox"/>	

On	Uses only the specified range of captured data in results calculation. In the Magnitude Capture Buffer trace, two vertical lines mark the specified range.
Off	Uses all the captured data in results calculation.

In the "Gate Settings" dialog box, the following parameters are set:

Delay	Start point of captured data to be used in results calculation, i.e. the delay from the start of the captured data in time or samples. If the delay is specified in time, the number of samples is updated accordingly, and vice versa.
Length	Amount of captured data to be used in results calculation. If the length is specified in time, the number of samples is updated accordingly, and vice versa.
Link Gate and Marker	If activated, the position of the marker and the gate lines are linked. The marker is positioned half way between gate start and end. The marker position alters if the gate is modified, and the gate lines move with the marker if the marker position is altered.

The gate settings are defined for following measurements: Spectrum FFT, CCDF, Spectrum Mask, Spectrum ACPR.

If a frequency sweep measurement is active (Spectrum Mask and Spectrum ACP), the result display is switched to the Magnitude Capture Buffer display in order to help defining the gate settings correctly.

SCPI command:

[\[SENSe:\] SWEep:EGATe](#) on page 216

[\[SENSe:\] SWEep:EGATe:HOLDoff:SAMPle](#) on page 217

[\[SENSe:\] SWEep:EGATe:LENGth:SAMPle](#) on page 217

[\[SENSe:\] SWEep:EGATe:LINK](#) on page 217

#### **Import ← PVT**

Opens the "Choose the file to import" dialog box.

Select the IQ data file you want to import and press ENTER. The extension of data files is \*.iqw.

This function is not available while a measurement is running.

SCPI command:

[MMEMory:LOAD:IQ:STATe](#) on page 201

#### **Export ← PVT**

Opens the "Choose the file to export" dialog box.

Enter the path and the name of the IQ data file you want to export and press ENTER. The extension of data files is \*.iqw. If the file cannot be created or there is no valid IQ data to export an error message is displayed.

This function is not available while a measurement is running.

SCPI command:

[MMEMory:STORe:IQ:STATe](#) on page 201

#### **R&S Support ← PVT**

Stores useful information for troubleshooting in case of errors.

This data is stored in the `C:\R_S\Instr\user\Support` directory on the instrument.

If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

**EVM Constell**

Opens a submenu to select the error vector magnitude (EVM) or the constellation result displays.

**EVM vs Symbol/Carrier ← EVM Constell**

Selects the EVM vs Symbol or EVM vs Carrier result displays.

- EVM vs Symbol (IEEE 802.16-2004 OFDM)
 

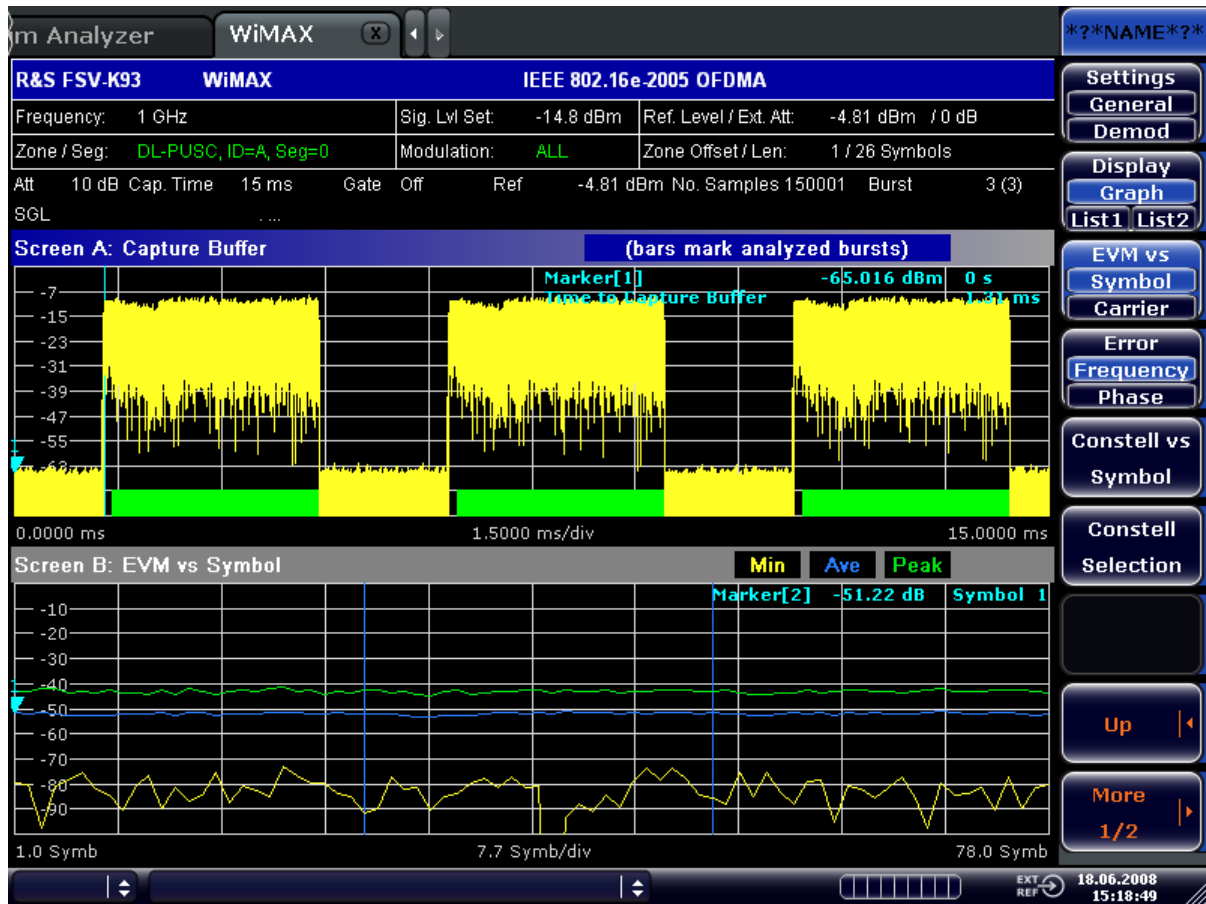
This result display shows the EVM measured over the full range of the measured input data. The results are displayed on a per-symbol basis, with blue vertical lines marking the boundaries of each burst. Note that burst boundary lines are only displayed if the number of analyzed bursts is less than 250. The minimum, average, and maximum traces are displayed.

For the trace labeled with EVM a commonly used EVM definition is applied, which is the square root of the momentary error power normalized by the averaged reference power. For details of this measurement refer to [chapter 3.2.1, "Understanding Signal Processing of the IEEE 802.16-2004 OFDM Measurement Application"](#), on page 18.

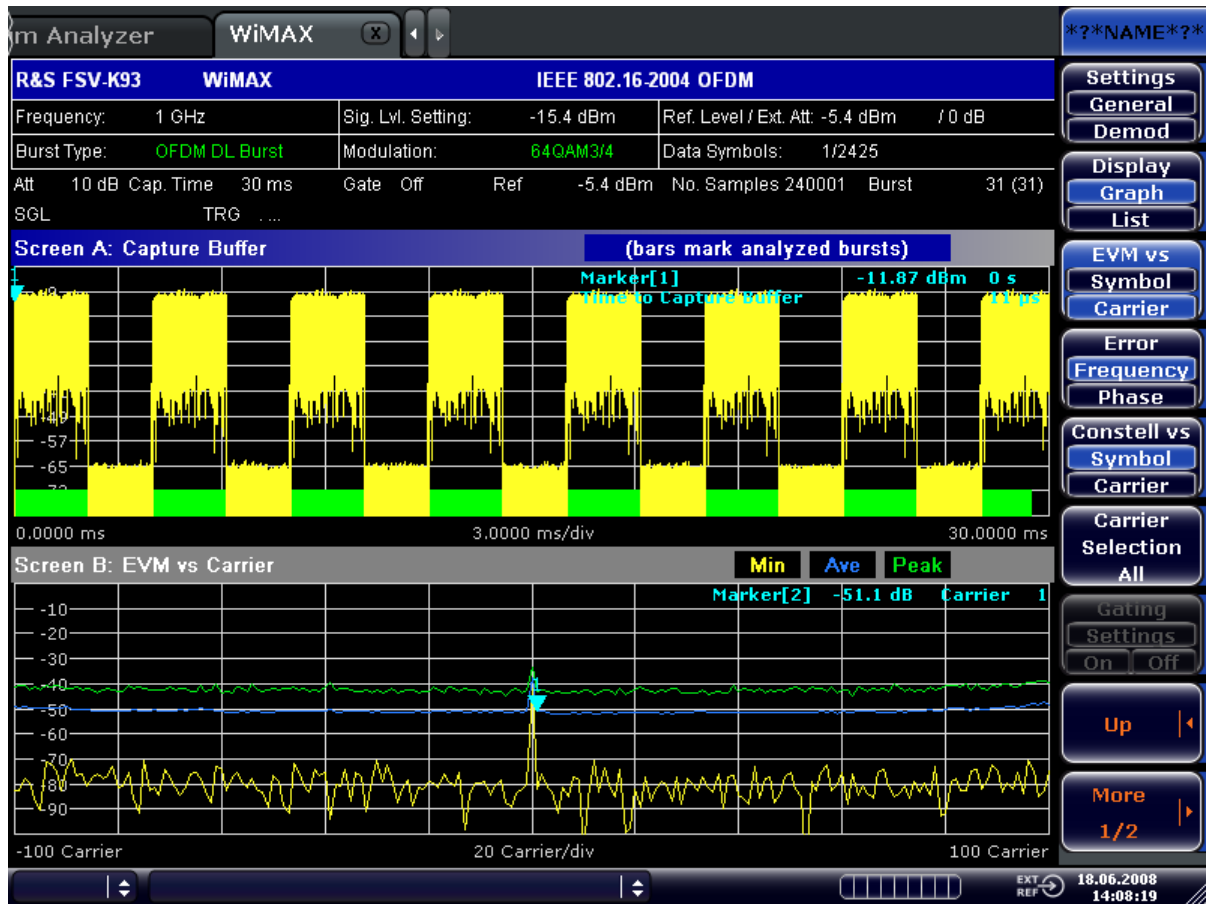


- EVM vs Symbol (IEEE 802.16e-2005 OFDMA/WiBro)
 

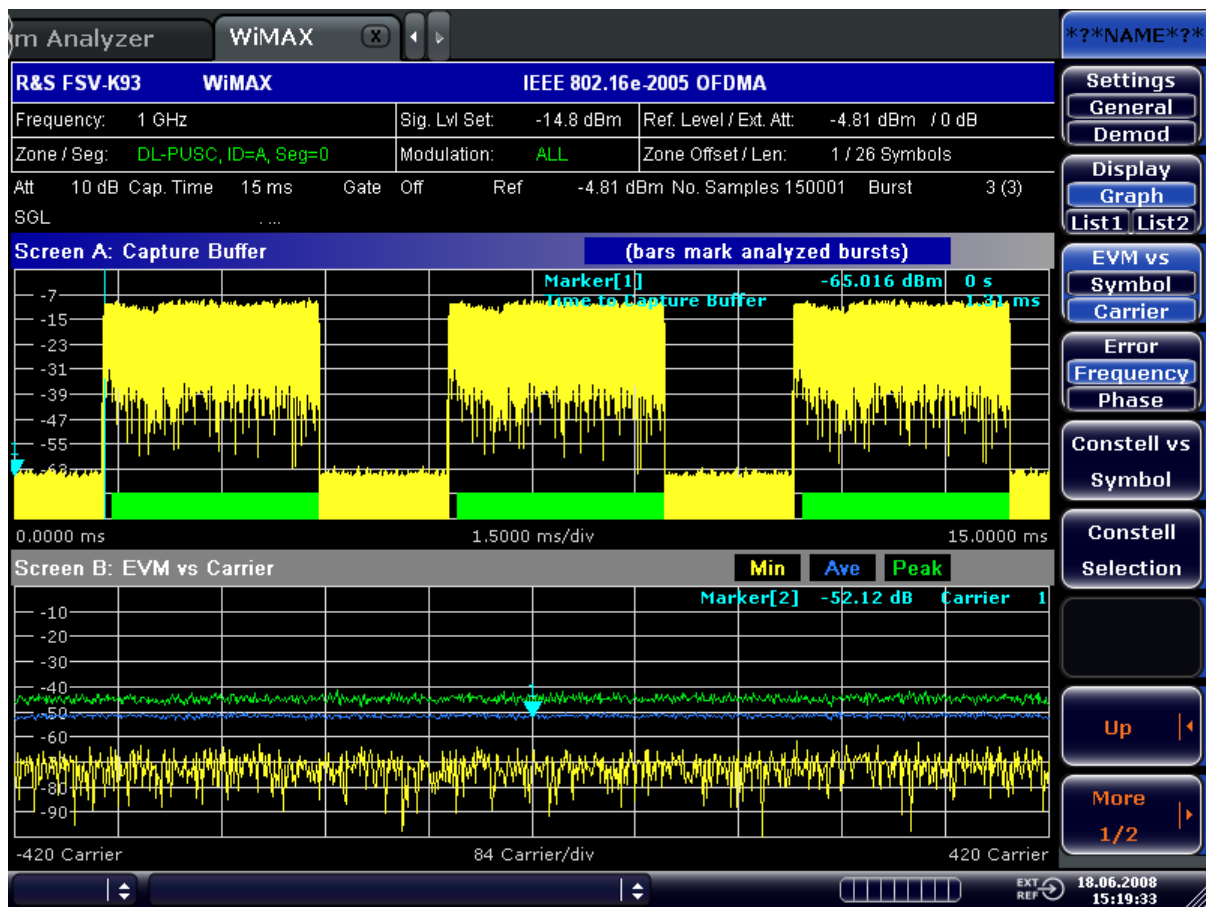
This result display shows all EVM values versus the symbols of the analyzed zone. If the capture buffer contains more than one analyzed zones, the corresponding result graphs will be appended. The minimum, mean, and maximum statistics is performed over carriers.



- EVM vs Carrier (IEEE 802.16-2004 OFDM)  
This result display shows all EVM values recorded on a per-carrier basis over the full set of measured data. The minimum, average and maximum traces are displayed.



- EVM vs Carrier (IEEE 802.16e-2005 OFDMA/WiBro)  
This result display shows all EVM values versus the physical carriers. The minimum, mean, and maximum statistics is performed over the symbols of all analyzed zones in the capture buffer.



SCPI command:

EVM vs Symbol: `CONF:BURS:EVM:ESYM`, see `CONFigure:BURSt:EVM:ESYMBOL[:IMMediate]` on page 155

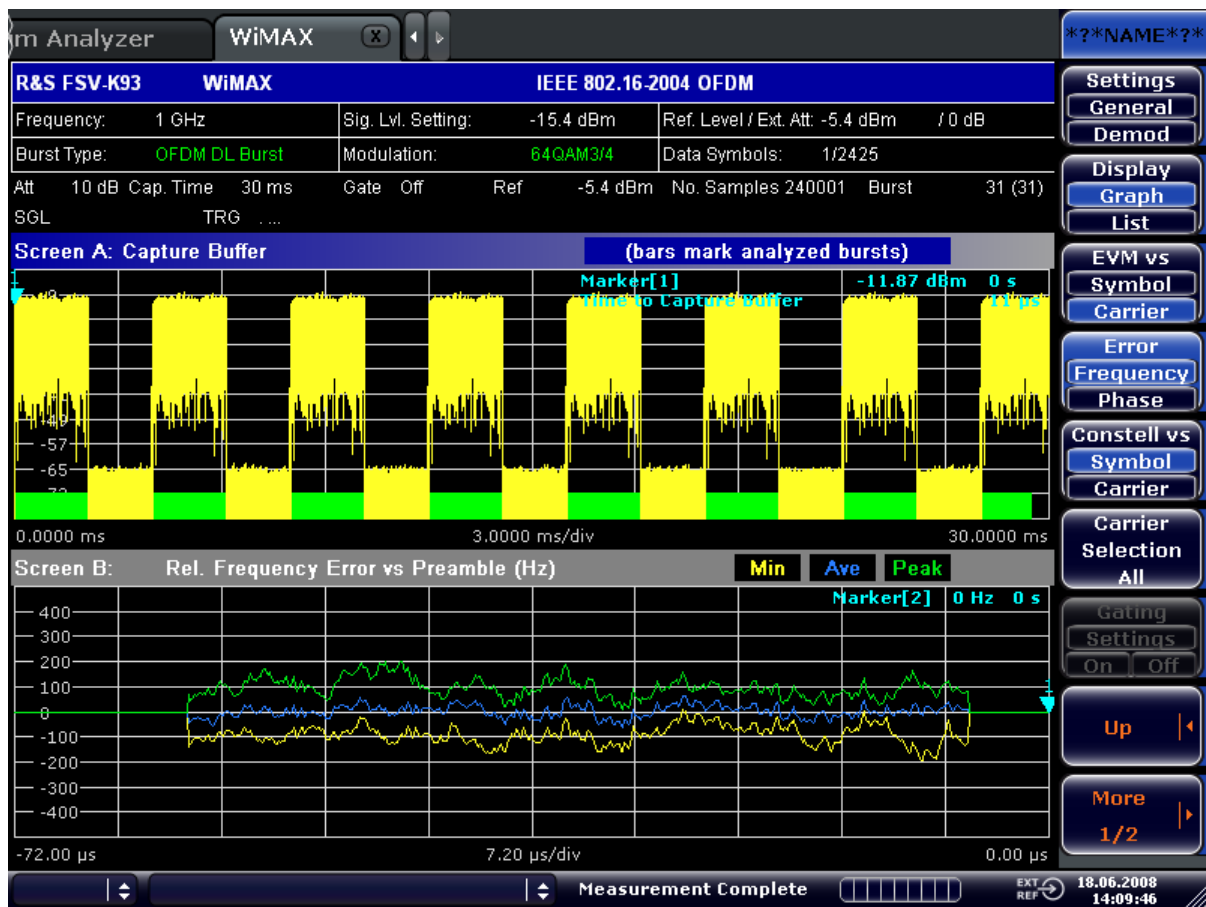
EVM vs Carrier: `CONF:BURS:EVM:ECAR`, see `CONFigure:BURSt:EVM:ECARrier[:IMMediate]` on page 155

#### Error Frequency/Phase (IEEE 802.16-2004 OFDM) ← EVM Constell

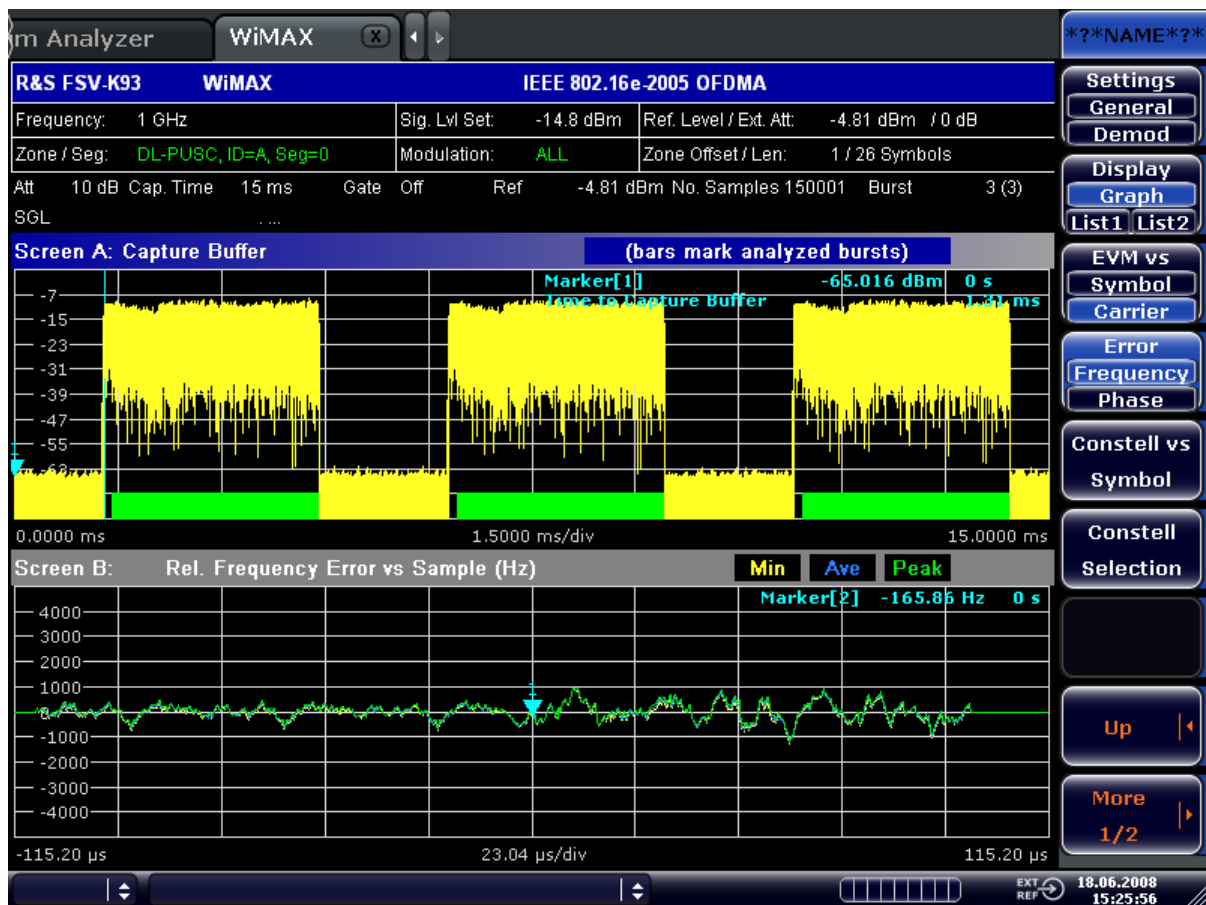
Selects the Frequency Error vs Preamble or the Phase Error vs Preamble result displays.

- Error Frequency/Phase (IEEE 802.16-2004 OFDM)  
These result displays show the error values recorded over the preamble part of the burst. A minimum, average and maximum error are displayed. The results display either relative frequency error or phase error.  
Using the **Y-Axis/Div** softkey, the scaling of the y-axis can be modified to allow the results to be scaled to an optimum level.





- Error Frequency/Phase (IEEE 802.16e-2005 OFDMA/WiBro)  
 These result displays show the error values recorded over the first two symbols of the subframe. In OFDMA/WiBro this measurement result is available under the following condition: All subchannels are used by data bursts. A minimum, average and maximum trace are displayed. The results display either relative frequency error or phase error.  
 Using the **Y-Axis/Div** softkey, the scaling of the y-axis can be modified to allow the results to be scaled to an optimum level.



SCPI command:

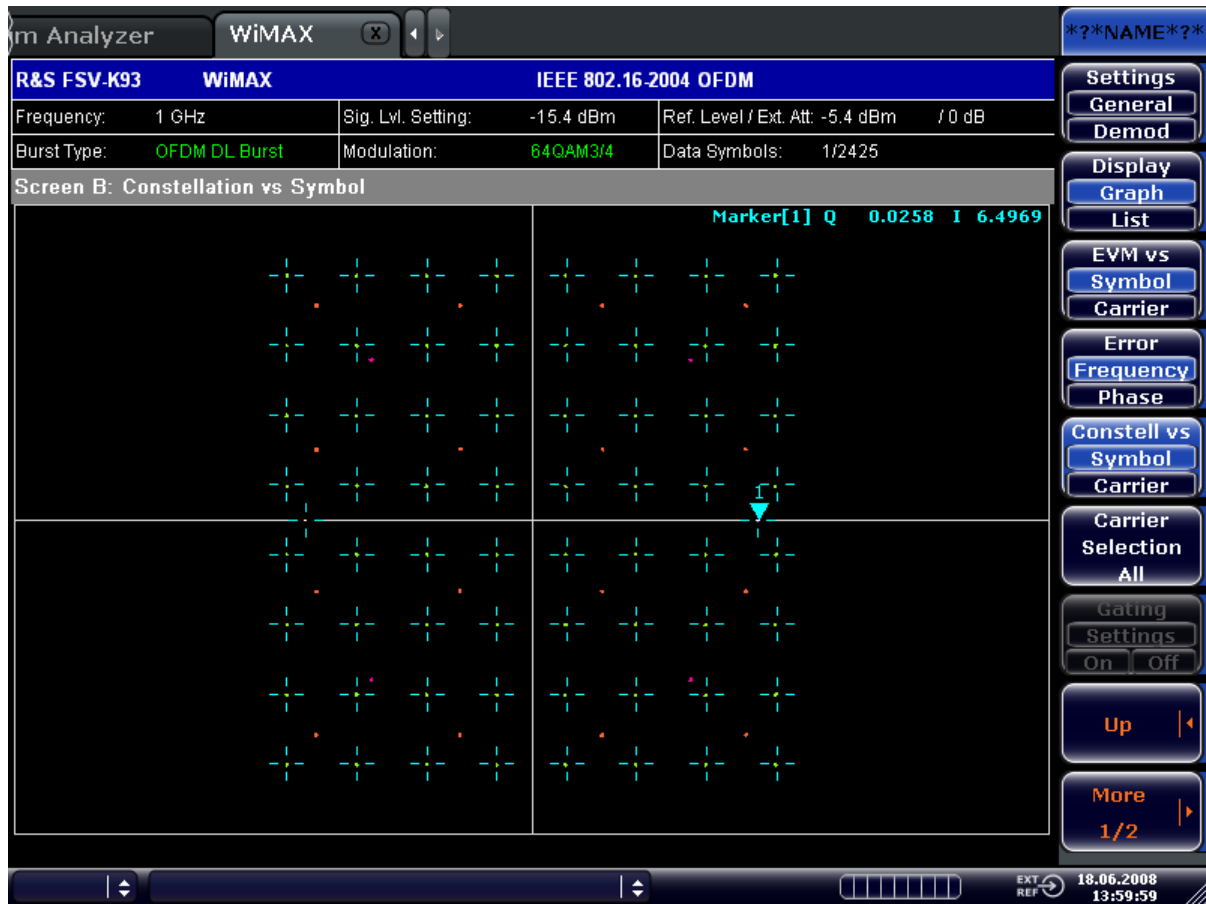
[CONFigure: BURSt: PREamble\[: IMMEDIATE\]](#) on page 155

[CONFigure: BURSt: PREamble: SElect](#) on page 156

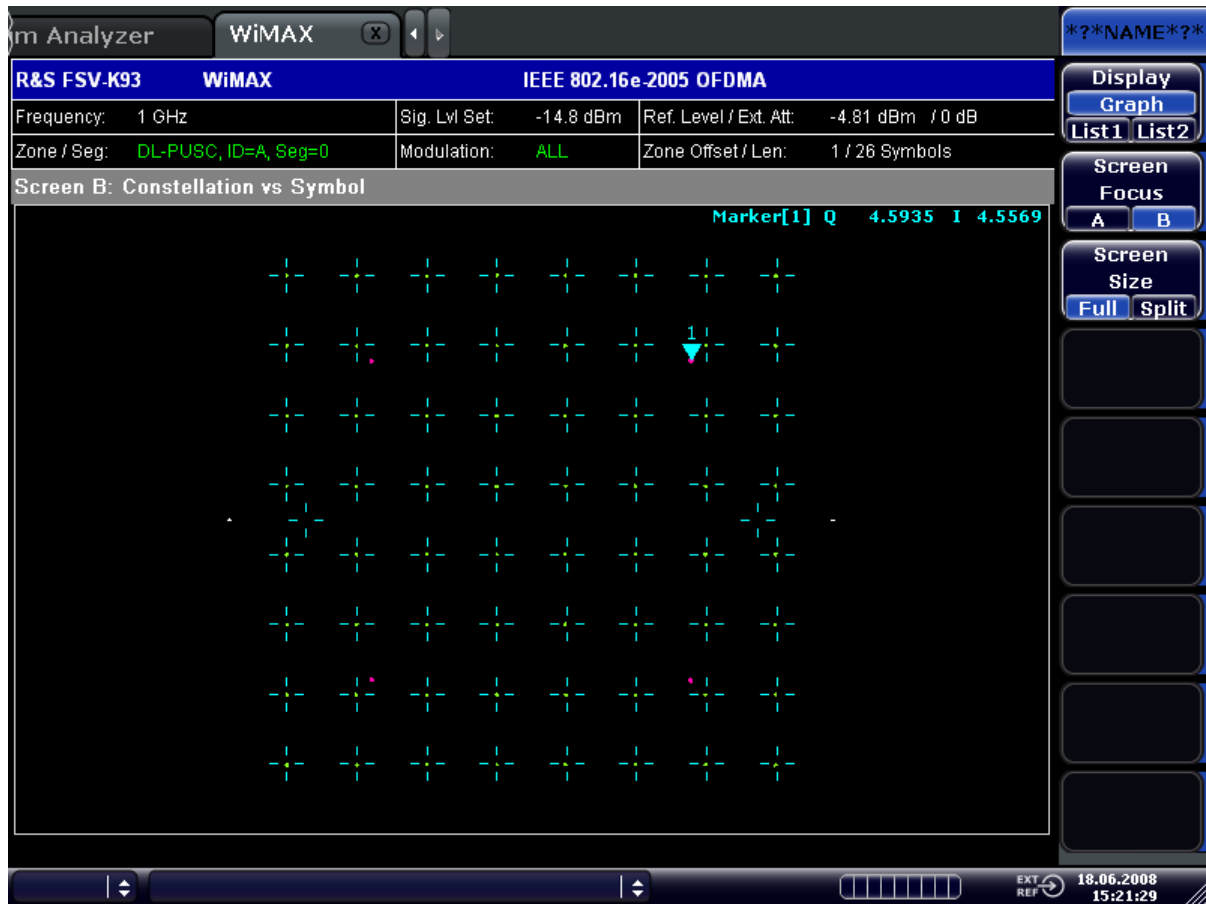
### Constell vs Symbol/Carrier ← EVM Constell

Selects the Constellation vs Symbol or the Constellation vs Carrier result displays.

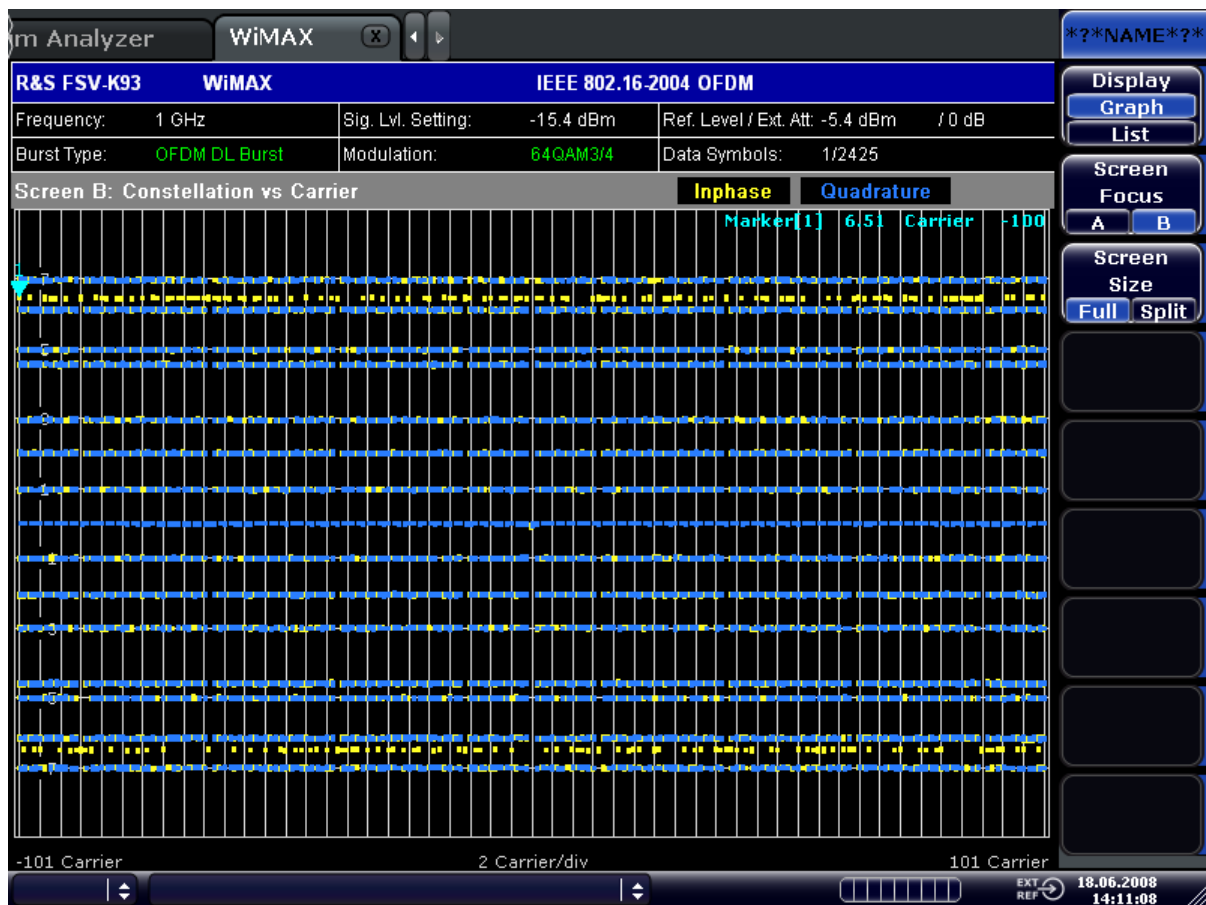
- Constellation vs Symbol (IEEE 802.16-2004 OFDM)  
This result display shows the in-phase and quadrature phase results over the full range of the measured input data. The ideal points for the selected modulations scheme are displayed for reference purposes.  
The amount of data displayed in the Constellation result display can be reduced by selecting the carrier or carriers for which data is to be displayed ([Carrier Selection All \(IEEE 802.16-2004 OFDM\)](#) softkey).



- **Constellation vs Symbol (IEEE 802.16e-2005 OFDMA/WiBro)**  
This result display shows the complex constellation diagram of the modulation symbols. The modulation symbols belong to the bursts of the analyzed zone. The different modulation formats are displayed in unique colors. The same color assignment is used in the Bitstream result display.  
The amount of data displayed in the Constellation result display can be reduced via the [Constell Selection \(IEEE 802.16e-2005 OFDMA/WiBro\)](#) softkey.



- Constellation vs Carrier (IEEE 802.16-2004 OFDM)  
This result display shows the in-phase and quadrature phase results over the full range of the measured input data plotted on a per-carrier basis. The magnitude of the in-phase and quadrature part is shown on the y-axis, both are displayed as separate traces (I-> trace 1, Q-> trace 2).



SCPI command:

[CONFigure:BURSt:CONSt:CSYMBOL\[:IMMEDIATE\]](#) on page 154

[CONFigure:BURSt:CONSt:CCARrier\[:IMMEDIATE\]](#) on page 154

#### **Carrier Selection All (IEEE 802.16-2004 OFDM) ← EVM Constell**

Opens a dialog box to select the carrier for data display. Either a specific carrier number, pilots only or all carriers can be selected.

SCPI command:

[CONFigure:BURSt:CONSt:CARRier:SElect](#) on page 153

#### **Constell Selection (IEEE 802.16e-2005 OFDMA/WiBro) ← EVM Constell**

Opens a dialog box for filtering the displayed results. The results may be filtered by any combination of modulation, burst, symbol, or carrier. If the constellation selection parameters are changed, the result display is updated accordingly.

SCPI command:

[CONFigure:BURSt:CONSt:SYMBOL:SElect](#) on page 154

[CONFigure:BURSt:CONSt:FORMat:SElect](#) on page 154

[CONFigure:BURSt:CONSt:BURSt:SElect](#) on page 153

#### **Y-Axis/Div ← EVM Constell**

Opens a dialog box to modify the y-axis settings (EVM vs Symbol/Carrier, Error Frequency/Phase measurements, if trace data is displayed):

- "Auto Scaling" The scaling of the y-axis is calculated automatically
- "Per Division" Specifies the scaling to be used if Auto Scaling is deactivated
- "Unit" Specifies the y-axis unit

SCPI command:

[DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]:AUTO](#) on page 182

[DISPlay\[:WINDow<n>\]:TRACe1:Y\[:SCALe\]:PDIVision](#) on page 183

[UNIT:EVM](#) on page 237

[UNIT:PREamble](#) on page 238

### Spectrum

Opens a submenu for frequency measurements.

#### **Spectrum Flat./Diff./Group Delay (IEEE 802.16-2004 OFDM, WiBro) ← Spectrum**

Toggles between the Spectrum Flatness, Flatness Difference, or Group Delay result display. The result can be displayed.

- **Spectrum Flatness**

The result display shows the average energy of the constellation points for the physical carriers being used for the channel estimation. You can define which parts of the subframe are to be used for the channel estimation. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics are performed over the parts of the subframe contributing to the channel estimation.

[CONFigure:BURSt:SPECTrum:FLATness\[:IMMediate\]](#) on page 158

Starts the Spectrum Flatness measurement.

[CONFigure:BURSt:SPECTrum:FLATness:SElect](#) on page 158

Selects the display mode for the results to be spectrum flatness.

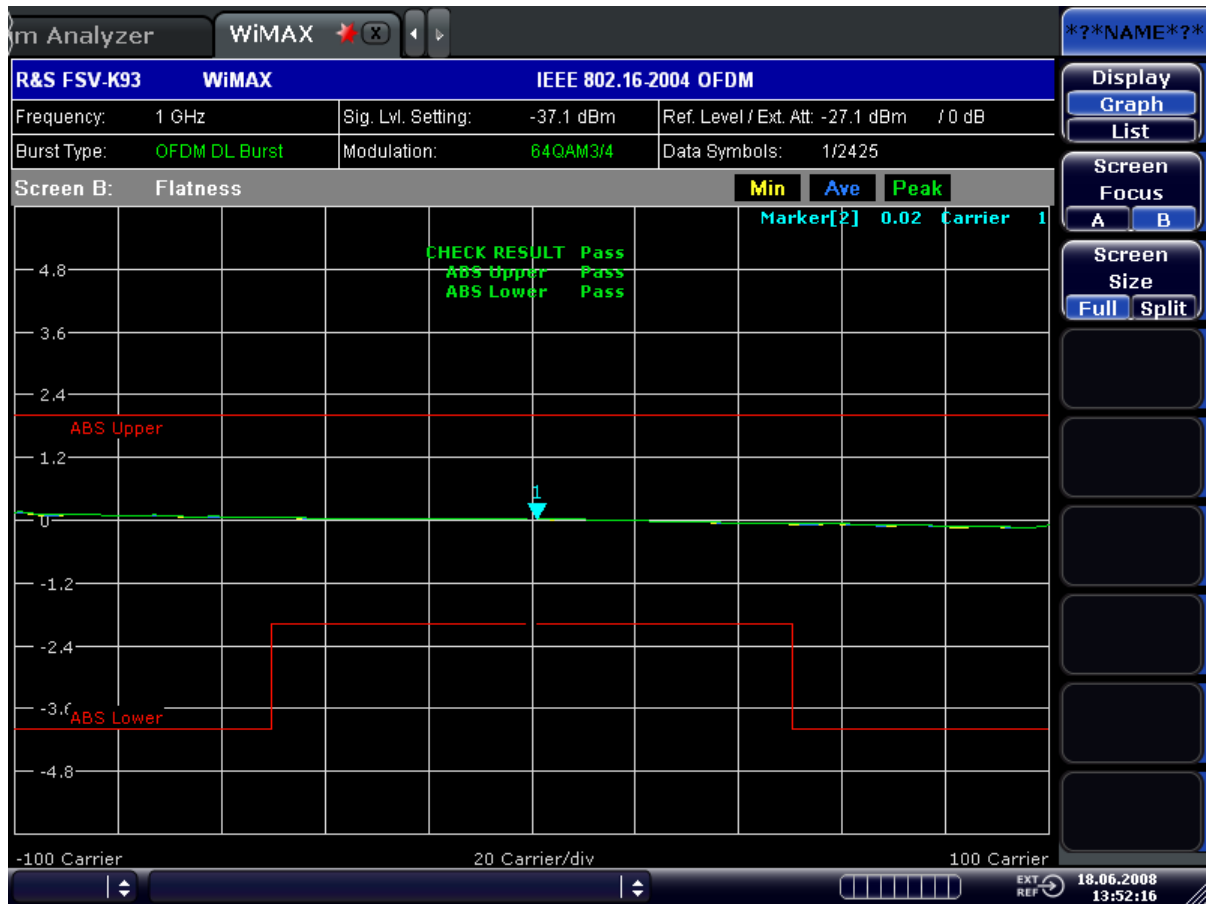


Fig. 4-7: Spectrum Flatness for IEEE 802.16-2004 OFDM and WiBro

- **Spectrum Flatness Difference**

The result display shows the absolute difference of adjacent carriers being used for the channel estimation. You can define which parts of the subframe are to be used for the channel estimation. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics are performed over the parts of the subframe contributing to the channel estimation.

[CONFigure:BURSt:SPECTrum:FLATness\[:IMMediate\]](#) on page 158

Selects the Spectrum Flatness measurement.

[CONFigure:BURSt:SPECTrum:FLATness:SElect](#) on page 158

Selects the display mode for the results to be spectrum flatness difference.

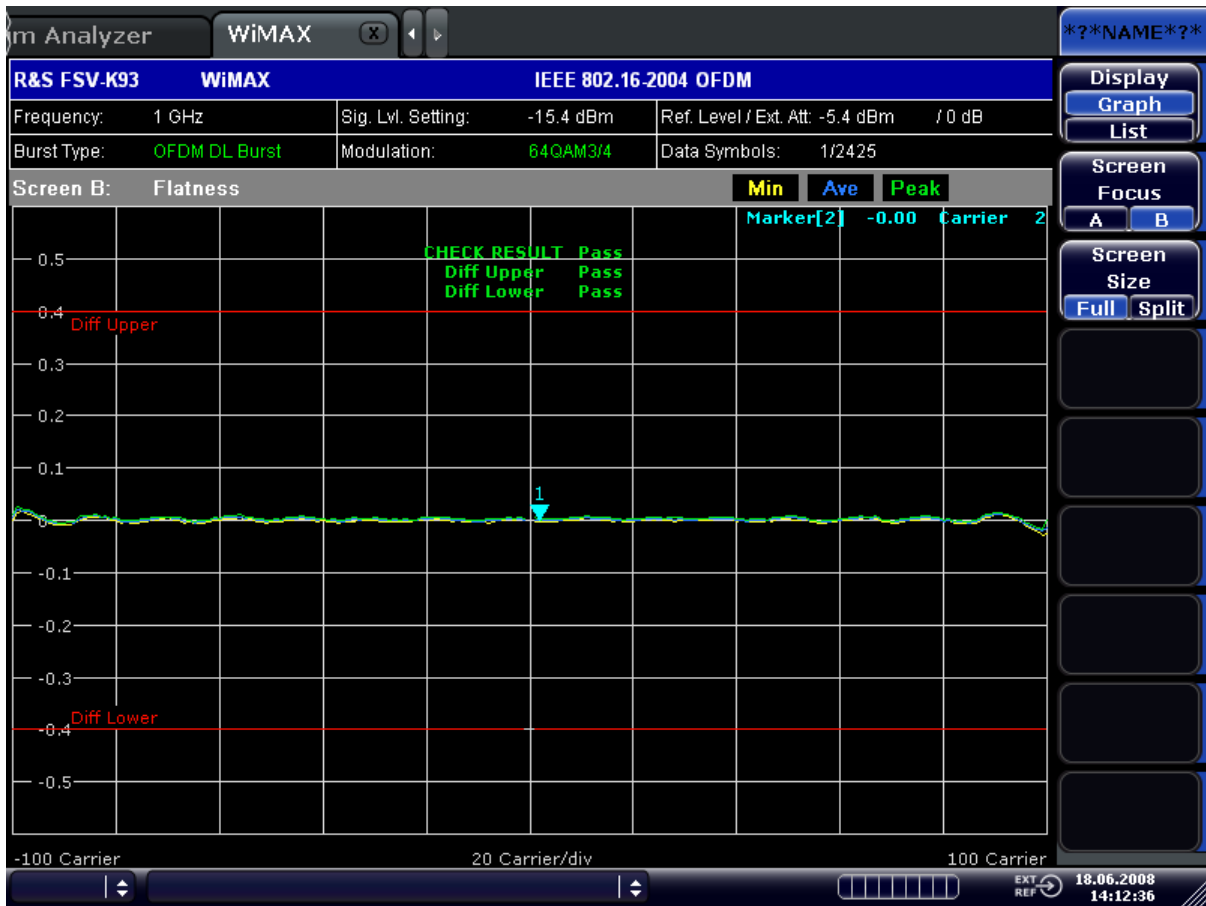


Fig. 4-8: Spectrum Flatness Difference for IEEE 802.16-2004 OFDM

- Group Delay



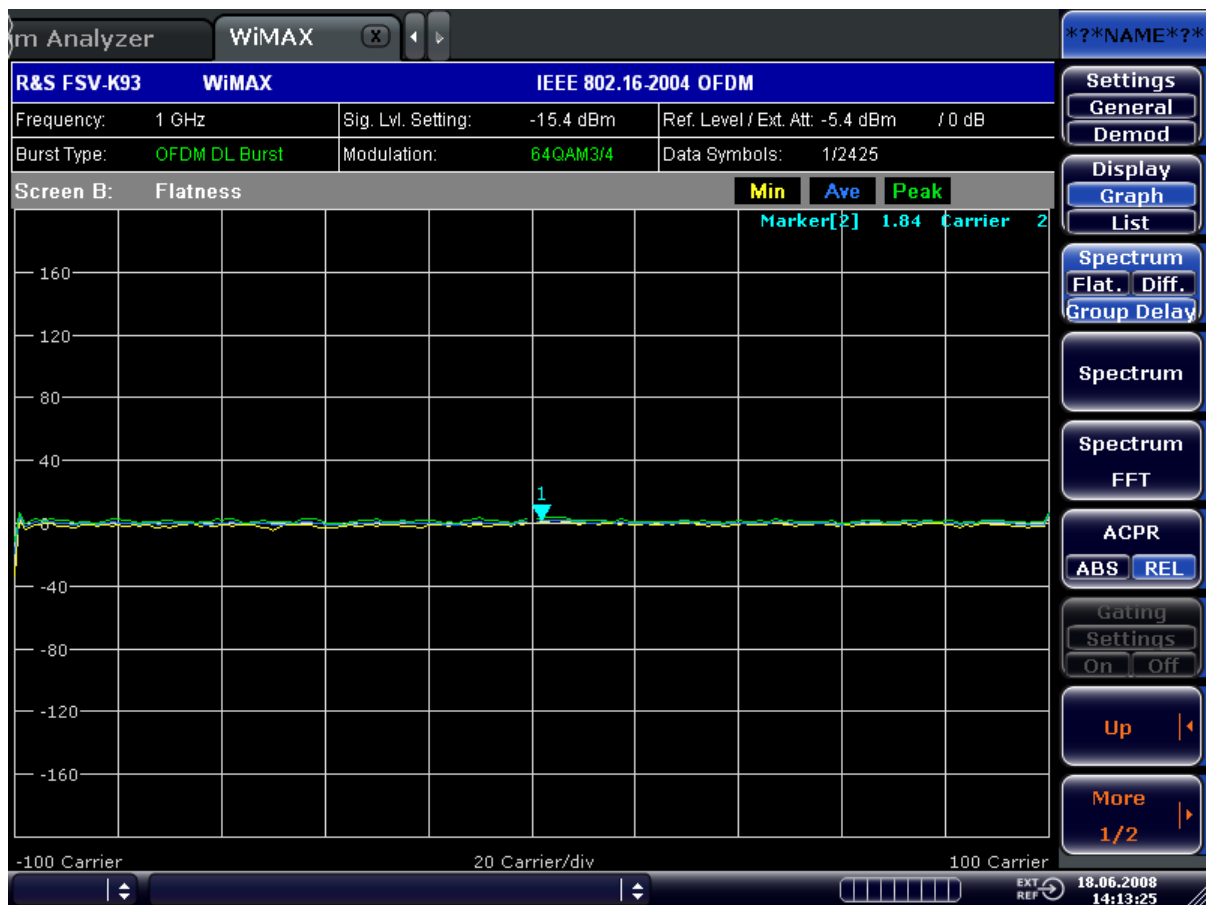


Fig. 4-9: Group Delay for IEEE 802.16-2004 OFDM

[CONFIGure:BURSt:SPECTrum:FLATness\[:IMMediate\]](#) on page 158

Selects the Spectrum Flatness measurement.

[CONFIGure:BURSt:SPECTrum:FLATness:SElect](#) on page 158

Selects the display mode for the results to be group delay.

#### Spectrum Flatness/Difference (IEEE 802.16e-2005 OFDMA) ← Spectrum

Toggles between the Spectrum Flatness and Flatness Difference result display. The result can be displayed.

- **Spectrum Flatness**

The result display shows the average energy of the constellation points for the physical carriers being used for the channel estimation. You can define which parts of the subframe are to be used for the channel estimation. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics are performed over the parts of the subframe contributing to the channel estimation.

[CONFIGure:BURSt:SPECTrum:FLATness\[:IMMediate\]](#) on page 158

Selects the Spectrum Flatness measurement.

[CONFIGure:BURSt:SPECTrum:FLATness:SElect](#) on page 158

Selects the display mode for the results to be spectrum flatness.

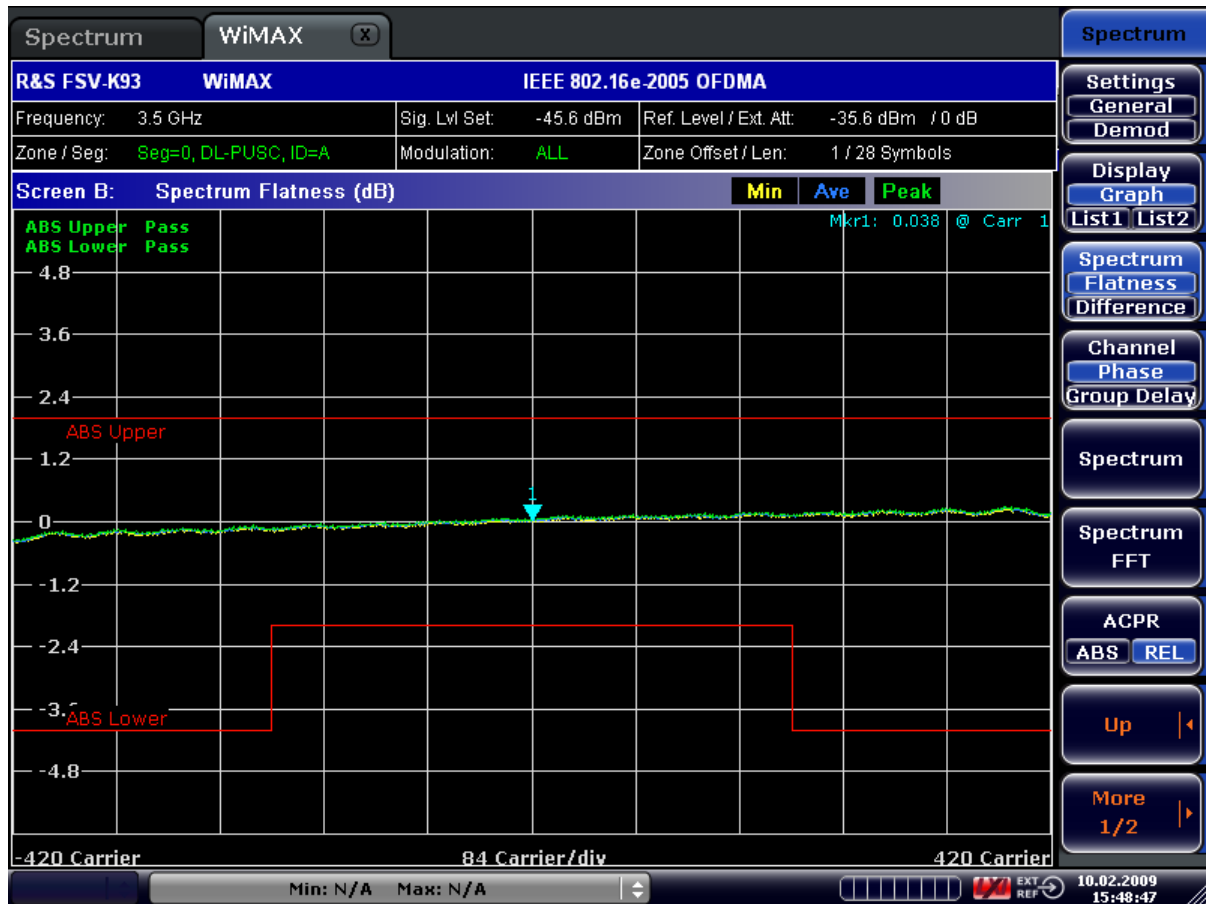


Fig. 4-10: Spectrum Flatness for IEEE 802.16e-2005 OFDMA

- **Spectrum Flatness Difference**

The result display shows the absolute difference of adjacent carriers being used for the channel estimation. You can define which parts of the subframe are to be used for the channel estimation. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics are performed over the parts of the subframe contributing to the channel estimation.

[CONFIGure:BURSt:SPECTrum:FLATness\[:IMMediate\]](#) on page 158

Selects the Spectrum Flatness measurement.

[CONFIGure:BURSt:SPECTrum:FLATness:SElect](#) on page 158

Selects the display mode for the results to be spectrum flatness difference.

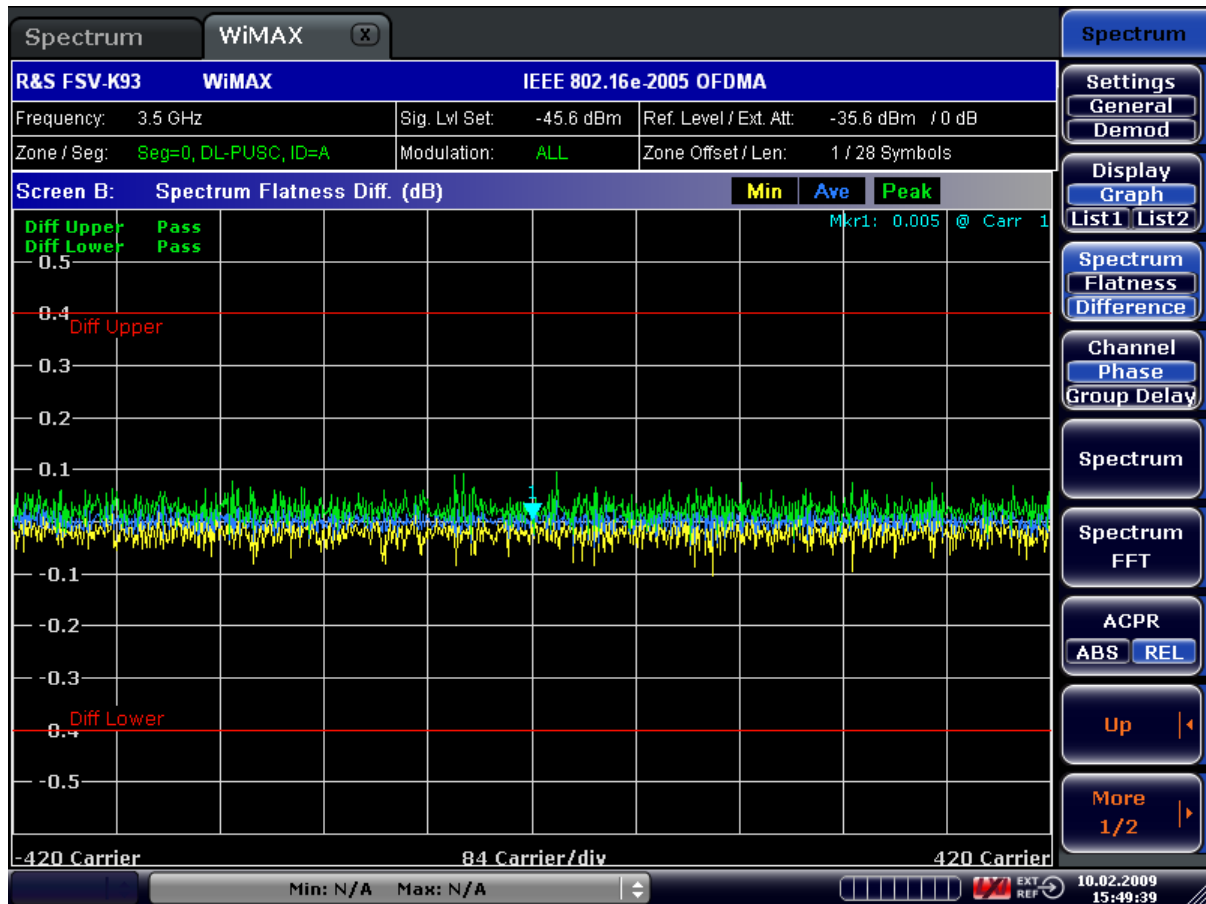


Fig. 4-11: Spectrum Flatness Difference for IEEE 802.16e-2005 OFDMA

#### Channel Phase/Group Delay (IEEE 802.16e-2005 OFDMA) ← Spectrum

Toggles between the Preamble Channel Frequency Response Phase and the Group Delay result display. The result can be displayed.

- **Channel Phase**

The result display shows the phase of the preamble channel frequency response. The limit lines are displayed according to the requirements of the standard. The Triangle marker indicated with a U indicates the minimal distance to the Upper Limit Line. The Triangle marker indicated with an L indicates the minimal distance to the Lower Limit Line. The minimum, mean, and maximum statistics are performed over the preambles of the analyzed subframes.

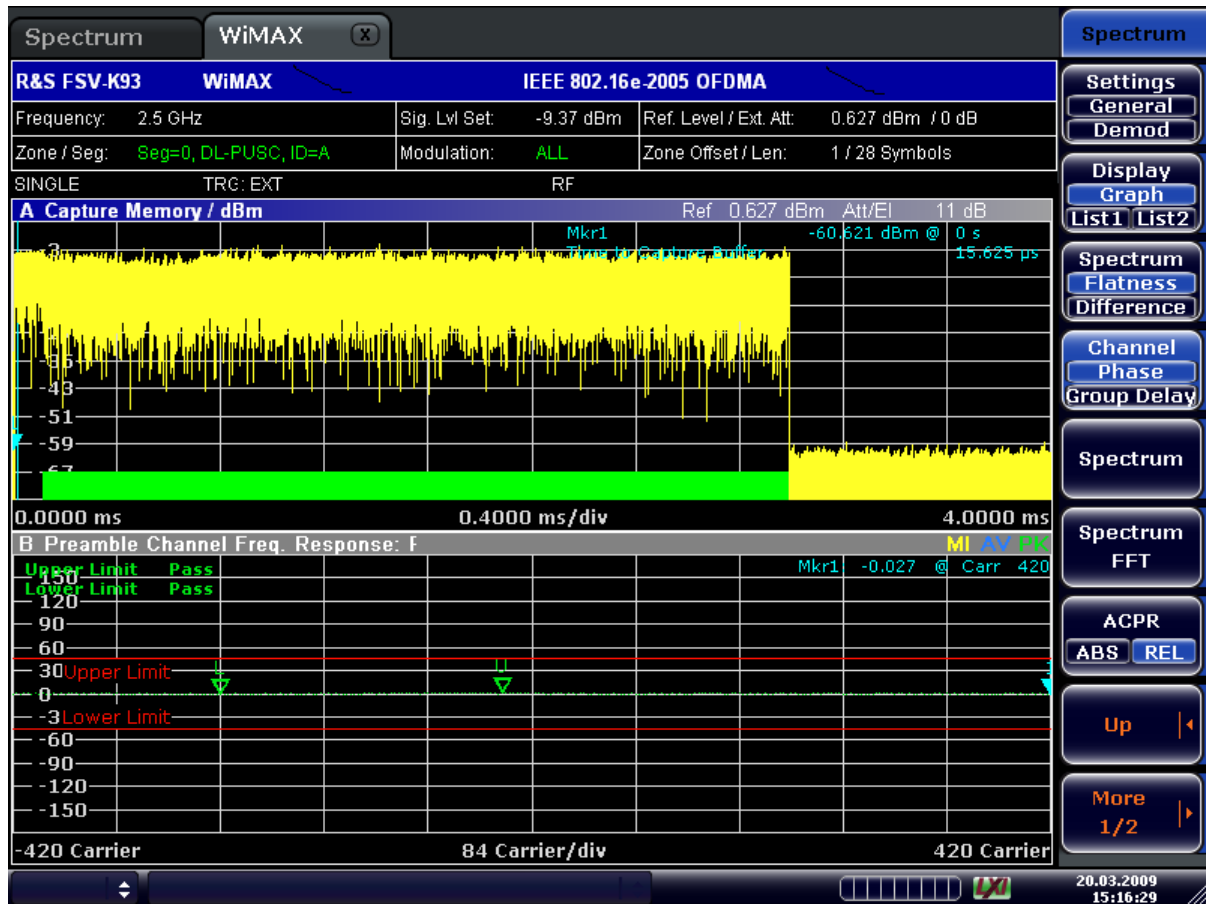


Fig. 4-12: Preamble Channel Frequency Response Phase for IEEE 802.16e-2005 OFDMA

CONFIGure: BURSt: SPECTrum: PHASe: PREAmble[: IMMEDIATE] on page 159  
Selects the Preamble Channel Frequency Response: Phase measurement.

- **Group Delay**

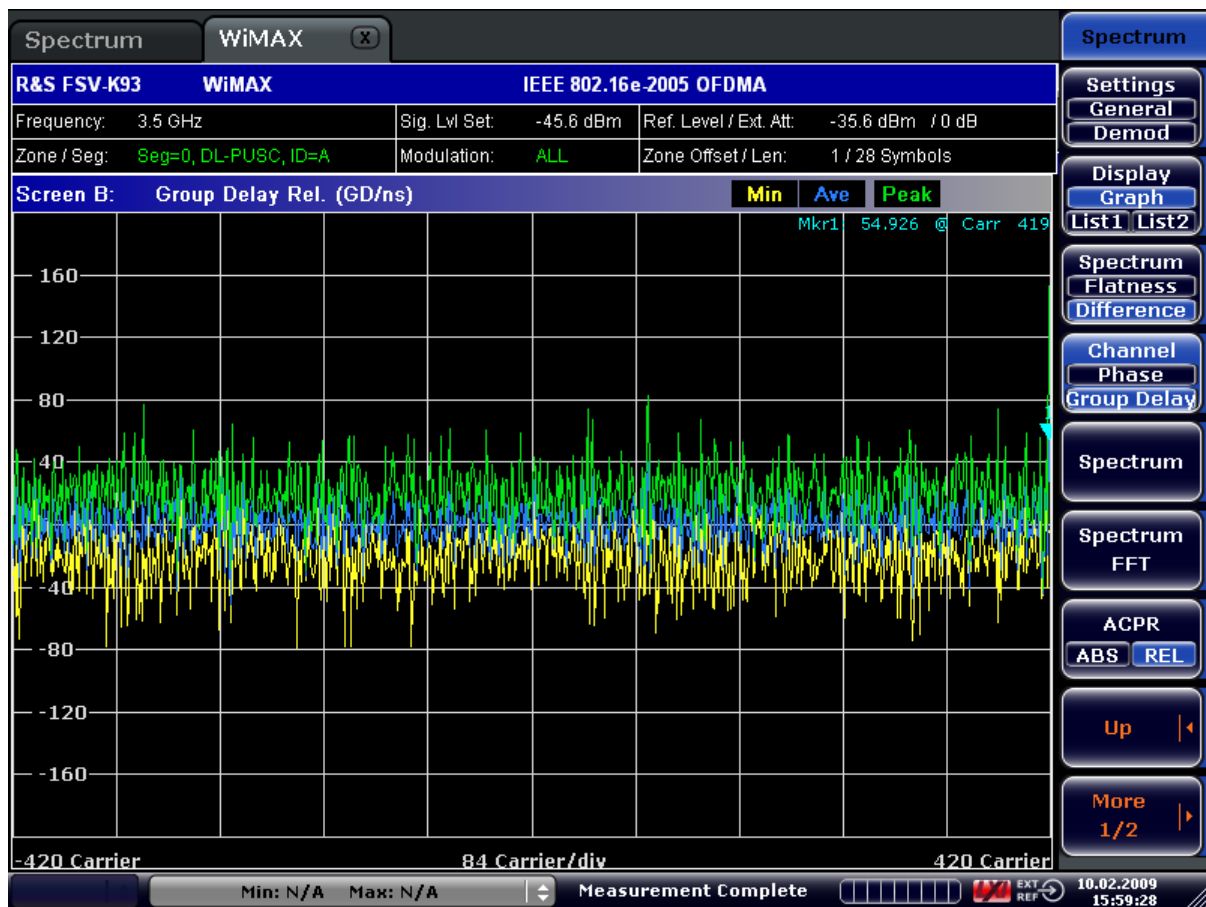


Fig. 4-13: Group Delay for IEEE 802.16e-2005 OFDMA/WiBro

#### Restrictions on OFDMA/WiBro Group Delay measurements

The measurement requires all useful carriers to be active (for example for a 1024 FFT size, 840 positions are required). This requirement does not depend on the subchannel bitmap, i.e. the bitgroups that are switched on. It solely depends on the FFT size and guard band.

This requirement is affected by the Channel Estimation Range parameters in the Demod Settings:

- - If Downlink (DL) = Preamble Only, then the requirement is automatically met.
- - If Downlink (DL) = Preamble and Payload/Payload Only, then all bitgroups must be switched on and all channels must be covered by data bursts.

#### Spectrum ← Spectrum

Selects the Spectrum Emission Mask result display, which consists of a graphical and tabular result.

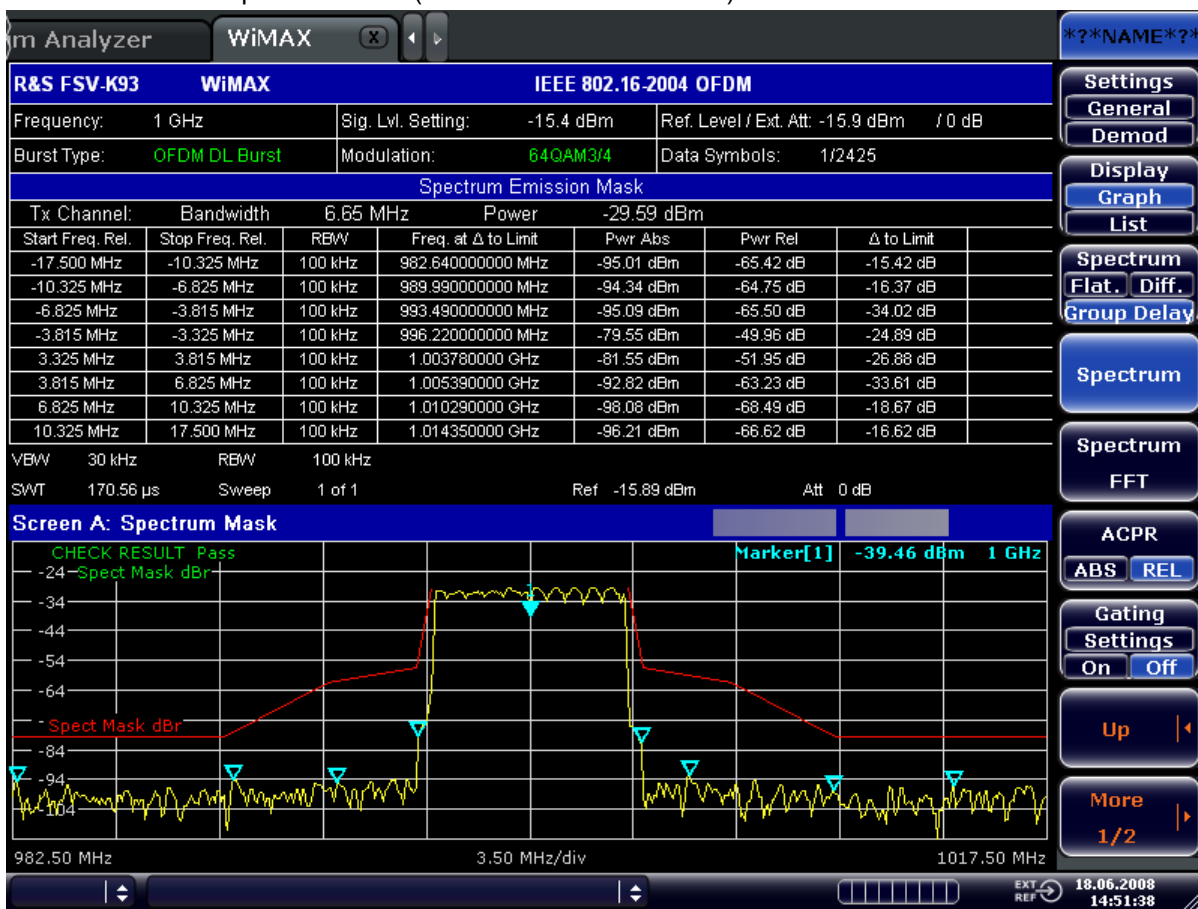
This result display shows power against frequency (as opposed to "Spectrum FFT" on page 74). A limit line representing the spectrum mask specified for the selected standard is displayed and an overall pass/fail status is displayed for the obtained results against this limit line.

For the IEEE 802.16-2004 OFDM, IEEE 802.16e-2005 OFDMA standards, the span of the results is related to the specified sample rate.

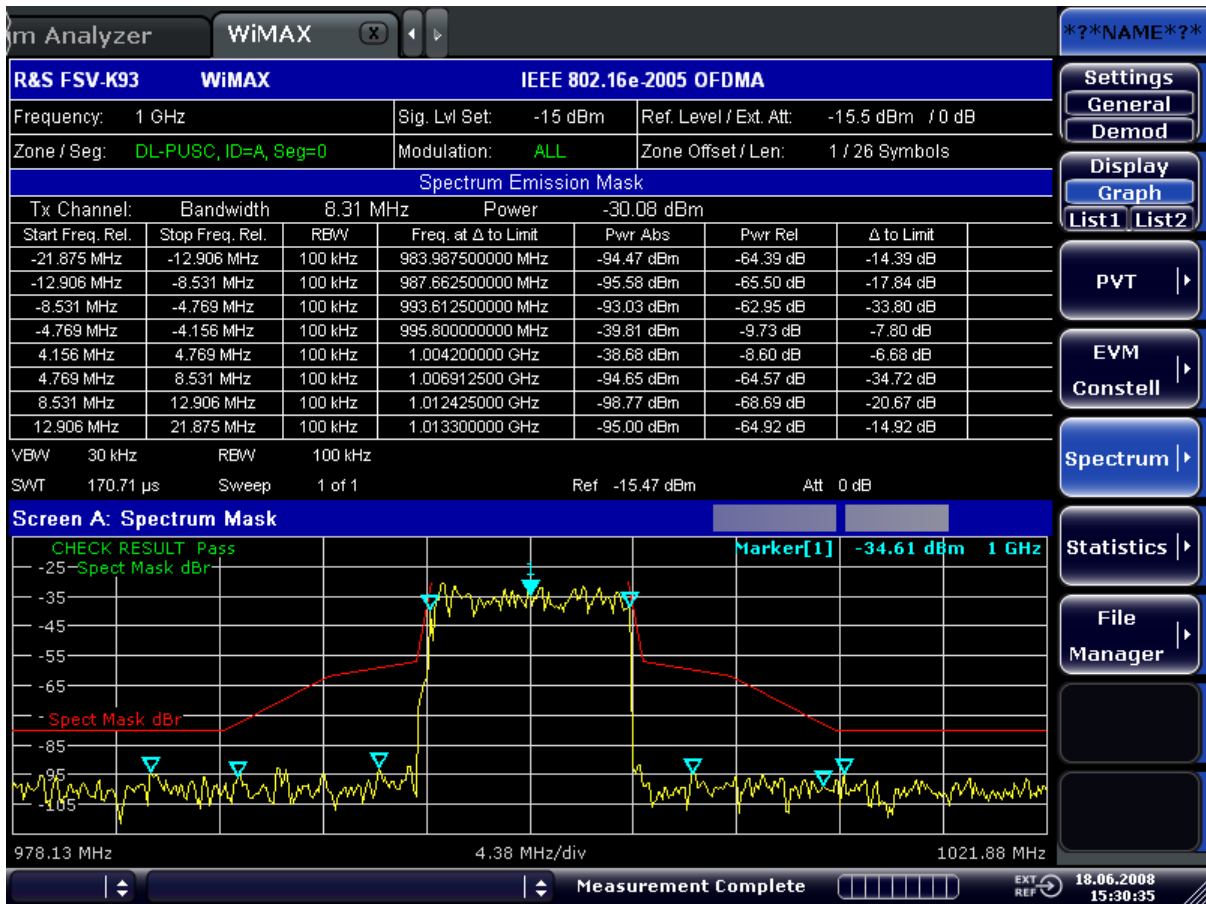
For the IEEE 802.16e-2005 WiBro standard, the table contains the results for each of the individual frequency ranges. On the trace, the highest power value is marked for each of the specified frequency ranges with a marker.

The number of sweeps is set in the General Settings dialog box, Sweep Count field. If the measurement is performed over multiple sweeps both a max hold trace and an average trace are displayed. For the IEEE 802.16e-2005 WiBro standard, the Spectrum Emission Mask measurement is configured via the [SEM Settings](#) softkey.

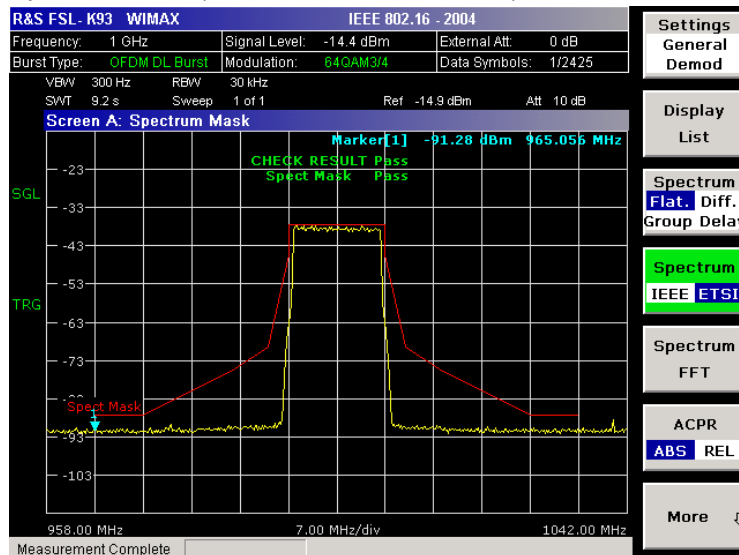
- Spectrum IEEE (IEEE 802.16-2004 OFDM)



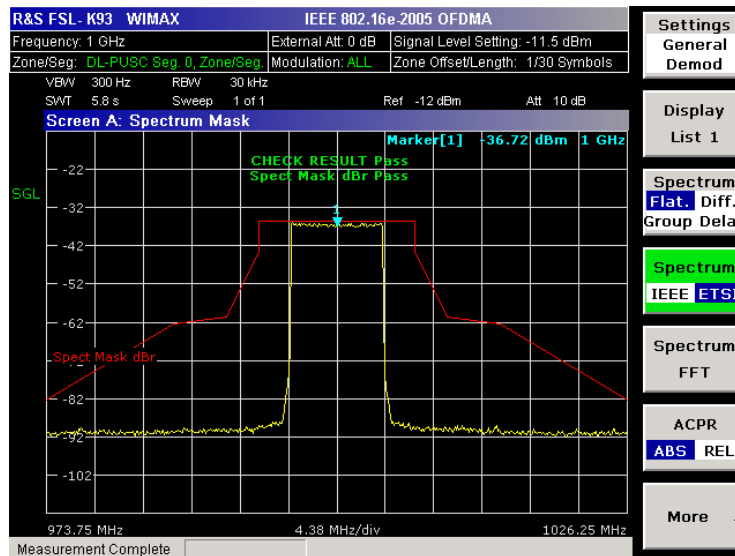
- Spectrum IEEE (IEEE 802.16e-2005 OFDMA)



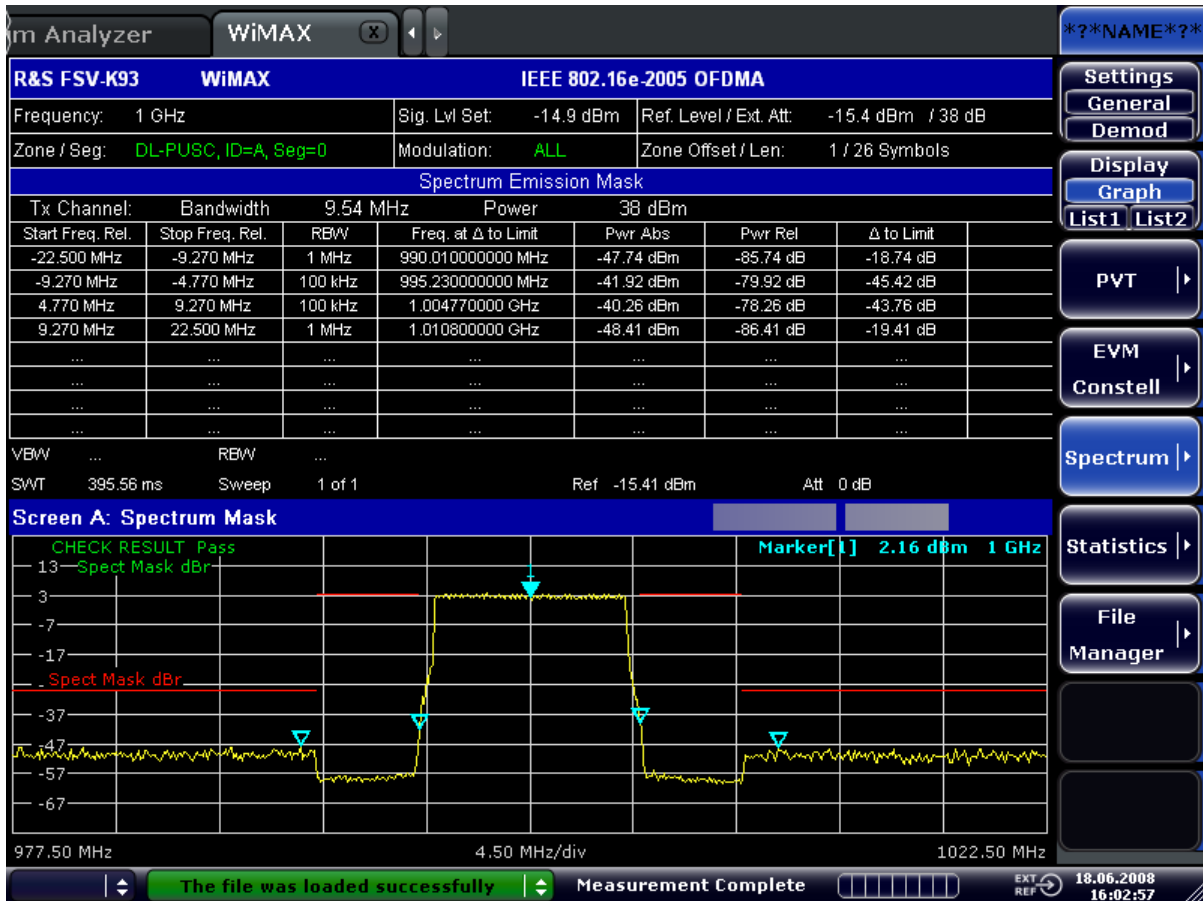
- Spectrum ETSI (IEEE 802.16-2004 OFDM)



- Spectrum ETSI (IEEE 802.16e-2005 OFDMA)



- IEEE 802.16e-2005 WiBro



SCPI command:  
[CONFigure:BURSt:SPECTrum:MASK\[:IMMEDIATE\]](#) on page 159  
[CONFigure:BURSt:SPECTrum:MASK:SELEct](#) on page 159

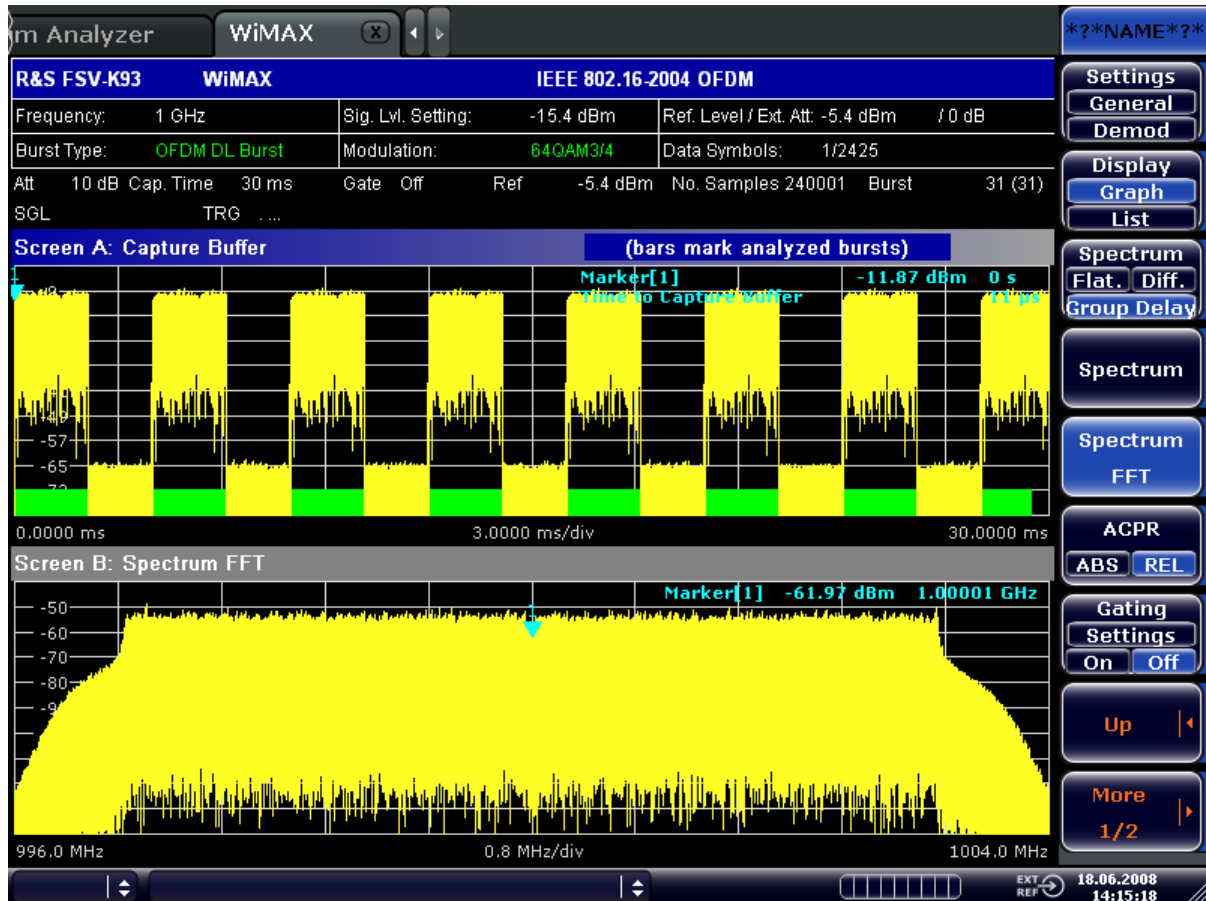


**Spectrum FFT ← Spectrum**

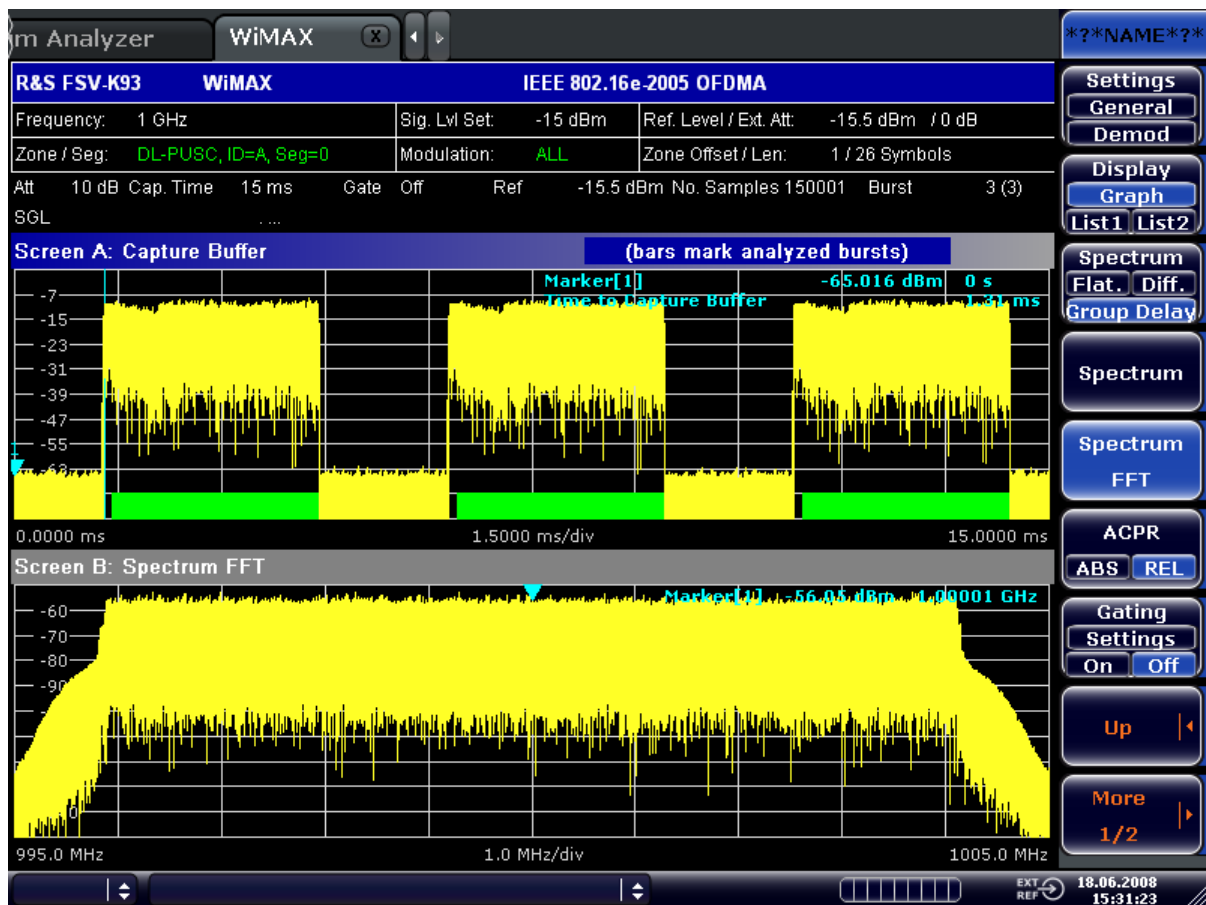
Selects the Spectrum FFT result display (as opposed to "Spectrum" on page 70), either in graphical form ("Display Graph" selected), or in tabular form ("Display List 1/2" selected).

This result display shows the Power vs Frequency results obtained from a FFT performed over the range of data in the Magnitude Capture Buffer which lies within the gate lines. If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the **Refresh** softkey in the Sweep menu.

- IEEE 802.16-2004 OFDM



- IEEE 802.16e-2005 OFDMA/WiBro



SCPI command:

`CONF:BURSt:SPECTrum:FFT[:IMMediate]` on page 158

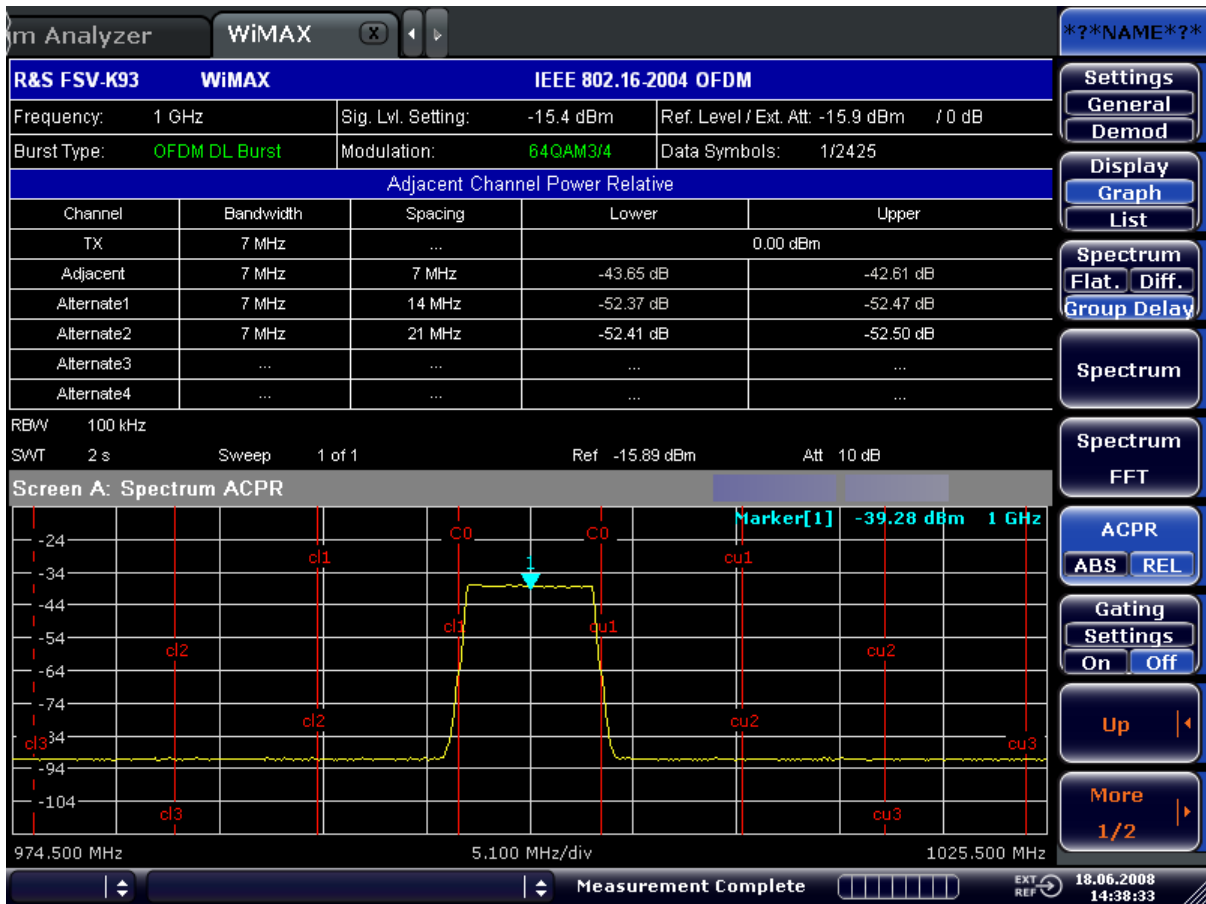
#### ACPR Abs/Rel ← Spectrum

Sets the ACPR (Adjacent Channel Power Relative) result display in graphical form ("Display Graph" selected), or in tabular form ("Display List 1/2" selected).

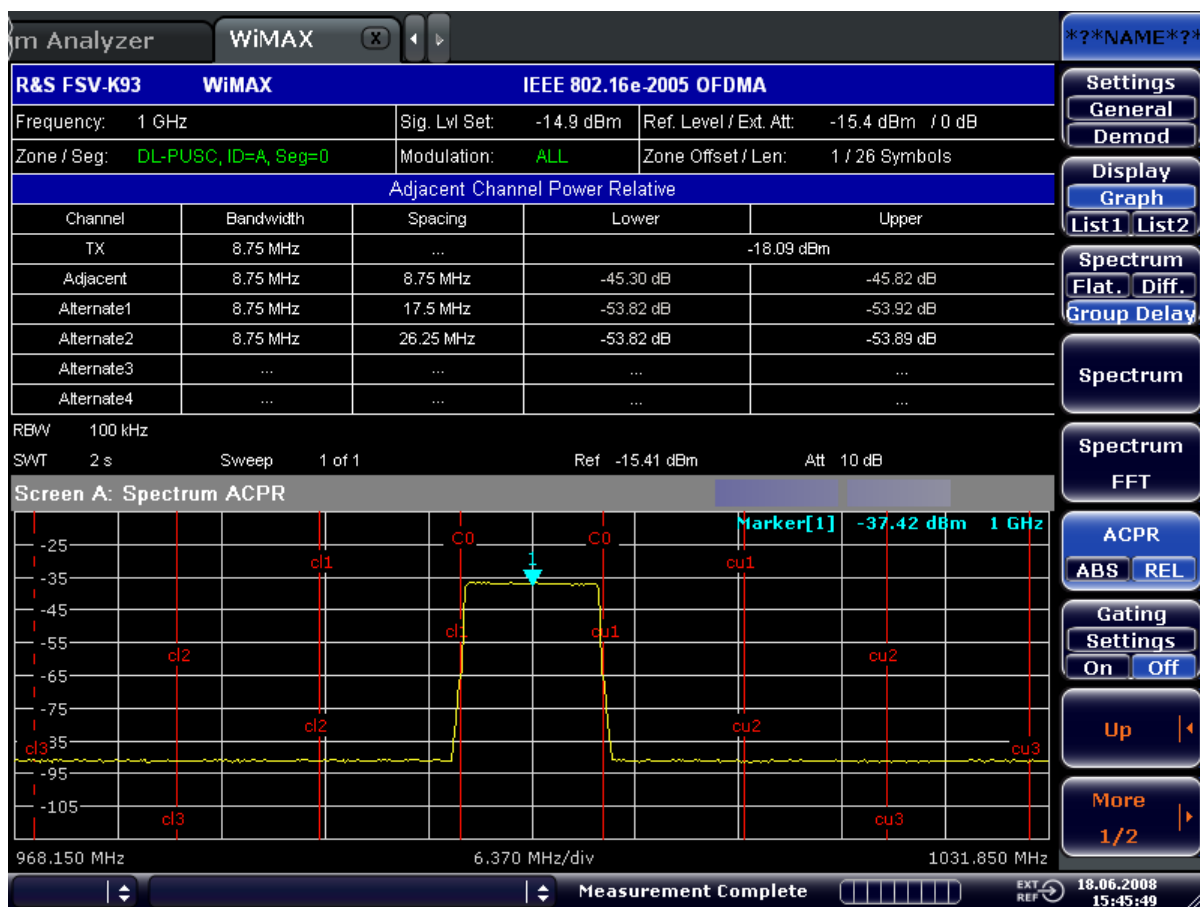
This result display is similar to the Spectrum Mask measurement, and provides information about leakage into adjacent channels. The results show the relative power measured in the three nearest channels either side of the measured channel. This measurement is the same as the adjacent channel power measurement provided by the spectrum analyzer.

The number of sweeps is set in the "General Settings" dialog box, "Sweep Count" field (see [chapter 4.3.2, "General Settings Dialog Box"](#), on page 86). If the measurement is performed over multiple sweeps both a max hold trace and an average trace are displayed.

- IEEE 802.16-2004 OFDM



- IEEE 802.16e-2005 OFDMA/WiBro



SCPI command:

[CONFigure: BURSt: SPECTrum: ACPR\[: IMMEDIATE\]](#) on page 157

[CONFigure: BURSt: SPECTrum: ACPR: SElect](#) on page 157

[CALCulate<n>: MARKer<m>: FUNCTION: POWer: RESult\[: CURrent\]](#) on page 145

[CALCulate<n>: MARKer<m>: FUNCTION: POWer: RESult: MAXHold](#) on page 149

### SEM Settings ← Spectrum

Opens the "Spectrum Emission Mask Settings" dialog box to configure the Spectrum Emission Mask measurement.

The other parameters are set by default.

SCPI command:

[\[SENSe:\] POWer: SEM: TTA](#) on page 214

[\[SENSe:\] POWer: SEM: MODE](#) on page 213

[\[SENSe:\] POWer: SEM: CLASs](#) on page 213

### SEM according to ← SEM Settings ← Spectrum

Specifies how the Spectrum Emission Mask settings and limits are applied. This parameter provides the following settings:

"TTA Stand-ard" as specified in the standard

"ETSI" Settings and limits are as specified in the standard (OFDM/OFDMA)

"USER" as specified in the selected XML file

SCPI command:

[SENSe:] POWER:SEM:TTA on page 214

#### File Name ← SEM Settings ← Spectrum

When "SEM according to":"User" settings are specified, "File Name" shows the name of the loaded XML file. Clicking the arrow switches to the File Manager to locate an XML file, and automatically selects "SEM according to":"User".

When using "ETSI" or "IEEE" standards, "File Name" indicates the name of the built-in configuration.

SCPI command:

MMEMory:LOAD:SEM:STATe 1, on page 201

#### Link Direction ← SEM Settings ← Spectrum

Sets the link direction:

"UL" uplink

"DL" downlink

#### Power Class ← SEM Settings ← Spectrum

Sets the power class

"Auto" automatic selection

"(-INF, 23) power class values for uplink  
dBm, (23, INF)  
dBm"

"(-INF, 29) power class values for downlink  
dBm, (29, 40)  
dBm, (40, INF)  
dBm"

SCPI command:

[SENSe:] POWER:SEM:CLASs on page 213

#### SEM Configuration ← SEM Settings ← Spectrum

The table shows the settings and limits applied over specified frequency ranges around the TX channel. The displayed settings depend on the selected [Power Class](#) and [Link Direction](#)

#### ACP Settings ← Spectrum

Opens the "ACP Settings" dialog box to configure the ACPR result display. By default, the ACP settings are derived from the "General Settings" dialog box, "Channel BW" field (see [chapter 4.3.2, "General Settings Dialog Box"](#), on page 86).

Group	Field	Description
Channels	No. of Channels	Specifies the number of channels adjacent to the transmit channel to be measured. If set to 0, only the transmit channel is measured.
TX/ACP Channel BW	TX	Specifies the bandwidth of the transmit channel to be measured by the ACP measurement.
	Adjacent, Alternate 1, Alternate 2, Alternate 3, Alternate 4	Specifies the bandwidth of the first to fifth channel before and after the transmit channel to be measured.
ACP Channel Spacing	Adjacent, Alternate 1, Alternate 2, Alternate 3, Alternate 4	Specifies the spacing of the first to fifth channel before and after the transmit channel to be measured.

SCPI command:

[\[SENSe:\] POWER:ACHannel:ACPairs](#) on page 210

[\[SENSe:\] POWER:ACHannel:BANDwidth|BWIDth\[:CHANnel<channel>\]](#)  
on page 210

[\[SENSe:\] POWER:ACHannel:SPACing\[:ACHannel\]](#) on page 212

[\[SENSe:\] POWER:ACHannel:SPACing:ALternate<channel>](#) on page 212

[\[SENSe:\] POWER:ACHannel:BANDwidth|BWIDth:ACHannel](#) on page 211

[\[SENSe:\] POWER:ACHannel:BANDwidth|BWIDth:ALternate<channel>](#)  
on page 211

### Statistics

Opens a submenu to display statistics measurement results.

#### CCDF ← Statistics

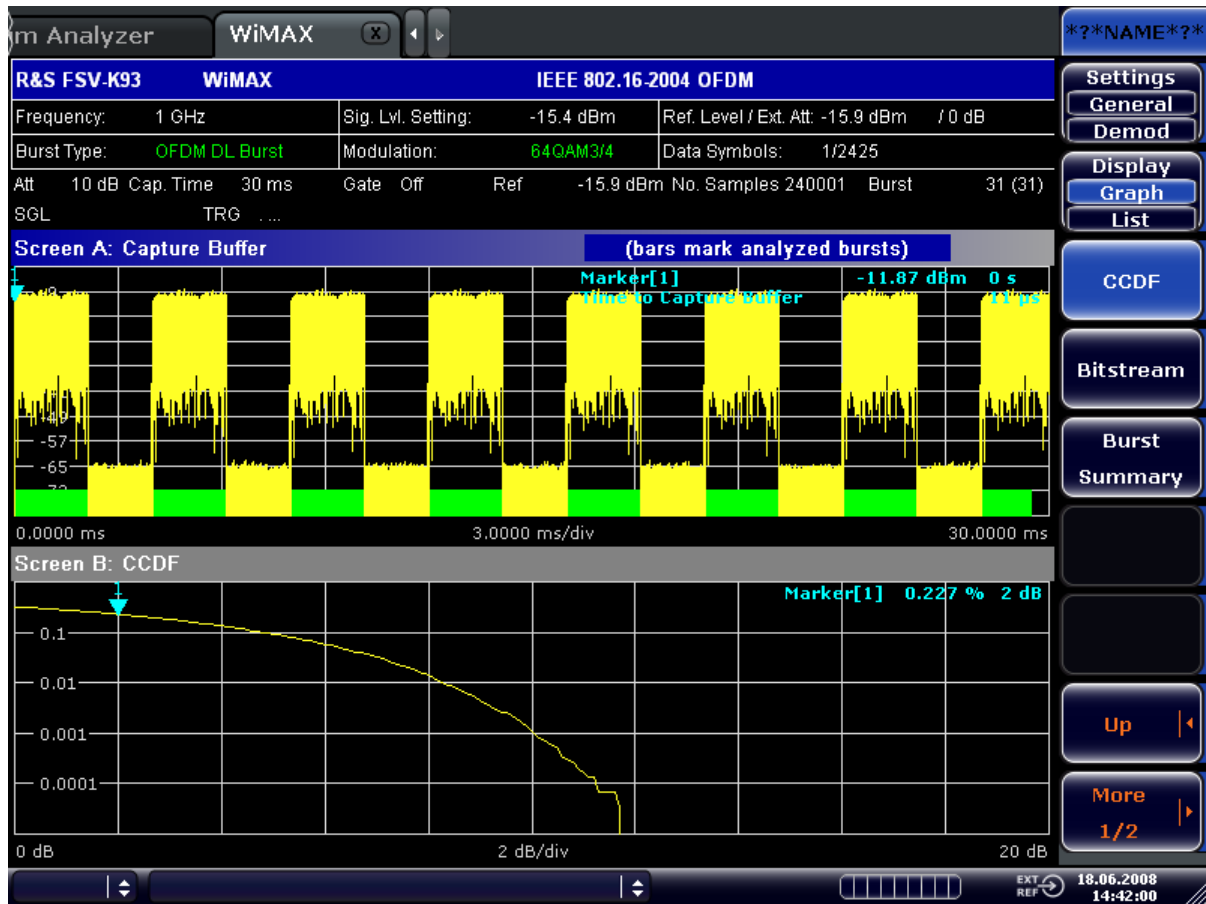
Sets the CCDF result display.

This result display shows the probability of an amplitude within the gating lines exceeding the mean power measured between the gating lines. The x-axis displays power relative to the measured mean power.

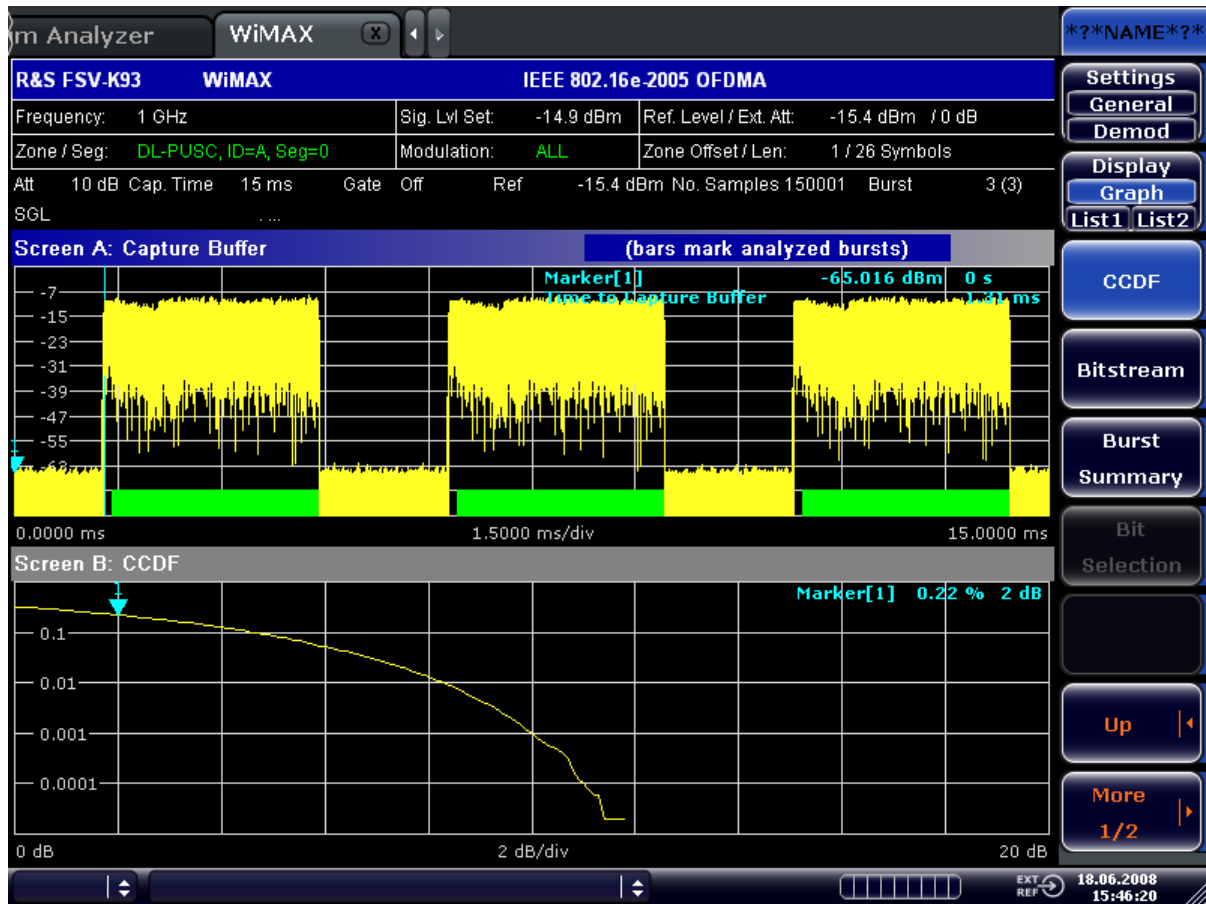
If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the [Refresh](#) softkey in the "Sweep" menu.

- IEEE 802.16-2004 OFDM

## Softkeys of the WiMAX, WiBro Menu (R&amp;S FSV-K93)



- IEEE 802.16e-2005 OFDMA/WiBro



SCPI command:

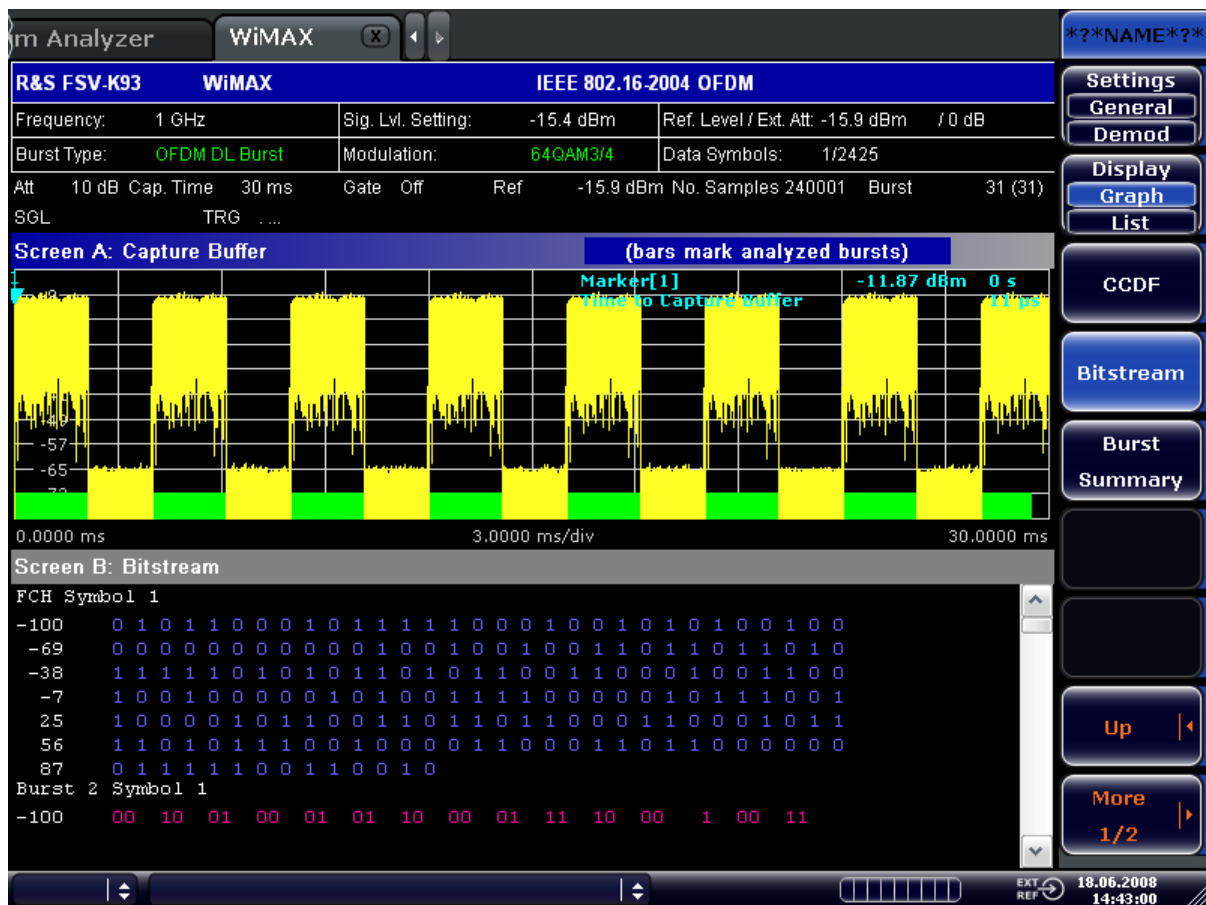
[CONFigure: BURSt: STATistics: CCDF\[: IMMEDIATE\]](#) on page 161

#### Bitstream ← Statistics

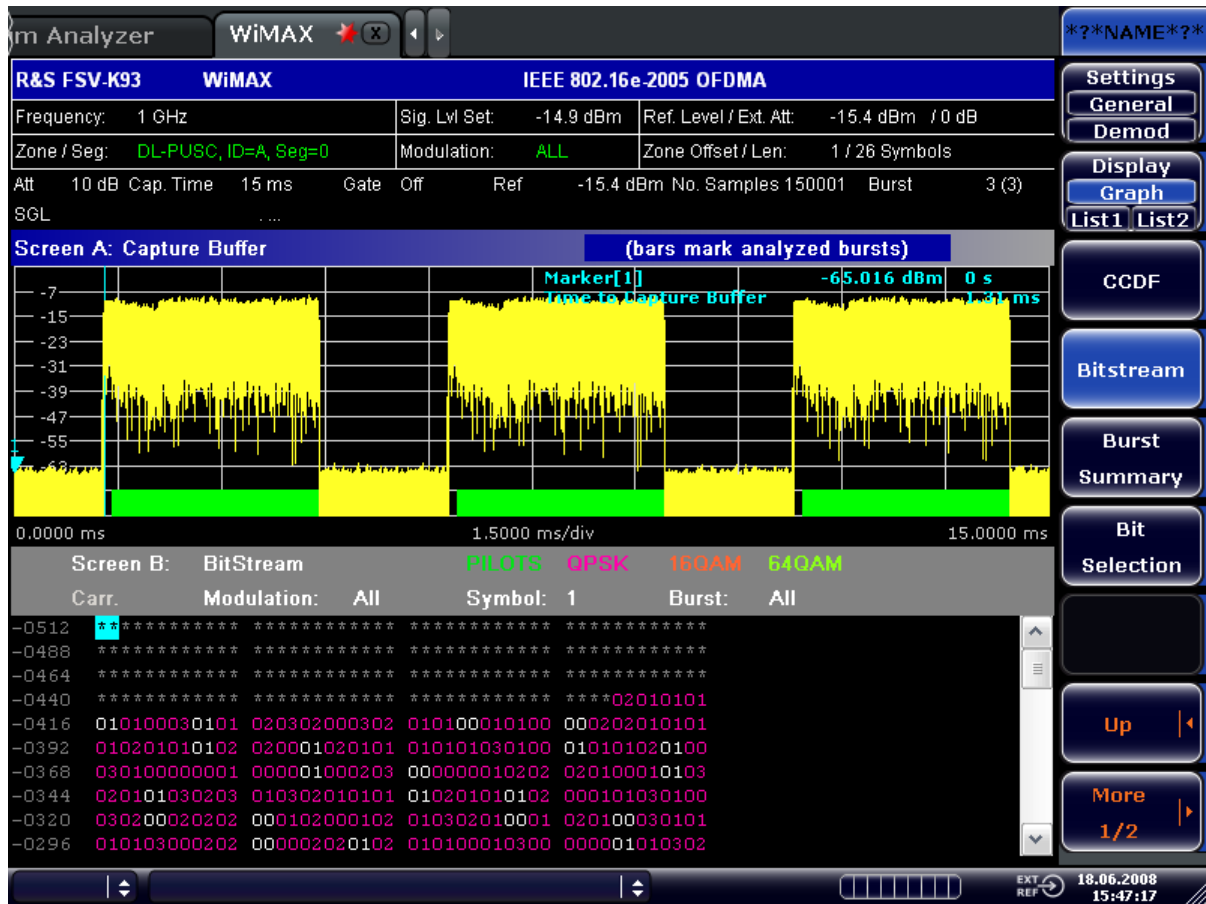
Sets the Bitstream result display.

- IEEE 802.16-2004 OFDM  
This result display shows the demodulated data stream. These results are grouped by burst and symbol. If no dialog boxes are displayed, the results can be scrolled through using the cursor keys or rotary knob.





- IEEE 802.16e-2005 OFDMA/WiBro  
 This result display shows the modulation symbols of the bursts from the analyzed zone. The different modulation formats are displayed in unique colors. The same color assignment is used in the Constellation vs Symbol result display. The modulation symbols define bit sequences. The mapping is defined in the standard. Signals with erroneous pilot sequences (i.e. where the detected pilot sequence does not match that according to the standard) are highlighted with a red background. The amount of data displayed in the Bitstream result display can be reduced via the [Bit Selection \(IEEE 802.16e-2005 OFDMA/WiBro\)](#) softkey.



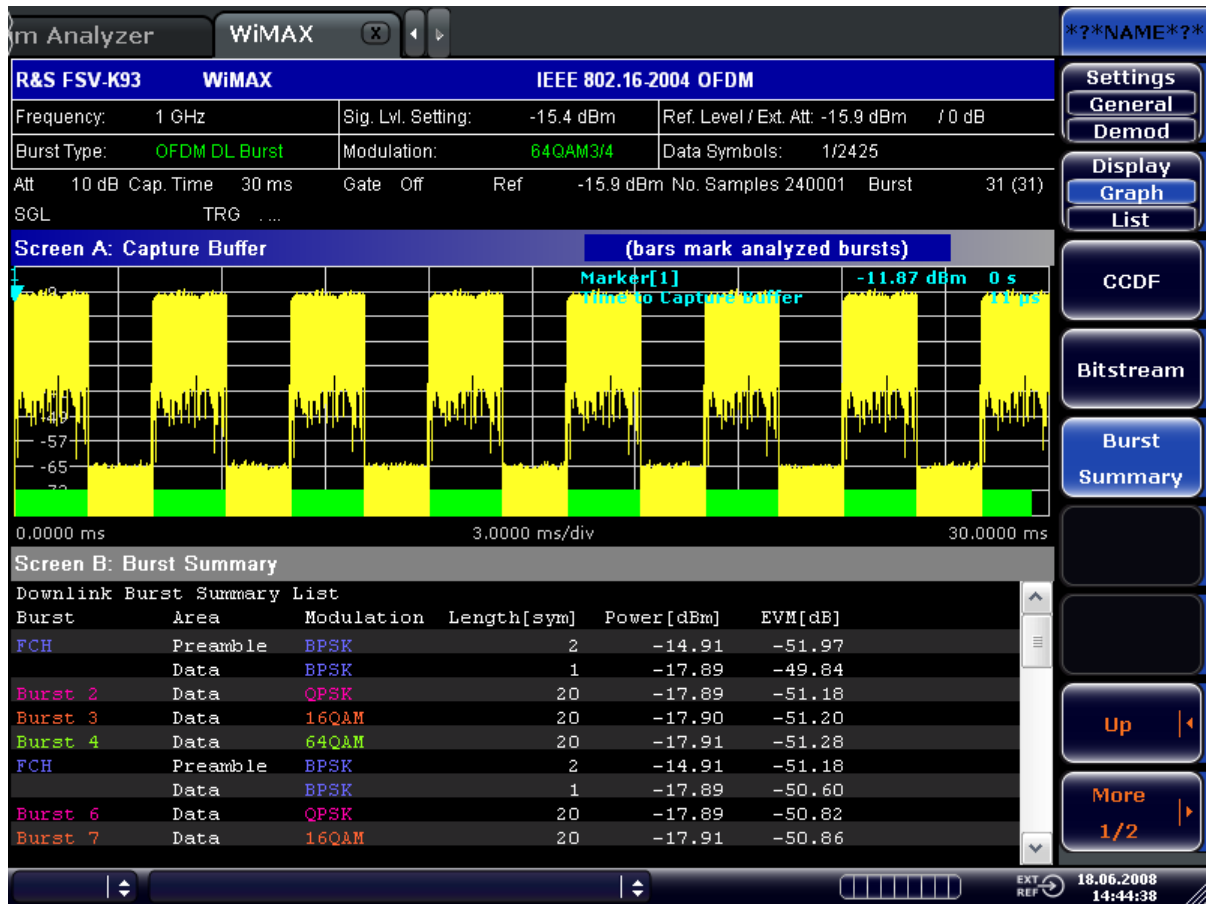
SCPI command:

[CONFigure:BURSt:STATistics:BSTReam\[:IMMEDIATE\]](#) on page 159

#### Burst Summary ← Statistics

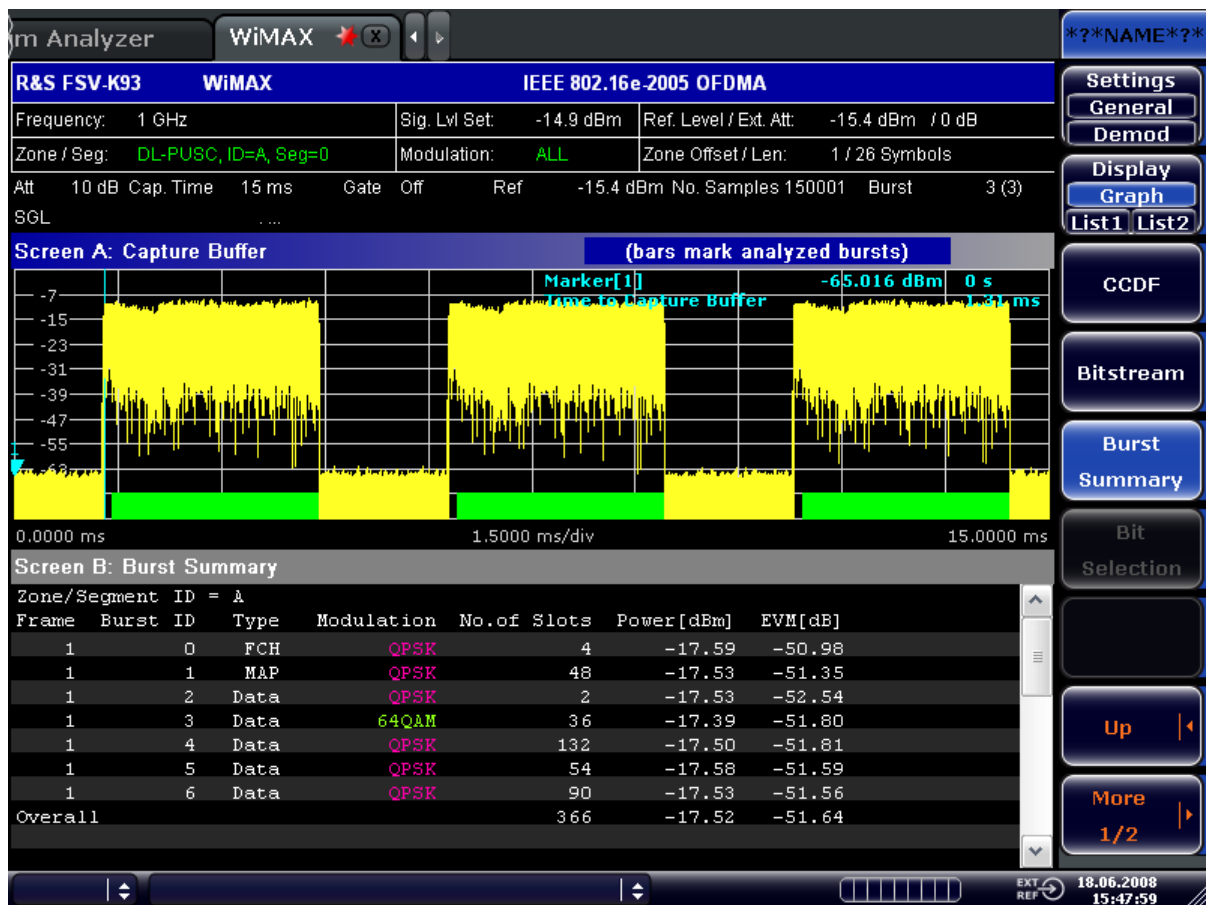
This result display shows the summary data for the analyzed bursts. If no dialog boxes are displayed, the results can be scrolled through using the cursor keys or rotary knob.

- IEEE 802.16-2004 OFDM



- IEEE 802.16e-2005 OFDMA/WiBro

This result display provides information about the bursts from the analyzed zone, i.e. modulation of the burst, power boosting information, EVM of the burst. Each analyzed zone will produce a set of burst results.



SCPI command:

[CONFigure:BURSt:STATistics:BSUMmary\[:IMMediate\]](#) on page 161

#### Bit Selection (IEEE 802.16e-2005 OFDMA/WiBro) ← Statistics

Opens a dialog box for filtering the displayed results. The results may be filtered by any combination of modulation, symbol or burst. If the bit selection parameters are changed, the result display is updated accordingly.

This softkey is only available if the Bitstream measurement ( [Bitstream](#) softkey) is selected.

SCPI command:

[CONFigure:BURSt:STATistics:BSTReam:SYMBOL:SElect](#) on page 161

[CONFigure:BURSt:STATistics:BSTReam:FORMat:SElect](#) on page 160

[CONFigure:BURSt:STATistics:BSTReam:BURSt:SElect](#) on page 160

#### File Manager (IEEE 802.16e-2005 OFDMA/WiBro)

Opens the "File Manager" dialog box. The File Manager allows you to transfer WiMAX settings from an R&S SMU signal generator via LAN. For step-by-step instructions see [chapter 4.2.5, "Transferring the Current R&S SMU WiMAX Settings via LAN"](#), on page 46 . The File Manager also offers some general file management support.

The File Manager writes into the directory `C:\R_S\Instr\user\WMAN` and its subdirectories or a USB memory stick only.

Under "File Types", filter the displayed files by selecting:

All (*.*)	All file types are displayed. Use this selection to perform general file management tasks.
SMU WiMax	Only files with the extension WiMAX are displayed.

Depending on the focus, the following softkeys are provided:

- Recall
- New Folder
- Copy
- Paste
- Rename
- Delete File

To close the File Manager, press ESC.

For further information refer to the description of the SAVE/RCL key in the base unit.

SCPI command:

[chapter 5.14, "MMEMory Subsystem \(WiMAX / WiBro, K93\)", on page 200](#)

### 4.3.2 General Settings Dialog Box

In the "General Settings" dialog box, all settings related to the overall measurement can be modified. The tab with the advanced settings is only displayed if the "Advanced Settings" option is activated. The "General Settings" dialog box contains the following elements:

General Settings.....	87
L Standard.....	87
L Frequency.....	87
L Channel No (IEEE 802.16-2004 OFDM).....	87
L Frequency Band.....	88
L FFT Size $N_{\text{FFT}}$ (IEEE 802.16e-2005 OFDMA/WiBro).....	88
L Channel BW.....	88
L $F_s/BW$ .....	88
L Sample Rate.....	88
L $G = T_g/T_b$ .....	88
L Signal Level.....	88
L Auto Level.....	88
L Ext Att.....	89
L Capture Time.....	89
L Burst Count (IEEE 802.16-2004 OFDM).....	89
L Analyze Bursts (IEEE 802.16-2004 OFDM).....	89
L Capture Count (IEEE 802.16e-2005 OFDMA/WiBro).....	89
L No. Subframes (IEEE 802.16e-2005 OFDMA/WiBro).....	90
L Sweep Time.....	90
L Sweep Count.....	90
L Trigger Mode.....	90
L Trigger Offset.....	91
L Trigger Holdoff.....	91

L Trigger Hysteresis.....	91
L Power Level.....	91
L Power Level Auto.....	91
Advanced Settings.....	91
L Swap IQ (IEEE 802.16-2004 OFDM).....	91
L Input.....	92
L Baseband Settings.....	92
L Input Sample Rate.....	92
L Full Scale Level.....	92
L Auto Level.....	92
L Auto Track Time.....	93
L Ref Level.....	93
L RF Att.....	93
L RSSI, CINR avg.....	93
L List Results Unit.....	93
L Measure Capture Buffer to .....	93
L SMU Address (IEEE 802.16e-2005 OFDMA/WiBro).....	94

### General Settings

This tab contains the general measurement settings.

#### Standard ← General Settings

Displays a list of all installed standards to select the WiMAX/WiBro standard. This is necessary to ensure that the measurements are performed according to the specified standard with the correct limit values and limit lines.

SCPI command:

`CONFigure:STANdard` on page 163

#### Frequency ← General Settings

Specifies the center frequency of the signal to be measured. If the frequency is modified, the "Channel No" field is updated accordingly.

SCPI command:

`[SENSe:]FREQuency:CENTer` on page 210

#### Channel No (IEEE 802.16-2004 OFDM) ← General Settings

Specifies the channel to be measured. If the "Channel No" field is modified, the center frequency is derived according to the section in the standard mentioned below and updated.

- For the Licensed Bands {ETSI, MMDS, WCS}:  
Channel numbers are supported according to IEEE Std 802.16-2004 "8.3.10.2 Transmitter channel bandwidth and RF carrier frequencies". For the target frequency bands see IEEE Std 802.16-2004 "B.1 Targeted frequency bands".
- For the License Exempt Bands {U-NII, CEPT}:  
Channel numbers are supported according to IEEE Std 802.16-2004 "8.5.1 Channelization".

SCPI command:

`CONFigure:CHANnel` on page 162

**Frequency Band ← General Settings**

Specifies the relationship between the "Channel BW" on page 88 and the "Sample Rate" on page 88 parameters.

SCPI command:

`CONFigure:WIMax:FBANd` on page 165

**FFT Size  $N_{FFT}$  (IEEE 802.16e-2005 OFDMA/WiBro) ← General Settings**

Specifies the maximum number of carriers supported by the signal to be measured.

SCPI command:

`CONFigure:WIMax:NFFT` on page 169

**Channel BW ← General Settings**

Specifies the bandwidth of the channel to be measured.

SCPI command:

`[SENSe:]BANDwidth:CHANnel` on page 204

**Fs/BW ← General Settings**

Specifies the ration of the Sample Rate (Fs) to Channel Bandwidth (BW). This ration can either be set to auto (as specified by the selected standard), or manually specified.

SCPI command:

`CONFigure:WIMax:FSBWratio:AUTO` on page 168

`CONFigure:WIMax:FSBWratio:FS` on page 168

`CONFigure:WIMax:FSBWratio:BW` on page 168

**Sample Rate ← General Settings**

Specifies the sample rate used for IQ measurements.

SCPI command:

`TRACe:IQ:SRATe` on page 226

 **$G = T_g/T_b$  ← General Settings**

Specifies the guard time ratio.

SCPI command:

`CONFigure:WIMax:IGRatio` on page 168

**Signal Level ← General Settings**

Specifies the expected mean level of the RF input signal. If an automatic level detection measurement has been executed the signal level (RF) is updated.

SCPI command:

`CONFigure:POWer:EXPected:RF` on page 162

**Auto Level ← General Settings**

Activates or deactivates the automatic setting of the reference level for measurements.

- "ON" The reference level is measured 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 result in slightly increased measurement times. For details about automatic level detection refer to [chapter 3.1.2, "Performing the Level Detection"](#), on page 16.
- "OFF" The reference level is defined manually in the ["Signal Level"](#) on page 88 field.

SCPI command:

[CONFigure:POWer:AUTO](#) on page 162

[CONFigure:POWer:AUTO:SWEep:TIME](#) on page 162

#### **Ext Att ← General Settings**

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 are shifted by this value.

SCPI command:

[DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]:RLEVel:OFFSet](#) on page 184

#### **Capture Time ← General Settings**

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

SCPI command:

[\[SENSe:\]SWEep:TIME](#) on page 218

#### **Burst Count (IEEE 802.16-2004 OFDM) ← General Settings**

Activates or deactivates a specified number of bursts for capture and analysis.

On	The data analysis is performed over a number of consecutive sweeps until the required number of bursts has been captured and analyzed.
Off	The data analysis is performed on a single measurement sweep.

SCPI command:

[\[SENSe:\]BURSt:COUNT:STATe](#) on page 204

#### **Analyze Bursts (IEEE 802.16-2004 OFDM) ← General Settings**

Specifies the number of bursts to be measured, if the ["Burst Count \(IEEE 802.16-2004 OFDM\)"](#) on page 89 option is activated.

If the number of bursts of the specified type is not contained in a single measurement sweep, the measurement sweeps continue until the requested number of bursts have been captured.

SCPI command:

[\[SENSe:\]ZONE:COUNT:STATe](#) on page 220

#### **Capture Count (IEEE 802.16e-2005 OFDMA/WiBro) ← General Settings**

Specifies whether a specified number of subframes are to be captured and analyzed.

If deactivated, data analysis is performed on a single measurement sweep.



If activated, data analysis is performed over a number of consecutive sweeps until the required number of subframes (see "[No. Subframes \(IEEE 802.16e-2005 OFDMA/WiBro\)](#)" on page 90) have been captured and analyzed.

SCPI command:

[SENSe:] ZONE:COUNT:STATe on page 220

#### **No. Subframes (IEEE 802.16e-2005 OFDMA/WiBro) ← General Settings**

Specifies the number of subframes to be measured. If the specified number of subframes are not contained in a single measurement sweep, then measurement sweeps will continue to be performed until the requested number of subframes have been captured.

This setting is only available if "[Capture Count \(IEEE 802.16e-2005 OFDMA/WiBro\)](#)" on page 89 is activated.

SCPI command:

[SENSe:] ZONE:COUNT on page 220

#### **Sweep Time ← General Settings**

Specifies the sweep time for the Spectrum Mask and Spectrum ACP/ACPR measurements:

- If the "Auto" option is activated, the sweep time is calculated automatically.
- If the "Auto" option is deactivated, specify the sweep time.

SCPI command:

[SENSe:] SWEEp:ACPR:TIME on page 215

[SENSe:] SWEEp:ACPR:TIME:AUTO on page 215

#### **Sweep Count ← General Settings**

Specifies the number of sweeps to be performed for Spectrum ACP/ACPR and Spectrum Mask measurements.

SCPI command:

[SENSe:] SWEEp:COUNT on page 216

#### **Trigger Mode ← General Settings**

Sets the source of the trigger for the measurement sweep.

"Free Run"	The measurement sweep starts immediately.
"External"	The measurement sweep starts if the external trigger signal meets or exceeds the external trigger level (a fixed value that cannot be altered) at the input connector EXT TRIGGER/GATE IN on the rear panel.
"IF Power"	The measurement sweep starts if the signal power meets or exceeds the specified power trigger level.
"RF Power"	The next measurement is triggered by the first intermediate frequency of the RF signal.
"Power Sensor"	The next measurement is triggered by the external power sensor (requires R&S FSV-K9 option).

SCPI command:

TRIGger<n>[:SEQuence]:SOURce on page 236

**Trigger Offset ← General Settings**

Specifies the time offset between the trigger signal and the start of the sweep. A negative value indicates a pre-trigger. This field is not available in the "Free Run" trigger mode.

SCPI command:

`TRIGger[:SEquence]:HOLDoff` on page 234

**Trigger Holdoff ← General Settings**

Defines the value for the trigger holdoff. The holdoff value in s is the time which must pass before triggering, in case another trigger event happens.

This softkey is only available if "IFPower", "RF Power" or "BBPower" is the selected trigger source.

SCPI command:

`TRIGger<n>[:SEquence]:IFPower:HOLDoff` on page 234

**Trigger Hysteresis ← General Settings**

Defines the value for the trigger hysteresis for "IF power" or "RF Power" trigger sources. The hysteresis in dB is the value the input signal must stay below the power trigger level in order to allow a trigger to start the measurement. The range of the value is between 3 dB and 50 dB with a step width of 1 dB.

SCPI command:

`TRIGger<n>[:SEquence]:IFPower:HYSteresis` on page 234

**Power Level ← General Settings**

Specifies the trigger level if one of the "Power" trigger modes is set (see "Trigger Mode" on page 90 field).

SCPI command:

`TRIGger[:SEquence]:LEVel:POWer` on page 235

**Power Level Auto ← General Settings**

Activates or deactivates the automatic measurement of the power trigger level if the "IF Power" trigger mode is set (see "Trigger Mode" on page 90 field).

On	The power trigger level is measured automatically at the start of each measurement sweep. This ensures that the power trigger level is always set at the optimal level for obtaining accurate results but will result in a slightly increased measurement times.
Off	The power trigger level is defined manually in the "Power Level" on page 91 field.

SCPI command:

`TRIGger[:SEquence]:LEVel:POWer:AUTO` on page 235

**Advanced Settings**

This tab contains advanced measurement settings.

**Swap IQ (IEEE 802.16-2004 OFDM) ← Advanced Settings**

Activates or deactivates the inverted I/Q modulation.

On	I and Q signals are interchanged.
Off	Normal I/Q modulation.

SCPI command:

[\[SENSe:\]SWAPiQ](#) on page 215

#### **Input ← Advanced Settings**

Defines whether "RF" or "Baseband Digital" input is used for measurements.

"Baseband Digital" is only available if option R&S FSV-B17 (Digital Baseband interface) is installed.

For details see the Digital Baseband Interface description in the base unit document.

#### **Baseband Settings ← Advanced Settings**

For "IQ Digital" input, the Baseband Settings can be defined here.

#### **Input Sample Rate ← Baseband Settings ← Advanced Settings**

Defines the sample rate of the digital I/Q signal source. This sample rate must correspond with the sample rate provided by the connected device, e.g. a generator.

SCPI command:

[INPut:DIQ:SRATe](#) on page 198

#### **Full Scale Level ← Baseband Settings ← Advanced Settings**

The "Full Scale Level" defines the level that should correspond to an I/Q sample with the magnitude "1".

The level is defined in Volts.

SCPI command:

[INPut:DIQ:RANGe\[:UPPer\]](#) on page 197

#### **Auto Level ← Advanced Settings**

Activates or deactivates the automatic setting of the reference level for measurements.

"ON"                    The reference level is measured 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 result in slightly increased measurement times. For details about automatic level detection refer to [chapter 3.1.2, "Performing the Level Detection"](#), on page 16.

"OFF"                    The reference level is defined manually in the ["Auto Level"](#) on page 92 field.

SCPI command:

[CONFigure:POWer:AUTO](#) on page 162

[CONFigure:POWer:AUTO:SWEep:TIME](#) on page 162

**Auto Track Time ← Advanced Settings**

Specifies the sweep time used for the automatic level measurements.

SCPI command:

[CONFigure:POWer:AUTO:SWEep:TIME](#) on page 162

**Ref Level ← Advanced Settings**

Specifies the reference level to use for measurements. If the reference level is modified, the signal level is updated accordingly (depending on the currently selected standard and measurement type). If you select a reference level manually, the "Auto Level" on page 92 is deactivated.

SCPI command:

[DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]:RLEVEL](#) on page 184

**RF Att. ← Advanced Settings**

Specifies the settings for the attenuator. This field is only editable if the "Auto Level" on page 92 option is deactivated. If the "Auto Level" on page 92 option is activated, the RF attenuator setting is coupled to the reference level setting.

SCPI command:

[INPut:ATTenuation](#) on page 197

**RSSI, CINR avg. ← Advanced Settings**

Specifies the mean and standard deviation for the RSSI and CINR results (see IEEE Std 802.16-2004 "8.3.9.2 RSSI mean and standard deviation", "8.3.9.3 CINR mean and standard deviation").

SCPI command:

[CONFigure:WIMax:AVERaging](#) on page 163

**List Results Unit ← Advanced Settings**

Specifies the units for the results in the results summary table.

SCPI command:

[UNIT:TABLE](#) on page 238

**Measure Capture Buffer to ... ← Advanced Settings**

The "Capture Memory" display provides the "Time to Capture Buffer Start" measurement. This measurement can be performed in 2 different modes.

- For "Measure Capture Buffer to FFT Start", the "Time to Capture Buffer Start" measurement shows the time between the capture buffer start and the FFT start of the first ofdm symbol from the analyzed subframe. For an ideal channel, the FFT start sample is the sample in the center of the cyclic prefix.
- For "Measure Capture Buffer to Frame Start", the "Time to Capture Buffer Start" measurement shows the time between the capture buffer start and the first sample of the first ofdm symbol from the analyzed subframe. This is hold for an ideal channel.

SCPI command:

[CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:START](#) on page 148

**SMU Address (IEEE 802.16e-2005 OFDMA/WiBro) ← Advanced Settings**

Specifies the TCP/IP address of an external R&S SMU signal generator connected via TCP/IP. This enables the R&S FSV to download the frame zone setup directly.

SCPI command:

`SYSTem:COMMunicate:TCPIP:ADDRESS` on page 224

**4.3.3 Demod Settings Dialog Box**

In the "Demod Settings" dialog box, the settings associated with the signal modulation can be modified. The content of the "Demod Settings" dialog box depends on the selected standard:

- IEEE 802.16-2004 OFDM  
The settings under "Burst to Analyze" specify the characteristics of the bursts to be considered in the measurement results. Only the bursts which meet the criteria specified in this group will be included in measurement analysis. The settings under "Tracking" allow various errors in measurement results to be compensated for. For IEEE 802.16-2004 OFDM, the "Demod Settings" dialog box contains the following elements:

Group	Setting
Burst to Analyze	"Link Mode (IEEE 802.16-2004 OFDM)" on page 96
	"Use FCH Content (IEEE 802.16-2004 OFDM)" on page 96
	"Mod. Detection (IEEE 802.16-2004 OFDM)" on page 96
	"Demodulator (IEEE 802.16-2004 OFDM)" on page 97
	"Subchannelization (IEEE 802.16-2004 OFDM)" on page 97
	"UL Phys. Modifier (IEEE 802.16-2004 OFDM)" on page 97
	"Equal Burst Length (IEEE 802.16-2004 OFDM)" on page 97
	"Min Data Symbols (IEEE 802.16-2004 OFDM)" on page 98
	"Max Data Symbols (IEEE 802.16-2004 OFDM)" on page 98
	"Channel Estimation (IEEE 802.16-2004 OFDM)" on page 98
Tracking	"Phase" on page 98
	"Timing" on page 99
	"Level" on page 99

- IEEE 802.16e-2005 OFDMA/WiBro  
The "Demod Settings" dialog box contains three tabs. Use the left/right arrow keys to navigate between the tabs. On the "Demod Settings" tab, the channel estimation range is set. The settings under "Bursts to Analyze" specify the characteristics of the bursts to be considered in the measurement results. The settings under "Tracking" allow various errors in measurement results to be compensated for.

On the "Frame Global" tab, the common settings associated with the frame to be analyzed can be modified.

On the "Frame Config" tab, the settings associated with the frame configuration can be modified. The "Zone/Segment List" and the "Burst List" are displayed. The content of the selected list is graphically displayed under the "Zone/Segment Map" and the "Burst Map", respectively. To edit the "Frame Config" tab, softkeys are available (see the table below).

For IEEE 802.16e-2005 OFDMA/WiBro the "Demod Settings" dialog box contains the following elements:

Group	Setting
"Demod Settings"	
Channel Estimation Range	"Downlink (DL) (IEEE 802.16e-2005 OFDMA/WiBro)" on page 99
	"Uplink (UL) (IEEE 802.16e-2005 OFDMA/WiBro)" on page 99
Bursts to Analyze	"Burst Boosting (IEEE 802.16e-2005 OFDMA/WiBro)" on page 99
Tracking Settings	"Phase" on page 98
	"Timing" on page 99
	"Level" on page 99
	"Channel Est. based on (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100
	"Pilots for Tracking (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100
Advanced	"FFT Start Offset (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100
"Frame Global"	
Frame	"Use for analysis (IEEE 802.16e-2005 OFDMA/WiBro)" on page 100
	"File Name (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101
	"IDCell (IEEE 802.16e-2005 OFDMA/WiBro)" on page 101
DL Subframe	"Preamble Mode (IEEE 802.16e-2005 OFDMA/WiBro)" on page 102
	"Preamble Index (IEEE 802.16e-2005 OFDMA/WiBro)" on page 102
	"Used Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro)" on page 102
UL Subframe	"UL Control Region Len (IEEE 802.16e-2005 OFDMA/WiBro)" on page 102
	"Frame Number (IEEE 802.16e-2005 OFDMA/WiBro)" on page 102
	"Allocated Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro)" on page 103

The settings in the "Frame Config" tab are defined using the following softkeys:

"List Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 103
"Copy Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 106
"Insert Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 106
"New Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 106
"New Segment (IEEE 802.16e-2005 OFDMA/WiBro)" on page 106
"Delete Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)" on page 107
"File Manager (IEEE 802.16e-2005 OFDMA/WiBro)" on page 85

### Demod Settings tab

This tab contains general demodulation settings.

#### Link Mode (IEEE 802.16-2004 OFDM) ← Demod Settings tab

Specifies the link mode of bursts that are to be included in measurement analysis. The following link mode types are supported:

UL	Up Link
DL	Down Link

SCPI command:

`CONFigure:WIMax:LMODE` on page 169

#### Use FCH Content (IEEE 802.16-2004 OFDM) ← Demod Settings tab

Activates or deactivates the decoding of the captured burst data FCH field.

OFF	This is the default setting and cannot be altered currently.
ON	Only the bursts with a modulation format matching the format specified in the "Demodulator" list are included in the results analysis.

#### Mod. Detection (IEEE 802.16-2004 OFDM) ← Demod Settings tab

Specifies the demodulation of the signal. The following values are supported:

None	No modulation detection is performed. The signal will be analyzed according to the "Demodulator" setting. Therefore the "Demodulator" setting must match with the modulation format of the subframe. This setting excludes the analysis of multiple modulation formats in a subframe.
First Symbol	The first data symbol specifies the modulation format, i.e. the signal will be analyzed according to the modulation format of the first data symbol. This setting supports multiple modulation formats in a subframe.  If "First Symbol" is selected, the "Demodulator" setting is disabled and is automatically updated with the modulation scheme detected in the first symbol.

USER	Only bursts matching the setting in the "Demodulator" list are analyzed. This setting supports multiple modulation formats in a subframe.
All	All bursts individual payload modulations are analyzed accordingly. This setting is useful to get an overview of the signal content.

SCPI command:

[SENSe:] DEMod:FORMat [:BContent] :AUTO on page 208

#### **Demodulator (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Defines the modulation format for signal analysis if the Mod. Detection is set to None or User (see "Link Mode (IEEE 802.16-2004 OFDM)" on page 96 field).

The measurement application does not distinguish between different coding rates for the same modulation format. If the signal to be analyzed contains the profiles (modulation format A, coding rate B) and (modulation format C, coding rate D), the signal to be analyzed must hold the following condition in order to produce correct measurement results:

[A == C ⇒ B == D]

SCPI command:

[SENSe:] DEMod:FORMat:BANalyze on page 206

#### **Subchannelization (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Activates or deactivates the subchannelization, if the "Up Link" mode is set (see "Link Mode (IEEE 802.16-2004 OFDM)" on page 96 field). If activated, the subchannel index of uplink bursts is analyzed, defined by the "Index (IEEE 802.16-2004 OFDM)" on page 97 field.

SCPI command:

[SENSe:] SUBChannel:STATe on page 214

#### **Index (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Defines the subchannelization index of uplink bursts to be analyzed. Subchannelization index 16 is the default subchannel with full occupation.

SCPI command:

[SENSe:] SUBChannel on page 214

#### **UL Phys. Modifier (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Specifies a common UL physical modifier for all uplink bursts.

SCPI command:

[SENSe:] SUBChannel:ULPHysmod on page 214

#### **Equal Burst Length (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Activates or deactivates the burst selection for measurement analysis according to the range or specific number of data symbols/bytes.



On	Only bursts with exactly the number of symbols specified in the " <a href="#">Data Symbols (IEEE 802.16-2004 OFDM)</a> " on page 98 field are considered for measurement analysis.
Off	Only bursts within the range of data symbols specified by the " <a href="#">Min Data Symbols (IEEE 802.16-2004 OFDM)</a> " on page 98 and " <a href="#">Max Data Symbols (IEEE 802.16-2004 OFDM)</a> " on page 98 fields are considered for measurement analysis.

SCPI command:

[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:EQUal](#) on page 207

#### **Data Symbols (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Specifies the number of symbols that a burst must have to be considered for measurement analysis. This field is only available if the "[Equal Burst Length \(IEEE 802.16-2004 OFDM\)](#)" on page 97 option is activated.

SCPI command:

[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:MIN](#) on page 207

#### **Min Data Symbols (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Specifies the minimum number of data symbols that a burst must have to be considered in measurement analysis. This field is only available if the "[Equal Burst Length \(IEEE 802.16-2004 OFDM\)](#)" on page 97 option is deactivated.

SCPI command:

[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:MIN](#) on page 207

#### **Max Data Symbols (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Specifies the maximum number of data symbols that a burst must have to be considered in measurement analysis. This field is only available if the "[Equal Burst Length \(IEEE 802.16-2004 OFDM\)](#)" on page 97 option is deactivated.

SCPI command:

[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:MAX](#) on page 207

#### **Channel Estimation (IEEE 802.16-2004 OFDM) ← Demod Settings tab**

Specifies how accurately the EVM results are calculated.

Preamble	The channel estimation is performed in the preamble as required in the standard.
Payload	The channel estimation is performed in the payload.

SCPI command:

[\[SENSe:\]DEMod:CESTimation](#) on page 204

#### **Phase ← Demod Settings tab**

Activates or deactivates the compensation for the phase error. If activated, the measurement results are compensated for phase error on a per-symbol basis.

SCPI command:

[\[SENSe:\]TRACking:PHASe](#) on page 219

**Timing ← Demod Settings tab**

Activates or deactivates the compensation for the timing error. If activated, the measurement results are compensated for timing error on a per-symbol basis.

SCPI command:

[SENSe:]TRACking:TIME on page 219

**Level ← Demod Settings tab**

Activates or deactivates the compensation for the level error. If activated, the measurement results are compensated for level error on a per-symbol basis.

SCPI command:

[SENSe:]TRACking:LEVel on page 218

**Downlink (DL) (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

Specifies how channel estimation is performed for downlink signals.

Preamble Only	The channel estimation is performed in the preamble only.
Preamble and Payload	The channel estimation is performed in the preamble and in the payload (payload comprises pilots and data).
Payload Only	The channel estimation is performed in the payload only.

SCPI command:

[SENSe:]DEMod:CESTimation on page 204

**Uplink (UL) (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

Displays the channel estimation performed for uplink signals.

This field is for information purposes only as channel estimation for uplink signals are always performed in payload only (payload comprises pilots and data).

**Burst Boosting (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

specifies how the information about the burst boosting factors is derived.

- "Predefined"     The burst boosting factors are taken from the "Frame Config" dialog.
- "Estimated"     The measurement application estimates the burst boosting factors from the signal to be analyzed.

SCPI command:

CONFigure:BURSt:BOOSting on page 152

**Modulation Analysis Scope (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

Displays the modulation formats to be analyzed.

This field is for information purposes only as all detected modulation schemes are analyzed.

**Demodulator (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

Displays the modulation scheme detected in the analyzed signal. For signals using multiple modulation schemes, the modulation scheme with the highest data rate is displayed. The field also indicates the limits that are applied to the EVM results in the table or results.

This field is for information purposes only.

SCPI command:

[\[SENSe:\]DEMod:FORMat:BANalyze](#) on page 206

#### **Channel Est. based on (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

This setting is used to specify if the processing of the Channel Estimation uses the user-selected Phase, Timing and Level settings or whether these settings are determined by the DSP, in which case all tracking options are used.

SCPI command:

[\[SENSe:\]DEMod:CESTimation](#) on page 204

#### **Pilots for Tracking (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

Specifies how, for downlink signals, the pilot sequence is determined for tracking purposes.

For uplink signals, this field is for information purposes only as tracking is performed according to the selected standard.

According to Standard	The pilot sequence is computed according to the standard.
Detected	The pilot sequence uses the values detected in the signal.

SCPI command:

[\[SENSe:\]TRACking:PILot](#) on page 219

#### **FFT Start Offset (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

Adds an offset to the FFT starting point determined by the application.

The setting range is from -100 % to +100 % of the cyclic prefix (CP) length. In the case of 0 %, the optimal FFT starting point, determined by the application, is used. This is the default setting.

SCPI command:

[\[SENSe:\]FFT:OFFSet](#) on page 209

#### **Rel to CP Cntr (IEEE 802.16e-2005 OFDMA/WiBro) ← Demod Settings tab**

Indicates the number of samples the offset corresponds to, relative to the center of the cyclic prefix (CP).

SCPI command:

[\[SENSe:\]FFT:OFFSet](#) on page 209

#### **Frame Global tab**

This tab contains global frame settings.

#### **Use for analysis (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

The option specifies whether the analysis should be performed using the current user-defined configuration, or whether automatic determination of the frame configuration should be performed.

Automatic detection of the frame configuration requires several measurement parameters to be correctly configured:

- Frequency
- Sample Rate/Channel Bandwidth
- FFT size
- Guard Time
- IDCell
- Preamble Index (if not in the range 0 – 96)

**Note:** Loading a WiMAX file automatically sets "Predefined MAP".

"Predefined MAP" Uses the current user-defined configuration

"Auto Demod DL-MAP" Performs an additional initial sweep to determine the configuration from the downlink signal.

"Auto Demod UL-MAP/PHY Det." Uplink signals can be analysed without knowledge about the UL-MAP. The following signals can be measured with auto demodulation detection:

- A single UL-PUSC data burst.
- A single data burst to the right of a specified control region. The control region itself is ignored. It is specified via the UL Control Region Length field.

Selecting "Auto Demod UL-MAP/PHY Det." automatically sets "Pilots for Tracking" (in "Demod Settings") to "Detected" (see "[Pilots for Tracking \(IEEE 802.16e-2005 OFDMA/WiBro\)](#)" on page 100).

After a successful auto demod measurement the "Frame Config" dialog contains the frame configuration according to the parameters detected in the signal.

SCPI command:

[\[SENSe:\] DEMod: FORMat \[: BCONtent\] : AUTO](#) on page 208

#### **Analyze Zone ← Use for analysis (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

This setting is only available if "[Use for analysis \(IEEE 802.16e-2005 OFDMA/WiBro\)](#)" on page 100 is set to auto demodulation. It allows any zone to be analyzed which is available in the signal. In case the specified zone is not available in the signal, the zone to be analyzed is adjusted to the last available zone in the signal.

SCPI command:

[CONFigure: WIMax: FRAME: ZONetouse](#) on page 167

#### **File Name (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

Displays the name of the loaded \*.WIMAX settings file. If no file is loaded the '...' is displayed.

This field is for information purposes only.

#### **IDCell (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

Specifies the downlink IDCell number and affects the definition of the preamble sequence (in conjunction with the used segments according to the "[Used Subchannel Bitmap \(IEEE 802.16e-2005 OFDMA/WiBro\)](#)" on page 102 setting), the pilot sequence of the first zone and the subchannel definition of the first zone.

If "AUTO" is selected, the IDcell is determined from the signal by the application.

SCPI command:

[CONFigure:WIMax:DLSFrame:IDCell](#) on page 163

#### **Preamble Mode (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

Specifies how the preamble index is calculated.

Auto	The preamble index is automatically calculated according to the " <a href="#">IDCell (IEEE 802.16e-2005 OFDMA/WiBro)</a> " on page 101 and " <a href="#">Used Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro)</a> " on page 102 parameters.
USER	The preamble index can be specified manually, i.e. the preamble pattern is chosen according to the standard using the " <a href="#">Preamble Index (IEEE 802.16e-2005 OFDMA/WiBro)</a> " on page 102 parameter.

SCPI command:

[CONFigure:WIMax:DLSFrame:PREamble:MODE](#) on page 164

#### **Preamble Index (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

Specifies the preamble pattern (according to the standard) to be used, if the "[Preamble Index \(IEEE 802.16e-2005 OFDMA/WiBro\)](#)" on page 102 parameter is set to USER.

SCPI command:

[CONFigure:WIMax:DLSFrame:PREamble:INDEX](#) on page 164

#### **Used Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

Assigns subchannel groups to segments, see [802.16e-2005], page 360, table 268a "Subchannel index of the six subchannel groups". This table defines how many subchannels are available for the "Burst List" ("Frame Config" tab) belonging to the corresponding segment of a DL-PUSC zone (with Use All Subchannels being false). In the burst list – corresponding to the segment – this selection controls the height of the white area in the burst map.

SCPI command:

[CONFigure:WIMax:DLSFrame:SEGment<1...3>](#) on page 164

#### **UL Control Region Len (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

UL Control Region Length specifies the length, in symbols, of a control region to be found at the start of any UL zone.

The control region will not be analysed, but the length must be specified to allow synchronisation.

SCPI command:

[CONFigure:WIMax:ULSFrame:CRLength](#) on page 170

#### **Frame Number (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

Specifies the number of the frame to be analyzed. For UL subframe analysis, the frame number must be constant for the signal to be analyzed.

SCPI command:

[CONFigure:WIMax:ULSFrame:FRAME](#) on page 170

**Allocated Subchannel Bitmap (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Global tab**

Specifies the subchannels to be analyzed.

This parameter is for information purposes only as all subchannels are used in the UL subframe.

**Frame Configuration tab**

This tab contains frame configuration settings.

**List Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab**

Sets the focus on the "Zone/Segment List" or the "Burst List" to enter and modify data. To insert, copy, and delete rows, use the softkeys available with the "Frame Config" tab.

The content of the selected list is graphically displayed under the "Zone/Segment Map" and the "Burst Map" respectively.

The "Zone/Segment List" contains the following columns:

Column	Description
ID	Provides a unique ID for the zone. This parameter is read only. If there are any errors in the zone/segment configuration, the background is displayed in red color.
Bursts	Pressing the rotary knob or the ENTER key with focus on this field changes the focus to the "Burst List" and displays the "Burst Map".
Analyze	Defines the zone/segment to be analyzed. Only one zone/segment can be selected for analysis at any given time.
Zone	Defines the zone type. The following types are supported: DL-PUSC, DL-FUSC, DL-AMC 2 x 3, UL-PUSC, UL-AMC 2 x 3
Segment	Defines the segment for a DL-PUSC zone. For DL-FUSC zones, this parameter has no effect.
Length	Defines the length in OFDMA symbols of the zone. The zone length must be a multiple of the symbol numbers per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start.
Offset	Defines the offset in OFDMA symbols from the start of the subframe. The first DL-PUSC zone starts with 1. The first UL-PUSC zone starts with 0.
PermBase	Specifies the permbase that is required for the calculation of the subchannel – physical carrier assignment permutation.
PRBS_ID	Specifies the permbase ID that is required for the calculation of the pilot sequence.

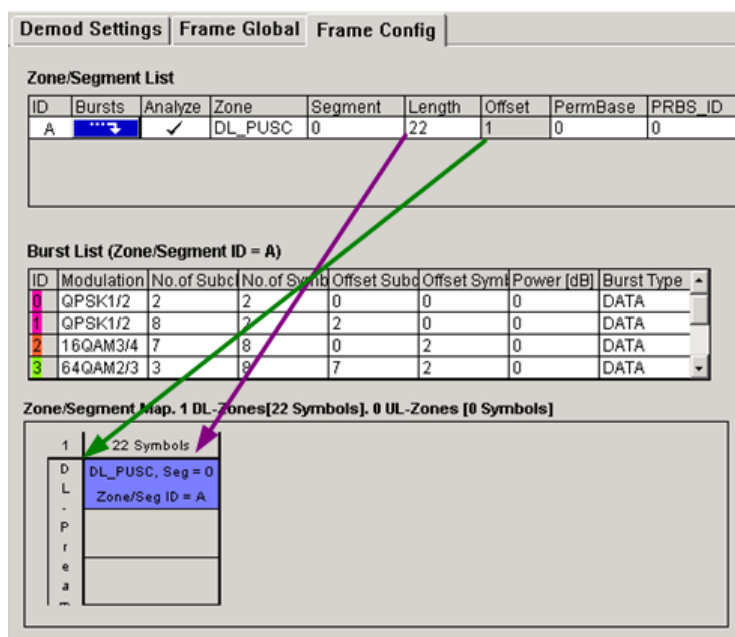


Fig. 4-14: Definition of the Zone Offset [green arrow] and the Zone Length [violet arrow] parameters from the Zone/Segment List

The "Burst List" contains the following parameters, depending on the zone selection:

Column	Description	Zone restrictions
ID	Provides a unique ID for the burst. This parameter is read only. The background color of this parameter reflects the modulation of the burst. If there are any errors in the burst configuration then the background of this item will be red.	
Modulation	Defines the modulation format of the burst. In the "Burst Map", identical modulation formats are displays in the same color.	
No. of Subch.	Defines the number of logical subchannels occupied by the burst.	DL_FUSC, DL_PUSC
No. of Symb.	Defines the number of OFDMA symbols occupied by the burst. It must be a multiple of the symbol numbers per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start.	DL_FUSC, DL_PUSC
Duration [Slots]	Specifies the unit of time for the allocating bandwidth.	UL_PUSC
Auto	If selected, the Offset Subch. and the Offset Symb. parameters are set automatically.	UL_PUSC
Offset Subch.	Defines the offset in logical subchannels from subchannel 0.	
Offset Symb.	Defines the offset in OFDMA symbols. It must be a multiple of the number of symbols per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start.  The start of the zone defines symbol 0.	

Column	Description	Zone restrictions
Power[dB]	Defines the boosting factor of the burst.	
Burst Type	Defines the burst type from the protocol layer perspective.	DL_FUSC, DL_PUSC

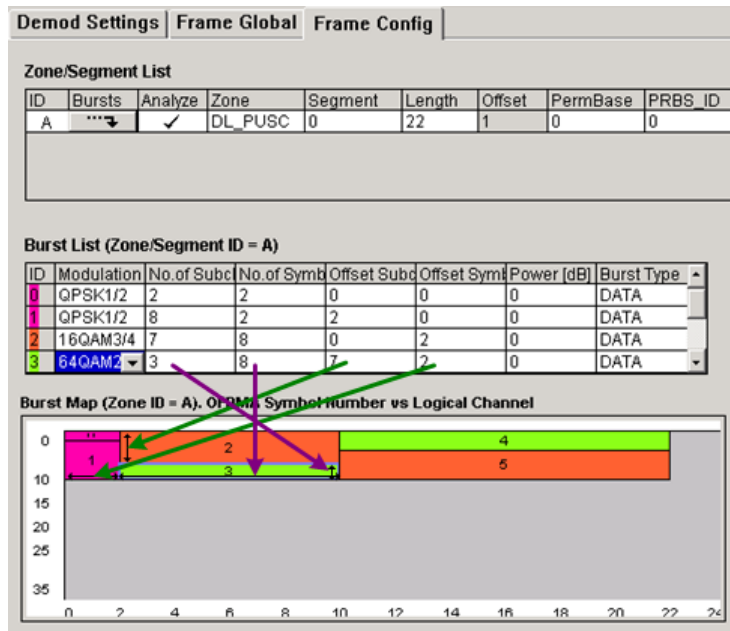


Fig. 4-15: Definition of the Burst Offset [green arrows] and the Burst Length [violet arrows] parameters from the Burst List

**Note:** If a burst is specified as DL\_MAP, the number of slots is specified instead of the number of subchannels and symbols for the burst.

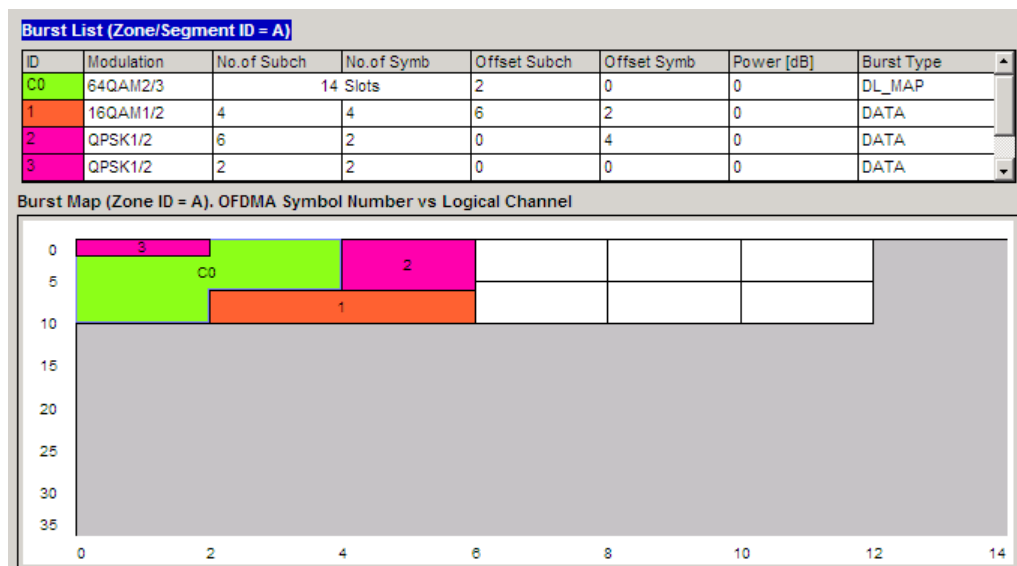


Fig. 4-16: Zone containing a wrapping DL\_MAP burst (C0).



Note the shape of the burst, which fills the available symbols in the first column (of two symbols), and then uses the second column.

The "Zone/Segment Map" and the "Burst Map" display areas are located at the bottom of the "Frame Config" tab. They display a graphical view of the selected "Zone/Segment List".

- Zone/Segment Map

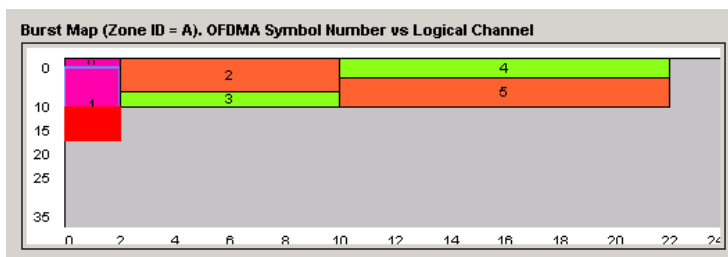
Displays a graphical view of the selected "Zone/Segment List".

- Burst Map

Displays a graphical view of the selected "Burst List". The background color of each burst in the diagram match the modulation format of the burst. Any burst that is incorrectly configured is displayed with a red background. The measurement does only start if the frame definition is correct.

Example:

The "Burst Map" with burst 1 exceeds the available amount of logical subchannels. The area causing the problem is highlighted red.



The configuration is corrected by doing one of the following:

- Reducing the number of subchannels for burst 1 in the "Burst List".
- Assigning more subchannels to the zone/segment to which burst 1 belongs.
- Increasing  $N_{FFT}$ .

SCPI command:

[CONFigure:WIMax:ZONE<1...26>\[:ANALyze\]:STATe](#) on page 171 and following

**Copy Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab**  
Copies the selected zone or burst to the clipboard.

**Insert Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab**  
Pastes the zone or burst below the focused zone or burst.

**New Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab**  
Inserts a new zone or burst below the focused zone or burst.

SCPI command:

[CONFigure:WIMax:ZONE<1...26>:CONTrol\[:DATA\]](#) on page 177

[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:CONTrol\[:DATA\]](#) on page 171

**New Segment (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Configuration tab**  
Inserts a new segment below the focused zone/segment. This softkey is only available, if the focus is on the "Zone/Segment List".

**Delete Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)** ← **Frame Configuration tab**  
Deletes the focused zone or burst.

SCPI command:

[CONFigure:WIMax:ZONE<1...26>:DELete](#) on page 178

[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:DELete](#) on page 173

## 4.4 Softkeys of the Sweep Menu – SWEEP Key (R&S FSV-K93)

The following table shows all softkeys available in the "Sweep" menu in "WiMAX" mode (SWEEP key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

<a href="#">Run Single/Cont</a> .....	107
<a href="#">Auto Level</a> .....	107
<a href="#">Refresh</a> .....	107

### Run Single/Cont

Selects the sweep mode.

"Single"            single sweep mode

"Cont"             continuous sweep mode

SCPI command:

[INITiate<n>:CONTInuous](#) on page 196

### Auto Level

Starts an automatic level detection measurement. After the automatic level detection has been completed, the trace is displayed in the Magnitude Capture Buffer display.

If this softkey is pressed while a measurement is running, the current measurement is aborted and the automatic level detection measurement is started. If the aborted measurement was a continuous measurement, it is resumed after the automatic level detection is completed.

SCPI command:

[CONFigure:POWer:AUTO](#) on page 162

### Refresh

Updates the current measurement results with respect to the current gate settings. This softkey is only available if the measurement results are effected by the gate settings (Spectrum FFT, CCDF, Spectrum Mask, Spectrum ACPR) and if the gate settings are modified after a measurement result has been obtained.

SCPI command:

[INITiate:REFResh](#) on page 196

## 4.5 Softkeys of the Marker Menu – MKR Key (R&S FSV-K93)

The following table shows all softkeys available in the "Marker" menu in "WLAN" mode (MKR key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description. Close all settings dialog boxes before opening the "Marker" menu.

### Marker 1

Opens a dialog box to adjust the marker. The contents of the dialog box depend on the type of graph the marker is adjusted to. After every change, the marker position in the trace and the marker information are updated.

SCPI command:

[CALCulate<n>:MARKer<m>\[:STATe\]](#) on page 140

[CALCulate<n>:MARKer<1>:X](#) on page 143

[CALCulate<n>:MARKer<1>:Y](#) on page 144

[CALCulate<n>:MARKer<1>:SYMBOL](#) on page 142

[CALCulate<n>:MARKer<1>:CARRIER](#) on page 141

### Frame Start Marker

Opens an edit dialog box to define the subframe to which the frame start marker is set. The "Time to Capture Buffer" and "Subframe Length" measurements are based on this frame.

SCPI command:

[CALCulate<n>:MARKer<m>:FUNCTION:TTcapture:FRAME](#) on page 146

### Ref. Power (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Start Marker

The frame length is calculated for the smoothed trace of the selected subframe where it crosses the threshold:

Ref. Power + Ref. Pwr. Offset

In case of a successful demodulation, the RMS Subframe or Peak Subframe power is derived from the corresponding result summary power. Alternatively, you can specify your own reference power.

SCPI command:

[CALCulate<n>:MARKer<m>:FUNCTION:TTcapture:RPTYPE](#) on page 148

[CALCulate<n>:MARKer<m>:FUNCTION:TTcapture:RPOWER](#) on page 147

### Ref. Pwr. Offset (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Start Marker

The frame length is calculated for the smoothed trace of the selected subframe where it crosses the threshold:

Ref. Power + Ref. Pwr. Offset

"Percentage S/ N" uses the specified percentage of the signal to noise ratio S/N, in dB, as reference power offset

Note the S/N is identical to the EVM measurement result and therefore negative or positive.

"User" user-defined reference power offset in dB  
 In case the reference power offset is positive, the offset is added to the reference power. In case the reference power offset is negative, the offset is subtracted from the reference power.

SCPI command:

[CALCulate<n>:MARKer<m>:FUNction:TTCapture:RPOType](#) on page 147

[CALCulate<n>:MARKer<m>:FUNction:TTCapture:RPOffset](#) on page 147

#### **Averaging (IEEE 802.16e-2005 OFDMA/WiBro) ← Frame Start Marker**

The frame length is calculated for the smoothed trace of the selected subframe where it crosses the threshold:

Ref. Power + Ref. Pwr. Offset

The odd averaging value defines the number of samples to average, from the original trace, in order to calculate the smoothed trace.

SCPI command:

[CALCulate<n>:MARKer<m>:FUNction:TTCapture:AVERaging](#) on page 146

#### **Unzoom**

Cancels the marker zoom.

SCPI command:

[CALCulate<n>:MARKer<m>:FUNction:ZOOM](#) on page 150

#### **Marker Zoom**

Opens an edit dialog box to select the magnification factor for the zoom. The maximum magnification depends on the type of result display.

This function is only available for Magnitude Capture Buffer, PVT, Constellation vs Symbol, Constellation vs Carrier.

SCPI command:

[CALCulate<n>:MARKer<m>:FUNction:ZOOM](#) on page 150

#### **Marker Off**

Switches off all markers in the active result display.

SCPI command:

[CALCulate<n>:MARKer<m>:AOFF](#) on page 140

## **4.6 Softkeys of the Marker to Menu – MKR-> Key (R&S FSV-K93)**

The following table shows all softkeys available in the "Marker To" menu in "WiMAX" mode (MKR-> key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

**MKR -> Trace**

Opens an edit dialog box to enter the number of the trace, on which the marker is to be placed. This softkey is available for all result displays with more than one trace.

SCPI command:

[CALCulate<n>:MARKer<m>:TRACe](#) on page 142

## 4.7 Softkeys of the Lines Menu – LINES Key (R&S FSV-K93)

The following table shows all softkeys available in the "Lines" menu in "WiMAX" mode (LINES key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

This menu is only available if the result summary lists are displayed (see [chapter 4.2.3, "Result Summary List"](#), on page 41 and [Display Graph/List](#) softkey).

Command
<a href="#">"Default Current"</a> on page 110
<a href="#">"Default All"</a> on page 110

**Default Current**

Resets all limits for the current modulation scheme to the values specified in the selected standard.

SCPI command:

[chapter 5.5, "CALCulate:LIMit Subsystem \(WiMAX/WiBro, K93\)"](#), on page 121

**Default All**

Resets all limits for all modulation schemes to the values specified in the selected standard.

SCPI command:

[chapter 5.5, "CALCulate:LIMit Subsystem \(WiMAX/WiBro, K93\)"](#), on page 121

## 4.8 Softkeys of the Trace Menu – TRAC Key (R&S FSV-K93)

The following table shows all softkeys available in the "Trace" menu in "WiMAX" mode (TRACE key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

**Display Graph/List**

Configures the result display. The measurement results are displayed either in form of a list of measurement points or as a graphical trace.

For details on the result displays refer to [chapter 4.2.3, "Result Summary List"](#), on page 41 and [chapter 4.2.4, "Result Display Graph"](#), on page 44.

SCPI command:

`DISPlay[:WINDow<n>]:TABLE` on page 181

#### Screen Focus A/B

Selects the active screen for IQ measurement results in split and full screen mode. Only the markers of an active screen can be controlled.

SCPI command:

`DISPlay[:WINDow<n>]:SElect` on page 181

#### Screen Size Full/Split

Changes the display between split and full screen for IQ measurement results. Frequency sweep measurement results are always displayed in full screen.

SCPI command:

`DISPlay:FORMat` on page 180

## 4.9 Softkeys of the Input/Output Menu for WiMAX Measurements

The following chapter describes all softkeys available in the "Input/Output" menu for WiMAX measurements.

Note that the digital baseband functions are only available if the optional Digital Baseband Interface (R&S FSV-B17) is installed.

For details see the base unit description.

EXIQ.....	111
L TX Settings.....	112
L RX Settings.....	112
L Send To.....	112
L Firmware Update.....	112
L R&S Support.....	112
L DiglConf.....	112

#### EXIQ

Opens a configuration dialog box for an optionally connected R&S EX-IQ-BOX and a submenu to access the main settings quickly.

If the optional R&S DiglConf software is installed, the submenu consists only of one key to access the software. **Note that R&S DiglConf requires a USB connection (not LAN!) from the R&S FSV to the R&S EX-IQ-BOX in addition to the R&S Digital I/Q Interface connection. R&S DiglConf version 2.10 or higher is required.**

For typical applications of the R&S EX-IQ-BOX see also the description of the R&S Digital I/Q Interface (R&S FSV-B17) in the base unit manual.

For details on configuration see the "R&S®Ex I/Q Box - External Signal Interface Module Manual".

For details on installation and operation of the R&S DigIConf software, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

**TX Settings ← EXIQ**

Opens the "EX-IQ-BOX Settings" dialog box to configure the R&S FSV for digital output to a connected device ("Transmitter" Type).

**RX Settings ← EXIQ**

Opens the "EX-IQ-BOX Settings" dialog box to configure the R&S FSV for digital input from a connected device ("Receiver" Type).

**Send To ← EXIQ**

The configuration settings defined in the dialog box are transferred to the R&S EX-IQ-BOX.

**Firmware Update ← EXIQ**

If a firmware update for the R&S EX-IQ-BOX is delivered with the R&S FSV firmware, this function is available. In this case, when you select the softkey, the firmware update is performed.

**R&S Support ← EXIQ**

Stores useful information for troubleshooting in case of errors.

This data is stored in the `C:\R_S\Instr\user\Support` directory on the instrument.

If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

**DigIConf ← EXIQ**

Starts the optional R&S DigIConf application. This softkey is only available if the optional software is installed.

To return to the R&S FSV application, press any key on the front panel. The application is displayed with the "EXIQ" menu, regardless of which key was pressed.

For details on the R&S DigIConf application, see the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

**Note:** If you close the R&S DigIConf window using the "Close" icon, the window is minimized, not closed.

If you select the "File > Exit" menu item in the R&S DigIConf window, the application is closed. Note that in this case the settings are lost and the EX-IQ-BOX functionality is no longer available until you restart the application using the "DigIConf" softkey in the R&S FSV once again.

SCPI command:

Remote commands for the R&S DigIConf software always begin with `SOURce:EBOX`. Such commands are passed on from the R&S FSV to the R&S DigIConf automatically which then configures the R&S EX-IQ-BOX via the USB connection.

All remote commands available for configuration via the R&S DigIConf software are described in the "R&S®EX-IQ-BOX Digital Interface Module R&S®DigIConf Software Operating Manual".

**Example 1:**

```
SOURce:EBOX:*RST
```

```
SOURce:EBOX:*IDN?
```

Result:

```
"Rohde&Schwarz,DigIConf,02.05.436 Build 47"
```

**Example 2:**

```
SOURce:EBOX:USER:CLOCK:REference:FREQuency 5MHZ
```

Defines the frequency value of the reference clock.





## 5 Remote Commands of the WiMAX/WiBro Measurements (R&S FSV-K93)

This section describes the remote commands specific to the WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93). This option includes the functionality of the WiMAX 802.16 OFDM Measurements option (R&S FSV-K93). Accordingly both options are described together in this section, differentiated by the corresponding standards:

- WiMAX 802.16 OFDM Measurements (R&S FSV-K93)
  - IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode  
The corresponding remote control mode is OFDM. In chapter "Instrument Functions", the short form IEEE 802.16-2004 OFDM is used to reference this standard.
- WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93)
  - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode  
The corresponding remote control mode is OFDMA. In chapter "Instrument Functions", the short form IEEE 802.16e-2005 OFDMA is used to reference this standard.
  - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro  
The corresponding remote control mode is WiBro. In chapter "Instrument Functions", the short form IEEE 802.16e-2005 WiBro is used to reference this standard.

For details on conventions used in this chapter refer to [chapter 5.1, "Notation"](#), on page 117.

For further information on analyzer or basic settings commands, refer to the corresponding subsystem in the base unit description.

### Subsystems of the WiMAX, WiBro Measurements options (K93)

<b>5.1</b>	<b>Notation</b> .....	<b>117</b>
<b>5.2</b>	<b>ASCII Formats for Returned Values</b> .....	<b>119</b>
<b>5.3</b>	<b>ABORt subsystem</b> .....	<b>121</b>
<b>5.4</b>	<b>CALCulate:BURSt Subsystem (WiMAX/WiBro, K93)</b> .....	<b>121</b>
<b>5.5</b>	<b>CALCulate:LIMit Subsystem (WiMAX/WiBro, K93)</b> .....	<b>121</b>
<b>5.6</b>	<b>CALCulate:MARKer Subsystem (WiMAX / WiBro, K93)</b> .....	<b>139</b>
5.6.1	Commands of the CALCulate:MARKer Subsystem (WiMAX / WiBro, K93).....	140
5.6.2	CALCulate:MARKer:FUNCTion Subsystem (WiMAX / WiBro, K93).....	144
<b>5.7</b>	<b>CONFigure Subsystem (WiMAX / WiBro, K93)</b> .....	<b>150</b>
<b>5.8</b>	<b>DISPlay Subsystem (WiMAX / WiBro, K93)</b> .....	<b>180</b>
<b>5.9</b>	<b>FETCh Subsystem (WiMAX / WiBro, K93)</b> .....	<b>185</b>
<b>5.10</b>	<b>FORMat Subsystem (WiMAX / WiBro, K93)</b> .....	<b>195</b>

<b>5.11</b>	<b>INITiate Subsystem (WiMAX / WiBro, K93)</b> .....	<b>195</b>
<b>5.12</b>	<b>INPUt subsystem</b> .....	<b>197</b>
<b>5.13</b>	<b>INSTRument Subsystem (WiMAX / WiBro, K93)</b> .....	<b>200</b>
<b>5.14</b>	<b>MMEMory Subsystem (WiMAX / WiBro, K93)</b> .....	<b>200</b>
<b>5.15</b>	<b>SENSE Subsystem (WiMAX / WiBro, K93)</b> .....	<b>202</b>
5.15.1	Analysis Modulation Format.....	202
5.15.2	Commands of the SENSE Subsystem (K93).....	204
<b>5.16</b>	<b>STATus Subsystem (OFDMA/WiBro, K93)</b> .....	<b>220</b>
<b>5.17</b>	<b>SYSTEM Subsystem (WiMAX, K93)</b> .....	<b>224</b>
<b>5.18</b>	<b>TRACe Subsystem (WiMAX, K93)</b> .....	<b>224</b>
5.18.1	TRACe commands.....	225
5.18.2	Constellation vs Symbol.....	226
5.18.3	Constellation vs Carrier.....	227
5.18.4	Power vs Time – Full Burst and Start / End Data.....	227
5.18.5	Power vs Time – Full Subframe and Rising/Falling Subframe.....	227
5.18.6	Spectrum Flatness/Group Delay/Flatness Difference.....	228
5.18.7	Spectrum FFT.....	229
5.18.8	Statistics Bitstream Data.....	229
5.18.9	Statistics Burst Summary Data.....	230
5.18.10	Statistics CCDF – Complementary Cumulative Distribution Function.....	231
5.18.11	EVM vs Carrier.....	231
5.18.12	EVM vs Symbol.....	232
5.18.13	Frequency Sweep Measurements.....	232
5.18.14	Spectrum Mask.....	232
5.18.15	Spectrum ACPR.....	233
<b>5.19</b>	<b>TRIGger Subsystem (WiMAX, K93)</b> .....	<b>233</b>
<b>5.20</b>	<b>UNIT Subsystem (WiMAX, K93)</b> .....	<b>237</b>
<b>5.21</b>	<b>Status Reporting System (Option R&amp;S FSV-K93)</b> .....	<b>238</b>
5.21.1	STATus:OPERation Register.....	241
5.21.2	STATus:QUEStionable Register.....	241
5.21.3	STATus:QUEStionable:LIMit Register.....	242
5.21.4	STATus:QUEStionable:SYNC Register.....	243

## 5.1 Notation

In the following sections, all commands implemented in the instrument are first listed 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.

### 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.

The options and operating modes for which a command can be used are indicated by the following abbreviations:

Abbreviation	Description
A	spectrum analysis
A-F	spectrum analysis – span > 0 only (frequency mode)
A-T	spectrum analysis – zero span only (time mode)
ADEMOD	analog demodulation (option R&S FSV-K7)
BT	Bluetooth (option R&S FSV-K8)
CDMA	CDMA 2000 base station measurements (option R&S FSV-K82)
EVDO	1xEV-DO base station analysis (option R&S FSV-K84)
GSM	GSM/Edge measurements (option R&S FSV-K10)
IQ	IQ Analyzer mode
OFDM	WiMAX IEEE 802.16 OFDM measurements (option R&S FSV-K93)
OFDMA/WiBro	WiMAX IEEE 802.16e OFDMA/WiBro measurements (option R&S FSV-K93)
NF	Noise Figure measurements (R&S FSV-K30)
PHN	Phase Noise measurements (R&S FSV-K40)
PSM	Power Sensor measurements (option R&S FSV-K9)
SFM	Stereo FM measurements (option R&S FSV-K7S)
SPECM	Spectrogram mode (option R&S FSV-K14)
TDS	TD-SCDMA base station / UE measurements (option R&S FSV-K76/K77)
VSA	Vector Signal Analysis (option R&S FSV-K70)
WCDMA	3GPP Base Station measurements (option R&S FSV-K72), 3GPP UE measurements (option R&S FSV-K73)
WLAN	WLAN TX measurements (option R&S FSV-K91)



The spectrum analysis mode is implemented in the basic unit. For the other modes, the corresponding options are required.

### 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 differs, depending on which parameter is used.

Example: Selection of the parameters for the command

```
[SENSe<1...4>:]AVERage<1...4>:TYPE VIDEo | LINear
```

[]	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 standardization, 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 is briefly explained in the following.

For details see the chapter "SCPI Command Structure" in the base unit description.

#### <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 be set using specific keywords (character data). The following keywords given below are permitted:

- **MAXimum**: This keyword sets the parameter to the largest possible value.
- **MINimum**: This keyword sets the parameter to the smallest 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.

## 5.2 ASCII Formats for Returned Values

The results are output as a list of result strings separated by commas.

**OFDM results**

```
<min EVM all bursts>,<average EVM all bursts>,<max EVM all bursts>
<min EVM data carriers>,<average EVM data carriers>,<max EVM data carriers>
<min EVM pilots>,<average EVM pilots>,<max EVM pilots>
<min IQ offset>,<average IQ offset>,<maximum IQ offset>
<min gain imbalance>,<average gain imbalance>,<max gain imbalance>
<min quadrature offset>,<average quadrature offset>,<max quadrature offset>
<min frequency error>,<average frequency error>,<max frequency error>
<min symbol error>,<average symbol error>,<max symbol error>
<min burst power>,<average burst power>,<max burst power>
<min crest factor>,<average crest factor>,<max crest factor>
<min SS timing>,<average SS timing>,<max SS timing>
<min RSSI>,<average RSSI>,<max RSSI>
```

<min RSSI Standard Deviation>, <average RSSI Standard Deviation>, <max RSSI Standard Deviation>

<min CINR>, <average CINR>, <max CINR>

<min CINR Standard Deviation>, <average CINR Standard Deviation>, <max CINR Standard Deviation>

#### **OFMDA Uplink results**

<min BER pilots>, <average BER pilots>, <max BER pilots>

<min EVM all bursts>, <average EVM all bursts>, <max EVM all bursts>

<min EVM data carriers>, <average EVM data carriers>, <max EVM data carriers>

<min EVM pilots>, <average EVM pilots>, <max EVM pilots>

<min IQ offset>, <average IQ offset>, <maximum IQ offset>

<min gain imbalance>, <average gain imbalance>, <max gain imbalance>

<min quadrature offset>, <average quadrature offset>, <max quadrature offset>

<min frequency error>, <average frequency error>, <max frequency error>

<min symbol error>, <average symbol error>, <max symbol error>

<min power all>, <average power all>, <max power all>

<min power data>, <average power data>, <max power data>

<min power pilots>, <average power pilots>, <max power pilots>

<min crest factor>, <average crest factor>, <max crest factor>

#### **OFDMA Downlink results**

<min BER pilots>, <average BER pilots>, <max BER pilots>

<min EVM all bursts>, <average EVM all bursts>, <max EVM all bursts>

<min EVM data carriers>, <average EVM data carriers>, <max EVM data carriers>

<min EVM pilots>, <average EVM pilots>, <max EVM pilots>

<min IQ offset>, <average IQ offset>, <maximum IQ offset>

<min gain imbalance>, <average gain imbalance>, <max gain imbalance>

<min quadrature offset>, <average quadrature offset>, <max quadrature offset>

<min frequency error>, <average frequency error>, <max frequency error>

<min symbol error>, <average symbol error>, <max symbol error>

<min power DL preamble>, <average power DL preamble>, <max power DL preamble>

<min power all>, <average power all>, <max power all>

<min power data>, <average power data>, <max power data>

<min power pilots>, <average power pilots>, <max power pilots>

<min crest factor>,<average crest factor>,<max crest factor>  
 <min RSSI>,<average RSSI>,<max RSSI>,<RSSI Standard Deviation>  
 <min CINR>,<average CINR>,<max CINR>,<CINR Standard Deviation>

## 5.3 ABORt subsystem

### ABORt

This command aborts a current measurement and resets the trigger system.

**Example:** ABOR; INIT: IMM

**Mode:** all

## 5.4 CALCulate:BURSt Subsystem (WiMAX/WiBro, K93)

The CALCulate:BURSt subsystem checks the IQ measurement results.

### Commands of the CALCulate:BURSt Subsystem

CALCulate<n>:BURSt[:IMMEDIATE].....121

#### CALCulate<n>:BURSt[:IMMEDIATE]

This command forces the IQ measurement results to be recalculated according to the current settings.

**Suffix:**

<n> 1...4  
 window

**Example:** CALC1: BURS  
 Starts the recalculation of the IQ measurement results.

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro

## 5.5 CALCulate:LIMit Subsystem (WiMAX/WiBro, K93)

The CALCulate:LIMit subsystem contains commands for the limit lines and the corresponding limit checks.



**Commands of the CALCulate:LIMit Subsystem**

CALCulate<n>:LIMit<m>:FAIL.....	122
CALCulate<n>:LIMit<m>:BURSt:ALL.....	123
CALCulate<n>:LIMit<m>:BURSt:ALL:RESult.....	124
CALCulate<n>:LIMit<m>:BURSt:BERPilot[:AVERAge].....	125
CALCulate<n>:LIMit<m>:BURSt:BERPilot[:AVERAge]:RESult.....	125
CALCulate<n>:LIMit<m>:BURSt:BERPilot:MAXimum.....	125
CALCulate<n>:LIMit<m>:BURSt:BERPilot:MAXimum:RESult.....	126
CALCulate<n>:LIMit<m>:BURSt:EVM:ALL[:AVERAge].....	126
CALCulate<n>:LIMit<m>:BURSt:EVM:ALL[:AVERAge]:RESult.....	127
CALCulate<n>:LIMit<m>:BURSt:EVM:ALL:MAXimum.....	128
CALCulate<n>:LIMit<m>:BURSt:EVM:ALL:MAXimum:RESult.....	128
CALCulate<n>:LIMit<m>:BURSt:EVM:DATA[:AVERAge].....	129
CALCulate<n>:LIMit<m>:BURSt:EVM:DATA[:AVERAge]:RESult.....	129
CALCulate<n>:LIMit<m>:BURSt:EVM:DATA:MAXimum.....	130
CALCulate<n>:LIMit<m>:BURSt:EVM:DATA:MAXimum:RESult.....	130
CALCulate<n>:LIMit<m>:BURSt:FERRor[:AVERAge].....	131
CALCulate<n>:LIMit<m>:BURSt:FERRor[:AVERAge]:RESult.....	131
CALCulate<n>:LIMit<m>:BURSt:FERRor:MAXimum.....	132
CALCulate<n>:LIMit<m>:BURSt:FERRor:MAXimum:RESult.....	132
CALCulate<n>:LIMit<m>:BURSt:IQOFfset[:AVERAge].....	133
CALCulate<n>:LIMit<m>:BURSt:IQOFfset[:AVERAge]:RESult.....	133
CALCulate<n>:LIMit<m>:BURSt:IQOFfset:MAXimum.....	134
CALCulate<n>:LIMit<m>:BURSt:IQOFfset:MAXimum:RESult.....	134
CALCulate<n>:LIMit<m>:BURSt:SSTiming[:AVERAge].....	135
CALCulate<n>:LIMit<m>:BURSt:SSTiming[:AVERAge]:RESult.....	135
CALCulate<n>:LIMit<m>:BURSt:SSTiming:MAXimum.....	136
CALCulate<n>:LIMit<m>:BURSt:SSTiming:MAXimum:RESult.....	136
CALCulate<n>:LIMit<m>:BURSt:SYMBolerror[:AVERAge].....	136
CALCulate<n>:LIMit<m>:BURSt:SYMBolerror[:AVERAge]:RESult.....	137
CALCulate<n>:LIMit<m>:BURSt:SYMBolerror:MAXimum.....	138
CALCulate<n>:LIMit<m>:BURSt:SYMBolerror:MAXimum:RESult.....	138
CALCulate<n>:LIMit<m>:SPECTrum:MASK:CHECK:X.....	139
CALCulate<n>:LIMit<m>:SPECTrum:MASK:CHECK:Y.....	139

**CALCulate<n>:LIMit<m>:FAIL?**

This command queries the limit check result of the limit line indicated in the selected measurement window. To obtain a valid result, a complete sweep must be performed. A synchronization with \*OPC, \*OPC? or \*WAI is therefore recommended.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Result>            0 | 1  
**0**  
 PASSED  
**1**  
 FAILED

**Example:**

```
INIT; *WAI
Starts a new sweep and waits for its end.
CALC2:LIM1:FAIL?
Queries the result of the check for limit line 1 in screen B.
```

**Usage:**

Query only

**Mode:**

OFDM, OFDMA/WiBro

**Table 5-1: Limit line suffix**

Suffix	Limit
1 to 2	These indexes are not used
3	ETSI Spectrum Mask limit line
4	IEEE Spectrum Mask limit line
5	Spectrum Flatness (Upper) limit line
6	Spectrum Flatness (Lower) limit line
7	Spectrum Flatness Difference (Upper) limit line
8	Spectrum Flatness Difference (Lower) limit line

**CALCulate<n>:LIMit<m>:BURSt:ALL**

This command sets or returns all the limit values.

**Suffix:**

<n>                    1...4  
 window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m>                    1...8  
 Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Result>            The results are input or output as a list of values separated by commas in the (ASCII) format described in [table 5-2](#).

**Example:**

```
CALC:LIM:BURS:ALL?
All limit values are returned.
```

**Mode:**

OFDM, OFDMA/WiBro

**Table 5-2: ASCII format for burst results**

Result input/output in ASCII format	Description
<average EVM all bursts>, <max EVM all bursts>	dB or % depending on selected units ("UNIT:TABLE")
<average EVM data carriers >, <max EVM data carriers >	dB or % depending on selected units ("UNIT:TABLE")
<average Frequency Error>, <max Frequency Error>	Down Link Mode: Hz; .Up Link Mode: %
<average Symbol Error>, <max Symbol Error>	Down Link Mode: ppm; Up Link Mode: %
<average SS Timing>, <maximum SS Timing >	only returned in Up Link mode
<average IQ Offset>, <max IQ Offset>	dB or % depending on selected units ("UNIT:TABLE")

**CALCulate<n>:LIMit<m>:BURSt:ALL:RESult?**

This command returns all the limit results.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

The results are output as a list of result strings separated by commas. For the output order see [CALCulate<n>:LIMit<m>:BURSt:ALL](#) on page 123 command.

**Example:** CALC:LIM:BURS:ALL:RES?  
All limit values are returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:BERPilot[:AVERAge] <BitErrorRate>**

This command sets the average bit error rate for pilot carriers limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<BitErrorRate> Range: -1000000 to 1000000  
Default unit: %

**Example:** CALC:LIM:BURS:BERP -25.0  
Average bit error rate for pilot carriers limit is set to -25.0 dB.

**Mode:** OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:BERPilot[:AVERAge]:RESult?**

This command returns the bit error rate for pilot carriers limit result.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Result> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:** CALC:LIM:BURS:BERP:RES?  
Average EVM for all carrier limit result is returned.

**Usage:** Query only

**Mode:** OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:BERPilot:MAXimum <BitErrorRate>**

This command sets the maximum bit error rate limit.

<b>Suffix:</b>	
<n>	1...4 window
	<b>Note</b> No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.
<m>	1...8 Specifies the limit lines according to <a href="#">table 5-1</a> .
<b>Parameters:</b>	
<BitErrorRate>	Range: -1000000 to 1000000 Default unit: %
<b>Example:</b>	CALC:LIM:BURS:EVM:ALL:MAX? Maximum EVM for all carrier limit is returned.
<b>Mode:</b>	OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:BERPilot:MAXimum:RESult?**

This command returns the maximum error vector magnitude limit result. This is a combined figure that represents the pilot, data and the free carrier.

<b>Suffix:</b>	
<n>	1...4 window
	<b>Note</b> No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.
<m>	1...8 Specifies the limit lines according to <a href="#">table 5-1</a> .
<b>Return values:</b>	
<Result>	0   1 <b>0</b> PASSED <b>1</b> FAILED
<b>Example:</b>	CALC:LIM:BURS:EVM:ALL:MAX:RES? Maximum EVM for all carrier limit result is returned.
<b>Usage:</b>	Query only
<b>Mode:</b>	OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:EVM:ALL[:AVERage] <Limit>**

This command sets the average error vector magnitude limit. This is a combined figure that represents the pilot, data and the free carrier.

<b>Suffix:</b>	
<n>	1...4 window
	<b>Note</b> No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.
<m>	1...8 Specifies the limit lines according to <a href="#">table 5-1</a> .
<b>Parameters:</b>	
<Limit>	Range: -1000000 to 1000000 Default unit: dB or % If no unit is specified the unit specified by the <a href="#">UNIT:TABLE</a> on page 238 command is used.
<b>Example:</b>	<code>CALC:LIM:BURS:EVM:ALL -25.0</code> Average EVM for all carrier limit is set to -25.0 dB.
<b>Mode:</b>	OFDM, OFDMA/WiBro

---

#### CALCulate<n>:LIMit<m>:BURSt:EVM:ALL[:AVERAge]:RESult?

This command returns the average error vector magnitude limit result. This is a combined figure that represents the pilot, data and the free carrier.

<b>Suffix:</b>	
<n>	1...4 window
	<b>Note</b> No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.
<m>	1...8 Specifies the limit lines according to <a href="#">table 5-1</a> .
<b>Return values:</b>	
<Result>	0   1 <b>0</b> PASSED <b>1</b> FAILED
<b>Example:</b>	<code>CALC:LIM:BURS:EVM:ALL:RES?</code> Average EVM for all carrier limit result is returned.
<b>Usage:</b>	Query only
<b>Mode:</b>	OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:EVM:ALL:MAXimum <Limit>**

This command sets the maximum error vector magnitude limit. This is a combined figure that represents the pilot, data and the free carrier.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000  
Default unit: dB or %  
If no unit is specified the unit specified by the [UNIT:TABLE](#) on page 238 command is used.

**Example:**

CALC:LIM:BURS:EVM:ALL:MAX?  
Maximum EVM for all carrier limit is returned.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:EVM:ALL:MAXimum:RESult?**

This command returns the maximum error vector magnitude limit result. This is a combined figure that represents the pilot, data and the free carrier.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Result> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:**

CALC:LIM:BURS:EVM:ALL:MAX:RES?  
Maximum EVM for all carrier limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:EVM:DATA[:AVERAge] <Limit>**

This command sets the average error vector magnitude limit for the data carrier.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000 dB  
Default unit: %  
If no unit is specified the unit specified by the [UNIT:TABLE](#) on page 238 command is used.

**Example:** `CALC:LIM:BURS:EVM:DATA -30.0`  
Average EVM for data carrier limit is set to -30.0 dB.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:EVM:DATA[:AVERAge]:RESult?**

This command returns the average Error Vector Magnitude limit result summary for the data carrier in dB.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:** `CALC:LIM:BURS:EVM:DATA:RES?`  
Average EVM for data carrier limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro



**CALCulate<n>:LIMit<m>:BURSt:EVM:DATA:MAXimum <Limit>**

This command sets the maximum error vector magnitude limit for the data carrier.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000 dB  
Default unit: %  
If no unit is specified the unit specified by the [UNIT:TABLE](#) on page 238 command is used.

**Example:** CALC:LIM:BURS:EVM:DATA:MAX?  
Maximum EVM for data burst limit is returned.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:EVM:DATA:MAXimum:RESult?**

This command returns the maximum Error Vector Magnitude limit result summary for the data carrier in dB.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Result> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:** CALC:LIM:BURS:EVM:DATA:MAX:RES?  
Maximum EVM for data carrier limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:FERRor[:AVERAge] <Limit>**

This command sets the average frequency error limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000  
Default unit: Hz or %  
If no unit is specified the unit depends on the current Up/Down Link Mode: Hz in Down Link mode, % in Up Link mode.  
There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

**Example:** CALC:LIM:BURS:FERR 10000  
The average frequency error limit is set to 10000 Hz.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:FERRor[:AVERAge]:RESult?**

This command returns the average frequency error limit result.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:** CALC:LIM:BURS:FERR:RES?  
Average frequency error limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:LIMit<m>:BURSt:FERRor:MAXimum <Limit>**

This command sets the maximum frequency error limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000  
Default unit: Hz or %  
If no unit is specified the unit depends on the current Up/Down Link Mode: Hz in Down Link mode, % in Up Link mode.  
There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

**Example:** CALC:LIM:BURS:FERR:MAX?  
Maximum frequency error limit is returned.

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:LIMit<m>:BURSt:FERRor:MAXimum:RESult?**

This command returns the maximum frequency error limit result.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:** CALC:LIM:BURS:FERR:MAX:RES?  
Maximum frequency error limit result is returned

**Usage:** Query only  
**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:LIMit<m>:BURSt:IQOFset[:AVERAge] <Limit>**

This command sets the average IQ offset error limit.

**Suffix:**

<n> 1...4  
 window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
 Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000  
 Default unit: dB or %  
 If no unit is specified the unit specified by the [UNIT:TABLE](#) on page 238 command is used.

**Example:** CALC:LIM:BURS:IQOF -10.0  
 Average IQ offset error limit is set to -10.0 dB.

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:LIMit<m>:BURSt:IQOFset[:AVERAge]:RESult?**

This command returns the average IQ offset error limit result.

**Suffix:**

<n> 1...4  
 window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
 Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
 PASSED  
**1**  
 FAILED

**Example:** CALC:LIM:BURS:IQOF:RES?  
 Average IQ offset error limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:LIMit<m>:BURSt:IQOFset:MAXimum <Limit>**

This command sets the maximum IQ offset error limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000  
Default unit: dB or %  
If no unit is specified the unit specified by the [UNIT:TABLE](#) on page 238 command is used.

**Example:** CALC:LIM:BURS:IQOF:MAX 15.0DB  
Maximum IQ offset error limit is set to 15.0 dB.

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:LIMit<m>:BURSt:IQOFset:MAXimum:RESult?**

This command returns the maximum IQ offset error limit result.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:** CALC:LIM:BURS:IQOF:MAX:RES?  
Maximum IQ offset error limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:SSTiming[:AVERAge] <Limit>**

This command is only supported for reasons of compatibility with the FSP family. It sets the average Subscriber Station Timing limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> 0PCT

**Example:**

CALC:LIM:BURS:SST 0

The average SS Timing limit is set to 0 %.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:SSTiming[:AVERAge]:RESult?**

This command returns the average Subscriber Station Timing limit result.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:**

CALC:LIM:BURS:SST:RES?

Average SS Timing limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:SSTiming:MAXimum <Limit>**

This command is only supported for reasons of compatibility with the FSP family. It sets the maximum Subscriber Station Timing limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> 0PCT

**Example:**

CALC:LIM:BURS:SST:MAX?  
Maximum SS Timing limit is returned.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:SSTiming:MAXimum:RESult?**

This command returns the maximum Subscriber Station Timing limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:**

CALC:LIM:BURS:SST:MAX:RES?  
Maximum SS Timing limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:SYMBOLerror[:AVERAge] <Limit>**

This command sets the average symbol error limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000  
Default unit: ppm or %  
If no unit is specified the unit depends on the current Up/Down Link Mode: ppm in Down Link mode, % in Up Link mode.  
There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

**Example:** CALC:LIM:BURS:SYMB 10000  
The average symbol error limit is set to 10000 Hz.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:SYMBolerror[:AVERage]:RESult?**

This command returns the average symbol error limit result.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:** CALC:LIM:BURS:SYMB:RES?  
Average symbol error limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro



**CALCulate<n>:LIMit<m>:BURSt:SYMBolerror:MAXimum <Limit>**

This command sets the maximum symbol error limit.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Parameters:**

<Limit> Range: -1000000 to 1000000  
Default unit: %  
If no unit is specified the unit depends on the current Up/Down Link Mode: ppm in Down Link mode, % in Up Link mode.  
There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

**Example:** CALC:LIM:BURS:SYMB:MAX?  
Maximum symbol error limit is returned.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:LIMit<m>:BURSt:SYMBolerror:MAXimum:RESult?**

This command returns the maximum symbol error limit result.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Return values:**

<Return values> 0 | 1  
**0**  
PASSED  
**1**  
FAILED

**Example:** CALC:LIM:BURS:SYMB:MAX:RES?  
Maximum symbol error limit result is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:LIMit<m>:SPECtrum:MASK:CHECK:X?**

This command returns the x-value at the maximum overstepping of the spectrum mask limits.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Example:** CALC:LIM:SPEC:MASK:CHECK:X?  
Returns the frequency at the maximum overstepping.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:LIMit<m>:SPECtrum:MASK:CHECK:Y?**

This command returns the y-value at the maximum overstepping of the spectrum mask limits.

**Suffix:**

<n> 1...4  
window

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0.

<m> 1...8  
Specifies the limit lines according to [table 5-1](#).

**Example:** CALC:LIM:SPEC:MASK:CHECK:Y?  
Returns the power at the maximum overstepping.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

## 5.6 CALCulate:MARKer Subsystem (WiMAX / WiBro, K93)

The CALCulate:MARKer subsystem checks the marker functions of the instrument.

The following subsystem is included:

chapter 5.6.2, "CALCulate:MARKer:FUNCTION Subsystem (WiMAX / WiBro, K93)",  
on page 144

### Commands of the CALCulate:MARKer Subsystem

- 5.6.1 Commands of the CALCulate:MARKer Subsystem (WiMAX / WiBro, K93)..... 140
- 5.6.2 CALCulate:MARKer:FUNCTION Subsystem (WiMAX / WiBro, K93)..... 144

### 5.6.1 Commands of the CALCulate:MARKer Subsystem (WiMAX / WiBro, K93)

CALCulate<n>:MARKer<m>[:STATe].....	140
CALCulate<n>:MARKer<m>:AOFF.....	140
CALCulate<n>:MARKer<m>:BURSt.....	141
CALCulate<n>:MARKer<1>:CARRier.....	141
CALCulate<n>:MARKer<1>:MAXimum.....	142
CALCulate<n>:MARKer<1>:MINimum.....	142
CALCulate<n>:MARKer<1>:SYMBol.....	142
CALCulate<n>:MARKer<m>:TRACe.....	142
CALCulate<n>:MARKer<1>:X.....	143
CALCulate<n>:MARKer<1>:Y.....	144

---

#### CALCulate<n>:MARKer<m>[:STATe] <State>

This command activates a marker in the specified window. If no indication is made, marker 1 is selected automatically. If activate, the marker is switched to normal mode.

#### Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> depends on mode  
marker number; For applications that do not have more than 1 marker, the suffix <m> is irrelevant.

#### Parameters:

<State> ON | OFF  
\*RST: OFF

#### Example:

CALC:MARK3 ON  
Switches on marker 3 or switches to marker mode.

Mode: all

---

#### CALCulate<n>:MARKer<m>:AOFF

This command switches off all active markers, delta markers, and marker measurement functions in the specified window.

<b>Suffix:</b>	
<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	depends on mode irrelevant
<b>Example:</b>	<code>CALC:MARK:AOFF</code> Switches off all markers.
<b>Mode:</b>	all

---

#### **CALCulate<n>:MARKer<m>:BURSt <BurstNumber>**

This command positions the selected marker in the specified measurement window to the indicated burst. This command is only available for the Constellation vs Symbol result display.

<b>Suffix:</b>	
<n>	window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.
<m>	marker number
<b>Parameters:</b>	
<BurstNumber>	1 to <number of captured bursts in capture buffer>
<b>Example:</b>	<code>CALC2:MARK:BURS 2</code> Positions marker 1 in screen B to burst 2. <code>CALC2:MARK:BURS?</code> Outputs the symbol value of marker 1 in screen B.
<b>Mode:</b>	OFDM, OFDMA/WiBro

---

#### **CALCulate<n>:MARKer<1>:CARRier <Carrier>**

This command positions the selected marker to the indicated carrier.

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

<b>Suffix:</b>	
<n>	1...4 irrelevant
<b>Parameters:</b>	
<Carrier>	
<b>Example:</b>	<code>CALC:MARK:CARR -7</code> Positions marker 1 to carrier -7. <code>CALC:MARK:CARR?</code> Outputs the carrier value of marker 1.
<b>Mode:</b>	WLAN, OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<1>:MAXimum**

This command sets the selected marker to the maximum peak value in the current trace. This command is only available for the Spectrum Flatness result display.

**Suffix:**

<n> 1...4  
window

**Example:**

CALC2:MARK:MAX  
Set marker 1 in screen B to maximum value in trace.

**Mode:**

WLAN, OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<1>:MINimum**

This command sets the selected marker to the minimum peak value in the current trace. This command is only available for the Spectrum Flatness result display.

**Suffix:**

<n> 1...4  
window

**Example:**

CALC2:MARK:MIN  
Set marker 1 in screen B to minimum value in trace.

**Mode:**

WLAN, OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<1>:SYMBOL <Symbol>**

This command positions the selected marker to the indicated symbol.

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

**Suffix:**

<n> 1...4  
window

**Parameters:**

<Symbol> 1 to <number of symbols in selected burst>

**Example:**

CALC2:MARK:SYMB 2  
Positions marker 1 in screen B to symbol 2.  
CALC2:MARK:SYMB?  
Outputs the symbol value of marker 1 in screen B.

**Mode:**

WLAN, OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<m>:TRACe <TraceNumber>**

This command assigns the selected marker to the indicated measurement curve in the selected measurement window.

This command is only available for the following result displays:

- Constellation versus Carrier
- EVM vs Symbol
- EVM vs Carrier
- Frequency Error vs Preamble
- Phase Error vs Preamble
- PVT Rising / Falling
- Spectrum Flatness
- Spectrum Flatness Difference
- Spectrum Mask, if Max Hold trace is displayed
- Spectrum ACP/ACPR, if Max Hold trace is displayed

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

<TraceNumber> Range: 1 to 3  
\*RST: 1

**Example:**

"CALC2:MARK:TRAC 2  
Assigns marker 1 in screen B to trace 2.

**Mode:** OFDM, OFDMA/WiBro

**CALCulate<n>:MARKer<1>:X <Position>**

This command positions the selected marker to the indicated inphase (Constellation vs Symbol), frequency (Spectrum FFT, Spectrum Mask, Spectrum APCR), time (Magnitude Capture Buffer, Auto level, PVT Full Burst, PVT Rising / Falling), power (CCDF), sub-carrier (Constellation vs Carrier, EVM vs Carrier, Spectrum Flatness) or symbol (EVM vs Symbol) in the selected measurement window.

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

**Suffix:**

<n> 1...4  
window

**Parameters:**

<Position> 1 to <maximum range for selected measurement>

**Example:**

CALC:MARK:X 2ms  
Positions marker 1 in screen A to time 2ms.

**Mode:** WLAN, OFDMA/WiBro

**CALCulate<n>:MARKer<1>:Y <Position>**

This command positions the selected marker to the indicated quadrature (Constellation vs Symbol), magnitude of I or Q (Constellation vs Carrier), EVM (EVM vs Carrier) or abs (Spectrum Flatness) in the selected measurement window.

This command is query only for the following result displays:

- Auto Level
- Constellation vs Symbol
- Constellation vs Carrier
- EVM vs Symbol
- PVT Full
- PVT Rising/Falling
- Magnitude Capture Buffer
- Spectrum Mask
- Spectrum ACP/ACPR
- Spectrum FFT
- CCDF

**Suffix:**

<n>                      1...4  
                              window

**Parameters:**

<Position>

**Example:**

```
CALC2:MARK:Y -2
Positions marker 1 in screen B to -2.
CALC:MARK:Y?
Outputs the measured value of marker 1.
```

**Mode:**                      WLAN; OFDMA/WiBro

## 5.6.2 CALCulate:MARKer:FUNCTION Subsystem (WiMAX / WiBro, K93)

The measurement window is selected by CALCulate 1 (screen A) or 2 (screen B).

### Commands of the CALCulate:MARKer:FUNCTION Subsystem

CALCulate<n>:MARKer<m>:FUNCTION:POWER:RESult[:CURRent].....	145
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture.....	145
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:AVERaging.....	146
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:FRAME.....	146
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:LENGth.....	146
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:RPOffset.....	147
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:RPOType.....	147
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:RPOWER.....	147
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:RPTYpe.....	148
CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:START.....	148

CALCulate<n>:MARKer<m>:FUNction:TTcapture[:TIME].....	149
CALCulate<n>:MARKer<m>:FUNction:POWer:RESult:MAXHold.....	149
CALCulate<n>:MARKer<m>:FUNction:ZOOM.....	150

---

### CALCulate<n>:MARKer<m>:FUNction:POWer:RESult[:CURRent]?

This command queries the current result values of the adjacent channel power 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. Adjacent channel power values are output in dB.

The order is as follows:

- Power of main channel
- Power of lower adjacent channel
- Power of upper adjacent channel
- Power of lower alternate adjacent channel 1
- Power of upper alternate adjacent channel 1
- Power of lower alternate adjacent channel 2
- Power of upper alternate adjacent channel 2
- Power of lower alternate adjacent channel 3
- Power of upper alternate adjacent channel 3
- Power of lower alternate adjacent channel 4
- Power of upper alternate adjacent channel 4

#### Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Example:** CALC2:MARK:FUNC:POW:RES?

**Usage:** Query only

**Mode:** OFDMA/WiBro

---

### CALCulate<n>:MARKer<m>:FUNction:TTcapture?

This command returns the time to the start of the first frame in the capture buffer.

#### Suffix:

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Example:** CALC:MARK:TTC?

Returns the time to the start of the first frame in the capture buffer.

**Usage:** Query only



**Mode:** OFDMA/WiBro

---

**CALCulate<n>:MARKer<m>:FUNcTion:TTCapture:AVERaging <Factor>**

This command sets the smoothing factor of the "subframe length" calculation.

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

<Factor> Odd number

\*RST: 11

**Example:** CALC:MARK:FUNC:TTC:AVER 129

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<m>:FUNcTion:TTCapture:FRAMe <Frames>**

This command sets or returns the frame upon which the "Time to Capture Buffer Marker" measurement is based. This frame corresponds to the one defined using the ["Frame Start Marker"](#) on page 108 softkey.

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

<Frames> Integer from 1 to the highest number of detected subframes.

\*RST: 1

If 0 is returned for a query, no subframes were detected.

**Example:** CALC2:MARK:FUNC:TTC:FRAM 2  
Measurement is based on subframe 2.

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<m>:FUNcTion:TTCapture:LENGth?**

This command returns the result of the "subframe length" calculation.

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Example:** CALC:MARK:FUNC:TTC:LENG?

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<m>:FUNction:TTCapture:RPOffset <Offset>**

This command sets the reference power offset of the "subframe length" calculation.

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

<Offset> \*RST: 5

**Example:** CALC:MARK:FUNC:TTC:RPOF 5

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<m>:FUNction:TTCapture:RPOType <OffsetType>**

This command sets the type of the reference power offset of the "subframe length" calculation.

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

<OffsetType> **PSN**  
The offset is calculated as a percentage of the "EVM Data and Pilots" result.

**USER**  
The offset is user-defined.

\*RST: PSN

**Example:** CALC:MARK:FUNC:TTC:RPOT USER

**Mode:** OFDM, OFDMA/WiBro

---

**CALCulate<n>:MARKer<m>:FUNction:TTCapture:RPOWer <Power>**

This command sets the reference power of the "subframe length" calculation if the reference power type is "USER" (see [CALCulate<n>:MARKer<m>:FUNction:TTCapture:RPTYPE](#) on page 148).

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

<Power> Reference power  
 \*RST: 0

**Example:**

CALC:MARK:FUNC:TTC:RPOW -20

**Mode:**

OFDM, OFDMA/WiBro

**CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:RPTYPE <PowerType>**

This command sets the type of the reference power for the "subframe length" calculation. The following types are available:

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

<PowerType>

**RMS**

The reference power is relative to the RMS power of the subframe.

**PEAK**

The reference power is relative to the peak power of the subframe.

**USER**

The reference power is user-defined.

\*RST: RMS

**Example:**

CALC:MARK:FUNC:TTC:RPTY RMS

**Mode:**

OFDM, OFDMA/WiBro

**CALCulate<n>:MARKer<m>:FUNCTION:TTCapture:START <Mode>**

Defines the mode for the "Time to Capture Buffer Start" measurement.

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

&lt;Mode&gt; FFT | FRAM

**FFT**

The "Time to Capture Buffer Start" measurement shows the time between the capture buffer start and the FFT start of the first ofdm symbol from the analyzed subframe. For an ideal channel, the FFT start sample is the sample in the center of the cyclic prefix.

**FRAMe**

The "Time to Capture Buffer Start" measurement shows the time between the capture buffer start and the first sample of the first ofdm symbol from the analyzed subframe. This is hold for an ideal channel.

\*RST: FRAM

**Example:**

CALC:MARK:FUNC:TTC:STAR FFT

**Mode:**

OFDM, OFDMA/WiBro

**CALCulate<n>:MARKer<m>:FUNCTion:TTCapture[:TIME]?**

This command returns the "Capture buffer to frame start" time for the subframe selected by the [CALCulate<n>:MARKer<m>:FUNCTion:TTCapture:FRAMe](#) command or the [Frame Start Marker](#) softkey.

**Suffix:**

&lt;n&gt; window; For applications that do not have more than 1 measurement window, the suffix &lt;n&gt; is irrelevant.

&lt;m&gt; marker number

**Example:**

CALC2:MARK:FUNC:TTC?

**Usage:**

Query only

**Mode:**

OFDM, OFDMA/WiBro

**CALCulate<n>:MARKer<m>:FUNCTion:POWer:RESult:MAXHold?**

This command queries the maximum result values of the adjacent channel power measurement. An ACPR (Adjacent channel power relative) measurement must have previously been run with more than one sweep to provide the summary data.

For details on the output refer to [CALCulate<n>:MARKer<m>:FUNCTion:POWer:RESult\[:CURRENT\]](#) on page 145.

**Suffix:**

&lt;n&gt; window; For applications that do not have more than 1 measurement window, the suffix &lt;n&gt; is irrelevant.

&lt;m&gt; marker number

**Example:**

CALC:MARK:FUNC:POW:RES:MAXH?

**Usage:**

Query only

**Mode:** OFDMA/WiBro

---

**CALCulate<n>:MARKer<m>:FUNCTION:ZOOM <Factor>**

This command defines the factor to be zoomed around the marker 1 in the selected measurement window. The default value is 1, where the full trace is shown. This command is available for the following result displays:

- Constellation vs Carrier
- Constellation vs Symbol
- PVT Full Burst
- PVT Rising / Falling
- Magnitude Capture Buffer

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.

<m> marker number

**Parameters:**

<Factor> Range: 1 to 1000000  
\*RST: 1

**Example:**

CALC:MARK:FUNC:ZOOM 2  
Zooms 50 % in screen A.  
CALC:MARK:FUNC:ZOOM 4  
Zooms 25 % in screen A.  
CALC:MARK:FUNC:ZOOM 1  
Deactivates zooming in screen A.

**Mode:** WLAN, OFDMA/WiBro

## 5.7 CONFigure Subsystem (WiMAX / WiBro, K93)

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 are queried.

CONFigure:ADDRESS:SMU.....	152
CONFigure:BURSt:BOOSting.....	152
CONFigure:BURSt:CONSt:BURSt:SElect.....	153
CONFigure:BURSt:CONSt:CARRier:SElect.....	153
CONFigure:BURSt:CONSt:CCARRier[:IMMediate].....	154
CONFigure:BURSt:CONSt:CSYMBOL[:IMMediate].....	154
CONFigure:BURSt:CONSt:FORMat:SElect.....	154
CONFigure:BURSt:CONSt:SYMBOL:SElect.....	154
CONFigure:BURSt:EVM:ECARRier[:IMMediate].....	155
CONFigure:BURSt:EVM:ESYMBOL[:IMMediate].....	155
CONFigure:BURSt:PREamble[:IMMediate].....	155

CONFigure:BURSt:PREamble:SElect.....	156
CONFigure:BURSt:PVT[:IMMediate].....	156
CONFigure:BURSt:PVT:BURSt.....	156
CONFigure:BURSt:PVT:SElect.....	157
CONFigure:BURSt:SPEctrum:ACPR[:IMMediate].....	157
CONFigure:BURSt:SPEctrum:ACPR:SElect.....	157
CONFigure:BURSt:SPEctrum:FFT[:IMMediate].....	158
CONFigure:BURSt:SPEctrum:FLATness[:IMMediate].....	158
CONFigure:BURSt:SPEctrum:FLATness:SElect.....	158
CONFigure:BURSt:SPEctrum:MASK[:IMMediate].....	159
CONFigure:BURSt:SPEctrum:MASK:SElect.....	159
CONFigure:BURSt:SPEctrum:PHASe:PREamble[:IMMediate].....	159
CONFigure:BURSt:STATistics:BSTReam[:IMMediate].....	159
CONFigure:BURSt:STATistics:BSTReam:BURSt:SElect.....	160
CONFigure:BURSt:STATistics:BSTReam:FORMat:SElect.....	160
CONFigure:BURSt:STATistics:BSTReam:SYMBOL:SElect.....	161
CONFigure:BURSt:STATistics:BSUMmary[:IMMediate].....	161
CONFigure:BURSt:STATistics:CCDF[:IMMediate].....	161
CONFigure:CHANnel.....	162
CONFigure:POWER:AUTO.....	162
CONFigure:POWER:AUTO:SWEEp:TIME.....	162
CONFigure:POWER:EXPEcted:RF.....	162
CONFigure:STANdard.....	163
CONFigure:WIMax:AVERaging.....	163
CONFigure:WIMax:DLSFrame:IDCell.....	163
CONFigure:WIMax:Frame:IDCell.....	163
CONFigure:WIMax:DLSFrame:PREamble:INDex.....	164
CONFigure:WIMax:DLSFrame:PREamble:MODE.....	164
CONFigure:WIMax:DLSFrame:SEGMENT<1...3>.....	164
CONFigure:WIMax:FBANd.....	165
CONFigure:WIMax:Frame:IDCell:AUTO.....	166
CONFigure:WIMax:FRAME:PREDefmap:CONFig.....	167
CONFigure:WIMax:FRAME:PREDefmap:IQDL.....	167
CONFigure:WIMax:FRAME:PREDefmap:IQUL.....	167
CONFigure:WIMax:FRAME:PREDefmap:SMU.....	167
CONFigure:WIMax:FRAME:ZONetouse.....	167
CONFigure:WIMax:FSBWratio:AUTO.....	168
CONFigure:WIMax:FSBWratio:BW.....	168
CONFigure:WIMax:FSBWratio:FS.....	168
CONFigure:WIMax:IGRatio.....	168
CONFigure:WIMax:LMODe.....	169
CONFigure:WIMax:NFFT.....	169
CONFigure:WIMax:TDDFrame:TTG.....	170
CONFigure:WIMax:ULSFrame:CRLength.....	170
CONFigure:WIMax:ULSFrame:FRAME.....	170
CONFigure:WIMax:ULSFrame:SEGMENT<1..3>:BITMap<1..18>.....	171
CONFigure:WIMax:ZONE<1...26>[:ANALyze]:STATe.....	171
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:CONTRol[:DATA].....	171
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:COUNt.....	173
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:DELeTe.....	173

CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:FORMat.....	173
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:OFFSet:AUTO.....	174
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:POWER.....	175
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:RESet.....	175
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:SLOT:DURation.....	175
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:COUNT.....	175
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:OFFSet.....	175
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:SYMBol:COUNT.....	176
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:SYMBol:OFFSet.....	176
CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:TYPE.....	176
CONFigure:WiMax:ZONE<1...26>:CONTrol[:DATA].....	177
CONFigure:WiMax:ZONE<1...26>:CONTrol:STCConfig.....	177
CONFigure:WiMax:ZONE<1...26>:COUNT.....	178
CONFigure:WiMax:ZONE<1...26>:DELete.....	178
CONFigure:WiMax:ZONE<1...26>:IDSegment.....	178
CONFigure:WiMax:ZONE<1...26>:PERMbase.....	178
CONFigure:WiMax:ZONE<1...26>:PRBS.....	179
CONFigure:WiMax:ZONE<1...26>:RESet.....	179
CONFigure:WiMax:ZONE<1...26>:SYMB:OFFSet.....	179
CONFigure:WiMax:ZONE<1...26>:SYMB:COUNT.....	179
CONFigure:WiMax:ZONE<1...26>:TYPE.....	179

---

#### CONFigure:ADDRess:SMU <IPAddress>

This remote control command is used to specify the IP address of the SMU to which WiMax settings can be uploaded or downloaded.

##### Parameters:

<IPAddress>                      String representing IP address

**Example:**                      CONF:ADDR:SMU '192.168.1.68'

**Mode:**                              OFDMA/WiBro

---

#### CONFigure:BURSt:BOOSting <BurstData>

This remote control configures whether the signal is analysed using the burst power specified in the burst map or if the burst power is estimated.

##### Parameters:

<BurstData>                      PREDefined | ESTimated

##### **PREDefined**

uses the burst power as defined in the burst map

##### **ESTimated**

estimates the burst power

\*RST:                      PRED

**Example:**                      CONF:BURS:BOOS EST  
Analysis estimates the burst power.

**Mode:**                              OFDMA/WiBro

**CONFigure:BURSt:CONSt:BURSt:SElect** <Mode>

This command selects bursts and pilots. It is only available if the Constellation vs Symbol measurement is selected (see [CONFigure:BURSt:CONSt:CSYMBOL\[:IMMEDIATE\]](#) on page 154 command).

**Parameters:**

<Mode> 0 to 9999 | ALL | PILOTS  
**0 to 9999**  
 burst number  
**ALL**  
 all bursts  
**PILOTS**  
 only pilots

**Example:**

```
CONF: BURS: CONS: CSYM
Configures the Constellation vs Symbol measurement type.
CONF: BURS: CONS: BURS: SEL 1
Selects burst 1.
INIT
Starts a Constellation vs Symbol measurement. The results of the
selected burst (1) are calculated.
```

**Mode:** OFDMA/WiBro

**CONFigure:BURSt:CONSt:CARRier:SElect** <Mode>

This command selects carriers and pilots. It is only available if the Constellation vs Symbol measurement is selected (see [CONFigure:BURSt:CONSt:CSYMBOL\[:IMMEDIATE\]](#) on page 154 command).

**Parameters:**

<Mode> -100 to 100 | ALL | PILOTS  
**-100 to 100**  
 carrier number  
**ALL**  
 all carriers  
**PILOTS**  
 only pilots  
 \*RST: ALL

**Example:**

```
CONF: BURS: CONS: CSYM
Configures the Constellation vs Symbol measurement type.
CONF: BURS: CONS: CARR: SEL -26
Carrier -26 is selected.
INIT
Starts a Constellation vs Symbol measurement. The results of the
selected carrier (-26) are calculated.
```

**Mode:** OFDM, OFDMA/WiBro



**CONFigure:BURSt:CONSt:CCARrier[:IMMEDIATE]**

This command configures the Constellation vs Carrier measurement type.

**Example:**           CONF: BURS: CONS: CCAR  
Configures the Constellation vs Carrier measurement type.  
INIT  
Starts a Constellation vs Carrier measurement.

**Usage:**            Event

**Mode:**            OFDM

**CONFigure:BURSt:CONSt:CSYMBOL[:IMMEDIATE]**

This command configures the Constellation vs Symbol measurement type.

**Example:**           CONF: BURS: CONS: CSYM  
Configures the Constellation vs Symbol measurement type.  
INIT  
Starts a Constellation vs Symbol measurement.

**Usage:**            Event

**Mode:**            OFDM, OFDMA/WiBro

**CONFigure:BURSt:CONSt:FORMat:SELEct <Mode>**

This command selects the modulation format. It is only available if the Constellation vs Symbol measurement is selected (see [CONFigure:BURSt:CONSt:CSYMBOL\[:IMMEDIATE\]](#) on page 154 command).

**Parameters:**

<Mode>            ALL | QPSK | QAM16 | QAM64

**Example:**           CONF: BURS: CONS: CSYM  
Configures the Constellation vs Symbol measurement type.  
CONF: BURS: CONS: FORM: SEL QPSK  
Selects the QPSK modulation formats.  
INIT  
Starts a Constellation vs Symbol measurement. The results of the selected modulation formats (QPSK) are calculated.

**Mode:**            OFDMA/WiBro

**CONFigure:BURSt:CONSt:SYMBOL:SELEct <Mode>**

This command selects the symbol. It is only available if the Constellation vs Symbol measurement is selected (see [CONFigure:BURSt:CONSt:CSYMBOL\[:IMMEDIATE\]](#) on page 154 command).

**Parameters:**

<Mode> 0 to 9999 | ALL  
**0 to 9999**  
 symbol number  
**ALL**  
 all symbols

**Example:**

```
CONF: BURS: CONS: CSYM
Confirms the Constellation vs Symbol measurement type.
CONF: BURS: CONS: SYMB: SEL 1
Selects symbol 1.
INIT
Starts a Constellation vs Symbol measurement. The results of the
selected symbol (1) are calculated.
```

**Mode:** OFDMA/WiBro

**CONFigure: BURSt: EVM: ECARrier[:IMMEDIATE]**

This command configures the EVM vs Carrier measurement type.

**Example:**

```
CONF: BURS: EVM: ECAR
Confirms the EVM vs Carrier measurement type.
INIT
Starts a EVM vs Carrier measurement.
```

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro

**CONFigure: BURSt: EVM: ESYMBOL[:IMMEDIATE]**

This command configures the EVM vs Symbol measurement type.

**Example:**

```
CONF: BURS: EVM: ESYM
Confirms the EVM vs Symbol measurement type.
INIT
Starts a EVM vs Symbol measurement.
```

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro

**CONFigure: BURSt: PREAmble[:IMMEDIATE]**

This command configures the Phase or Frequency vs Preamble measurement type. The selection between the two measurements is made using the [CONFigure: BURSt: PREAmble: SElect](#) on page 156 command.

<b>Example:</b>	<pre>CONF: BURS: PRE</pre> <p>Configures the Phase or Frequency vs Preamble measurement type.</p> <pre>CONF: BURS: PRE: SEL FREQ</pre> <p>The measurement results are interpreted as Frequency Error vs Preamble.</p> <pre>INIT</pre> <p>Starts a Frequency Error vs Preamble measurement.</p>
<b>Usage:</b>	Event
<b>Mode:</b>	OFDM, OFDMA/WiBro

---

#### CONFigure: BURSt: PREamble: SElect <Mode>

This command configures the interpretation of the preamble measurement results.

##### Parameters:

<Mode> PHASe | FREQuency

<b>Example:</b>	<pre>CONF: BURS: PRE</pre> <p>Configures the Phase or Frequency vs Preamble measurement type.</p> <pre>CONF: BURS: PRE: SEL FREQ</pre> <p>The measurement results are interpreted as Frequency Error vs Preamble.</p>
-----------------	---

**Mode:** OFDM, OFDMA/WiBro

---

#### CONFigure: BURSt: PVT[:IMMediate]

This command configures the Power vs Time (PVT) measurement type. For further settings of the Power vs Time measurement see the [CONFigure: BURSt: PVT: BURSt](#) on page 156 and [CONFigure: BURSt: PVT: SElect](#) on page 157 commands.

<b>Example:</b>	<pre>CONF: BURS: PVT</pre> <p>Configures the Power vs Time measurement type.</p> <pre>INIT</pre> <p>Starts a Power vs Time measurement.</p>
-----------------	---

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro

---

#### CONFigure: BURSt: PVT: BURSt <Burst>

This command specifies the burst that is used for the Power vs Time measurement results.

##### Parameters:

<Burst> Range: 1 to 10922

**Example:** `CONF: BURS: PVT`  
 Configures the Power vs Time measurement type.  
`CONF: BURS: PVT: BURS 1`  
 Uses burst 1 for the Power vs Time measurement results.

**Mode:** OFDM

---

#### CONFigure: BURSt: PVT: SElect <Mode>

This command configures the interpretation of the Power vs Time (PVT) measurement results. The available measurement types depend on the selected standard.

**Parameters:**

<Mode> **FULL**  
 PVT Full Burst (OFDM)  
 PVT Full Subframe (OFDMA/WiBro)

**EDGE**  
 PVT Start and End (OFDM)  
 PVT Rising / Falling (OFDMA/WiBro)

\*RST: FULL

**Example:** `CONF: BURS: PVT`  
 Configures the Power vs Time measurement type.  
`CONF: BURS: PVT: SEL FULL`  
 The measurement results are interpreted as full burst.

**Mode:** OFDM, OFDMA/WiBro

---

#### CONFigure: BURSt: SPECtrum: ACPR[: IMMEDIATE]

This command configures the ACPR (adjacent channel power relative) measurement type.

**Example:** `CONF: BURS: SPEC: ACPR`  
 Configures the ACPR measurement type.  
`INIT`  
 Starts an ACPR measurement.

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro

---

#### CONFigure: BURSt: SPECtrum: ACPR: SElect <Mode>

This command specifies the type of ACP measurement to be performed.

**Parameters:**

<Mode> ABSolute | RELative  
 \*RST: REL

**Example:** `CONF: BURS: SPEC: ACPR: SEL ABS`  
 Specifies the ACP measurement type absolute.

**Mode:** OFDM, OFDMA/WiBro

**CONFigure:BURSt:SPECtrum:FFT[:IMMEDIATE]**

This command configures the FFT (Fast Fourier Transform) measurement type.

**Example:**           CONF: BURS: SPEC: FFT  
Configures the FFT measurement type.  
INIT  
Starts an FFT measurement.

**Usage:**            Event

**Mode:**            OFDM, OFDMA/WiBro

**CONFigure:BURSt:SPECtrum:FLATness[:IMMEDIATE]**

This command configures the Spectrum Flatness measurement type. For settings for the Spectrum Flatness measurement see the [CONFigure:BURSt:SPECtrum:FLATness:SElect](#) on page 158 command.

**Example:**           CONF: BURS: SPEC: FLAT  
Configures the Spectrum Flatness measurement type.  
INIT  
Starts a Spectrum Flatness measurement.

**Usage:**            Event

**Mode:**            OFDM, OFDMA/WiBro

**CONFigure:BURSt:SPECtrum:FLATness:SElect <Mode>**

This command configures the interpretation of the Spectrum Flatness measurement results.

**Parameters:**  
<Mode>               FLATness | GRDelay | DIFFerence  
**FLATness**  
spectrum flatness  
**GRDelay**  
group delay  
**DIFFerence**  
flatness difference  
\*RST:                FLAT

**Example:**           CONF: BURS: SPEC: FLAT  
Configures the Spectrum Flatness measurement type.  
CONF: BURS: SPEC: FLAT: SEL GRD  
Configures the group delay for the Spectrum Flatness measurement.

**Mode:**            OFDM, OFDMA/WiBro

**CONFigure:BURSt:SPECTrum:MASK[:IMMediate]**

This command configures the Spectrum Mask measurement type. For settings for the Spectrum Mask measurement see `CONFigure:BURSt:SPECTrum:MASK:SELEct` on page 159 command.

**Example:** `CONF: BURS: SPEC: MASK`  
Configures the Spectrum Mask measurement type.  
`INIT`  
Starts a Spectrum Mask measurement.

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro

**CONFigure:BURSt:SPECTrum:MASK:SELEct <Mode>**

This command configures the interpretation of the Spectrum Mask measurement results..

**Parameters:**  
<Mode> IEEE | ETSI | ETSI301021 | ETSI30254401 [,BW5M | BW10M]  
**IEEE**  
interpretation according to IEEE standard  
**ETSI | ETSI301021**  
interpretation according to ETSI EN 301021 SEM standard  
**ETSI30254401 | ETSI30254401, BW5M**  
interpretation according to ETSI EN 30254401 SEM standard for 5MHz BW  
**ETSI30254401, BW10M**  
interpretation according to ETSI EN 30254401 SEM standard for 10MHz BW

**Example:** `CONF: BURS: SPEC: MASK`  
Configures the Spectrum Mask measurement type.  
`CONF: BURS: SPEC: MASK: SEL ETSI`  
The measurement results are interpreted using the ETSI standard.

**Mode:** OFDM, OFDMA/WiBro

**CONFigure:BURSt:SPECTrum:PHASe:PREamble[:IMMediate]**

This command configures the measurement type to be "Preamble Channel Frequency Response: Phase". After this command has been executed, the specified measurement is only started after you execute the `INITiate` command.

**Example:** `CONF: BURS: SPEC: PHAS: PRE`

**Mode:** OFDMA/WiBro DL

**CONFigure:BURSt:STATistics:BSTReam[:IMMediate]**

This command configures the Bitstream measurement type.

**Example:** `CONF:BURS:STAT:BSTR`  
Configures the Bitstream measurement type.  
`INIT`  
Starts a Bitstream measurement.

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro

---

#### **CONFigure:BURSt:STATistics:BSTReam:BURSt:SElect <Mode>**

This command selects bursts and pilots. It is only available if the Bitstream measurement is selected (see [CONFigure:BURSt:STATistics:BSTReam\[:IMMEDIATE\]](#) on page 159 command).

**Parameters:**

<Mode> 0 to 9999 | ALL | PILOTS

**0 to 9999**  
burst number

**ALL**  
all bursts

**PILOTS**  
only pilots

\*RST: ALL

**Example:** `CONF:BURS:STAT:BSTR`  
Configures the Bitstream measurement type.  
`CONF:BURS:STAT:BSTR:BURS:SEL 1`  
Selects burst 1.  
`INIT`  
Starts a Bitstream measurement. The results of the selected burst (1) are calculated.

**Mode:** OFDMA/WiBro

---

#### **CONFigure:BURSt:STATistics:BSTReam:FORMat:SElect <Mode>**

This command selects the modulation format. It is only available if the Bitstream measurement is selected (see [CONFigure:BURSt:STATistics:BSTReam\[:IMMEDIATE\]](#) on page 159 command).

**Parameters:**

<Mode> ALL | QPSK | QAM16 | QAM64

\*RST: ALL

**Example:** `CONF:BURS:STAT:BSTR`  
Configures the Bitstream measurement type.  
`CONF:BURS:STAT:BSTR:FORM:SEL QPSK`  
Selects the QPSK modulation formats.  
`INIT`  
Starts a Bitstream measurement. The results of the selected modulation formats (QPSK) are calculated.

**Mode:** OFDMA/WiBro

---

**CONFigure:BURSt:STATistics:BSTReam:SYMBOL:SELEct** <Mode>

This command selects the symbol. It is only available if the Bitstream measurement is selected ( [CONFigure:BURSt:STATistics:BSTReam\[:IMMEDIATE\]](#) on page 159).

**Parameters:**

<Mode> 0 to 9999 | ALL  
**0 to 9999**  
 symbol number  
**ALL**  
 all symbols

**Example:**

```
CONF: BURS: STAT: BSTR
Configures the Bitstream measurement type.
CONF: BURS: STAT: BSTR: SYMB: SEL 1
Selects symbol 1.
INIT
Starts a Bitstream measurement. The results of the selected symbol (1) are calculated.
```

**Mode:** OFDMA/WiBro

---

**CONFigure:BURSt:STATistics:BSUMmary[:IMMEDIATE]**

This command configures the Burst Summary measurement type.

**Example:**

```
CONF: BURS: STAT: BSUM
Configures the Burst Summary measurement type.
INIT
Starts a the Burst Summary measurement.
```

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro

---

**CONFigure:BURSt:STATistics:CCDF[:IMMEDIATE]**

This command configures the CCDF (conditional cumulative distribution functions) measurement type.

**Example:**

```
CONF: BURS: STAT: CCDF
Configures the CCDF measurement type.
INIT
Starts a CCDF measurement.
```

**Usage:** Event

**Mode:** OFDM, OFDMA/WiBro



**CONFigure:CHANnel** <Channel>

This command specifies the measurement input channel. It automatically causes the internal measurement frequency to be recalculated.

**Parameters:**

<Channel>                    Range:     0 to 3153  
                                  \*RST:     0

**Example:**

CONF:CHAN 9  
 Defines the frequency of channel 9 as measurement range.

**Mode:**                    OFDM

**CONFigure:POWer:AUTO** <Mode>

This command switches on or off the automatic power level detection.

**Parameters:**

<Mode>                    ON | OFF | ONCE

**Example:**

CONF:POW:AUTO ON  
 At the start of every measurement sweep the input power level is detected automatically.

**Mode:**                    OFDM, OFDMA/WiBro

**CONFigure:POWer:AUTO:SWEep:TIME** <SweepTime>

This command specifies the sweep time for the automatic power level detection.

**Parameters:**

<SweepTime>                1ms to 1s  
                                  \*RST:     100 ms

**Example:**

CONF:POW:AUTO ON  
 At the start of every measurement sweep the input power level is detected automatically.  
 CONF:POW:AUTO:SWE:TIME 200MS  
 The sweep time is set to 200 ms power level.

**Mode:**                    OFDM, OFDMA/WiBro

**CONFigure:POWer:EXPEcted:RF** <PowerLevel>

This command specifies the input power level of the source signal that will be supplied at the analyzer RF input.

**Parameters:**

<PowerLevel>                Range:     -999.99 to 999.99  
                                  \*RST:     -30 dBm  
                                  Default unit: dBm

**Example:** `CONF:POW:EXP:RF -20`  
Assumes an input signal strength of -20 dBm.

**Mode:** OFDM, OFDMA/WiBro

#### CONFigure:STANdard <Standard>

This command specifies the Wireless LAN standard to be measured.

**Parameters:**

<Standard> 0 | 1 | 2  
**0**  
 IEEE 802.16-2004 = OFDM  
**1**  
 IEEE 802.16e-2005 = OFDMA  
**2**  
 IEEE 802.16e-2005 = WiBro  
 \*RST: 1

**Example:** `CONF:STAN 0`  
The measurements will be performed according to IEEE 802.16-2004.

**Mode:** OFDM, OFDMA/WiBro

#### CONFigure:WIMax:AVERaging <Value>

This command specifies the RSSI, CINR averaging parameter.

**Parameters:**

<Value> Range: 0.000001 to 0.999999  
 \*RST: Parameters

**Example:** `CONF:WIM:AVER 0.1`  
Sets the value to 0.1

**Mode:** OFDMA/WiBro

#### CONFigure:WIMax:DLSFrame:IDCell CONFigure:WIMax:Frame:IDCell <IDCellNo>

This command specifies the downlink.IDCell number, which in turn is used as the "DL\_PermBase" parameter for the permutation equations to partly set the sub-carrier randomizer initialisation vector.

**Parameters:**

<IDCellNo> \*RST: 0

**Example:** `CONF:WIM:DLSFFRAME:IDC 0`

**Mode:** OFDM, OFDMA/WiBro

**CONFigure:WIMax:DLSFrame:PREamble:INDEX** <PreamblePattern>

This command specifies the preamble pattern (according to the standard) to be used.

**Parameters:**

<PreamblePattern> integer from 0 to 113

**Example:**

```
CONF:WIM:DLSF:PRE:MOD USER
```

Deactivates the automatic calculation of the preamble index.

```
CONF:WIM:DLSF:PIND 31
```

Specifies the preamble pattern.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:DLSFrame:PREamble:MODE** <Mode>

This command specifies how the preamble index is calculated.

**Parameters:**

<Mode> AUTO | USER

**AUTO**

The preamble index is automatically calculated according to the parameters set by the [CONFigure:WIMax:DLSFrame:IDCell](#) on page 163 and [CONFigure:WIMax:DLSFrame:SEGMENT<1...3>](#) on page 164 commands.

**USER**

The preamble index can be specified manually, i.e. the preamble pattern is chosen by the [CONFigure:WIMax:DLSFrame:PREamble:INDEX](#) on page 164 command according to the standard.

```
*RST: USER
```

**Example:**

```
CONF:WIM:DLSF:PRE:MOD AUTO
```

Activates the automatic calculation of the preamble index.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:DLSFrame:SEGMENT<1...3>** <LogSubchannel>

This command specifies the allowed logical subchannel usage of the transmission spectrum for one of the three downlink PUSC segments.

Note that the indexes specified on the instrument are based on 0, whereas under remote control they are based on 1. This means the first segment on the instrument is labeled segment 0 and would be accessed with the command `CONF:WIM:DLSF:SEG1`.

**Parameters:**

<LogSubchannel> Range: 0 to 63

```
*RST: 0
```

**Example:** `CONF:WIM:DLSF:SEGM1 63`  
 Specifies the logical subchannel usage of the transmission spectrum for the first downlink PUSC segment to 63.

**Mode:** OFDMA/WiBro

---

### CONFigure:WIMax:FBAND <MeasType>

This command configures the Phase or Frequency vs Preamble measurement type.

#### Setting parameters:

<MeasType> ETSI | ETSI1 | ETSI2 | MMDS | MMDS1 | MMDS2 | WCS | WCS1 | WCS2 | CEPT | CEPT1 | CEPT2 | UNII | UNII1 | UNII2

#### ETSI | ETSI1

3.410-4.200 GHz Licensed Band

#### ETSI2

10.000-10.680 GHz Licensed Band

#### MMDS | MMDS1

2.150-2.162 GHz Licensed Band

#### MMDS2

2.500-2.690 GHz Licensed Band

#### WCS | WCS1

2.305-2.320 GHz Licensed Band

#### WCS2

2.345-2.360 GHz Licensed Band

#### CEPT | CEPT1

5.470-5.725 GHz License Exempt Band

#### CEPT2

5.725-5.875 GHz License Exempt Band

#### UNII | UNII1

5.250-5.350 GHz License Exempt Band

#### UNII2

5.725-5.825 GHz License Exempt Band

**Return values:**

&lt;Result&gt;

ETSI | ETSI2 | MMDS | MMDS2 | WCS | WCS2 | CEPT | CEPT2 |  
UNII | UNII2**ETSI**

3.410-4.200 GHz Licensed Band

**ETSI2**

10.000-10.680 GHz Licensed Band

**MMDS**

2.150-2.162 GHz Licensed Band

**MMDS2**

2.500-2.690 GHz Licensed Band

**WCS**

2.305-2.320 GHz Licensed Band

**WCS2**

2.345-2.360 GHz Licensed Band

**CEPT**

5.470-5.725 GHz License Exempt Band

**CEPT2**

5.725-5.875 GHz License Exempt Band

**UNII**

5.250-5.350 GHz License Exempt Band

**UNII2**

5.725-5.825 GHz License Exempt Band

**Example:**

CONF:WIM:FBAN ETSI

Configures the frequency band to be ETSI 3.41GHz – 4.2GHz.

CONF:WIM:FBAN?

After frequency band is set to ETSI this will return "ETSI" as the  
current frequency band.

CONF:WIM:FBAN ETSI1

Configures the frequency band to be ETSI 3.41GHz – 4.2GHz.

CONF:WIM:FBAN?

After frequency band is set to ETSI1 this will return "ETSI" as the  
current frequency band.

CONF:WIM:FBAN ETSI2

Configures the frequency band to be ETSI 10.0GHz – 10.68GHz.

CONF:WIM:FBAN?

After frequency band is set to ETSI2 this will return "ETSI2" as the  
current frequency band.

INIT

Starts a Phase or Frequency vs Preamble measurement.

**Mode:**

OFDM, OFDMA/WiBro

**CONFigure:WIMax:Frame:IDCell:AUTO <State>**

This command specifies that the IDCell number is determined by analysis.

**Parameters:**

<State> ON | OFF  
 \*RST: 0

**Example:**

CONF:WIM:FRAME:IDC:AUTO 1

**Mode:**

OFDM, OFDMA/WiBro

**CONFigure:WIMax:FRAME:PREDefmap:CONFig****CONFigure:WIMax:FRAME:PREDefmap:IQDL****CONFigure:WIMax:FRAME:PREDefmap:IQUL****CONFigure:WIMax:FRAME:PREDefmap:SMU <State>**

This command defines the predefined map mode for auto demod.

- **CONFig**: frame configuration settings used
- **IQDL**: downlink; determined by a loaded IQW file
- **IQUL**: uplink, determined by an IQW file
- **SMU**: the current SMU or equivalent generator settings are used

**Parameters:**

<State> ON | OFF  
 \*RST: 0

**Example:**

CONF:WIM:FRAME:PREDefmap CONFig 1

**Mode:**

OFDM, OFDMA/WiBro

**CONFigure:WIMax:FRAME:ZONetouse <Zone>**

This command configures the zone to be used for auto demodulation.

**Parameters:**

<Zone> LAST | Z1 | Z2 | Z3 | Z4 | Z5 | Z6 | Z7 | Z8 | Z9 | Z10 | Z11 | Z12 |  
 Z13 | Z14 | Z15 | Z16 | Z18 | Z19 | Z20 | Z21 | Z22 | Z23 | Z24 |  
 Z25 | Z26

**LAST**

The last available zone.

**Z1 | ... | Z26**

Zone number 1 to zone 26.

\*RST: Z1

**Example:**

CONF:WIM:FRAME:ZONE LAST

Last zone is used

CONF:WIM:FRAME:ZONE Z2

Zone 2 is used

**Mode:**

OFDM, OFDMA/WiBro

**CONFigure:WIMax:FSBWratio:AUTO** <State>

This remote control command only switches the Fs/BS ratio to automatic (as per standard) or to user defined values. User mode is only available when the Frequency Band is set to UNSPECIFIED.

**Parameters:**

<State> ON | OFF  
\*RST: on

**Example:** CONF:WIM:FSBW:AUTO ON  
Sets FS/BW ratrion to auto.

**Mode:** OFDM, OFDMA/WiBro

**CONFigure:WIMax:FSBWratio:BW**

This remote control command sets the Channel Bandwidth (BW) part of the ratio used to calculate the relationship between the Channel Bandwidth (BW) and the Sample Rate (Fs). Ratio = Fs/BW.

**Parameters:**

\*RST: 7

**Example:** CONF:WIM:FSBW:BW 1.5  
Sets the Channel Bandwidth ratio to 1.5.

**Mode:** OFDM, OFDMA/WiBro

**CONFigure:WIMax:FSBWratio:FS**

This remote control command sets the Sample Rate (Fs) part of the ratio used to calculate the relationship between the Channel Bandwidth (BW) and the Sample Rate (FS). Ratio = Fs/BW.

**Parameters:**

\*RST: 8

**Example:** CONF:WIM:FSBW:FS 2  
Sets the Channel Bandwidth ratio to 1.5.

**Mode:** OFDM, OFDMA/WiBro

**CONFigure:WIMax:IGRatio** <NoGuardSamples>

This command specifies the number of guard samples.

**Parameters:**

<NoGuardSamples> Value | 4 | 8 | 16 | 32

**Value**

Guard samples (Tg/Tb)

**4**

1/4

**8**

1/8

**16**

1/16

**32**

1/32

valid range:

$\frac{T_g}{T_b} \in \{1/32, 1/16, 1/8, 1/4\}$

The ration can be set to one of four values – 4, 8, 16 or 32. The table below shows the relationship between these values and the number of guard samples.

**Example:**

CONF:WIM:IGR 16

Sets the number of guard samples to 1/16.

**Mode:**

OFDM, OFDMA/WiBro

**CONFigure:WIMax:LMODe** <Mode>

This command specifies only to analyze the Down Link or Up Link bursts during a measurement.

**Parameters:**

<Mode> UL | DL

**Example:**

CONF:WIM:LMODe UL

Only the Up Link bursts are analyzed.

**Mode:**

OFDM, OFDMA/WiBro

**CONFigure:WIMax:NFFT** <FFTSize>

This command specifies the current FFT size.



**Parameters:**

<FFTSize> FFT128 | FFT512 | FFT1024 | FFT2048

**FFT128**

FFT size of 128 carriers

**FFT512**

FFT size of 512 carriers

**FFT1024**

FFT size of 1024 carriers

**FFT2048**

FFT size of 2048 carriers

\*RST: FFT1024

**Example:**

CONF:WIM:NFFT FFT2048

Sets the FFT size to 2048 carriers.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:TDDFrame:TTG <TransitionGap>**

This command specifies the TDD frame TX Transition Gap (TTG).

**Parameters:**

<TransitionGap> Range: 0 to 2  
\*RST: 5us  
Default unit: seconds

**Example:**

CONF:WIM:TDDF:TTG 10us

Specifies the TDD frame TX Transition Gap as 10 µs.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:ULSFrame:CRLength <Length>**

This remote control command is used to specify the Control Region length for the uplink frame.

**Parameters:**

<Length> Range: 0 to 30  
\*RST: 0

**Example:**

CONF:WIM:ULSF:CRL 0

Set the uplink control region length to 0.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:ULSFrame:FRAME <FrameNumber>**

This command selects the frame number of the uplink frame in which the UL map that specifies the uplink burst was transmitted.

**Parameters:**

<FrameNumber>      Range:      0 to 10  
                          \*RST:        0

**Example:**

CONF:WIM:ULSF:FRAM 0  
 Selects frame number 0.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:ULSFrame:SEGMENT<1..3>:BITMap<1..18>**

This remote control command is used to specify the allowable logical sub channel bitmap usage of the transmission spectrum for one of the three uplink segments.

**Parameters:**

\*RST:            0

**Example:**

CONF:WIM:ULSF:SEG1:BITM1 ?

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>[:ANALyze]:STATe <State>**

This command sets a zone for analysis. This will come into effect when the next measurement is executed.

**Parameters:**

<State>            ON | OFF

**Example:**

CONF:WIM:ZONE1:ANAL ON  
 Sets zone 1 for analysis.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:CONTrol[:DATA] <Modulation>, <Subchannels>, <Symbols>, <Slot Duration>, <Subchannel Offset>, <Symbol Offset>, <Burst Power>, <Burst Type>**

This command associates a burst definition with a specific zone. A zone may have up to 32 bursts defined within it.

New bursts can only be appended to the end of the existing burst list. For example if 4 bursts are already defined, then the suffix required to enter a new burst is 5.

**Parameters:**

<Modulation>	AUTO   QPSK   QPSK_1_2   QPSK_3_4   QAM16   QAM16_1_2   QAM16_3_4   QAM64   QAM64_1_2   QAM64_2_3   QAM64_3_4   QAM64_5_6 modulation scheme <b>AUTO</b> Auto Detect – modulation is detected when the signal is analysed <b>QPSK</b> QPSK_1_2 <b>QPSK_1_2</b> QPSK code rate 1/2 <b>QPSK_3_4</b> QPSK code rate 3/4 <b>QAM16</b> QAM16_1_2 <b>QAM16_1_2</b> 16 QAM code rate 1/2 <b>QAM16_3_4</b> 16 QAM code rate 3/4 <b>QAM64</b> QAM64_1_2 <b>QAM64_1_2</b> 64 QAM code rate 1/2 <b>QAM64_2_3</b> 64 QAM code rate 2/3 <b>QAM64_3_4</b> 64 QAM code rate 3/4 <b>QAM64_5_6</b> 64 QAM code rate 5/6
<Subchannels>	number of subchannels used by the burst
<Symbols>	number of symbols used by the burst
<Slot Duration>	slot duration (only applies to uplink bursts; ignored by downlink bursts)
<Subchannel Offset>	subchannel offset of the burst
<Symbol Offset>	symbol offset of the burst
<Burst Power>	boosting power of the burst
<Burst Type>	FCH   DLMAP   ULMAP   DATA   HARQ   FASTfeedback burst type

**Example:**            `CONF:WIM:ZONE1:BURSt:CONT`  
                          `QAM16_1_2,5,10,20,0,0,0,DATA`  
 Defines a 16 QAM 1/2 burst using 5 subchannels and 10 symbols.  
                          `CONF:WIM:ZONE1:BURSt:CONT`  
                          `QAM16_1_2,0,0,6,0,0,0,DLMAP`  
 To define a 16 QAM 1/2 DL Map burst of 6 slots in length.

**Mode:**                OFDM, OFDMA/WiBro

#### **CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:COUNT?**

This command returns the current count of user defined bursts within the specified zone.  
 This command is only a query and therefore has no \*RST value.

**Example:**            `CONF:WIM:ZONE1:BURSt:COUN?`  
 Returns the user defined bursts within zone 1.

**Usage:**                Query only

**Mode:**                OFDMA/WiBro

#### **CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:DELeTe**

This command deletes a specific burst from within the specified zone.

**Example:**            `CONF:WIM:ZONE1:BURSt:DEL`  
 Deletes burst 1 from zone 1.

**Mode:**                OFDMA/WiBro

#### **CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:FORMat <Modulation>**

This command specifies the burst modulation format for the specified zone.

**Parameters:**

<Modulation> AUTO | QPSK | QPSK\_1\_2 | QPSK\_3\_4 | QAM16 | QAM16\_1\_2 | QAM16\_3\_4 | QAM64 | QAM64\_1\_2 | QAM64\_2\_3 | QAM64\_3\_4 | QAM64\_5\_6  
 modulation scheme

**AUTO**  
 Auto Detect – modulation is detected when the signal is analysed

**QPSK**  
 QPSK\_1\_2

**QPSK\_1\_2**  
 QPSK code rate 1/2

**QPSK\_3\_4**  
 QPSK code rate 3/4

**QAM16**  
 QAM16\_1\_2

**QAM16\_1\_2**  
 16 QAM code rate 1/2

**QAM16\_3\_4**  
 16 QAM code rate 3/4

**QAM64**  
 QAM64\_1\_2

**QAM64\_1\_2**  
 64 QAM code rate 1/2

**QAM64\_2\_3**  
 64 QAM code rate 2/3

**QAM64\_3\_4**  
 64 QAM code rate 3/4

**QAM64\_5\_6**  
 64 QAM code rate 5/6

**Example:** CONF:WIM:ZONE1:BURSt1:FORM QAM64\_3D4  
 Sets the burst modulation format to QAM64\_3D4.

**Mode:** OFDM, OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:OFFSet:AUTO <State>**

This command allows, for the specified zone and burst, the logical subchannel and symbol offsets to be automatically calculated so that they are contiguous. The command only applies to uplink bursts.

**Parameters:**

<State> ON | OFF

**Example:** CONF:WIM:ZONE1:BURSt1:OFFS:AUTO ON  
 Activates the automatic calculation of the logical subchannel and symbol offsets.

**Mode:** OFDMA/WiBro

**CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:POWER <BoostingPower>**

This command specifies, for the specified zone and burst, the boosting power associated with the burst.

**Parameters:**

<BoostingPower>      Range:      -80 to 10

**Example:**

CONF:WIM:ZONE1:BURSt1:POW 0

Sets the boosting power associated with the burst to 0.

**Mode:**

OFDMA/WiBro

**CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:RESet**

This remote control command removes all burst data associated with a specific zone. The burst index is ignored.

**Example:**

CONF:WIM:ZONE1:BURSt1:RESet

**Mode:**

OFDMA/WiBro

**CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:SLOT:DURation <Duration>**

This command defines, for the specified zone and burst, the duration of an uplink burst in slots in seconds. The command has no effect on downlink bursts.

**Parameters:**

<Duration>              Range:      1 to 3000

**Example:**

CONF:WIM:ZONE1:BURSt1:SLOT:DUR 10

Sets the duration of uplink burst 1 to 10.

**Mode:**

OFDMA/WiBro

**CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:COUNT  
<NoSubchannels>**

This command defines, for the specified zone and burst, the number of logical subchannels used by the burst.

**Parameters:**

<NoSubchannels>      Range:      1 to 60

**Example:**

CONF:WIM:ZONE1:BURSt1:SUBC:COUN 5

Sets the number of logical subchannels used by burst 1 to 5.

**Mode:**

OFDMA/WiBro

**CONFigure:WiMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:OFFSet <Offset>**

This command defines, for the specified zone and burst, the logical subchannels offset for the burst. This, together with the symbol offset, can be used to specify the frequency bandwidth in use by specific bursts.

**Parameters:****<Offset>** Range: 0 to 60**Example:**

```
CONF:WIM:ZONE1:BURSt1:SUBC:OFFS 5
```

Sets the subchannels offset for burst 1 to 5.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SYMBol:COUNT <NoSymbols>**

This command defines, for the specified zone and burst, the number of symbols used by the burst.

**Parameters:****<NoSymbols>** Range: 1 to 1000**Example:**

```
CONF:WIM:ZONE1:BURSt1:SYMB:COUN 5
```

Sets the number of symbols used by burst 1 to 5.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SYMBol:OFFSet <Offset>**

This command defines, for the specified zone and burst, the symbol offset for the burst. This, together with the logical subchannel offset, can be used to specify the frequency bandwidth in use by specific bursts.

**Parameters:****<Offset>** Range: 0 to 1000**Example:**

```
CONF:WIM:ZONE1:BURSt1:SYMB:OFFS 5
```

Sets the symbol offset for burst 1 to 5.

**Mode:**

OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:TYPE <Type>**

For the specified zone and burst, this command specifies the type of burst from the protocol layer perspective, i.e. if the burst contains signaling information or if it is just a data burst.

**Parameters:****<Type>** FCH | DLMAP | ULMAP | DATA**FCH**

frame control header

**DLMAP**

downlink map

**ULMAP**

uplink map

**DATA**

data burst

**Example:** `CONF:WIM:ZONE1:BURS1:TYPE DATA`  
Burst 1 is a data burst.

**Mode:** OFDMA/WiBro

### **CONFigure:WIMax:ZONE<1...26>:CONTRol[:DATA]**

<Analyze>,<Type>,<Segment>,<Length>,<Offset>,<Permbase>,<PRBS\_ID>

This command adds a new zone. Up to 26 user zones can be defined.

New zones can only be appended to the end of the existing defined zones. For example, if 4 zones are already defined, then the suffix required to enter a new zone is 5.

#### **Parameters:**

<Analyze> ON | OFF  
Specifies whether the zone is too be marked for analysis.

<Type> DLFUSC | DLPUSC | ULPUSC  
Zone type  
**DLFUSC**  
downlink FUSC (Fully Used Subchannelization) zone  
**DLPUSC**  
downlink PUSC (Partial Used Subchannelization) zone  
**ULPUSC**  
uplink PUSC zone

<Segment> 0 | 1 | 2  
downlink PUSC zone segment

<Length> zone symbol length

<Offset> zone symbol offset

<Permbase> permbase to be used for channel decoding

<PRBS\_ID> PRBS to be used for channel decoding

**Example:** `CONF:WIM:ZONE1:CONT ON,DLFUSC,0,10,0,0,0`  
Adds a DL\_PUSC zone with a length of 10 symbols.

**Mode:** OFDMA/WiBro

### **CONFigure:WIMax:ZONE<1...26>:CONTRol:STCConfig <Coding>**

This remote control specifies the space time coding.

#### **Parameters:**

<Coding> **NOSTC**  
No space time coding  
**TX2**  
Two antennas  
\*RST: NOSTC



**Example:** CONF:WIM:ZONE1:CONT:STCC TX2  
**Mode:** OFDM, OFDMA/WiBro

#### CONFigure:WIMax:ZONE<1...26>:COUNT?

This command returns the current count of the specified zone.

**Example:** CONF:WIM:ZONE1:COUN?  
 Returns the count of zone 1.

**Usage:** Query only

**Mode:** OFDMA/WiBro

#### CONFigure:WIMax:ZONE<1...26>:DELete

This command deletes a specific zone. If the specified zone is within a larger list of zones, then all following zones will be shuffled down to take up the space occupied by the deleted zone.

**Example:** CONF:WIM:ZONE1:DEL  
 Deletes zone 1.

**Usage:** Event

**Mode:** OFDMA/WiBro

#### CONFigure:WIMax:ZONE<1...26>:IDSegment <SegmentNumber>

This command specifies the segment number associated with the zone. This is only valid for PUSC zones and will have no effect on other zone types.

**Parameters:**  
 <SegmentNumber> 0 | 1 | 2

**Example:** CONF:WIM:ZONE1:IDS 0  
 Sets the segment number for zone 1 to 0.

**Mode:** OFDMA/WiBro

#### CONFigure:WIMax:ZONE<1...26>:PERMbase <PermBase>

This command specifies the perm base which is used in the permutation equations for the specified zone.

**Parameters:**  
 <PermBase> Range: 0 to 31

**Example:** CONF:WIM:ZONE1:PERM 0  
 For zone 1, perm base 0 is used in the permutation equations.

**Mode:** OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:PRBS <BinarySequence>**

This command specifies a known PRBS (pseudo random binary sequence) modulated data sequence that is in use by the DUT of the specified zone.

**Parameters:**

<BinarySequence> 0, 1, 2, 3

**Example:** `CONF:WIM:ZONE1:PRBS 0`  
Sets the PRBS to 0.

**Mode:** OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:RESet**

This remote control command removes all zone and burst data. The zone index is ignored.

**Example:** `CONF:WIM:ZONE1:RESet`

**Mode:** OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:SYMB:OFFSet <Offset>**

This command specifies the symbol offset associated with the specified zone. This is used to analyze signals which contain multiple zones and allows any zone in a subframe to be set up for analysis.

**Parameters:**

<Offset> Range: 1 to 1000

**Example:** `CONF:WIM:ZONE1:SYMB:OFFS 0`  
Sets the symbol offset for zone 1 to 0.

**Mode:** OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:SYMB:COUNT <NoSymbols>**

This command specifies the number of symbols defined to the specified zone.

**Parameters:**

<NoSymbols> Range: 1 to 1000

**Example:** `CONF:WIM:ZONE1:SYMB:COUNT 10`  
Sets the number of symbols for zone 1 to 10.

**Mode:** OFDMA/WiBro

**CONFigure:WIMax:ZONE<1...26>:TYPE <ZoneType>**

This command specifies the zone type of the specified zone.

**Parameters:**

<ZoneType> DLFUSC | DLPUSC | ULPUSC

**DLFUSC**  
downlink FUSC zone

**DLPUSC**  
downlink PUSC zone

**ULPUSC**  
uplink PUSC zone

**Example:**

CONF:WIM:ZONE1:TYPE DLPUSC  
Specifies zone 1 as downlink PUSC zone.

**Mode:**

OFDMA/WiBro

## 5.8 DISPlay Subsystem (WiMAX / WiBro, K93)

The DISPlay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display. In contrast to the basic device, the WiMAX IEEE 802.16 OFDM, OFDMA Measurements option supports the split screen modus.

### Commands of the DISPlay Subsystem

DISPlay:FORMat.....	180
DISPlay[:WINDow<n>]:SElect.....	181
DISPlay[:WINDow<n>]:SSElect.....	181
DISPlay[:WINDow<n>]:TABLE.....	181
DISPlay[:WINDow<n>]:TABLE:LIST.....	181
DISPlay[:WINDow<n>]:TABLE:UNIT.....	182
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO.....	182
DISPlay[:WINDow<n>]:TRACe1:Y[:SCALe]:PDIVision.....	183
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel[:RF].....	183
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel.....	184
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:IQ.....	184
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet.....	184

---

### DISPlay:FORMat <Format>

This command switches the measurement result display between FULL SCREEN and SPLIT SCREEN.

**Parameters:**

<Format> SINGLE | SPLit

**SPLit**  
Show 2 or more screens on the display

**SINGLE**  
Show only 1 screen on the display

\*RST: SPL

**Example:** DISP:FORM SING

**Mode:** all

#### DISPlay[:WINDow<n>]:SElect

This command selects whether window A or B is active (see also [DISPlay\[:WINDow<n>\]:SSElect](#) on page 181)

**Suffix:**

<n> 1 | 2  
window; 1 = window A, 2 = window B

**Example:** DISP:WIND1 SEL  
Sets window A active.

**Mode:** OFDMA/WiBro

#### DISPlay[:WINDow<n>]:SSElect

This command selects whether window A or B is active.

**Suffix:**

<n> 1 | 2  
window; 1 = window A, 2 = window B

**Example:** DISP:WIND1:SSEL  
Sets window A active.

**Mode:** OFDM, OFDMA/WiBro

#### DISPlay[:WINDow<n>]:TABLe <State>

This command shows or hides the results table.

**Suffix:**

<n> 1...4  
window

**Parameters:**

<State> ON | OFF  
\*RST: OFF

**Example:** DISP:TABL OFF  
Hides the results table.

**Mode:** OFDM, OFDMA/WiBro

#### DISPlay[:WINDow<n>]:TABLe:LIST <PageNumber>

This command displays the requested page for the results table. The number of available pages depends on the selected standard (e.g. OFDM has 1 page, OFDMA has 2 pages).

**Suffix:**

<n> 1...4  
window

**Parameters:**

<PageNumber> Range: 1 to 2  
\*RST: 1

**Example:**

DISP:TABLE:LIST 1  
Selects page 1 of the table of results.

**Mode:**

OFDM, OFDMA/WiBro

**DISPlay[:WINDow<n>]:TABLe:UNIT <Unit>**

This command specifies the unit for the parameters listed in the results table.

**Suffix:**

<n> 1...4  
window

**Parameters:**

<Unit> DB | PCT  
**DB**  
results returned in dB  
**PCT**  
results returned in percent  
\*RST: DB

**Example:**

DISP:TABLE:UNIT DB  
Results are returned in dB.

**Mode:**

OFDM, OFDMA/WiBro

**DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO <Mode>**

This command switches on or off automatic scaling of the Y-axis for the specified trace display. Automatic scaling sets the Y-axis to automatically scale to best fit the measurement results.

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

**Suffix:**

<n> window; For applications that do not have more than 1 measurement window, the suffix <n> is irrelevant.  
  
<t> only 1  
trace

**Parameters:**

<Mode> ON | OFF | ONCE

**ON**  
Automatic scaling is on.

**OFF**  
Automatic scaling is off.

**ONCE**  
Automatic scaling is performed once, then switched off again.

\*RST: OFF

**Example:**

DISP:WIND2:TRAC:Y:SCAL:AUTO ONCE  
Activates automatic scaling of the Y-axis for the active trace

**Mode:**

CDMA, EVDO, OFDM, OFDMA/WiBro, PHN

**DISPlay[:WINDow<n>]:TRACe1:Y[:SCALe]:PDIVision <ScaleDivision>**

This command sets the size of each y scale division for trace 1. It has no affect if automatic scaling of the y-axis is enabled (see [DISPlay\[:WINDow<n>\]:TRACe<t>:Y\[:SCALe\]:AUTO](#) on page 182).

This command is query only for the following result displays:

- Constellation vs Symbol
- Constellation vs Carrier

**Suffix:**

<n> 1...4  
window

**Parameters:**

<ScaleDivision> Range: 1E-6 to 10E12  
\*RST: 3

**Example:**

DISP:WIND2:TRAC1:Y:AUTO OFF  
Switches off automatic scaling of the y-axis for the active trace.  
DISP:WIND2:TRAC1:Y:PDIV 2  
Sets the y scale division to size 2.

**Usage:**

SCPI confirmed

**Mode:**

OFDM, OFDMA/WiBro

**DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel[:RF] <Level>**

This command specifies the reference level applied to an RF measurement.

**Suffix:**

<n> irrelevant  
<t> irrelevant

**Parameters:**

<Level> \*RST: 0 dB

**Example:**            `DISP:TRAC:Y:RLEV 10`  
 Reference level of the analyzer is 10 dB  
`DISP:TRAC:Y:RLEV:RF -10`  
 Reference level of the analyzer is -10 dB

**Usage:**            SCPI confirmed

**Mode:**             OFDM, OFDMA/WiBro

#### **DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel?**

This command queries the current internal instrument reference level used when performing measurements.

**Suffix:**

<n>                    irrelevant.

<t>                    irrelevant

**Example:**            `DISP:TRAC:Y:RLEV?`  
 Returns the current reference level in use.

**Usage:**            Query only  
 SCPI confirmed

**Mode:**             OFDM, OFDMA/WiBro

#### **DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:IQ <Level>**

This command can be used to retrieve or set the current internal instrument reference level for baseband input used when performing measurements.

**Suffix:**

<n>                    irrelevant

<t>                    irrelevant

**Parameters:**

<Level>               <numeric value> in V  
 \*RST:                1 V

**Example:**            `DISP:TRAC:Y:IQ?`  
 Returns the current baseband reference level in use.  
`DISP:TRAC:Y:RLEV:IQ 1`  
 Sets the instrument reference level to 1.

**Mode:**             OFDM, OFDMA/WiBro

#### **DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet <Value>**

This command sets the reference level offset.

**Suffix:**

<n>                    irrelevant.

<t>                    irrelevant

**Parameters:**

<Value> -200dB to 200dB  
 \*RST: 0dB

**Example:**

DISP:TRAC:Y:RLEV:OFFS -10dB

**Mode:**

ALL

## 5.9 FETCh Subsystem (WiMAX / WiBro, K93)

The FETCh subsystem contains commands for reading out results of complex measurement tasks. This subsystem is closely linked to the CONFigure and SENSE subsystems.

FETCh:BURSt:ALL.....	186
FETCh:BURSt:BERPilot:AVERAge.....	187
FETCh:BURSt:BERPilot:MINimum.....	187
FETCh:BURSt:BERPilot:MAXimum.....	187
FETCh:BURSt:CINR.....	187
FETCh:BURSt:CINR:AVERAge.....	187
FETCh:BURSt:CINR:MINimum.....	187
FETCh:BURSt:CINR:MAXimum.....	187
FETCh:BURSt:COUNt[:ALL].....	187
FETCh:BURSt:CRESt:AVERAge.....	188
FETCh:BURSt:CRESt:MAXimum.....	188
FETCh:BURSt:CRESt:MINimum.....	188
FETCh:BURSt:EVM:ALL:AVERAge.....	188
FETCh:BURSt:EVM:ALL:MAXimum.....	188
FETCh:BURSt:EVM:ALL:MINimum.....	188
FETCh:BURSt:EVM:DATA:AVERAge.....	188
FETCh:BURSt:EVM:DATA:MAXimum.....	188
FETCh:BURSt:EVM:DATA:MINimum.....	188
FETCh:BURSt:EVM:PILot:AVERAge.....	189
FETCh:BURSt:EVM:PILot:MAXimum.....	189
FETCh:BURSt:EVM:PILot:MINimum.....	189
FETCh:BURSt:EVM:PREAmble:AVERAge.....	189
FETCh:BURSt:EVM:PREAmble:MAXimum.....	189
FETCh:BURSt:EVM:PREAmble:MINimum.....	189
FETCh:BURSt:FERRor:AVERAge.....	189
FETCh:BURSt:FERRor:MAXimum.....	189
FETCh:BURSt:FERRor:MINimum.....	189
FETCh:BURSt:GIMBalance:AVERAge.....	189
FETCh:BURSt:GIMBalance:MAXimum.....	189
FETCh:BURSt:GIMBalance:MINimum.....	189
FETCh:BURSt:IQOFfset:AVERAge.....	190
FETCh:BURSt:IQOFfset:MAXimum.....	190
FETCh:BURSt:IQOFfset:MINimum.....	190
FETCh:BURSt:QUADoffset:AVERAge.....	190
FETCh:BURSt:QUADoffset:MAXimum.....	190
FETCh:BURSt:QUADoffset:MINimum.....	190



FETCh:BURSt:RMS:ALL:AVERage.....	190
FETCh:BURSt:RMS:ALL:MAXimum.....	190
FETCh:BURSt:RMS:ALL:MINimum.....	190
FETCh:BURSt:RMS:AVERage.....	190
FETCh:BURSt:RMS:MAXimum.....	190
FETCh:BURSt:RMS:MINimum.....	190
FETCh:BURSt:RMS:DATA:AVERage.....	191
FETCh:BURSt:RMS:DATA:MAXimum.....	191
FETCh:BURSt:RMS:DATA:MINimum.....	191
FETCh:BURSt:RMS:DLPReamble:AVERage.....	191
FETCh:BURSt:RMS:DLPReamble:MAXimum.....	191
FETCh:BURSt:RMS:DLPReamble:MINimum.....	191
FETCh:BURSt:RMS:PILot:AVERage.....	191
FETCh:BURSt:RMS:PILot:MAXimum.....	191
FETCh:BURSt:RMS:PILot:MINimum.....	191
FETCh:BURSt:RSSI.....	192
FETCh:BURSt:RSSi:AVERage.....	192
FETCh:BURSt:RSSi:MAXimum.....	192
FETCh:BURSt:RSSi:MINimum.....	192
FETCh:BURSt:SYMBolerror:AVERage.....	192
FETCh:BURSt:SYMBolerror:MAXimum.....	192
FETCh:BURSt:SYMBolerror:MINimum.....	192
FETCh:BURSt:TDOMain:PREamble.....	192
FETCh:BURSt:TDOMain:PREamble:AVERage.....	193
FETCh:BURSt:TDOMain:PREamble:MAXimum.....	193
FETCh:BURSt:TDOMain:PREamble:MINimum.....	193
FETCh:BURSt:TDOMain:SUBFrame.....	193
FETCh:BURSt:TDOMain:SUBFrame:AVERage.....	193
FETCh:BURSt:TDOMain:SUBFrame:MAXimum.....	193
FETCh:BURSt:TDOMain:SUBFrame:MINimum.....	193
FETCh:BURSt:TDOMain:ZONE.....	193
FETCh:BURSt:TDOMain:ZONE:AVERage.....	194
FETCh:BURSt:TDOMain:ZONE:MAXimum.....	194
FETCh:BURSt:TDOMain:ZONE:MINimum.....	194
FETCh:BURSt:USERror:AVERage.....	194
FETCh:BURSt:USERror:MAXimum.....	194
FETCh:BURSt:USERror:MINimum.....	194
FETCh:SYMBol:COUNT.....	194
FETCh:ZONE:COUNT.....	195

---

### FETCh:BURSt:ALL?

This command returns all the results. The results are output as a list of result strings separated by commas in ASCII format. Different sets of results are obtained depending on the used standard and uplink/downlink mode. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119.

The units for the EVM results are specified with the `UNIT:EVM` command.

**Example:**                    `FETC:BURS:ALL?`  
All calculated results are returned

**Usage:** Query only  
**Mode:** OFDM, OFDMA/WiBro

---

**FETCh:BURSt:BERPilot:AVERAge?**  
**FETCh:BURSt:BERPilot:MINimum?**  
**FETCh::BURSt:BERPilot:MAXimum?**

These commands return the determined BER values for pilots (average, minimum or maximum value). The result is returned in ASCII format. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119 .

**Example:** `FETC:BURS:BERP:MAX?`  
 The calculated maximum BER value is returned.

**Usage:** Query only  
**Mode:** OFDMA/WiBro

---

**FETCh:BURSt:CINR?**

This command returns all the CINR results separated by commas. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119 .

**Example:** `FETC:BURS:CINR?`  
 The calculated CINR results from the most recent measurement are returned.

**Usage:** Query only  
**Mode:** OFDM, OFDMA/WiBro

---

**FETCh:BURSt:CINR:AVERAge?**  
**FETCh:BURSt:CINR:MINimum?**  
**FETCh:BURSt:CINR:MAXimum?**

These commands return the determined CINR (carrier to interference and noise ratio) standard deviation value (average, minimum or maximum value). The result is returned in ASCII format. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119 .

**Example:** `FETC:BURS:RSS:MAX?`  
 The calculated maximum CINR value is returned.

**Usage:** Query only  
**Mode:** OFDMA/WiBro

---

**FETCh:BURSt:COUNt[:ALL]?**

This command returns the number of bursts analyzed in the last sweep.

<b>Example:</b>	<code>FETC:BURS:COUN?</code> The number of analyzed bursts in the most recent measurement is returned.
<b>Usage:</b>	Query only
<b>Mode:</b>	OFDM, OFDMA/WiBro

**FETCh:BURSt:CRESt:AVERage?**  
**FETCh:BURSt:CRESt:MAXimum?**  
**FETCh:BURSt:CRESt:MINimum?**

These commands return the determined crest factor (average, minimum or maximum value) in dBm. The crest factor is the ratio of peak power to average power.

<b>Example:</b>	<code>FETC:BURS:CRES:MAX?</code> The calculated maximum crest factor from the most recent measurement is returned.
<b>Usage:</b>	Query only
<b>Mode:</b>	OFDM, OFDMA/WiBro

**FETCh:BURSt:EVM:ALL:AVERage?**  
**FETCh:BURSt:EVM:ALL:MAXimum?**  
**FETCh:BURSt:EVM:ALL:MINimum?**

This command returns the Error Vector Magnitude (EVM) measurement results summary (average, minimum or maximum value) in dB. The EVM result is based on the pilot and data subcarriers.

<b>Example:</b>	<code>FETC:BURS:EVM:ALL:MIN?</code> The minimum Error Vector Magnitude value is returned.
<b>Usage:</b>	Query only
<b>Mode:</b>	OFDM, OFDMA/WiBro

**FETCh:BURSt:EVM:DATA:AVERage?**  
**FETCh:BURSt:EVM:DATA:MAXimum?**  
**FETCh:BURSt:EVM:DATA:MINimum?**

This command returns the Error Vector Magnitude measurement results summary (average, minimum or maximum value) for the data carrier in dB.

<b>Example:</b>	<code>FETC:BURS:EVM:DATA:MAX?</code> The maximum EVM recorded for the data carrier is returned.
<b>Usage:</b>	Query only
<b>Mode:</b>	OFDM, OFDMA/WiBro

---

**FETCh:BURSt:EVM:PILot:AVERage?**  
**FETCh:BURSt:EVM:PILot:MAXimum?**  
**FETCh:BURSt:EVM:PILot:MINimum?**

This command returns the Error Vector Magnitude measurement results summary for the EVM pilot carrier in dB.

**Example:**                    `FETC:BURS:EVM:PIL:MAX?`  
The maximum EVM recorded for the EVM pilot carrier is returned.

**Usage:**                    Query only

**Mode:**                    OFDM, OFDMA/WiBro

---

**FETCh:BURSt:EVM:PREamble:AVERage?**  
**FETCh:BURSt:EVM:PREamble:MAXimum?**  
**FETCh:BURSt:EVM:PREamble:MINimum?**

This command returns the Error Vector Magnitude (EVM) measurement results summary for the preamble carriers in dB.

Note this is a OFDMA/WiBro DL result only!

**Example:**                    `FETC:BURS:EVM:PRE:MAX?`  
The maximum EVM recorded for the preamble carriers is returned.

**Usage:**                    Query only

**Mode:**                    OFDMA/WiBro

---

**FETCh:BURSt:FERRor:AVERage?**  
**FETCh:BURSt:FERRor:MAXimum?**  
**FETCh:BURSt:FERRor:MINimum?**

This command returns the measured average, minimum or maximum frequency errors in Hz.

**Example:**                    `FETC:BURS:FERR:MAX?`  
The maximum frequency error from the most recent measurement is returned.

**Usage:**                    Query only

**Mode:**                    OFDM, OFDMA/WiBro

---

**FETCh:BURSt:GIMBalance:AVERage?**  
**FETCh:BURSt:GIMBalance:MAXimum?**  
**FETCh:BURSt:GIMBalance:MINimum?**

This command returns the measured average, minimum or maximum IQ imbalance errors in dB.

**Example:**                    `FETC:BURS:GIMB:MAX?`  
The maximum IQ Imbalance error from the most recent measurement is returned.

**Usage:** Query only  
**Mode:** OFDM, OFDMA/WiBro

**FETCh:BURSt:IQOFfset:AVERAge?**  
**FETCh:BURSt:IQOFfset:MAXimum?**  
**FETCh:BURSt:IQOFfset:MINimum?**

This command returns the measured average, minimum or maximum IQ offset errors in dB.

**Example:** `FETC:BURS:IQOF:MAX?`  
 The maximum IQ Offset error from the most recent measurement is returned.

**Usage:** Query only  
**Mode:** OFDM, OFDMA/WiBro

**FETCh:BURSt:QUADoffset:AVERAge?**  
**FETCh:BURSt:QUADoffset:MAXimum?**  
**FETCh:BURSt:QUADoffset:MINimum?**

This command returns the accuracy in terms of the phase error of symbols within a burst.

**Example:** `FETC:BURS:QUAD:MAX?`  
 The maximum angle error recorded for a symbol during the measurement.

**Usage:** Query only  
**Mode:** OFDM, OFDMA/WiBro

**FETCh:BURSt:RMS:ALL:AVERAge?**  
**FETCh:BURSt:RMS:ALL:MAXimum?**  
**FETCh:BURSt:RMS:ALL:MINimum?**

This command returns the average, minimum or maximum RMS burst power in dBm for all carriers measured during the measurement.

**Example:** `FETC:BURS:RMS:ALL:MAX?`  
 The maximum RMS burst power for all carriers recorded during the most recent measurement is returned.

**Usage:** Query only  
**Mode:** OFDM

**FETCh:BURSt:RMS:AVERAge?**  
**FETCh:BURSt:RMS:MAXimum?**  
**FETCh:BURSt:RMS:MINimum?**

This command returns the average, minimum or maximum RMS burst power in dBm measured during the measurement.

**Example:** `FETC: BURS: RMS: MAX?`  
The maximum burst power recorded for the most recent measurement is returned.

**Usage:** Query only

**Mode:** OFDM

**FETCh: BURSt: RMS: DATA: AVERage?**  
**FETCh: BURSt: RMS: DATA: MAXimum?**  
**FETCh: BURSt: RMS: DATA: MINimum?**

This command returns the average, minimum or maximum RMS burst power in dBm for data carriers measured during the measurement.

**Example:** `FETC: BURS: RMS: DATA: MAX?`  
The maximum RMS burst power for data carriers from the most recent measurement is returned.

**Usage:** Query only

**Mode:** OFDM

**FETCh: BURSt: RMS: DLPRreamble: AVERage?**  
**FETCh: BURSt: RMS: DLPRreamble: MAXimum?**  
**FETCh: BURSt: RMS: DLPRreamble: MINimum?**

This command returns the average, minimum or maximum RMS burst power in dBm for the downlink preamble measured during the measurement.

**Example:** `FETC: BURS: RMS: DLPR: MAX?`  
The maximum RMS burst power for the downlink preamble from the most recent measurement is returned.

**Usage:** Query only

**Mode:** OFDM

**FETCh: BURSt: RMS: PILot: AVERage?**  
**FETCh: BURSt: RMS: PILot: MAXimum?**  
**FETCh: BURSt: RMS: PILot: MINimum?**

This command returns the average, minimum or maximum RMS burst power in dBm for pilot carriers measured during the measurement.

**Example:** `FETC: BURS: RMS: PIL: MAX?`  
The maximum RMS burst power for pilot carriers from the most recent measurement is returned.

**Usage:** Query only

**Mode:** OFDM

---

**FETCh:BURSt:RSSI?**

This command returns all the received signal strength indicator (RSSI) results separated by commas. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119 .

**Example:** `FETC:BURS:RSSI?`  
The calculated RSSI results from the most recent measurement is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

---

**FETCh:BURSt:RSSi:AVERAge?****FETCh:BURSt:RSSi:MAXimum?****FETCh:BURSt:RSSi:MINimum?**

This command returns the average, minimum or maximum RSSI (received signal strength indicator) standard deviation value. This is an estimate of the total received power of the frame preamble of the segment of the connected BS. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119 .

**Example:** `FETC:BURS:RSS:MAX?`  
The maximum RSSI deviation value from the most recent measurement is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

---

**FETCh:BURSt:SYMBolerror:AVERAge?****FETCh:BURSt:SYMBolerror:MAXimum?****FETCh:BURSt:SYMBolerror:MINimum?**

This command returns the percentage of symbols that were outside permissible demodulation range within a burst.

**Example:** `FETC:BURS:SYMB:MAX?`  
The maximum number of symbols that were out of range per burst is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

---

**FETCh:BURSt:TDOMain:PREamble?**

This command returns the minimum, average and maximum preamble time domain values. The result is returned in (ASCII) format.

**Example:** `FETC:BURS:TDOM:PRE?`  
Returns the minimum, average and maximum preamble time domain values.

**Usage:** Query only  
**Mode:** OFDMA/WiBro

---

**FETCh:BURSt:TDOMain:PREAmble:AVERAge?**  
**FETCh:BURSt:TDOMain:PREAmble:MAXimum?**  
**FETCh:BURSt:TDOMain:PREAmble:MINimum?**

This command returns the average, minimum or maximum preamble time domain value. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119 .

**Example:** `FETC:BURS:RSS:MAX?`  
The maximum preamble value from the most recent measurement is returned.

**Usage:** Query only  
**Mode:** OFDM, OFDMA/WiBro

---

**FETCh:BURSt:TDOMain:SUBFrame?**

This command returns the minimum, average and maximum subframe time domain values. The result is returned in (ASCII) format.

**Example:** `FETC:BURS:TDOM:SUBF?`  
Returns the minimum, average and maximum subframe time domain values.

**Usage:** Query only  
**Mode:** OFDMA/WiBro

---

**FETCh:BURSt:TDOMain:SUBFrame:AVERAge?**  
**FETCh:BURSt:TDOMain:SUBFrame:MAXimum?**  
**FETCh:BURSt:TDOMain:SUBFrame:MINimum?**

This command returns the average, minimum or maximum subframe time domain value. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119 .

**Example:** `FETC:BURS:RSS:MAX?`  
The maximum subframe value from the most recent measurement is returned.

**Usage:** Query only  
**Mode:** OFDM, OFDMA/WiBro

---

**FETCh:BURSt:TDOMain:ZONE?**

This command returns the minimum, average and maximum zone time domain values. The result is returned in (ASCII) format.



**Example:** FETC: BURS: TDOM: ZONE?  
Returns the minimum, average and maximum zone time domain values.

**Usage:** Query only

**Mode:** OFDMA/WiBro

**FETCh: BURSt: TDOMain: ZONE: AVERage?**  
**FETCh: BURSt: TDOMain: ZONE: MAXimum?**  
**FETCh: BURSt: TDOMain: ZONE: MINimum?**

This command returns the average, minimum or maximum zone time domain value. For details on the format refer to [chapter 5.2, "ASCII Formats for Returned Values"](#), on page 119 .

**Example:** FETC: BURS: RSS: MAX?  
The maximum zone value from the most recent measurement is returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**FETCh: BURSt: USERror: AVERage?**  
**FETCh: BURSt: USERror: MAXimum?**  
**FETCh: BURSt: USERror: MINimum?**

This command returns Unmodulate Subcarrier Error for the analysed zone..

**Example:** FETC: BURS: USER: MAX?  
The maximum unmodulated subcarrier error is returned.

**Usage:** Query only

**Mode:** OFDMA/WiBro

**FETCh: SYMBol: COUNT?**

This command returns the number of symbol in each analyzed burst found in the last measurement sweep. The results are output as a list of result strings separated by commas in the following (ASCII) format:

<Symbols in 1st burst>,< Symbols in 2nd burst >,..., < Symbols in last burst >

**Example:** FETC: SYMB: COUN?  
The calculated symbols in the analyzed bursts for the most recent measurement are returned.

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**FETCH:ZONE:COUNT?**

This command returns the current number of zones found during measurement analysis.

**Example:**                    `FETCH:ZONE:COUN?`  
The current number of zones found during analysis is returned.

**Usage:**                    Query only

**Mode:**                    OFDMA/WiBro

## 5.10 FORMat Subsystem (WiMAX / WiBro, K93)

The FORMat subsystem specifies the data format of the data transmitted from and to the instrument.

[FORMat\[:DATA\]](#).....195

### **FORMat[:DATA] <Format>**

This command specifies the data format for the data transmitted from the instrument to the control PC. It is used for the transmission of trace data. The data format of trace data received by the instrument is automatically recognized, regardless of the format which is programmed.

(See also [TRACe\[:DATA\]](#) on page 225).

**Parameters:**

<Format>                    ASCII | REAL

**ASCII**

ASCII data are transmitted in plain text, separated by commas.

**REAL**

REAL data are transmitted as 32-bit IEEE 754 floating-point numbers in the "definite length block format".

\*RST:                    ASCII

**Example:**                    `FORM REAL,32`  
`FORM ASC`

**Mode:**                    all

## 5.11 INITiate Subsystem (WiMAX / WiBro, K93)

The INITiate subsystem configures the instrument prior to a measurement being carried out. It is basically used to tell the instrument which measurement is to be performed and takes any necessary step to set up the instrument for the measurement.

[INITiate<n>:CONTinuous](#).....196  
[INITiate<n>\[:IMMediate\]](#).....196  
[INITiate:REFResh](#).....196

**INITiate<n>:CONTInuous <State>**

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

**Suffix:**

<n> irrelevant

**Parameters:**

<State> ON | OFF  
\*RST: ON

**Example:**

```
INIT:CONT OFF
Switches the sequence to single sweep.
INIT:CONT ON
Switches the sequence to continuous sweep.
```

**Mode:** all

**INITiate<n>[:IMMEDIATE]**

The command initiates a new measurement sequence.

With sweep count > 0 or average count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

In single sweep mode, synchronization to the end of the indicated number of measurements can be achieved with the command \*OPC, \*OPC? or \*WAI. In continuous-sweep mode, synchronization to the sweep end is not possible since the overall measurement never ends.

**Suffix:**

<n> irrelevant

**Example:**

```
INIT:CONT OFF
Switches to single sweep mode.
DISP:WIND:TRAC:MODE AVER
Switches on trace averaging.
SWE:COUN 20
Setting the sweep counter to 20 sweeps.
INIT;*WAI
Starts the measurement and waits for the end of the 20 sweeps.
```

**Mode:** all

**INITiate:REFResh**

This command updates the current IQ measurement results to reflect the current measurement settings. Note that 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.

<b>Example:</b>	<code>INIT:REFR</code> Updates the IQ measurement results according to the current settings.
<b>Usage:</b>	SCPI confirmed
<b>Mode:</b>	OFDM, OFDMA/WiBro

## 5.12 INPut subsystem

---

### INPut:ATTenuation <Value>

This command programs the input attenuator. To protect the input mixer against damage from overloads, the setting 0 dB can be obtained by entering numerals, not by using the DOWN command.

The attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). If the defined reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

In the default state with "Spectrum" mode, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

This function is not available if the R&S Digital I/Q Interface (R&S FSV-B17) is active.

#### Parameters:

<Value>                    \*RST:        10 dB (AUTO is set to ON)

#### Example:

`INP:ATT 30dB`

Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

**Mode:**                    all

---

### INPut:DIQ:RANGe[:UPPer] <Level>

Defines or queries the "Full Scale Level", i.e. the level that should correspond to an I/Q sample with the magnitude "1".

It can be defined either in dBm or Volt (see "[Full Scale Level](#)" on page 92).

This command is only available if the optional R&S Digital I/Q Interface (option R&S FSV-B17) is installed.

For details see the R&S Digital I/Q Interface (R&S FSV-B17) description of the base unit.

#### Parameters:

<Level>                    <numeric value>  
Range:        70.711 nV to 7.071 V  
\*RST:        1 V

#### Example:

`INP:DIQ:RANG 1V`

**Mode:** A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

---

**INPut:DIQ:SRATe** <SampleRate>

This command specifies or queries the sample rate of the input signal from the R&S Digital I/Q Interface (see "Input Sample Rate" on page 92).

This command is only available if the optional R&S Digital I/Q Interface (option R&S FSV-B17) is installed.

For details see the R&S Digital I/Q Interface (R&S FSV-B17) description of the base unit.

**Parameters:**

<SampleRate> Range: 1 Hz to 10 GHz  
\*RST: 32 MHz

**Example:** INP:DIQ:SRAT 200 MHz

**Mode:** A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

---

**INPut:EATT** <Attenuation>

Requires option R&S FSV-B25.

Switches the electronic attenuator on (if not already active) and allows the attenuation of the electronic attenuator to be set.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

The attenuation can be varied in 1 dB steps from 0 to 25 dB. Other entries are rounded to the next lower integer value.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

**Parameters:**

<Attenuation> 0...25  
\*RST: 0 dB (OFF)

**Example:** INP1:EATT 10 dB

**Mode:** all

---

**INPut:EATT:AUTO** <State>

Switches the automatic behaviour of the electronic attenuator on or off. If activated, electronic attenuation is used to reduce the operation of the mechanical attenuation whenever possible.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

**Parameters:**

<State> ON | OFF  
 \*RST: ON

**Example:**

INP1:EATT:AUTO OFF

**Mode:**

all

**INPut:EATT:STATe** <State>

Switches the electronic attenuator on or off.

This command is only available with option R&S FSV-B25, but not if R&S FSV-B17 is active.

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:**

INP:EATT:STAT ON

Switches the electronic attenuator into the signal path.

**Mode:**

all

**INPut:GAIN:STATe** <State>

This command switches the preamplifier on or off (only for option RF Preamplifier, R&S FSV-B22/B24).

With option R&S FSV-B22, the preamplifier only has an effect below 7 GHz.

With option R&S FSV-B24, the amplifier applies to the entire frequency range.

This command is not available when using R&S Digital I/Q Interface (R&S FSV-B17).

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:**

INP:GAIN:STAT ON

Switches on 20 dB preamplification.

**Mode:**

A, ADEMOD, BT, CDMA, EVDO, NF, PHN, WCDMA, GSM, VSA, TDS

**INPut:SElect** <Source>

This command selects the signal source for measurements.

**Parameters:**

<Source>	RF   DIQ
	<b>RF</b> Radio Frequency ("RF INPUT" connector)
	<b>DIQ</b> Baseband Digital (IQ) (only available with R&S Digital I/Q Interface, option R&S FSV-B17)
	*RST: RF

**Example:** INP:SEL RF

**Mode:** A, IQ, NF, TDS, VSA, CDMA, EVDO, WCDMA, ADEMOD, GSM, OFDM, OFDMA/WiBro, WLAN

## 5.13 INSTrument Subsystem (WiMAX / WiBro, K93)

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

### Commands of the INSTrument Subsystem

INSTrument[:SElect].....	200
INSTrument:NSElect.....	200

---

#### INSTrument[:SElect] <Mode>

**Parameters:**

<Mode>	WiMAX
	Selects WiMax mode (WiMAX 802.16 OFDM Measurements option and WiMAX IEEE 802.16 OFDM, OFDMA Measurements option, R&S FSV-K93)

---

#### INSTrument:NSElect <Mode>

**Parameters:**

<Mode>	<b>6</b>
	Selects WiMax mode (WiMAX IEEE 802.16 OFDM, OFDMA Measurements option, R&S FSV-K93)
	<b>23</b>
	Selects WiMax mode (WiMAX 802.16 OFDM Measurements option, R&S FSV-K93)

## 5.14 MMEMory Subsystem (WiMAX / WiBro, K93)

The MMEMory (mass memory) subsystem provides commands to store and load IQ data.

## Commands of the MMEMory Subsystem

MMEMory:LOAD:FRAME:STATe 1,.....	201
MMEMory:LOAD:IQ:STATe.....	201
MMEMory:LOAD:SEM:STATe 1,.....	201
MMEMory:STORe:IQ:STATe.....	201

---

### MMEMory:LOAD:FRAME:STATe 1, <FileName>

This command loads a zone frame setup from the specified \*.xml file. This file is created by a R&S SMU signal generator in accordance to the IEEE 80216e-2005 standard.

#### Parameters:

<FileName> 1,<file\_name>

#### Example:

```
MMEM:STOR:FRAM:STAT 1, 'C:
\R_S\Instr\user\data.xml'
```

Loads the zone frame setup from the specified file.

**Mode:** OFDMA/WiBro

---

### MMEMory:LOAD:IQ:STATe 1, <FileName>

This command loads the I/Q data from the specified .iqw file.

#### Parameters:

<FileName> 1,<file\_name>

#### Example:

```
MMEM:LOAD:IQ:STAT 1, 'C:
\R_S\Instr\user\data.iqw'
```

Loads IQ data from the specified file.

**Usage:** Setting only

**Mode:** WLAN, OFDM, OFDMA/WiBro

---

### MMEMory:LOAD:SEM:STATe 1, <FileName>

This command loads a spectrum emission mask setup from an xml file.

#### Parameters:

<FileName> 1,<file\_name>

#### Example:

```
MMEM:LOAD:SEM:STAT 1, 'D:\USER\ETSI_SEM.xml'
```

Loads a spectrum emission mask setup from the specified file.

**Mode:** WLAN, OFDM, OFDMA/WiBro

---

### MMEMory:STORe:IQ:STATe 1, <FileName>

This command stores the I/Q data to the specified .iqw file.

#### Parameters:

<FileName> 1,<file\_name>



**Example:** `M MEM:STOR:IQ:STAT 1, 'C:  
 \R_S\Instr\user\data.iqw'`  
 Stores I/Q data to the specified file.

**Mode:** OFDM, OFDMA/WiBro

## 5.15 SENSe Subsystem (WiMAX / WiBro, K93)

The SENSe command is used to set and get the values of parameters in the remote instrument. The get variant of the SENSe command differs from set in that it takes no parameter values (unless otherwise stated) but is followed by the character '?' and will return the parameter's value in the same format as it is set.

5.15.1	Analysis Modulation Format.....	202
5.15.2	Commands of the SENSe Subsystem (K93).....	204

### 5.15.1 Analysis Modulation Format

Parameter	Standard	Description
'BPSK'	Alias for BI-Phase shift keying at higher data rate for selected standard	
'BPSK3'	IEEE 802.11j (10 MHz)	BI-Phase shift keying at 3 Mbps
'BPSK6'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	BI-Phase shift keying at 6 Mbps
'BPSK9'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	BI-Phase shift keying at 9 Mbps
'BPSK45'	IEEE 802.11j (10 MHz)	BI-Phase shift keying at 4.5 Mbps
'BPSK65'	IEEE 802.11n	BI-Phase shift keying at 6.5 Mbps
'BPSK72'	IEEE 802.11n	BI-Phase shift keying at 7.2 Mbps
'CCK11'	IEEE 802.11b & g (Single Carrier)	Complementary Code Keying at 11 Mbps
'CCK55'	IEEE 802.11b & g (Single Carrier)	Complementary Code Keying at 5.5 Mbps
'DBPSK'	IEEE 802.11b & g (Single Carrier)	Differential BI-Phase shift keying
'DQPSK'	IEEE 802.11b & g (Single Carrier)	Differential Quadrature phase shift keying
'PBCC11'	IEEE 802.11b & g (Single Carrier)	PBCC at 11 Mbps
'PBCC22'	IEEE 802.11g (Single Carrier)	PBCC at 11 Mbps
'PBCC55'	IEEE 802.11b & g (Single Carrier)	PBCC at 5.5 Mbps
'QAM16'	Alias for Quadrature Amplitude Modulation at higher data rate for selected standard	
'QAM64'	Alias for Quadrature Amplitude Modulation at higher data rate for selected standard	
'QAM1612'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 12 Mbps
'QAM1618'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 18 Mbps

Parameter	Standard	Description
'QAM1624'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 24 Mbps
'QAM1626'	IEEE 802.11n	Quadrature Amplitude Modulation at 26 Mbps
'QAM1636'	IEEE802.11a,g(OFDM),j(20 MHz)&Turbo	Quadrature Amplitude Modulation at 36 Mbps
'QAM1639'	IEEE 802.11n	Quadrature Amplitude Modulation at 39 Mbps
'QAM6424'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 24 Mbps
'QAM6427'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 27 Mbps
'QAM6448'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 48 Mbps
'QAM6452'	IEEE 802.11n	Quadrature Amplitude Modulation at 52 Mbps
'QAM6454'	IEEE802.11a,g(OFDM),j(20MHz)&Turbo	Quadrature Amplitude Modulation at 54 Mbps
'QAM6465'	IEEE 802.11n	Quadrature Amplitude Modulation at 65 Mbps
'QAM16289'	IEEE 802.11n	Quadrature Amplitude Modulation at 28.9 Mbps
'QAM16433'	IEEE 802.11n	Quadrature Amplitude Modulation at 43.3 Mbps
'QAM64578'	IEEE 802.11n	Quadrature Amplitude Modulation at 57.8 Mbps
'QAM64585'	IEEE 802.11n	Quadrature Amplitude Modulation at 58.5 Mbps
'QAM64722'	IEEE 802.11n	Quadrature Amplitude Modulation at 72.2 Mbps
'QPSK'	Alias for Quadrature phase shift keying at higher data rate for selected standard	
'QPSK6'	IEEE 802.11j (10 MHz)	Quadrature phase shift keying at 6 Mbps
'QPSK9'	IEEE 802.11j (10 MHz)	Quadrature phase shift keying at 9 Mbps
'QPSK12'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature phase shift keying at 12 Mbps
'QPSK13'	IEEE 802.11n	Quadrature phase shift keying at 13 Mbps
'QPSK18'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature phase shift keying at 18 Mbps
'QPSK144'	IEEE 802.11n	Quadrature phase shift keying at 14.4 Mbps
'QPSK195'	IEEE 802.11n	Quadrature phase shift keying at 19.5 Mbps
'QPSK217'	IEEE 802.11n	Quadrature phase shift keying at 21.7 Mbps

### 5.15.2 Commands of the SENSe Subsystem (K93)

---

#### [SENSe:]BANDwidth:CHANnel <Bandwidth>

This command specifies the channel bandwidth for the signal to be measured. The channel is selected via the `CONFigure:CHANnel` on page 162 command.

**Parameters:**

<Bandwidth>            Range:     1.25 MHz to 28 MHz  
                              \*RST:     1.75 MHz

**Example:**

`CONF:CHAN 9`  
 Defines the frequency of channel 9 as measurement range.  
`BAND:CHAN 7MHZ`  
 Sets a channel bandwidth value of 7 MHz.

**Usage:**                SCPI confirmed

**Mode:**                 OFDM

---

#### [SENSe:]BURSt:COUNt <NoBursts>

This command defines the number of bursts that will be analyzed by the measurement.

**Parameters:**

<NoBursts>            Range:     1 to 10922  
                              \*RST:     1

**Example:**

`BURS:COUN 16`  
 Sets the number of bursts to 16.

**Mode:**                 OFDM, OFDMA/WiBro

---

#### [SENSe:]BURSt:COUNt:STATe <State>

When this command is set to on, the burst count parameter will be used by the measurement, otherwise the burst count parameter will be ignored.

**Parameters:**

<State>                ON | OFF  
                              \*RST:     OFF

**Example:**

`BURS:COUN:STAT ON`  
 Sets the burst count state to ON

**Mode:**                 OFDM, OFDMA/WiBro

---

#### [SENSe:]DEMod:CEStimation <Standard>

This command defines how channel estimation is performed.

IEEE 802.16-2004 OFDM: The improved channel estimation is used for IQ measurements. The effect of this is most noticeable for the EVM measurement results, where the results will be improved if this feature is enabled. However, this functionality is not supported by the IEEE 802.16-2004 standard and must be disabled if the results are to be strictly measured against the standard.

IEEE 802.16e-2005 OFDMA/WiBro: The channel estimation is performed for downlink signals.

**Parameters:**

<Mode> ON | OFF | PAYLONLY | PREAMONLY | PREAMPAYL

**ON**  
IEEE 802.16-2004 OFDM: Improved channel estimation is performed

**OFF**  
IEEE 802.16-2004 OFDM: Improved channel estimation is not performed

**PAYLONLY**  
IEEE 802.16e-2005 OFDMA: Channel estimation is performed in the payload only

**PREAMONLY**  
IEEE 802.16e-2005 OFDMA: Channel estimation is performed in the preamble only

**PREAMPAYL**  
IEEE 802.16e-2005 OFDMA: Channel estimation is performed in both the preamble and the payload

\*RST: OFF (IEEE 802.16-2004 OFDM) , PREAMPAYL (IEEE 802.16e-2005 OFDMA)

**Example:** DEM:CEST ON  
Specifies that the IQ measurement results use improved channel estimation.

**Mode:** OFDM, OFDMA/WiBro

---

**[SENSe:]DEMod:FILTer:CATalog?**

This command reads the names of all available filters. The file names are output without file extension. Syntax of output format: filter\_1,filter\_2, ..., filter\_n.

This command is a query only and thus has no \*RST value.

**Parameters:**

\*RST: 0

**Example:** DEM:FILT:CAT?  
Reads all filter names

**Usage:** Query only

**Mode:** OFDM, OFDMA/WiBro

**[SENSe:]DEMod:FILTer:MODulation <TXFilter>, <RXFilter>**

This command selects the TX and RX filters. The names of the filters correspond to the file names; a query of all available filters is possible by means of the [\[SENSe:\]DEMod:FILTer:CATalog](#) on page 205 command.

**Parameters:**

<TXFilter>, \*RST: AUTO,AUTO  
<RXFilter> DEF\_TX: default transmit filter, DEF\_RX: default receive filter

**Example:**

DEM:FILT:MOD 'DEF\_TX', 'DEF\_RX'  
DEF\_TX is selected for the TX filter and DEF\_RX for the RX filter

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]DEMod:FORMat:BANalyze <Modulation>**

The remote control command sets the analysis modulation format that will be assumed for the measurement.

If the standard is IEEE 802.16e-2005 OFDMA or WiBro, this command is query only and returns the highest detected modulation format from the last measurement sweep.

**Parameters:**

<Modulation> BPSK1/2 | QPSK1/2 | QPSK3/4 | 16QAM1/2 | 16QAM3/4 |  
64QAM2/3 | 64QAM3/4

**BPSK1/2**

BI-Phase shift keying (OFDM only)

**QPSK1/2**

Quadrature phase shift keying

**QPSK3/4**

Quadrature phase shift keying

**16QAM1/2**

Quadrature Amplitude Modulation

**16QAM3/4**

Quadrature Amplitude Modulation

**64QAM2/3**

Quadrature Amplitude Modulation

**64QAM3/4**

Quadrature Amplitude Modulation

\*RST: 16QAM1/2

**Example:**

DEM:FORM:BAN '16QAM1/2'  
Only bursts that are of the QAM16 modulation format are analyzed.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal <State>**

If this command is activated only bursts of equal length will take part in the PVT analysis. The number of symbols that a burst must have in order to take part in the PVT analysis are specified by the `[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN` on page 207 command.

**Parameters:**

<State>                    ON | OFF  
 \*RST:                    OFF

**Example:**

DEM:FORM:BAN:SYMB:EQU ON  
 Only bursts of equal length will take part in the PVT analysis.

**Mode:**                    OFDM

**[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MAX <NoDataSymbols>**

This command specifies the maximum number of data symbols required for bursts to qualify for measurement analysis. Only bursts with the specified number of symbols will be used in the measurement analysis. The number of data symbols is defined as the uncoded bits including service and tail bits.

This value will not have any immediate effect if the `[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal` on page 207 command has been set to ON. In this case, no range of symbols is allowed and only bursts with exactly the number of symbols specified by the `[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN` on page 207 command shall take place in measurement analysis.

**Parameters:**

<NoDataSymbols>    Range:        1 to 2425  
 \*RST:                64

**Example:**

DEM:FORM:BAN:SYMB:MAX 1300  
 Only bursts which contain a maximum symbol count of 1300 are analyzed.

**Mode:**                    OFDM

**[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN <NoDataSymbols>**

This command specifies the number of data symbols required for bursts to qualify for measurement analysis. Only bursts with the specified number of symbols will be used in the measurement analysis. The number of data symbols is defined as the uncoded bits including service and tail bits.

If the `[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal` on page 207 command has been set to ON, this command specifies the exact number of symbols required for a burst to take part in measurement analysis. If the `[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal` on page 207 command is set to OFF, this command specifies the minimum number of symbols required for a burst to take part in measurement analysis.

**Parameters:**

<NoDataSymbols> Range: 1 to 2425  
\*RST: 1

**Example:**

DEM:FORM:BAN:SYMB:MIN 16

Only bursts which contain a symbol count of 16 are analyzed.

**Mode:**

OFDM

---

**[SENSe:]DEMod:FORMat[:BContent]:AUTO <Mode>**

This command specifies how the signal should be demodulated (OFDM) and whether the DSP should perform a pre-analysis to determine the zone, burst and downlink sub-channel map for the current captured signal prior to calculating the results (OFDMA).

**Parameters:**

&lt;Mode&gt;

NONE | FIRSt | USER | ALL | SIGNal | PREDefined | ULPHY |  
ULMAP | DLMAP**NONE**

Demodulation off (Brute force mode), the specified modulation is used for all bursts.

**FIRSt**

Retrieves the first valid payload modulation and analyzes all bursts with same modulation.

**USER**

Analyzes all bursts carrying the modulation specified.

**ALL**

Retrieves all bursts individual payload modulation and analyzes accordingly.

**SIGNal**

"OFDMA": pre-analyzes to determine the zone, burst and down-link sub-channel map prior to analyzing the first zone results.

**Note:** this setting is now referred to as DLMAP**PREDefined**

"OFDMA": analyzes using the predefined zone, burst and down-link sub-channel map for the current captured signal for the specified zone results

**ULPHY**

"OFDMA": the UL data burst in UL subframe is used

**ULMAP**"OFDMA": analyzes using UL map, pre-analyzes to determine the zone, burst and uplink sub-channel map prior to analyzing for the zone specified, see [CONFigure:WiMax:FRAMe:ZONetouse](#) on page 167**DLMAP**"OFDMA": analyzes using DL map, pre-analyzes to determine the zone, burst and downlink sub-channel map prior to analyzing for the zone specified, see [CONFigure:WiMax:FRAMe:ZONetouse](#) on page 167

\*RST: ALL

**Example:**

DEM:FORM:AUTO FIRS

Specifies that the first symbol field should be decoded.

**Mode:**

OFDM

---

**[SENSe:]FFT:OFFSet <Offset>**

This command specifies the FFT start offset relative to the GP centre.

**Parameters:**

&lt;Offset&gt;

Range: -100 to 100

\*RST: 0



**Example:** `FFT:OFF 0`  
Sets the FFT start offset to 0.

**Usage:** SCPI confirmed

**Mode:** OFDMA/WiBro

---

**[SENSe:]FREQuency:CENTer <Frequency>**

This command defines the center frequency of the analyzer or the measuring frequency for IQ measurements.

**Parameters:**

<Frequency>      Range:      0 to fmax  
                      \*RST:      5 GHz  
                      Default unit: Hz  
                       $f_{max}$  is specified in the data sheet. To help analyze signals located at the end of the frequency range, the  $f_{max}$  value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

**Example:** `FREQ:CENT 100 MHz`

**Mode:** OFDMA/WiBro

---

**[SENSe:]POWer:ACHannel:ACPairs <Value>**

This command sets the number of adjacent channels (upper and lower channel in pairs). The figure 0 stands for pure channel power measurement.

**Parameters:**

<Value>            0 to 12  
                      \*RST:      1

**Example:** `POW:ACH:ACP 3`  
Sets the number of adjacent channels to 3, i.e. the adjacent channel and alternate adjacent channels 1 and 2 are switched on.

**Mode:** A-F, CDMA, EVDO, TDS, WCDMA

---

**[SENSe:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel<channel>]  
 <Bandwidth>**

This command sets the channel bandwidth of the specified TX channel in the radio communication system. The bandwidths of adjacent channels are not influenced by this modification.

With `[SENSe<source>:]POWer:HSPeak` set to ON, steep-edged channel filters are available. For further information on filters refer to the "List of Available RRC and Channel Filters" in the base unit description.

**Parameters:**

<Bandwidth>      100 Hz to 40 GHz  
                      \*RST:      14 kHz

**Example:** POW:ACH:BWID:CHAN2 30 kHz  
Sets the bandwidth of the TX channel 2 to 30 kHz.

**Mode:** A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

---

**[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ACHannel <Bandwidth>**

This command defines the channel bandwidth of the adjacent channel of the radio transmission system. If the bandwidth of the adjacent channel is changed, the bandwidths of all alternate adjacent channels are automatically set to the same value.

With [SENSe<source>:]POWer:HSPeed set to ON, steep-edged channel filters are available. For further information on filters refer to the "List of Available RRC and Channel Filters" in the base unit description.

**Parameters:**  
<Bandwidth> 100 Hz to 40 GHz  
\*RST: 14 kHz

**Example:** POW:ACH:BWID:ACH 30 kHz  
Sets the bandwidth of all adjacent channels to 30 kHz.

**Mode:** A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

---

**[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ALternate<channel>  
<Bandwidth>**

This command defines the channel bandwidth of the first to fourth alternate adjacent channel of the system.

**Suffix:**  
<Channel> 1...4

**Parameters:**  
<Bandwidth> Range: 0 Hz to 100 GHz

**Example:** POW:ACH:BAND:ALT2 30kHz  
Sets the bandwidth of the second alternate adjacent channel to 30 kHz.

**Mode:** OFDM, OFDMA/WiBro

---

**[SENSe:]POWer:ACHannel:MODE <Mode>**

This command switches between absolute and relative adjacent channel measurement. The command is only available with span > 0 and if the number of adjacent channels is greater than 0.

**Parameters:**

<Mode> ABSolute | RELative

**ABSolute**  
absolute adjacent channel measurement

**RELative**  
relative adjacent channel measurement

\*RST: RELative

**Example:**

POW:ACH:MODE REL  
Sets the adjacent channel measurement mode to relative.

**Mode:**

A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, WCDMA, TDS

**[SENSe:]POWer:ACHannel:SPACing[:ACHannel] <Value>**

This command defines the spacing between the carrier signal and the adjacent channel (ADJ). The modification of the adjacent-channel spacing (ADJ) causes a change in all higher adjacent-channel spacings (ALT1, ALT2, ...): they are all multiplied by the same factor (new spacing value/old spacing value).

**Parameters:**

<Value> 100 Hz to 20 GHz

\*RST: 14 kHz

**Example:**

POW:ACH:SPAC 33kHz  
Sets the spacing between the carrier signal and the adjacent channel to 33 kHz, the alternate adjacent channel 1 to 66 kHz, the alternate adjacent channel 2 to 99 kHz, and so on.

**Mode:**

A-F, CDMA, EVDO, OFDM, OFDMA/WiBro, TDS, WCDMA

**[SENSe:]POWer:ACHannel:SPACing:ALternate<channel> <Spacing>**

This command defines the channel spacing of the first to fourth alternate adjacent channel to the TX channel.

**Suffix:**

<channel> 1...4  
the alternate adjacent channel

**Parameters:**

<Spacing> Range: 0 Hz to 100 GHz

**Example:**

POW:ACH:SPAC:ALT1 100kHz  
Sets the spacing between TX channel and first alternate adjacent channel to 100 kHz.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]POWer:SEM <Mode>**

This command sets the behaviour of the Spectrum Emission Mask (SEM) analysis to use a specific configuration:

**Parameters:**

<Mode> User | Standard | IEEE | ETSI

**User**

Analysis according to a user-defined configuration

**Standard**

Analysis according to the TTA standard (WiBro only)

**IEEE**

Analysis according to the ETSI standard (OFDM/OFDMA only)

**ETSI**

Analysis according to the IEEE standard (OFDM/OFDMA only)

\*RST: 0

**Example:**

POW:SEM USER

Sets the SEM configuration according to a user defined configuration.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]POWer:SEM:CLASs <Class>**

This command sets the Spectrum Emission Mask (SEM) power class.

**Parameters:**

<Class> 0 | 1 | 2 | 3

**0**

automatic selection

**1**

(-INF, 23) dBm for uplink, (-INF, 29) dBm for downlink

**2**

(23, INF) dBm for uplink, (29, 40) dBm for downlink

**3**

(40, INF) dBm for downlink

\*RST: 0

**Example:**

POW:SEM:CLAS 0

Sets the SEM power class to automatic.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]POWer:SEM:MODE <Mode>**

This command sets the Spectrum Emission Mask (SEM) analysis to be UL or DL (uplink or downlink). This command only available for WiBro standard.

**Parameters:**

<Mode> DL | UL

**Example:**

POW:SEM:MOD UL

Sets the Spectrum Emission Mask analysis to be UL.

**Mode:** OFDM, OFDMA/WiBro

---

**[SENSe:]POWer:SEM:TTA <Type>**

This command sets the Spectrum Emission Mask (SEM) analysis according to TTA standard or a user defined mask.

**Parameters:**

<Type> USER | STANDARD  
 \*RST: STANDARD

**Example:**

POW:SEM:TTA STANDARD  
 Sets the SEM analysis according to TTA standard.

**Mode:** WiBro

---

**[SENSe:]SUBChannel <Subchannel>**

This command sets the subchannel to be used in the measurement. It is only available in Up Link mode.

**Parameters:**

<Subchannel> Range: 1 to 31

**Example:**

SUBC 12  
 Sets the subchannel to 12.

**Mode:** OFDMA/WiBro

---

**[SENSe:]SUBChannel:STATe <State>**

This command enables or disables the use of subchannels in the measurement analysis. It is only available in Up Link mode.

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:**

SUBC:STAT ON  
 Specifies that the measurement will be analyzed using the specified SUBChannel.

**Usage:** SCPI confirmed

**Mode:** OFDMA/WiBro

---

**[SENSe:]SUBChannel:ULPHysmod <Modifier>**

This command sets the Up Link Physical Modifier to be used in the measurement. It is only available in Up Link mode.

**Parameters:**

<Modifier> Range: 0 to 255

**Example:** SUBC:ULPH 1  
Sets the UL Physical Modifier to 1.

**Mode:** OFDMA/WiBro

#### [SENSe:]SWAPiq <State>

This command defines whether or not the recorded IQ pairs should be swapped (I<->Q) before being processed. Swapping I and Q inverts the sideband.

**Parameters:**

<State> ON | OFF  
**ON**  
 I and Q are exchanged, inverted sideband, Q+j\*I  
**OFF**  
 Normal sideband, I+j\*Q,  
 \*RST: OFF

**Example:** SWAP ON  
Specifies that IQ values should be swapped.

**Mode:** WLAN, GSM, OFDM, OFDMA/WiBro

#### [SENSe:]SWEep:ACPR:TIME <Time>

This command specifies the sweep time for the Spectrum Mask and Spectrum ACP/ACPR measurements.

**Parameters:**

<Time> Range: 10 ms to 16000 s  
 \*RST: 2s

**Example:** SWE:ACPR:TIME:AUTO OFF  
Deactivates the automatic calculation of the sweep time.  
 SWE:ACPR:TIME 100S  
Sets the sweep time to 100 s.

**Usage:** SCPI confirmed

**Mode:** OFDM, OFDMA/WiBro

#### [SENSe:]SWEep:ACPR:TIME:AUTO <State>

This command activates or deactivates the automatic calculation of the sweep time for the Spectrum Mask and Spectrum ACP/ACPR measurements.

**Parameters:**

<State> ON | OFF  
 \*RST: ON

**Example:** SWE:ACPR:TIME:AUTO OFF  
Deactivates the automatic calculation of the sweep time.

**Usage:** SCPI confirmed

**Mode:** OFDM, OFDMA/WiBro

---

**[SENSe:]SWEep:COUNT <NoSweeps>**

This command specifies the number of sweeps for Spectrum Mask and Spectrum ACPR measurements.

**Parameters:**

<NoSweeps>            Range:     1 to 32767  
                          \*RST:       1

**Example:**            SWE:COUNT 64  
                          Sets the number of sweeps to 64.

**Usage:**                SCPI confirmed

**Mode:**                OFDM, OFDMA/WiBro

---

**[SENSe:]SWEep:EGATe <State>**

This command switches on/off the sweep control by an external gate signal. If the external gate is selected the trigger source is automatically switched to EXTERNAL as well.

In case of measurement with external gate, the measured values are recorded as long as the gate is opened. During a sweep the gate can be opened and closed several times. The synchronization mechanisms with \*OPC, \*OPC? and \*WAI remain completely unaffected.

The sweep end is detected when the required number of measurement points (691 in "Spectrum" mode) has been recorded.

**Parameters:**

<State>                ON | OFF  
                          \*RST:       OFF

**Example:**            SWE:EGAT ON  
                          Switches on the external gate mode.  
                          SWE:EGAT:TYPE EDGE  
                          Switches on the edge-triggered mode.  
                          SWE:EGAT:HOLD 100US  
                          Sets the gate delay to 100 µs.  
                          SWE:EGAT:LEN 500US  
                          Sets the gate opening time to 500 µs.  
                          INIT;\*WAI  
                          Starts a sweep and waits for its end.

**Mode:**                A, BT, EVDO, TDS, WLAN, OFDM, OFDMA/WiBro

---

**[SENSe:]SWEep:EGATe:HOLDoff[:TIME] <DelayTime>**

This command defines the gate delay in the capture buffer in time units.

**Parameters:**

<DelayTime>            Range:     0 to 262.14  
                              \*RST:     0 s  
                              Default unit: ms

**Example:**

SWE:EGAT:HOLD 125us  
 Sets a delay of 125 µs in the capture buffer.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]SWEep:EGATe:HOLDoff:SAMPlE <NoSamples>**

This command defines the gate delay in the capture buffer as a number of samples.

**Parameters:**

<NoSamples>            Range:     0 to 50E6  
                              \*RST:     0

**Example:**

SWE:EGAT:HOLD:SAMP 2500  
 Sets a delay of 2500 samples in the capture buffer.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]SWEep:EGATe:LENGth[:TIME] <Time>**

This command defines the gate time in the capture buffer in time units.

**Parameters:**

<Time>                    Range:     0 to 262.14  
                              \*RST:     0  
                              Default unit: ms

**Example:**

SWE:EGAT:LENG 100ms  
 Sets a gate length of 100 milliseconds between sweeps.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]SWEep:EGATe:LENGth:SAMPlE <NoSamples>**

This command defines the gate time in the capture buffer as a number of samples.

**Parameters:**

<NoSamples>            Range:     0 to 50E6  
                              \*RST:     0

**Example:**

SWE:EGAT:LENG:SAMP 2000000  
 Enforces a gate length of 2000000 samples in the capture buffer.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]SWEep:EGATe:LINK <State>**

This command links together the movement of the gating lines and the capture buffer marker.



**Parameters:**

<State> ON | OFF  
 \*RST: 0

**Example:**

SWE:EGAT:LINK ON

Keeps the capture buffer marker on the centre of the gating lines if the gating line delay and length are changed.

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]SWEep:TIME <Time>**

This command defines the sweep time. The available time values vary depending on the span setting.

If the sweep time is programmed directly using this command, automatic coupling to resolution bandwidth and video bandwidth is switched off.

**Parameters:**

<Time> Range: 24  $\mu$ s to 15.5 ms  
 \*RST: 24  $\mu$ s (AUTO is set to ON)

**Example:**

SWE:TIME 10s

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]TRACking:CESTimation[:BASE] <Mode>**

This command defines whether or not the reference signal is compensated with the user set tracking options (USERtracked) or with all tracking options being set (FULLYtracked). In case USERtracked is specified then the tracking options according to the user selection (Phase, Timing, Level) are applied to generate the reference signal. In case FULLYtracked is specified then all tracking options are applied (Phase, Timing, Level) to generate the reference signal. This option is not available if the Channel Estimation Range for downlink is set to "Preamble Only". In this case the user defined tracking options are used.

**Parameters:**

<Mode> USERtracked | FULLYtracked  
 \*RST: USER

**Example:**

TRAC:CEST USER

Specifies that the measurement results should be compensated for level.

**Usage:**

SCPI confirmed

**Mode:**

OFDMA

**[SENSe:]TRACking:LEVel <State>**

This command defines whether or not the measurement results should be compensated for level.

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:**

TRAC:LEV ON

Specifies that the measurement results should be compensated for level.

**Usage:**

SCPI confirmed

**Mode:**

OFDM

**[SENSe:]TRACking:PHASe <State>**

This command defines whether or not the measurement results should be compensated for phase.

**Parameters:**

<State> ON | OFF  
 \*RST: ON

**Example:**

TRAC:PHAS ON

Specifies that the measurement results should be compensated for phase.

**Usage:**

SCPI confirmed

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]TRACking:PILot <Mode>**

This command defines whether the measurement results should have predefined pilot tracking or whether the tracking should be determined when the measurement is run.

**Parameters:**

<Mode> PRED | DET  
**PRED**  
 Predefined pilot tracking is used.  
**DET**  
 Pilot tracking is determined when the measurement is run.  
 \*RST: PRED

**Example:**

TRAC:PILOT DET

Pilot tracking is determined when the measurement is run.

**Usage:**

SCPI confirmed

**Mode:**

OFDMA/WiBro

**[SENSe:]TRACking:TIME <State>**

This command defines whether or not the measurement results should be compensated for time.

**Parameters:**

<State> ON | OFF  
 \*RST: OFF

**Example:**

TRAC:TIME ON  
 Specifies that the measurement results should be compensated for time.

**Usage:**

SCPI confirmed

**Mode:**

OFDM, OFDMA/WiBro

**[SENSe:]ZONE:COUNT <Number>**

Defines or queries the number of zones that are to be analyzed by the measurement.

**Parameters:**

<Number> 0 | 1  
 \*RST: 1

**Example:**

ZONE:COUN 16  
 Sets the number of zones to 16.

**Mode:**

OFDMA/WiBro

**[SENSe:]ZONE:COUNT:STATe <State>**

When activated, the zone count parameter is used by the measurement, otherwise the zone count parameter is ignored..

**Parameters:**

<State> 0 | 1  
 \*RST: 0

**Example:**

ZONE:COUN:STAT 1  
 Activates the zone count.

**Mode:**

OFDMA/WiBro

## 5.16 STATus Subsystem (OFDMA/WiBro, K93)

The following commands can be used to query the contents of the status registers specific to the R&S FSV-K93 option. For details see [chapter 5.21, "Status Reporting System \(Option R&S FSV-K93\)"](#), on page 238.

STATus:OPERation:CONDition.....	221
STATus:OPERation[:EVENT].....	221
STATus:QUESTionable:CONDition.....	221
STATus:QUESTionable[:EVENT].....	221
STATus:QUESTionable:LIMit<Screen>[:EVENT].....	222
STATus:QUESTionable:SYNC[:EVENT].....	222
STATus:QUESTionable:LIMit<Screen>:CONDition.....	222

STATus:QUEStionable:SYNC:CONDition.....	222
STATus:QUEStionable:LIMit<Screen>:ENABLE.....	222
STATus:QUEStionable:SYNC:ENABLE.....	222
STATus:QUEStionable:LIMit<Screen>:NTRansition.....	223
STATus:QUEStionable:SYNC:NTRansition.....	223
STATus:QUEStionable:LIMit<Screen>:PTRansition.....	223
STATus:QUEStionable:SYNC:PTRansition.....	223

---

### STATus:OPERation:CONDition

This command queries the CONDition section of the STATus:OPERation register (see the base unit description of status registers in the Remote Control Basics chapter).

Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

**Example:** STAT:OPER:COND?

**Mode:** all

---

### STATus:OPERation[:EVENT]

This command queries the contents of the EVENT section of the STATus:OPERation register. The contents of the EVENT section are deleted after readout.

**Example:** STAT:OPER?

**Mode:** all

---

### STATus:QUEStionable:CONDition

This command queries the CONDition section of the "STATus:QUEStionable" register. This section contains the sum bit of the next lower register. This register part can only be read, but not written into or cleared. Readout does not delete the contents of the CONDition section.

**Example:** STAT:QUES:COND?

**Mode:** all

---

### STATus:QUEStionable[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable register. The EVENT part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the transition filters. It is permanently updated by the instrument. This part can only be read by the user. Reading the register clears it.

**Example:** STAT:QUES?

**Usage:** Query only

**Mode:** all

---

**STATus:QUESTionable:LIMit<Screen>[:EVENT]  
STATus:QUESTionable:SYNC[:EVENT]?**

The EVENT part indicates whether an event has occurred since the last reading. It only indicates events passed on by the transition filters. It is permanently updated by the instrument. This part can only be read by the user. Reading the register clears it.

Possible events are described in:

[chapter 5.21.4, "STATus:QUESTionable:SYNC Register"](#), on page 243

[chapter 5.21.3, "STATus:QUESTionable:LIMit Register"](#), on page 242

**Suffix:**

<Screen>                    1 | 2  
                                  1 = Screen A, 2 = Screen B  
 Note that limit lines are not displayed in screen A, thus  
 STAT:QUES:LIM1? always returns 0.

**Usage:**                    Query only  
                                  SCPI confirmed

**Mode:**                    OFDMA/WiBro

---

**STATus:QUESTionable:LIMit<Screen>:CONDition  
STATus:QUESTionable:SYNC:CONDition?**

Contains the current status of the instrument. This register part can only be read, but not written into or cleared. Readout does not delete the contents of the CONDition section.

**Suffix:**

<Screen>                    1 | 2  
                                  1 = Screen A, 2 = Screen B  
 Note that limit lines are not displayed in screen A, thus  
 STAT:QUES:LIM1:COND? always returns 0.

**Usage:**                    Query only  
                                  SCPI confirmed

**Mode:**                    OFDMA/WiBro

---

**STATus:QUESTionable:LIMit<Screen>:ENABLE  
STATus:QUESTionable:SYNC:ENABLE? <Filter>**

Determines whether the EVENT bit of the associated status register contributes to the sum bit of the STATus:QUESTionable register. Each bit of the EVENT part is "ANDed" with the associated ENABLE bit. The results of all logical operations of this part are passed on to the event sum bit via an "OR" function.

**Suffix:**

<Screen>                    1 | 2  
                                  1 = Screen A, 2 = Screen B  
 Note that limit lines are not displayed in screen A, thus  
 STAT:QUES:LIM1:ENAB is irrelevant.

**Parameters:**

<Filter> The sum of the decimal values of the event bits that are to be enabled for the summary bit.

Range: 0 to 65535

**Usage:** Query only  
SCPI confirmed

**Mode:** OFDMA/WiBro

**STATus:QUEStionable:LIMit<Screen>:NTRansition****STATus:QUEStionable:SYNC:NTRansition? <Mode>**

This bit acts as a transition filter. When a bit of the `CONDition` part of the associated status register for the result type is changed from 1 to 0, the `NTR` bit decides whether the `EVENT` bit is set to 1.

**Suffix:**

<Screen> 1 | 2  
1 = Screen A, 2 = Screen B  
Note that limit lines are not displayed in screen A, thus  
`STAT:QUES:LIM1:NTR` is irrelevant.

**Usage:** Query only  
SCPI confirmed

**Mode:** OFDMA/WiBro

**STATus:QUEStionable:LIMit<Screen>:PTRansition****STATus:QUEStionable:SYNC:PTRansition?**

This bit acts as a transition filter. When a bit of the `CONDition` part of the associated status register for the result type is changed from 0 to 1, the `PTR` bit decides whether the `EVENT` bit is set to 1.

**Suffix:**

<Screen> 1 | 2  
1 = Screen A, 2 = Screen B  
Note that limit lines are not displayed in screen A, thus  
`STAT:QUES:LIM1:PTR` is irrelevant.

**Parameters:**

<Filter> The sum of the decimal values of the event bits that are to be enabled.

Range: 0 to 65535

**Example:** `STAT:QUES:LIM:PTR 65535`  
All condition bits will be summarized in the Event register when a positive transition occurs.

**Usage:** Query only  
SCPI confirmed

**Mode:** OFDMA/WiBro

## 5.17 SYSTEM Subsystem (WiMAX, K93)

This subsystem contains a series of commands for general functions.

### Commands of the SYSTEM Subsystem

[SYSTem:COMMunicate:TCPIP:ADDRESS](#).....224

---

#### **SYSTem:COMMunicate:TCPIP:ADDRESS** <Address>

This command sets the lookup TCP/IP address of an external R&S SMU signal generator connected via TCP/IP. This enables the instrument to download the frame zone setup directly.

#### **Parameters:**

<Address>

#### **Example:**

`SYST:COMM:TCP:ADDR 192.168.1.1`

Sets the lookup TCP/IP address of the SMU to 192.168.1.1.

**Mode:** OFDMA/WiBro

## 5.18 TRACe Subsystem (WiMAX, K93)

The TRACe subsystem controls access to the instrument's internal trace memory. The format of the returned data depends on the measurement type performed and is described in the subsequent chapters.

5.18.1	TRACe commands.....	225
5.18.2	Constellation vs Symbol.....	226
5.18.3	Constellation vs Carrier.....	227
5.18.4	Power vs Time – Full Burst and Start / End Data.....	227
5.18.5	Power vs Time – Full Subframe and Rising/Falling Subframe.....	227
5.18.6	Spectrum Flatness/Group Delay/Flatness Difference.....	228
5.18.7	Spectrum FFT.....	229
5.18.8	Statistics Bitstream Data.....	229
5.18.9	Statistics Burst Summary Data.....	230
5.18.10	Statistics CCDF – Complementary Cumulative Distribution Function.....	231
5.18.11	EVM vs Carrier.....	231
5.18.12	EVM vs Symbol.....	232

5.18.13	Frequency Sweep Measurements.....	232
5.18.14	Spectrum Mask.....	232
5.18.15	Spectrum ACPR.....	233

### 5.18.1 TRACe commands

TRACe[:DATA].....	225
TRACe:IQ:SRATe.....	226
TRACe:IQ:DATA:MEMory .....	226

---

#### TRACe[:DATA]? <ResultType>

This command returns all the measured data that relates to the currently selected measurement type. All results are returned in ASCII format. The returned data depends on the currently selected measurement type. `DISPlay:FORMat` is not supported with this command.

The following measurement types are available:

- [chapter 5.18.2, "Constellation vs Symbol"](#), on page 226
- [chapter 5.18.3, "Constellation vs Carrier"](#), on page 227
- [chapter 5.18.4, "Power vs Time – Full Burst and Start / End Data"](#), on page 227
- [chapter 5.18.5, "Power vs Time – Full Subframe and Rising/Falling Subframe"](#), on page 227
- [chapter 5.18.6, "Spectrum Flatness/Group Delay/Flatness Difference"](#), on page 228
- [chapter 5.18.7, "Spectrum FFT"](#), on page 229
- [chapter 5.18.8, "Statistics Bitstream Data"](#), on page 229
- [chapter 5.18.9, "Statistics Burst Summary Data"](#), on page 230
- [chapter 5.18.10, "Statistics CCDF – Complementary Cumulative Distribution Function"](#), on page 231
- [chapter 5.18.11, "EVM vs Carrier"](#), on page 231
- [chapter 5.18.12, "EVM vs Symbol"](#), on page 232
- [chapter 5.18.13, "Frequency Sweep Measurements"](#), on page 232
- [chapter 5.18.14, "Spectrum Mask"](#), on page 232
- [chapter 5.18.15, "Spectrum ACPR"](#), on page 233

#### Query parameters:

<ResultType> TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST

For details on the parameters refer to the corresponding measurement type (see list above).

#### Example:

TRAC? TRACE2

The measurement data for the selected graph is returned.



**Usage:** Query only  
SCPI confirmed

**Mode:** OFDM, OFDMA/WiBro

**TRACe:IQ:SRATe** <SampleRate>

This command allows the sample rate for IQ measurements to be specified.

**Parameters:**

<SampleRate> Range: 1440000 to 32.248E6 Hz

**Example:** TRAC:IQ:SRAT 2000000  
Specifies a sample rate of 20 MHz.

**Mode:** OFDM, OFDMA/WiBro

**TRACe:IQ:DATA:MEMory ?** <OffsetSa>, <NoSamples>

Returns all the I/Q data associated with the measurement acquisition time. The result values are scaled linearly in Volts and correspond to the voltage at the RF input of the instrument. The command returns a comma-separated list of the measured voltage values in floating point format (Comma Separated Values = CSV). The number of values returned is 2 \* the number of samples, the first half being the I values, the second half the Q values.

**Query parameters:**

<OffsetSa> Offset of the values to be read related to the start of the acquired data.

Range: 0 to <NoSamples>

\*RST: RST value

<NoSamples> Number of measurement values to be read.

Range: 1 to (<NoSamples>-<OffsetSa>)

\*RST: RST value

**Example:** TRAC:IQ:DATA:MEM? 0,2000  
Requests first 2000 samples.

**Usage:** Query only

**Mode:** WLAN, OFDM, OFDMA/WiBro

## 5.18.2 Constellation vs Symbol

This measurement represents I and Q data. Data will be returned as a repeating array of interleaved I and Q data in groups of selected carriers, until all the data is exhausted.

Each I and Q point will be returned in floating point format. TRACE1 is used for this measurement results.

For the IEEE 802.16e-2005 OFDMA standard, the following rule applies: For all symbols, the results are returned in repeating groups of the FFT size. For example, if the FFT size

was 1024 and 12 symbols were found, then 12288 I/Q pairs worth of data would be returned. Carriers that do not exist or are filtered out by the current filter settings are denoted by the keyword **NAN**.

### 5.18.3 Constellation vs Carrier

This measurement represents I and Q data. Data will be returned as a repeating array of interleaved I and Q data in groups of 53 channels including the channel 0, until all the data is exhausted.

Each I and Q point will be returned in floating point format. TRACE1 is used for this measurement results.

### 5.18.4 Power vs Time – Full Burst and Start / End Data

This description applies to measurement results from the IEEE 802.16-2004 OFDM standard.

Both measurement results are once again simply slightly different views of the same results data.

All fully complete bursts within the capture time are analyzed. This data is returned in dBm values on a per sample basis. Each sample will in some way relate to an analysis of each corresponding sample within each processed burst.

The type of PVT data returned will be determined by the TRACE number passed as an argument to the SCPI command, in addition to the graphic type that is selected.

If the graphic type selected is full burst, then the return data is as follows.

TRACE1	full burst, burst data values
--------	-------------------------------

If the graphic type selected is rising/falling, then the return data is as follows.

TRACE1	start, burst data values
TRACE2	end, burst data values

The number of samples returned during full burst analysis will depend on the modulation type and will typically be 5000.

The number of samples returned when the rising and falling graphic type is selected will be less than what is returned for full burst and will be approximately 400 samples. The samples will be returned in floating point format as a single sequence of comma delimited values.

### 5.18.5 Power vs Time – Full Subframe and Rising/Falling Subframe

This description applies to measurement results from the IEEE 802.16e-2005 standard.

Both measurement results are once again simply slightly different views of the same results data.

All fully complete frames within the capture time are analyzed into three master frames. The three master frames relate to the minimum, maximum and average values across all complete frames. This data is returned in dBm values on a per sample basis. Each sample will in some way relate to an analysis of each corresponding sample within each processed frame.

The type of PVT data returned will be determined by the TRACE number passed as an argument to the SCPI command, in addition to the graphic type that is selected.

If the graphic type selected is full burst, then the return data is as follows.

TRACE1	full subframe, minimum frame data values
TRACE2	full subframe, mean frame data values
TRACE3	full subframe, maximum frame data values

If the graphic type selected is rising/falling, then the return data is as follows.

TRACE1	rising edge, minimum frame data values
TRACE2	rising edge, mean frame data values
TRACE3	rising edge, maximum frame data values
TRACE4	falling edge, minimum frame data values
TRACE5	falling edge, mean frame data values
TRACE6	falling edge, maximum frame data values

The number of samples returned during full frame analysis will depend on the modulation type and will typically be 5000.

The number of samples returned when the start/end graphic type is selected will be less than what is returned for full burst and will be approximately 400 samples. The samples will be returned in floating point format as a single sequence of comma delimited values.

### 5.18.6 Spectrum Flatness/Group Delay/Flatness Difference

There are three separate traces that are available with this measurements. Trace data for a particular trace will only be returnable by querying the appropriate trace.

All traces are all plotted on a per carrier basis. All carriers are drawn in addition to the unused 0 carrier.

Carriers that are not used are denoted by the keyword **NAN**.

For example, the return data will be a repeating group of 201 carriers for the IEEE 802.16-2004 OFDM standard.

TRACE1	Minimum absolute power value (ABS) or Minimum group delay values
TRACE2	Mean absolute power value (ABS) or Mean group delay values or
TRACE3	Maximum absolute power value (ABS) or Maximum group delay values or

Absolute power results are returned in dB or dB difference and group delay results are returned in ns.

### 5.18.7 Spectrum FFT

All FFT points will be returned if the data for this measurement is requested. This will be an exhaustive call, due to the fact that there are nearly always more FFT points than IQ samples. The number of FFT points is the number presented by a power of 2 that is higher than the total number of samples.

E.g. if there were 20000 samples, then 32768 FFT points would be returned.

Data will be returned in floating point format in dBm. TRACE1 is used for this measurement results.

### 5.18.8 Statistics Bitstream Data

Data will be returned depending on the selected standard from which the measurement was executed:

- For the IEEE 802.16-2004 OFDM standard, data is returned in repeating groups of 200 data channels where each symbol value will be represented by an integer value within one byte. Channel 0 is unused and will therefore not have any data associated with it, with no return data being provided.
- For the IEEE 802.16e-2005 OFDMA standard, the data is returned in groups of the selected FFT size, where each symbol value will be represented by an integer value within one byte. The FFT size is either 128, 512, 1024, or 2048 sub carriers. Unused carriers, including the zero carrier, are also returned. They are denoted by the string value **NAN**.

The number of repeating groups that are returned will be equal to the number of measured symbols.

64QAM has the highest data rate and it contains symbol values up to 63, making one byte sufficient in size to represent all symbol data values, regardless of the modulation type in use.

Data will be returned in ASCII printable hexadecimal character format. TRACE1 is used for this measurement results.

### 5.18.9 Statistics Burst Summary Data

The return data depends on the current standard and measurement results.

For the IEEE 802.16-2004 OFDM standard, the data will be returned in repeating groups of 6 comma separated values as follows:

- 1st value – burst number  
If this value is 0 then it is an FCH burst.
- 2nd value – area with:  
0 = preamble  
1 = data
- 3rd value – modulation with:  
0 = BPSK  
1 = QPSK  
2 = 16QAM  
3 = 64QAM
- 4th value – symbol length  
This is an integer value giving the number of symbols in the current area.
- 5th value – power in dBm for the current area  
This is returned as a float
- 6th value – EVM in dB for the current area  
This is returned as a float.

Example:

Burst	Area	Modulation	Length	Power	EVM
FCH	Preamble	QPSK	1	-1.96	-43.75
	Data	BPSK	1	-2.96	-33.75
Burst 2	Preamble	QPSK	1	-3.96	-23.75
	Data	64QAM	26	-4.96	-13.75

SCPI would return the following:

```
B|A|M|L |P |E
```

```
u|r|o|e |o |V
```

```
r|e|d|n |w |M
```

```
s|a| |e |
```

```
t| | |r |
```

```
0,0,1, 1,-1.96,-43.75,
```

```
0,1,0, 1,-2.96,-33.75,
```

```
2,0,1, 1,-3.96,-23.75,
```

```
2,1,3,26,-4.96,-13.75
```

The number of repeating groups that are returned will be equal to the number of rows in the Burst Summary results.

For the IEEE 802.16e-2005 OFDMA standard, the data will be returned in repeating groups of 7 comma separated values as follows:

- 1st value – subframe number
- 2nd value – burst number
- 3rd value – burst type:
  - 1 = FCH
  - 2 = DL map
  - 3 = UL map
  - 4 = data
- 4th value – modulation where:
  - 1 = QPSK
  - 2 = 16QAM
  - 3 = 64QAM
- 5th value – number of slots  
This is an integer value giving the number of slots associated with the burst.
- 6th value – power in dBm for the current area  
This is returned as a float.
- 7th value – EVM in dB for the current area  
This is returned as a float.

The number of repeating groups that are returned will be equal to the number of rows in the Burst Summary results.

Data will be returned in ASCII printable hexadecimal character format. TRACE1 is used for this measurement results.

#### 5.18.10 Statistics CCDF – Complementary Cumulative Distribution Function

Up to a maximum of 201 data points will be returned in addition to a data count value. The first value in the return data will represent the quantity of probability values that follow. Each of the potential 201 data points will be returned as probability value and will represent the total number of samples that are equal to or exceed the corresponding power level. Probability data will be returned up to the power level that contains at least one sample. It is highly unlikely that the full 201 data values will ever be returned.

Each probability value will be returned as a floating point number, with a value less than 1.

#### 5.18.11 EVM vs Carrier

Two trace types are provided with this measurement. There is an average EVM value for each of the 53 channels or a repeating group of EVM values for each channel. The number of repeating groups will correspond to the number of fully analyzed trains.

Each EVM value will be returned as a floating point number, expressed in units of dBm.

TRACE1	Average EVM values per channel
TRACE2	All EVM values per channel for each full train of the capture period

For the IEEE 802.16e-2005 standard, the number of sub carriers returned varies according to the FFT size.

Each EVM value will be returned as a floating point number, expressed in units of dBm or percentage.

TRACE1	Minimum EVM values
TRACE2	Mean EVM values
TRACE3	Maximum EVM values

### 5.18.12 EVM vs Symbol

Three traces types are available with this measurement. The basic trace types show either the minimum, mean or maximum EVM value, as measured over the complete capture period.

The number of repeating groups that are returned will be equal to the number of measured symbols.

Each EVM value will be returned as a floating point number, expressed in units of dBm.

TRACE1	Minimum EVM values
TRACE2	Mean EVM values
TRACE3	Maximum EVM values

### 5.18.13 Frequency Sweep Measurements

Currently, there is only one measurement that is performed in frequency sweep mode. This is the Spectrum Mask measurement. No data will be returned for this measurement, should it be requested, until such time as a measurement has been previously run.

Running an IQ measurement will not generate results for this type of measurement.

### 5.18.14 Spectrum Mask

Result data will be returned as 501 trace points in floating point format. These trace points are obtained directly from the base system via the measurement API and the quantity is therefore a fixed value. Only an array of Y data will be returned.

TRACE1	Clear write values
TRACE2	Max hold values
LIST	Spectrum Emission Mask (SEM) summary results (in WiBro standard only):

SEM summary results formats:

1st value	index into table of results (1 – 9)
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)

There are 5 rows of results for downlink, and 9 rows for uplink.

### 5.18.15 Spectrum ACPR

Result data will be returned as 501 trace points in floating point format. These trace points are obtained directly from the base system via the measurement API and the quantity is therefore a fixed value. Only an array of Y data will be returned.

TRACE1	Clear write values
TRACE2	Max hold values

## 5.19 TRIGger Subsystem (WiMAX, K93)

The trigger subsystem is used to synchronize device action(s) with events.

### Commands of the TRIGger Subsystem

TRIGger[:SEQuence]:HOLDoff.....	234
TRIGger<n>[:SEQuence]:IFPower:HOLDoff.....	234
TRIGger<n>[:SEQuence]:IFPower:HYSTeresis.....	234
TRIGger<n>[:SEQuence]:LEVel[:EXTernal].....	235
TRIGger[:SEQuence]:LEVel:POWer.....	235
TRIGger[:SEQuence]:LEVel:POWer:AUTO.....	235
TRIGger[:SEQuence]:MODE.....	235
TRIGger<n>[:SEQuence]:SOURce.....	236



**TRIGger[:SEQuence]:HOLDoff** <DelayTime>

This command defines the length of the trigger delay. A negative delay time (pretrigger) can be set in zero span only.

**Parameters:**

<DelayTime>            Range:        -3.25 to 837.33  
                          \*RST:        0 s  
                          Default unit: ms

**Example:**

TRIG:HOLD 500us

A holdoff period of 500  $\mu$ s is used after the trigger condition has been met.

**Usage:**

SCPI confirmed

**Mode:**

OFDM, OFDMA/WiBro

**TRIGger<n>[:SEQuence]:IFPower:HOLDoff** <Value>

This command sets the holding time before the next IF power trigger event.

**Suffix:**

<n>                      irrelevant

**Parameters:**

<Value>                \*RST:        150 ns

**Example:**

TRIG:SOUR IFP

Sets the IF power trigger source.

TRIG:IFP:HOLD 200 ns

Sets the holding time to 200 ns.

**Mode:**

A-F, ADEMOD, CDMA, EVDO, GSM, VSA, OFDM, OFDMA/  
 WiBro, TDS, WCDMA, WLAN

**TRIGger<n>[:SEQuence]:IFPower:HYSteresis** <Value>

This command sets the limit that the hysteresis value for the IF power trigger has to fall below in order to trigger the next measurement.

**Suffix:**

<n>                      irrelevant

**Parameters:**

<Value>                \*RST:        3 dB

**Example:**

TRIG:SOUR IFP

Sets the IF power trigger source.

TRIG:IFP:HYST 10DB

Sets the hysteresis limit value.

**Mode:**

ALL

---

**TRIGger<n>[:SEQuence]:LEVel[:EXTeRnal] <TriggerLevel>**

This command sets the level of the external trigger source in Volt.

**Suffix:**

<n> irrelevant

**Parameters:**

<TriggerLevel> Range: 0.5 V to 3.5 V  
\*RST: 1.4 V

**Example:** TRIG:LEV 2V

**Mode:** All

---

**TRIGger[:SEQuence]:LEVel:POWer <Level>**

This command sets the level of the input signal for which triggering will occur.

**Parameters:**

<Level> Range: -50 to 20  
\*RST: -20 DBM  
Default unit: dBm

**Example:** TRIG:MODE POW  
Sets the external trigger mode.  
TRIG:LEV:POW 10 DBM  
Sets the level to 10 dBm for RF measurement.

**Mode:** OFDM, OFDMA/WiBro

---

**TRIGger[:SEQuence]:LEVel:POWer:AUTO <State>**

This command specifies whether or not an automatic power trigger level calculation is performed before each main measurement. The setting of this command is ignored if the setting for the `TRIGger<n>[:SEQuence]:LEVel[:EXTeRnal]` command is not "POWer".

**Parameters:**

<State> ON | OFF  
\*RST: OFF

**Example:** TRIG:LEV:POW:AUTO ON  
Specifies that an automatic power trigger level calculation should be performed before the start of each main measurement.

**Mode:** OFDM, OFDMA/WiBro

---

**TRIGger[:SEQuence]:MODE <Mode>**

This command configures how triggering is to be performed.

**Parameters:**

&lt;Mode&gt;

IMMediate | EXTernal | POWer | PSEnSor | RFPower

**IMMediate**

No triggering is performed. This corresponds to the Free Run trigger mode.

**EXTernal**

The next measurement is triggered by the signal at the external trigger input e.g. a gated trigger.

**POWer**

The next measurement is triggered by signals outside the measurement channel.

**PSEn**

The next measurement is triggered by the external power sensor (requires R&S FSV-K9 option).

**RFPower**

The next measurement is triggered by the first intermediate frequency of the RF signal.

\*RST: IMMEDIATE

**Example:**

```
TRIG:MODE IMM
```

No triggering is performed.

**Mode:**

OFDM, OFDMA/WiBro

**TRIGger<n>[:SEQUENCE]:SOURCE <Source>**

This command selects the trigger source for the start of a sweep.

For details on trigger modes refer to the "Trg/Gate Source" softkey in the base unit description.

**Suffix:**

&lt;n&gt;

irrelevant

**Parameters:**

&lt;Source&gt;

IMMediate | EXTern | IFPower | RFPower | TIME | VIDEO |  
BBPower | PSEN**IMMediate**

Free Run

**EXTern**

External trigger

**IFPower**

Second intermediate frequency

**RFPower**

First intermediate frequency

**VIDEO**Video mode is only available in the time domain and only in Spec-  
trum mode.**BBPower**Baseband power (for digital input via the R&S Digital I/Q Interface,  
R&S FSV-B17)**PSEN**

External power sensor (requires R&amp;S FSV-K9 option)

\*RST: IMMediate

**Example:**

TRIG:SOUR EXT

Selects the external trigger input as source of the trigger signal

**Mode:**

ALL

## 5.20 UNIT Subsystem (WiMAX, K93)

The unit subsystem specifies the units for the specific result types.

**Commands of the UNIT Subsystem:**

- [UNIT:EVM](#) on page 237
- [UNIT:PREamble](#) on page 238
- [UNIT:TABLE](#) on page 238

**UNIT:EVM** <Unit>

This command specifies the units for EVM results.

**Parameters:**

&lt;Unit&gt;

DB | PCT

**DB**

EVM results returned in dB

**PCT**

EVM results returned in %

\*RST: DB

**Example:**           UNIT:EVM PCT  
EVM results to be returned in %.

**Mode:**             OFDM, OFDMA/WiBro

#### UNIT:PREamble <Unit>

This command specifies the units for Preamble error results.

**Parameters:**

<Unit>               HZ | DEG  
**HZ**  
Preamble error results returned in Hz  
**DEG**  
Preamble error results returned in degrees  
\*RST:                Hz

**Example:**           UNIT:PRE HZ  
Preamble error results to be returned in Hz.

**Mode:**             OFDM, OFDMA/WiBro

#### UNIT:TABLE <Unit>

This command specifies the parameters of the result summary that can be displayed as dB or degrees.

**Parameters:**

<Unit>               DB | PCT  
**DB**  
results returned in dB  
**PCT**  
results returned in %  
\*RST:                DB

**Example:**           UNIT:TABL DB  
Results to be returned in dB.

**Mode:**             OFDM, OFDMA/WiBro

## 5.21 Status Reporting System (Option R&S FSV-K93)

The status reporting system stores all information on the current operating state of the instrument, e.g. information on errors or limit violations which have occurred. This information is stored in the status registers and in the error queue. The status registers and the error queue can be queried via IEC bus.

In this section, only the new and altered status registers/bits for the WiMAX option (R&S FSV-K93) are described. Detailed information on the status registers of the base system is given in the section "Status Reporting System" in chapter 5 of the Operating

Manual on CD. A description of the remote commands required to query them is provided in "Remote Control – Description of Analyzer Commands" >"STATus:QUEStionable Subsystem" in the base unit documentation.

### **Description of the Status Registers**

The WiMAX option (R&S FSV-K93) uses only status registers provided by the base unit. However, some registers are used differently, as described in the following sections.

The commands to query the contents of the following status registers are described in [chapter 5.16, "STATus Subsystem \(OFDMA/WiBro, K93\)"](#), on page 220.

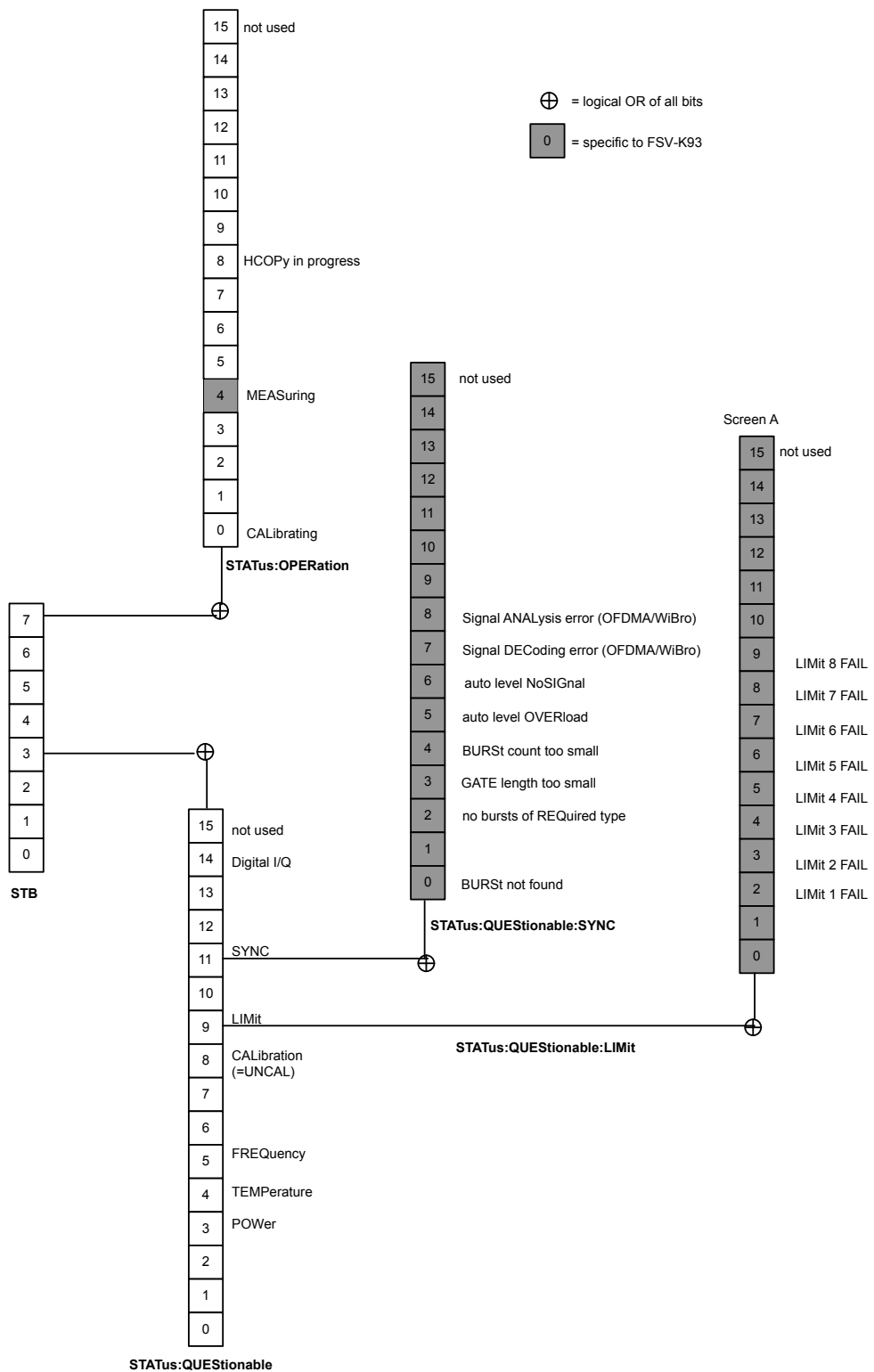


Fig. 5-1: Overview of WiMAX-specific status registers

5.21.1	STATus:OPERation Register.....	241
5.21.2	STATus:QUEStionable Register.....	241
5.21.3	STATus:QUEStionable:LIMit Register.....	242
5.21.4	STATus:QUEStionable:SYNC Register.....	243

### 5.21.1 STATus:OPERation Register

This register contains information on which actions the instrument is executing or which actions the instrument has executed since the last reading. It can be read using the commands `STATus:OPERation:CONDition` or `STATus:OPERation[:EVENT]`.

**Table 5-3: Meaning of the bits used in the STATus:OPERation register**

Bit No.	Meaning
0	<code>CALibrating</code> This bit is set as long as the instrument is performing a calibration.
1 - 3	Not used
4	<code>MEASuring</code> This bit is set when a measurement is in progress (application specific).
5 - 7	Not used
8	<code>HardCOpy</code> in progress This bit is set while the instrument is printing a hardcopy.
9 - 14	Not used
15	This bit is always 0.

### 5.21.2 STATus:QUEStionable Register

This register contains information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be read using the commands `STATus:QUEStionable:CONDition` or `STATus:QUEStionable[:EVENT]`.

**Table 5-4: Meaning of the bits used in the STATus:QUEStionable register**

Bit No.	Meaning
0 to 2	These bits are not used
3	<code>POWer</code> This bit is set if a questionable power occurs (see <code>STATus:QUEStionable:POWer</code> register in the base unit description).
4	<code>TEMPerature</code> This bit is set if a questionable temperature occurs.
5	<code>FREQuency</code> The bit is set if a frequency is questionable (see <code>STATus:QUEStionable:FREQuency</code> register in the base unit description). Not available from the R&S FSV-K93 option.



Bit No.	Meaning
6 to 7	Not used
8	CALibration The bit is set if a measurement is performed unaligned ("UNCAL" display)
9	LIMit (device-specific) This bit is set if a limit value is violated (see <a href="#">chapter 5.21.3, "STATus:QUEStionable:LIMit Register"</a> , on page 242). Note: The <code>Limit</code> register is associated with limit lines for the Spectrum Mask measurement only.
10	LMARgin (device-specific) This bit is set if a margin is violated (see <code>STATus:QUEStionable:LMARgin</code> in the base unit description). Not available from the R&S FSV-K93 option.
11	SYNC (device-specific) This bit is set if, in measurements or pre-measurements in WiMAX mode, synchronization fails, no signal is detected or no burst is found. This bit is also set if input settings conflict with the measurement setup (see <a href="#">chapter 5.21.4, "STATus:QUEStionable:SYNC Register"</a> , on page 243).
12 to 14	Not used
15	This bit is always 0.

### 5.21.3 STATus:QUEStionable:LIMit Register

This register contains information about the observance of limit lines. It can be read using the commands `STATus:QUEStionable:LIMit2:CONDition?` and `STATus:QUEStionable:LIMit2[:EVENT]?`.



The `Limit` register is associated with limit lines for the Spectrum Mask measurement only. No limit lines are displayed in screen A and as such all bits in the `LIMit1` register will always be set to 0.

**Table 5-5: Meaning of the bits used in the STATus:QUEStionable:LIMit2 register**

Bit No	Meaning
0 to 1	These bits are not used
2	LIMit FAIL This bit is set if the ETSI Spectrum Mask limit line is violated
3	LIMit FAIL This bit is set if the IEEE Spectrum Mask limit line is violated.
4	LIMit FAIL This bit is set if the Spectrum Flatness (Upper) limit line is violated
5	LIMit FAIL This bit is set if the Spectrum Flatness (Lower) limit line is violated

Bit No	Meaning
6	LIMit FAIL This bit is set if the Spectrum Flatness Difference (Upper) limit line is violated
7	LIMit FAIL This bit is set if the Spectrum Flatness Difference (Lower) limit line is violated
8 to 14	These bits are not used
15	This bit is always 0

#### 5.21.4 STATus:QUESTionable:SYNC Register

This register contains all information about sync and bursts not found, and about pre-measurement results exceeding or falling short of expected values. It can be read using the commands `STATus:QUESTionable:SYNC:CONDition` and `STATus:QUESTionable:SYNC[:EVENT]`.

**Table 5-6: Meaning of the bits used in the STATus:QUESTionable:SYNC register**

Bit No.	Meaning
0	BURSt not found This bit is set if an IQ measurement is performed and no bursts are detected
1	This bit is not used
2	No bursts of REQuired type This bit is set if an IQ measurement is performed and no bursts of the specified type are detected
3	GATE length too small This bit is set if gating is used in a measurement and the gate length is not set sufficiently large enough
4	BURSt count too small This bit is set if a PVT measurement is performed with gating active and there is not at least 1 burst within the gate lines
5	Auto level OVERload This bit is set if a signal overload is detected when an auto-level measurement is performed
6	Auto level NoSIGnal This bit is set if no signal is detected by the auto-level measurement
7	Signal DECoдинг error (OFDMA/WiBro) This bit is set if the signal cannot be decoded. This corresponds to incorrect configuration of primary measurement settings, an incorrect zone/burst configuration, or a failed auto-demodulation.
8	Signal ANALysis error (OFDMA/WiBro) This bit is set if the signal cannot be decoded due to an unexpected error within the DSP component.
9 - 14	These bits are not used.
15	This bit is always 0.



## List of Commands

ABORT.....	121
CALCulate<n>:BURSt[:IMMediate].....	121
CALCulate<n>:LIMit<m>:BURSt:ALL.....	123
CALCulate<n>:LIMit<m>:BURSt:ALL:RESult.....	124
CALCulate<n>:LIMit<m>:BURSt:BERPilot:MAXimum.....	125
CALCulate<n>:LIMit<m>:BURSt:BERPilot:MAXimum:RESult.....	126
CALCulate<n>:LIMit<m>:BURSt:BERPilot[:AVERAge].....	125
CALCulate<n>:LIMit<m>:BURSt:BERPilot[:AVERAge]:RESult.....	125
CALCulate<n>:LIMit<m>:BURSt:EVM:ALL:MAXimum.....	128
CALCulate<n>:LIMit<m>:BURSt:EVM:ALL:MAXimum:RESult.....	128
CALCulate<n>:LIMit<m>:BURSt:EVM:ALL[:AVERAge].....	126
CALCulate<n>:LIMit<m>:BURSt:EVM:ALL[:AVERAge]:RESult.....	127
CALCulate<n>:LIMit<m>:BURSt:EVM:DATA:MAXimum.....	130
CALCulate<n>:LIMit<m>:BURSt:EVM:DATA:MAXimum:RESult.....	130
CALCulate<n>:LIMit<m>:BURSt:EVM:DATA[:AVERAge].....	129
CALCulate<n>:LIMit<m>:BURSt:EVM:DATA[:AVERAge]:RESult.....	129
CALCulate<n>:LIMit<m>:BURSt:FERRor:MAXimum.....	132
CALCulate<n>:LIMit<m>:BURSt:FERRor:MAXimum:RESult.....	132
CALCulate<n>:LIMit<m>:BURSt:FERRor[:AVERAge].....	131
CALCulate<n>:LIMit<m>:BURSt:FERRor[:AVERAge]:RESult.....	131
CALCulate<n>:LIMit<m>:BURSt:IQOFfset:MAXimum.....	134
CALCulate<n>:LIMit<m>:BURSt:IQOFfset:MAXimum:RESult.....	134
CALCulate<n>:LIMit<m>:BURSt:IQOFfset[:AVERAge].....	133
CALCulate<n>:LIMit<m>:BURSt:IQOFfset[:AVERAge]:RESult.....	133
CALCulate<n>:LIMit<m>:BURSt:SSTiming:MAXimum.....	136
CALCulate<n>:LIMit<m>:BURSt:SSTiming:MAXimum:RESult.....	136
CALCulate<n>:LIMit<m>:BURSt:SSTiming[:AVERAge].....	135
CALCulate<n>:LIMit<m>:BURSt:SSTiming[:AVERAge]:RESult.....	135
CALCulate<n>:LIMit<m>:BURSt:SYMBolerror:MAXimum.....	138
CALCulate<n>:LIMit<m>:BURSt:SYMBolerror:MAXimum:RESult.....	138
CALCulate<n>:LIMit<m>:BURSt:SYMBolerror[:AVERAge].....	136
CALCulate<n>:LIMit<m>:BURSt:SYMBolerror[:AVERAge]:RESult.....	137
CALCulate<n>:LIMit<m>:FAIL.....	122
CALCulate<n>:LIMit<m>:SPECTrum:MASK:CHECK:X.....	139
CALCulate<n>:LIMit<m>:SPECTrum:MASK:CHECK:Y.....	139
CALCulate<n>:MARKer<1>:CARRier.....	141
CALCulate<n>:MARKer<1>:MAXimum.....	142
CALCulate<n>:MARKer<1>:MINimum.....	142
CALCulate<n>:MARKer<1>:SYMBol.....	142
CALCulate<n>:MARKer<1>:X.....	143
CALCulate<n>:MARKer<1>:Y.....	144
CALCulate<n>:MARKer<m>:AOFF.....	140
CALCulate<n>:MARKer<m>:BURSt.....	141
CALCulate<n>:MARKer<m>:FUNCTION:POWer:RESult:MAXHold.....	149
CALCulate<n>:MARKer<m>:FUNCTION:POWer:RESult[:CURRENT].....	145

CALCulate<n>:MARKer<m>:FUNction:TTcapture.....	145
CALCulate<n>:MARKer<m>:FUNction:TTcapture:AVERaging.....	146
CALCulate<n>:MARKer<m>:FUNction:TTcapture:FRAME.....	146
CALCulate<n>:MARKer<m>:FUNction:TTcapture:LENGth.....	146
CALCulate<n>:MARKer<m>:FUNction:TTcapture:RPOffset.....	147
CALCulate<n>:MARKer<m>:FUNction:TTcapture:RPOType.....	147
CALCulate<n>:MARKer<m>:FUNction:TTcapture:RPOwer.....	147
CALCulate<n>:MARKer<m>:FUNction:TTcapture:RPTYPE.....	148
CALCulate<n>:MARKer<m>:FUNction:TTcapture:START.....	148
CALCulate<n>:MARKer<m>:FUNction:TTcapture[:TIME].....	149
CALCulate<n>:MARKer<m>:FUNction:ZOOM.....	150
CALCulate<n>:MARKer<m>:TRACe.....	142
CALCulate<n>:MARKer<m>[:STATe].....	140
CONFigure:ADDReSS:SMU.....	152
CONFigure:BURSt:BOOSting.....	152
CONFigure:BURSt:CONSt:BURSt:SElect.....	153
CONFigure:BURSt:CONSt:CARRier:SElect.....	153
CONFigure:BURSt:CONSt:CCARrier[:IMMediate].....	154
CONFigure:BURSt:CONSt:CSYMBOL[:IMMediate].....	154
CONFigure:BURSt:CONSt:FORMat:SElect.....	154
CONFigure:BURSt:CONSt:SYMBOL:SElect.....	154
CONFigure:BURSt:EVM:ECARrier[:IMMediate].....	155
CONFigure:BURSt:EVM:ESYMBOL[:IMMediate].....	155
CONFigure:BURSt:PREAmble:SElect.....	156
CONFigure:BURSt:PREAmble[:IMMediate].....	155
CONFigure:BURSt:PVT:BURSt.....	156
CONFigure:BURSt:PVT:SElect.....	157
CONFigure:BURSt:PVT[:IMMediate].....	156
CONFigure:BURSt:SPECTrum:ACPR:SElect.....	157
CONFigure:BURSt:SPECTrum:ACPR[:IMMediate].....	157
CONFigure:BURSt:SPECTrum:FFT[:IMMediate].....	158
CONFigure:BURSt:SPECTrum:FLATness:SElect.....	158
CONFigure:BURSt:SPECTrum:FLATness[:IMMediate].....	158
CONFigure:BURSt:SPECTrum:MASK:SElect.....	159
CONFigure:BURSt:SPECTrum:MASK[:IMMediate].....	159
CONFigure:BURSt:SPECTrum:PHASe:PREAmble[:IMMediate].....	159
CONFigure:BURSt:STATistics:BSTReam:BURSt:SElect.....	160
CONFigure:BURSt:STATistics:BSTReam:FORMat:SElect.....	160
CONFigure:BURSt:STATistics:BSTReam:SYMBOL:SElect.....	161
CONFigure:BURSt:STATistics:BSTReam[:IMMediate].....	159
CONFigure:BURSt:STATistics:BSUMmary[:IMMediate].....	161
CONFigure:BURSt:STATistics:CCDF[:IMMediate].....	161
CONFigure:CHANnel.....	162
CONFigure:POWer:AUTO.....	162
CONFigure:POWer:AUTO:SWEep:TIME.....	162
CONFigure:POWer:EXPeCted:RF.....	162
CONFigure:STANdard.....	163
CONFigure:WIMax:AVERaging.....	163

CONFigure:WIMax:DLSFrame:IDCell.....	163
CONFigure:WIMax:DLSFrame:PREamble:INDex.....	164
CONFigure:WIMax:DLSFrame:PREamble:MODE.....	164
CONFigure:WIMax:DLSFrame:SEGment<1...3>.....	164
CONFigure:WIMax:FBANd.....	165
CONFigure:WIMax:FRAMe:PREDefmap:CONFig.....	167
CONFigure:WIMax:FRAMe:PREDefmap:IQDL.....	167
CONFigure:WIMax:FRAMe:PREDefmap:IQUL.....	167
CONFigure:WIMax:FRAMe:PREDefmap:SMU.....	167
CONFigure:WIMax:FRAMe:ZONetouse.....	167
CONFigure:WIMax:FSBWratio:AUTO.....	168
CONFigure:WIMax:FSBWratio:BW.....	168
CONFigure:WIMax:FSBWratio:FS.....	168
CONFigure:WIMax:Frame:IDCell.....	163
CONFigure:WIMax:Frame:IDCell:AUTO.....	166
CONFigure:WIMax:IGRatio.....	168
CONFigure:WIMax:LMODE.....	169
CONFigure:WIMax:NFFT.....	169
CONFigure:WIMax:TDDFrame:TTG.....	170
CONFigure:WIMax:ULSFrame:CRLength.....	170
CONFigure:WIMax:ULSFrame:FRAMe.....	170
CONFigure:WIMax:ULSFrame:SEGment<1..3>:BITMap<1..18>.....	171
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:CONTRol[:DATA].....	171
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:COUNT.....	173
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:DELeTe.....	173
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:FORMat.....	173
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:OFFSet:AUTO.....	174
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:POWEr.....	175
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:RESet.....	175
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SLOT:DURation.....	175
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:COUNT.....	175
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:OFFSet.....	175
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SYMBol:COUNT.....	176
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SYMBol:OFFSet.....	176
CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:TYPE.....	176
CONFigure:WIMax:ZONE<1...26>:CONTRol:STCConfig.....	177
CONFigure:WIMax:ZONE<1...26>:CONTRol[:DATA].....	177
CONFigure:WIMax:ZONE<1...26>:COUNT.....	178
CONFigure:WIMax:ZONE<1...26>:DELeTe.....	178
CONFigure:WIMax:ZONE<1...26>:IDSegment.....	178
CONFigure:WIMax:ZONE<1...26>:PERMbase.....	178
CONFigure:WIMax:ZONE<1...26>:PRBS.....	179
CONFigure:WIMax:ZONE<1...26>:RESet.....	179
CONFigure:WIMax:ZONE<1...26>:SYMB:COUNT.....	179
CONFigure:WIMax:ZONE<1...26>:SYMB:OFFSet.....	179
CONFigure:WIMax:ZONE<1...26>:TYPE.....	179
CONFigure:WIMax:ZONE<1...26>[:ANALyze]:STATe.....	171
DISPlay:FORMat.....	180

DISPlay[:WINDow<n>]:SElect.....	181
DISPlay[:WINDow<n>]:SSElect.....	181
DISPlay[:WINDow<n>]:TABLE.....	181
DISPlay[:WINDow<n>]:TABLE:LIST.....	181
DISPlay[:WINDow<n>]:TABLE:UNIT.....	182
DISPlay[:WINDow<n>]:TRACe1:Y[:SCALe]:PDIVision.....	183
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:AUTO.....	182
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel.....	184
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:IQ.....	184
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel:OFFSet.....	184
DISPlay[:WINDow<n>]:TRACe<t>:Y[:SCALe]:RLEVel[:RF].....	183
FETCh::BURSt:BERPilot:MAXimum.....	187
FETCh:BURSt:ALL.....	186
FETCh:BURSt:BERPilot:AVERage.....	187
FETCh:BURSt:BERPilot:MINimum.....	187
FETCh:BURSt:CINR.....	187
FETCh:BURSt:CINR:AVERage.....	187
FETCh:BURSt:CINR:MAXimum.....	187
FETCh:BURSt:CINR:MINimum.....	187
FETCh:BURSt:COUNt[:ALL].....	187
FETCh:BURSt:CRESt:AVERage.....	188
FETCh:BURSt:CRESt:MAXimum.....	188
FETCh:BURSt:CRESt:MINimum.....	188
FETCh:BURSt:EVM:ALL:AVERage.....	188
FETCh:BURSt:EVM:ALL:MAXimum.....	188
FETCh:BURSt:EVM:ALL:MINimum.....	188
FETCh:BURSt:EVM:DATA:AVERage.....	188
FETCh:BURSt:EVM:DATA:MAXimum.....	188
FETCh:BURSt:EVM:DATA:MINimum.....	188
FETCh:BURSt:EVM:PILot:AVERage.....	189
FETCh:BURSt:EVM:PILot:MAXimum.....	189
FETCh:BURSt:EVM:PILot:MINimum.....	189
FETCh:BURSt:EVM:PREamble:AVERage.....	189
FETCh:BURSt:EVM:PREamble:MAXimum.....	189
FETCh:BURSt:EVM:PREamble:MINimum.....	189
FETCh:BURSt:FERRor:AVERage.....	189
FETCh:BURSt:FERRor:MAXimum.....	189
FETCh:BURSt:FERRor:MINimum.....	189
FETCh:BURSt:GIMBalance:AVERage.....	189
FETCh:BURSt:GIMBalance:MAXimum.....	189
FETCh:BURSt:GIMBalance:MINimum.....	189
FETCh:BURSt:IQOffset:AVERage.....	190
FETCh:BURSt:IQOffset:MAXimum.....	190
FETCh:BURSt:IQOffset:MINimum.....	190
FETCh:BURSt:QUADoffset:AVERage.....	190
FETCh:BURSt:QUADoffset:MAXimum.....	190
FETCh:BURSt:QUADoffset:MINimum.....	190
FETCh:BURSt:RMS:ALL:AVERage.....	190

FETCh:BURSt:RMS:ALL:MAXimum.....	190
FETCh:BURSt:RMS:ALL:MINimum.....	190
FETCh:BURSt:RMS:AVERage.....	190
FETCh:BURSt:RMS:DATA:AVERage.....	191
FETCh:BURSt:RMS:DATA:MAXimum.....	191
FETCh:BURSt:RMS:DATA:MINimum.....	191
FETCh:BURSt:RMS:DLPReamble:AVERage.....	191
FETCh:BURSt:RMS:DLPReamble:MAXimum.....	191
FETCh:BURSt:RMS:DLPReamble:MINimum.....	191
FETCh:BURSt:RMS:MAXimum.....	190
FETCh:BURSt:RMS:MINimum.....	190
FETCh:BURSt:RMS:PILot:AVERage.....	191
FETCh:BURSt:RMS:PILot:MAXimum.....	191
FETCh:BURSt:RMS:PILot:MINimum.....	191
FETCh:BURSt:RSSI.....	192
FETCh:BURSt:RSSi:AVERage.....	192
FETCh:BURSt:RSSi:MAXimum.....	192
FETCh:BURSt:RSSi:MINimum.....	192
FETCh:BURSt:SYMBOLerror:AVERage.....	192
FETCh:BURSt:SYMBOLerror:MAXimum.....	192
FETCh:BURSt:SYMBOLerror:MINimum.....	192
FETCh:BURSt:TDOMain:PREamble.....	192
FETCh:BURSt:TDOMain:PREamble:AVERage.....	193
FETCh:BURSt:TDOMain:PREamble:MAXimum.....	193
FETCh:BURSt:TDOMain:PREamble:MINimum.....	193
FETCh:BURSt:TDOMain:SUBFrame.....	193
FETCh:BURSt:TDOMain:SUBFrame:AVERage.....	193
FETCh:BURSt:TDOMain:SUBFrame:MAXimum.....	193
FETCh:BURSt:TDOMain:SUBFrame:MINimum.....	193
FETCh:BURSt:TDOMain:ZONE.....	193
FETCh:BURSt:TDOMain:ZONE:AVERage.....	194
FETCh:BURSt:TDOMain:ZONE:MAXimum.....	194
FETCh:BURSt:TDOMain:ZONE:MINimum.....	194
FETCh:BURSt:USERror:AVERage.....	194
FETCh:BURSt:USERror:MAXimum.....	194
FETCh:BURSt:USERror:MINimum.....	194
FETCh:SYMBOL:COUNT.....	194
FETCh:ZONE:COUNT.....	195
FORMat[:DATA].....	195
INITiate:REFResh.....	196
INITiate<n>:CONTinuous.....	196
INITiate<n>[:IMMediate].....	196
INPut:ATTenuation.....	197
INPut:DIQ:RANGe[:UPPer].....	197
INPut:DIQ:SRATe.....	198
INPut:EATT.....	198
INPut:EATT:AUTO.....	198
INPut:EATT:STATe.....	199



INPut:GAIN:STATe .....	199
INPut:SElect.....	199
INSTRument:NSElect.....	200
INSTRument[:SElect].....	200
MMEMory:LOAD:FRAMe:STATe 1.....	201
MMEMory:LOAD:IQ:STATe.....	201
MMEMory:LOAD:SEM:STATe 1.....	201
MMEMory:STORE:IQ:STATe.....	201
STATus:OPERation:CONDition.....	221
STATus:OPERation[:EVENT].....	221
STATus:QUESTionable:CONDition.....	221
STATus:QUESTionable:LIMit<Screen>:CONDition.....	222
STATus:QUESTionable:LIMit<Screen>:ENABLE.....	222
STATus:QUESTionable:LIMit<Screen>:NTRansition.....	223
STATus:QUESTionable:LIMit<Screen>:PTRansition.....	223
STATus:QUESTionable:LIMit<Screen>[:EVENT].....	222
STATus:QUESTionable:SYNC:CONDition.....	222
STATus:QUESTionable:SYNC:ENABLE.....	222
STATus:QUESTionable:SYNC:NTRansition.....	223
STATus:QUESTionable:SYNC:PTRansition.....	223
STATus:QUESTionable:SYNC[:EVENT].....	222
STATus:QUESTionable[:EVENT].....	221
SYSTem:COMMunicate:TCPip:ADDRESS.....	224
TRACe:IQ:DATA:MEMory .....	226
TRACe:IQ:SRATe.....	226
TRACe[:DATA].....	225
TRIGger<n>[:SEquence]:IFPower:HOLDoff.....	234
TRIGger<n>[:SEquence]:IFPower:HYSTeresis.....	234
TRIGger<n>[:SEquence]:LEVel[:EXTernal].....	235
TRIGger<n>[:SEquence]:SOURce.....	236
TRIGger[:SEquence]:HOLDoff.....	234
TRIGger[:SEquence]:LEVel:POWer.....	235
TRIGger[:SEquence]:LEVel:POWer:AUTO.....	235
TRIGger[:SEquence]:MODE.....	235
UNIT:EVM.....	237
UNIT:PREamble.....	238
UNIT:TABLE.....	238
[SENSe:]BANDwidth:CHANnel.....	204
[SENSe:]BURSt:COUNT.....	204
[SENSe:]BURSt:COUNT:STATe.....	204
[SENSe:]DEMod:CEStimation.....	204
[SENSe:]DEMod:FILTer:CATalog.....	205
[SENSe:]DEMod:FILTer:MODulation.....	206
[SENSe:]DEMod:FORMat:BANalyze.....	206
[SENSe:]DEMod:FORMat:BANalyze:SYMBOLs:EQUal.....	207
[SENSe:]DEMod:FORMat:BANalyze:SYMBOLs:MAX.....	207
[SENSe:]DEMod:FORMat:BANalyze:SYMBOLs:MIN.....	207
[SENSe:]DEMod:FORMat[:BCONtent]:AUTO.....	208

[SENSe:]FFT:OFFSet.....	209
[SENSe:]FREQuency:CENTer.....	210
[SENSe:]POWer:ACHannel:ACPairs.....	210
[SENSe:]POWer:ACHannel:BANDwidth BWIDth:ACHannel.....	211
[SENSe:]POWer:ACHannel:BANDwidth BWIDth:ALTErnate<channel>.....	211
[SENSe:]POWer:ACHannel:BANDwidth BWIDth[:CHANnel<channel>].....	210
[SENSe:]POWer:ACHannel:MODE.....	211
[SENSe:]POWer:ACHannel:SPACing:ALTErnate<channel>.....	212
[SENSe:]POWer:ACHannel:SPACing[:ACHannel].....	212
[SENSe:]POWer:SEM.....	212
[SENSe:]POWer:SEM:CLASSs.....	213
[SENSe:]POWer:SEM:MODE.....	213
[SENSe:]POWer:SEM:TTA.....	214
[SENSe:]SUBChannel.....	214
[SENSe:]SUBChannel:STATe.....	214
[SENSe:]SUBChannel:ULPHysmod.....	214
[SENSe:]SWAPiq.....	215
[SENSe:]SWEep:ACPR:TIME.....	215
[SENSe:]SWEep:ACPR:TIME:AUTO.....	215
[SENSe:]SWEep:COUNT.....	216
[SENSe:]SWEep:EGATe.....	216
[SENSe:]SWEep:EGATe:HOLDoff:SAMPlE.....	217
[SENSe:]SWEep:EGATe:HOLDoff[:TIME].....	216
[SENSe:]SWEep:EGATe:LENGth:SAMPlE.....	217
[SENSe:]SWEep:EGATe:LENGth[:TIME].....	217
[SENSe:]SWEep:EGATe:LINK.....	217
[SENSe:]SWEep:TIME.....	218
[SENSe:]TRACKing:CESTimation[:BASE].....	218
[SENSe:]TRACKing:LEVel.....	218
[SENSe:]TRACKing:PHASe.....	219
[SENSe:]TRACKing:PILot.....	219
[SENSe:]TRACKing:TIME.....	219
[SENSe:]ZONE:COUNT.....	220
[SENSe:]ZONE:COUNT:STATe.....	220

# Index

- K73 ..... 101
- ## A
- abbreviations
    - WiMAX, WiBro measurements (K93) ..... 31
    - WiMAX measurements (K93) ..... 17
  - Amplitude menu
    - K93 ..... 48
  - analysis of measurement variables
    - K93 ..... 33
  - analysis steps
    - K93 ..... 24
  - Attenuation
    - Manual ..... 197
  - auto level detection
    - K93 ..... 16
- ## C
- capture buffer ..... 44, 93
  - Capture Count
    - K93 ..... 89
  - channel estimation
    - K93 ..... 33
  - channel results
    - K93 ..... 24
  - Characters
    - Special ..... 118
  - CINR
    - K93 ..... 28, 34
  - clock offset
    - K93 ..... 25
  - Commands
    - Description ..... 117
- ## D
- demodulation settings
    - K93 ..... 94
  - DigiConf
    - Softkey ..... 112
  - Digital Input
    - K93 ..... 92
- ## E
- Electronic input attenuation
    - FSV-B25 ..... 198
  - equalization
    - K93 ..... 33
  - EVM
    - K93 ..... 26, 33
  - EX-IQ-BOX ..... 111
    - DigiConf ..... 112
  - Exporting
    - I/Q data (remote) ..... 201
- ## F
- frequency
    - offset (K93) ..... 25
  - Frequency menu
    - K93 ..... 48
- Full Scale Level
    - Baseband Digital ..... 92
    - Digital I/Q Interface (remote control) ..... 197
- ## G
- General Settings dialog box
    - K93 ..... 48
- ## I
- I/Q data
    - Export (remote control) ..... 201
    - Import (remote control) ..... 201
  - I/Q imbalance
    - K93 ..... 35
  - IDCell
    - remote control (K93) ..... 166
  - IEC/IEEE bus
    - Command description ..... 117
  - Importing
    - I/Q data (remote) ..... 201
  - Input/Output menu
    - K93 ..... 111
  - Input sample rate
    - Baseband Digital ..... 92
  - IQ impairments
    - K93 ..... 26
  - IQ measurements
    - K93 ..... 44
- ## K
- key
    - INPUT/OUTPUT (K93) ..... 111
- ## L
- level
    - detection (K93) ..... 16
  - Lines menu
    - K93 ..... 110
  - literature
    - K93 ..... 36
  - Lower-case (commands) ..... 118
- ## M
- Marker menu
    - K93 ..... 108
  - Marker To menu
    - K93 ..... 109
  - measurement
    - WiMAX 802.16 OFDM/OFDMA/WiBro (K93) ..... 39
  - measurement example
    - basic (K93) ..... 14
  - Measurement menu
    - K93 ..... 47
  - measurement variables
    - CINR (K93) ..... 28, 34
    - EVM (K93) ..... 26, 33
    - I/Q imbalance ..... 35
    - IQ impairments (K93) ..... 26
    - K93 ..... 33, 36

- RSSI ..... 35
- RSSI (K93) ..... 27
- menu
  - Lines (K93) ..... 110
  - Marker (K93) ..... 108
  - Marker To (K93) ..... 109
  - Sweep (K93) ..... 107
  - Trace (K93) ..... 110
  - WiMAX (K93) ..... 37, 47
- Menu
  - Amplitude (K93) ..... 48
  - Frequency (K93) ..... 48
  - Trigger (K93) ..... 48
- N**
- No. Subframes
  - K93 ..... 90
  - K93 (remote control) ..... 220
- O**
- online help
  - working with ..... 8
- option
  - WiMAX IEEE 802.16e, WiBro Measurements (K93) ..... 37
- Options
  - FSV-B25 ..... 198
- P**
- Power Class
  - K91 ..... 78
- R**
- R&S Support
  - softkey ..... 53, 112
- RSSI
  - K93 ..... 27, 35
- RX Settings
  - softkey ..... 112
- S**
- Sample rate
  - Baseband Digital ..... 92
  - Digital I/Q Interface (remote control) ..... 198
- SCPI
  - Conformity information ..... 117
- SEM
  - Configuration (K91) ..... 78
- signal processing
  - block diagram (K93) ..... 31
  - IEEE 802.16-2004 OFDM (K93) ..... 17
  - IEEE 802.16 OFDMA (K93) ..... 29
- Signal Source
  - Remote control ..... 199
- softkey
  - # of Adj Chan (remote control) ..... 210
  - (remote control) ..... 220
  - ACLR Abs/Rel (remote control) ..... 211
  - ACPR Abs/Rel (K93) ..... 75
  - ACP Rel/Abs (remote control, K93) ..... 145, 149
  - ACP Settings (K93) ..... 78
  - ACP Settings (remote control, K93) ..... 211, 212
  - Auto Level (K93) ..... 107
  - Bit Selection (K93) ..... 85
  - Bitstream (K93) ..... 81
  - Burst Selection (K93) ..... 50
  - Burst Summary (K93) ..... 83
  - Carrier Selection (K93) ..... 62
  - CCDF (K93) ..... 79
  - Channel Bandwidth (remote control) ..... 210, 211
  - Channel Phase/Group Delay ..... 68
  - Channel Spacing (remote control) ..... 212
  - Constell Selection (K93) ..... 62
  - Constell vs Symbol/Carrier (K93) ..... 59
  - Continue Single Sweep (remote control) ..... 196
  - Continuous Sweep (remote control) ..... 196
  - Cont Meas (remote control) ..... 196
  - Copy Zone/Burst (K93) ..... 106
  - Default All (K93) ..... 110
  - Default Current (K93) ..... 110
  - Delete Zone/Burst (K93) ..... 107
  - Display Graph/Display List (K93) ..... 48, 110
  - Error Frequency/Phase (K93) ..... 57
  - EVM Constell (K93) ..... 54
  - EVM vs Symbol/Carrier (K93) ..... 54
  - Export (remote control) ..... 201
  - File Manager (K93) ..... 85
  - Frame Start Marker ..... 108, 146, 149
  - Full Burst (K93) ..... 48
  - Full Subframe (K93) ..... 50
  - Gated Trigger (remote control) ..... 216
  - Gating Settings On/Off (K93) ..... 52
  - Gating Settings On/Off (remote control, K93) ..... 216, 217
  - Import (remote control) ..... 201
  - Insert Zone/Burst (K93) ..... 106
  - List Zone/Burst (K93) ..... 103
  - Marker 1 (K91/91n) ..... 108
  - Marker 1 (remote control, K91/91n) ..... 141, 144
  - Marker 1 (remote control, K93) ..... 142, 143
  - Marker 1 to 4 (remote control) ..... 140
  - Marker Off (K91/91n) ..... 109
  - Marker Zoom (K93) ..... 109
  - Marker Zoom (remote control, K93) ..... 150
  - Meas Single/Cont (K91/91n) ..... 107
  - Min (remote control, K93) ..... 142
  - MKR -> Trace (K91/91n) ..... 110
  - MKR -> Trace (remote control, K93) ..... 142
  - New Segment (K93) ..... 106
  - New Zone/Burst (K93) ..... 106
  - Peak (remote control, K93) ..... 142
  - PVT (K93) ..... 48
  - R&S Support ..... 53, 112
  - Ref Level Offset (remote control) ..... 184
  - Refresh (K93) ..... 107
  - Rising/Falling (K93) ..... 51
  - Screen A/B (K91/91n) ..... 111
  - Screen Full/Split (K91/91n) ..... 111
  - Select 1 2 3 4 (remote control) ..... 140
  - SEM Settings (K93) ..... 77
  - Settings General/Demod (remote control, K93) ..... 204, 206, 207, 208, 209, 210, 214, 215, 216, 218, 219, 224, 226, 234, 235, 238
  - Single Meas (remote control) ..... 196
  - Single Sweep (remote control) ..... 196
  - Spectrum (K93) ..... 63, 70
  - Spectrum ACPR (remote control, K93) ..... 145, 149
  - Spectrum FFT (K93) ..... 74
  - Spectrum Flat./Diff./Group Delay (K93) ..... 63

Spectrum Flatness/Difference .....	66
Start End (K93) .....	49
Statistics (K93) .....	79
Trg/Gate Source (remote control) .....	235
Unzoom (K91/91n) .....	109
Unzoom (remote control, K93) .....	150
Y-Axis/Div (K93) .....	62
<b>Softkey</b>	
ACPR Abs/Rel (remote control, K93) .....	157
Annotation On/Off (remote control) .....	180
Auto Level (remote control, K93) .....	162
Bit Selection (remote control, K93) .....	160
Bitstream (remote control, K93) .....	159
Burst Selection (remote control, K93) .....	156
Burst Summary (remote control, K93) .....	161
Carrier Selection (remote control, K93) .....	153
CCDF (remote control, K93) .....	161
Constell Selection (remote control, K93) .....	153, 154
Constell vs Symbol/Carrier (remote control, K93) .....	154
Continuous Sweep (remote control) .....	196
Cont Meas (remote control) .....	196
DigiConf .....	112
Display Graph/Display List (remote control, K93) .....	181
EL Atten (remote control) .....	199
EL Atten Mode (Auto/Man) (remote control) .....	198
Error Frequency/Phase (remote control, K93) .....	155, 156
EVM vs Symbol/Carrier (remote control, K93) .....	155
EX-IQ-BOX .....	111
Export .....	53
Full Burst (remote control, K93) .....	157
IF Power Retrigger Holdoff (remote control) .....	234
IF Power Retrigger Hysteresis (remote control) .....	234
Import .....	53
Mech Atten Manual (remote control) .....	197
Preamp On/Off (remote control) .....	199
PVT (remote control, K93) .....	156
Refresh (remote control, K93) .....	196
RF Atten Manual (remote control) .....	197
Screen Focus A/B (remote control, K93) .....	181
Settings General/Demod (K93) .....	48
Settings General/Demod (remote control, K93) .....	184
Single Meas (remote control) .....	196
Single Sweep (remote control) .....	196
Spectrum FFT (remote control, K93) .....	158
Spectrum Flat./Diff./Group Delay (remote control, K93) .....	158
Spectrum IEEE/ETSI (remote control, K93) .....	159
Start End (remote control, K93) .....	157
Trg/Gate Source (remote control) .....	236
Trigger Holdoff .....	91
Trigger Hysteresis .....	91
Y-Axis/Div (remote control, K93) .....	183
Special characters .....	118
status bar	
K93 .....	46
Status registers	
STATus:OPERation .....	241
STATus:QUESTionable .....	241
STATus:QUESTionable:LIMit .....	242
STATus:QUESTionable:SYNC .....	243
Status reporting system .....	238
subchannelization	
K93 .....	24
Swap IQ	
remote control .....	215
Sweep menu	
K93 .....	107
symbols	
WiMAX, WiBro measurements (K93) .....	30
synchronization	
K93 .....	24, 32
<b>T</b>	
title bar	
K93 .....	46
Trace menu	
K93 .....	110
Trigger	
Holdoff .....	91
Hysteresis .....	91
Trigger menu	
K93 .....	48
TX Settings	
EX-IQ-BOX .....	112
<b>U</b>	
Upper-case (commands) .....	118
Use for analysis .....	100
<b>W</b>	
WiMAX menu	
K93 .....	37, 47