Software Manual
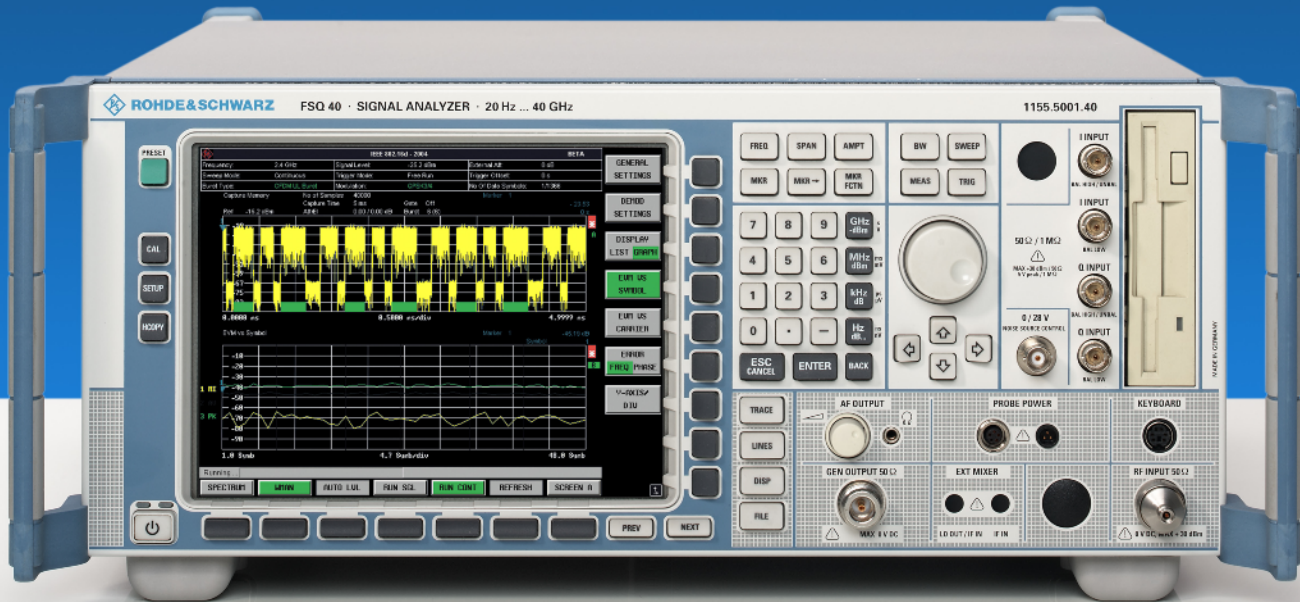
WiMAX IEEE 802.16-2004, IEEE 802.16e-2005 TX Tests

Applications Firmware R&S® FSQ-K92/K93

1300.7410.02

ROHDE&SCHWARZ

Test and Measurement

Contents

Before putting the product into operation for the first time, make sure to read the following

S a f e t y   I n s t r u c t i o n s

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

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

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

Symbols and safety labels

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

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

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

Tags and their meaning

DANGER	This tag indicates a definite hazard carrying a high risk of death or serious injury if not avoided.
WARNING	This tag indicates a possible hazard carrying a medium risk of death or (serious) injury if not avoided.
CAUTION	This tag indicates a hazard carrying a low risk of minor or moderate injury if not avoided.
ATTENTION	This tag indicates the possibility of incorrect use that can cause damage to the product.
NOTE	This tag indicates a situation where the user should pay special attention to operating the product but which does not lead to damage.

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

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 2000 m above sea level, max. transport altitude 4500 m above sea level.
Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).

3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.

4. If products/components are mechanically and/or 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, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.

6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.

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

8. Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.

9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.

10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.

11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.

12. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.

13. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).

14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.

15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.

16. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.

17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.

18. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.

19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a license electrician.

20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.

21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.

22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.

23. Rohde & Schwarz products are not protected against penetration of water, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.

24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.

25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.

26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.

27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.

29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.

30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).

31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.

32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.

33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.

Por favor lea imprescindiblemente antes de la primera puesta en funcionamiento las siguientes

Informaciones de seguridad

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estandards de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los estandards técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las informaciones, 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 solamente fue elaborado para ser utilizado en la industria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado dentro de las instrucciones de la correspondiente documentación de producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos profundos y conocimientos parciales del idioma inglés. Por eso se deberá tener en cuenta de exclusivamente autorizar para el uso del producto a personas peritas o debidamente minuciosamente instruidas con los conocimientos citados. Si fuera necesaria indumentaria de seguridad para el uso de productos de R&S, encontrará la información debida en la documentación del producto en el capítulo correspondiente.

Símbolos y definiciones de seguridad

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

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

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

Palabras de señal y su significado

PELIGRO	Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas.
ADVERTENCIA	Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas.
ATENCIÓN	Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas.
CUIDADO	Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
INFORMACIÓN	Indica una situación en la que deberían seguirse las instrucciones en el uso del producto, pero que no consecuentemente deben de llevar a un daño del mismo.

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

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S válido lo que sigue: como posición de funcionamiento se define principalmente la posición con el suelo de la caja para abajo , modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4.500 m sobre el nivel del mar.
A menos que se especifique otra cosa en la hoja de datos, se aplicará una tolerancia de ±10% sobre el voltaje nominal y de ±5% sobre la frecuencia nominal.

2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal perito autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Despues de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se producieran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.

4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.

5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberan ser tenidas en cuenta las prescipciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescipciones de seguridad especiales en la descripción del producto.

6. Ciertos productos, como por ejemplo las instalaciones de radiación HF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario/usario está comprometido a valorar y señalar areas de trabajo en las que se corra un riesgo aumentado de exposición a radiaciones para evitar riesgos.

7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.

8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del prodcuto.

9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.

10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto. Puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro, que es controlado su estado técnico de seguridad.

11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (según la medida del cable de distribución, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en construciones o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

12. No utilice nunca el producto si está dañado el cable eléctrico. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.

13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A (utilización de fusibles de mayor amperaje sólo previa consulta con el grupo de empresas Rohde & Schwarz).

14. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.

15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.

16. En las mediciones en circuitos de corriente con una tensión de entrada de $U_{eff} > 30$ V se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos de la EC950/EN60950.

18. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar heridas, fuego o daños en el producto.

19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, el circuito de suministro de corriente deberá estar protegido de manera que usuarios y productos estén suficientemente protegidos.

21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir corto circuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.

22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.

23. Los productos R&S no están protegidos contra el agua si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente para el usario o de daños en el producto lo cual también puede llevar al peligro de personas.

24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.

25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.

26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. No cortocircuitar baterías ni acumuladores. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención celulas de Litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Las baterías y acumuladores deben reutilizarse y no deben acceder a los vertederos. Las baterías y acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de evacuación y reciclaje.

28. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.

29. El producto puede poseer un peso elevado. Muévalo con cuidado para evitar lesiones en la espalda u otras partes corporales.

30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).

31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetados de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean tenidas en cuenta. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.

32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo. El fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.

33. Dado el caso de que esté integrado un producto de laser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación de producto. De otra manera pondrá en peligro su salud, ya que el rayo laser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo laser.

Certified Quality System

DIN EN ISO   9001 : 2000
DIN EN   9100 : 2003
DIN EN ISO 14001 : 2004

DQS REG. NO 001954 QM UM

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1 General Information

The Rohde & Schwarz FSQ-K92/K93 application extends the functionality of the R&S FSQ spectrum analyzer to enable WiMAX and WiBro TX-measurements according to the standards

1. IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode (R&S FSQ-K92/K93).
    The short form 'IEEE 802.16-2004 OFDM' is used in this document, to reference this standard.

2. IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode (R&S FSQ-K93 only). The short form 'IEEE 802.16e-2005 OFDMA' is used in this document, to reference this standard.

3. IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro (R&S FSQ-K93 only). The short form 'WiBro' is used in this document, to reference this standard.
    The standard is selected in the *General Settings Panel, Standard* field.

This manual supports the user in working with R&S FSQ-K92/K93. It aids the preparation, execution and evaluation of a measurement and gives many helpful hints and examples.

For the user wanting to make a quick start to using R&S FSQ-K92/K93, the Quick Start Guide section below works step-by-step through an ordinary measurement. The remainder of this section describes all of the basic information about how the R&S FSQ-K92/K93 application works, without covering measurements in detail. A detailed description of all measurement modes, settings and results can be found in section 2. Section 4 covers remote control operation of R&S FSQ-K92/K93.

This section covers the following subjects:

Introduction to R&S FSQ-K92/K93 measurements

·   Installation

·   Starting the application

·   Exiting the application

·   Quick start guide – allows the user to get up-and-running in minimum time

·   Navigation

·   Save/recall – saving & recalling user settings & measurement results

·   Printing

Introduction to R&S FSQ-K92/K93 WiMAX Measurements

The use of an R&S FSQ spectrum analyzer with its high sensitivity enables the accurate and reproducible TX-measurement of a WiMAX Device Under Test (DUT) according to the standards specified for the device:

- 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
  - Quadrature error
  - 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

- Transmit spectrum mask

- Adjacent Channel Power (Absolute and Relative)

- FFT, also over a selected part of the signal, e.g. preamble

- Payload bit information

- Burst Summary provides information about the analyzed bursts

- Capture time selectable up to 50 ms, multiple sweeps possible for large number of bursts

Installation

From the analyzer select firmware update.

➢ Press the SETUP hardkey followed by NEXT, FIRMWARE UPDATE and finally the FIRMWARE UPDATE softkey. Following the instructions displayed.

Once the installation has completed the analyzer will reboot.

Once the option has been installed it needs to be activated:

➢ Start up the analyzer.

➢ Press the *SETUP* hardkey, followed by the *GENERAL SETUP* softkey and then the *OPTIONS* softkey. A list of the options currently activated is displayed.

➢ Press the *INSTALL OPTION* softkey. A Dialog is displayed allowing the option key to be entered.
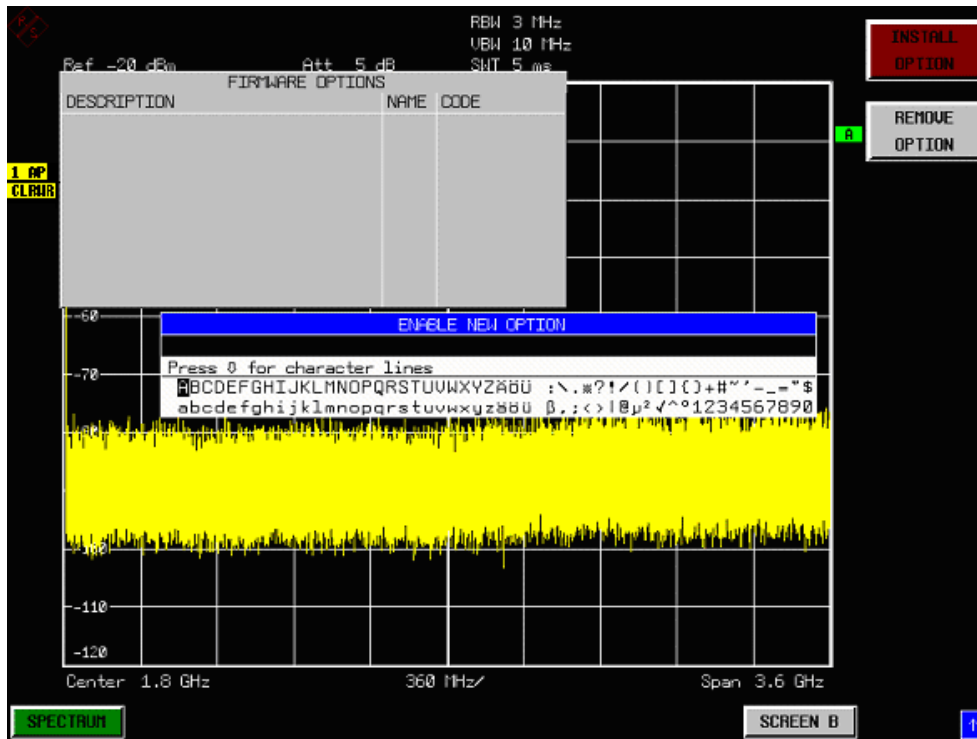
➢ Enter the option key supplied with the R&S FSQ-K92/K93 software. If upgrading from R&S FSQ-K92 to R&S FSQ-K93, the upgrade key needs to be entered in addition to the original R&S FSQ-K92 option key.

➢ When a valid option key has been supplied a dialog will be displayed explaining that a reboot is required to complete this operation. Select OK in this dialog and the instrument will be rebooted.

➢ When the analyzer starts after the reboot a new hotkey will be displayed at the bottom of the display labelled *WIMAX.* In addition an entry for the R&S FSQ-K92/K93 option will be displayed in the *FIRMWARE OPTIONS* dialog.
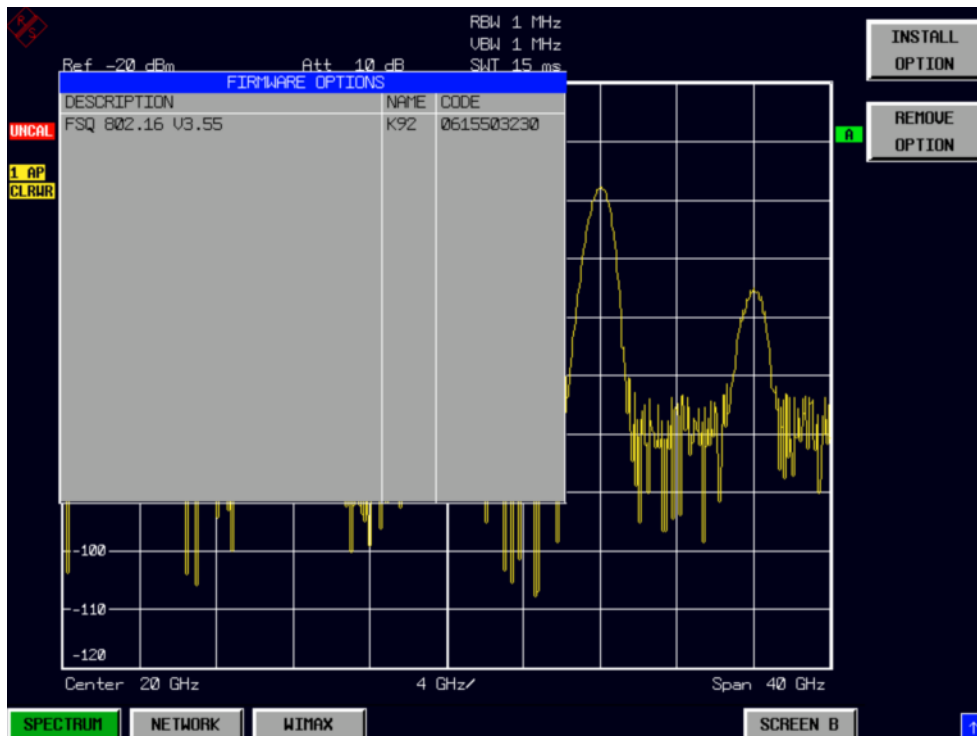
Starting the Application

Power up the R&S FSQ spectrum analyzer. When R&S FSQ-K92/K93 is correctly installed there will be a hotkey labelled *WIMAX* at the bottom of the screen. Press the *WIMAX* hotkey to start R&S FSQ-K92/K93.

Note that if the spectrum analyzer is powered down whilst R&S FSQ-K92/K93 is active, then when the spectrum analyzer is powered up again it will start up in the R&S FSQ-K92/K93 application.

Exiting the Application

To exit the R&S FSQ-K92/K93 option, press the *SPECTRUM* hotkey at the bottom of the screen. This will cause the option to exit and the spectrum analyzer to be activated.

Quick Start Guide

This section helps the user to quickly become familiar with R&S FSQ-K92/K93 by working step-by-step through an ordinary measurement. (Refer to section 2 for a detailed reference guide.)

For this example a DUT using IEEE 802.16-2004 will be used. The DUT will be connected to the analyzer using the RF input of the analyzer. The DUT will generate a signal modulated using 64QAM 2/3.

Setting up the Measurement

➢ Start the R&S FSQ-K92/K93 application.

➢ Press the *GENERAL SETTINGS* softkey to open the General Settings view.
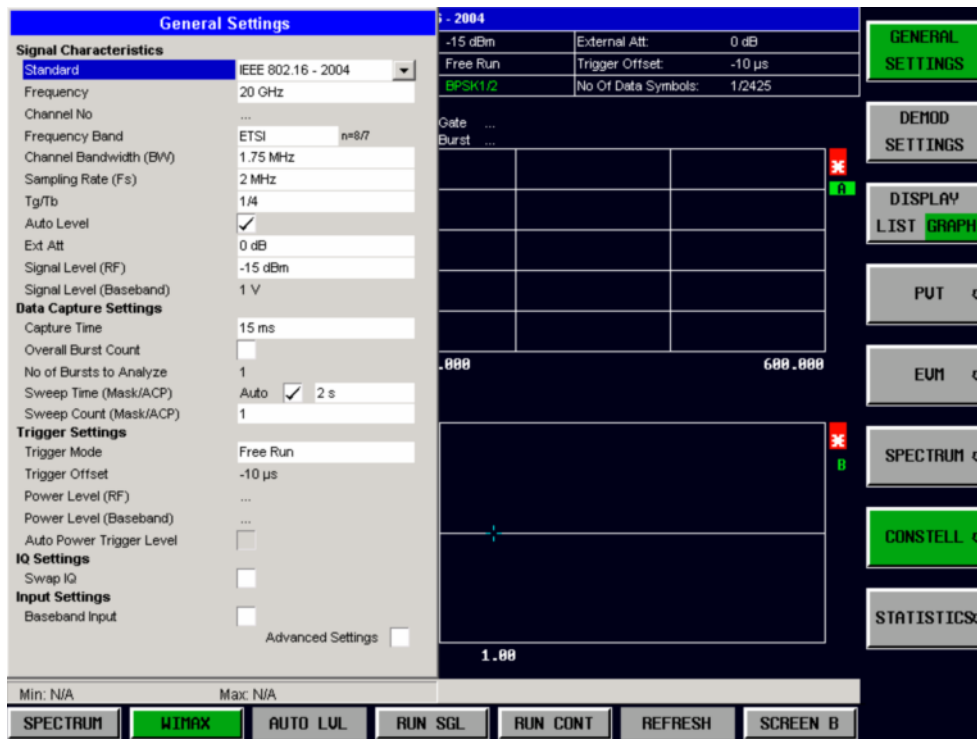
➢ Select the *Frequency* field and enter the desired frequency to measure. Note that when a valid frequency is entered the *Channel No* field updates.

➢ Select the *Frequency Band* in which the Signal to be analyzed is located. The target band is either one of the bands given as example in the 802.16-2004 standard[1] or an unspecified band.

➢ Select either the *Channel Bandwidth (BW)* or *Sampling Rate (Fs)* according to the characteristics of the signal to be analyzed. The second parameter is derived from the first according to the standard[2].

➢ Select the $G = T_g / T_b$ CP [Cyclic Prefix] to useful time ratio according to the characteristics of the signal to be analyzed.

➢ Switch Off the *Auto Level* Field. In this example the level detection measurement will be executed manually.

All other settings in this view are sufficient for this example.

---

[1] B.3.2 Wireless MAN-OFDM/OFDMA PHY symbol and performance parameters.

[2] 8.3.2.2 Derived Parameter definitions

➢ Press the *DEMOD SETTINGS* softkey to open the Demod Settings view
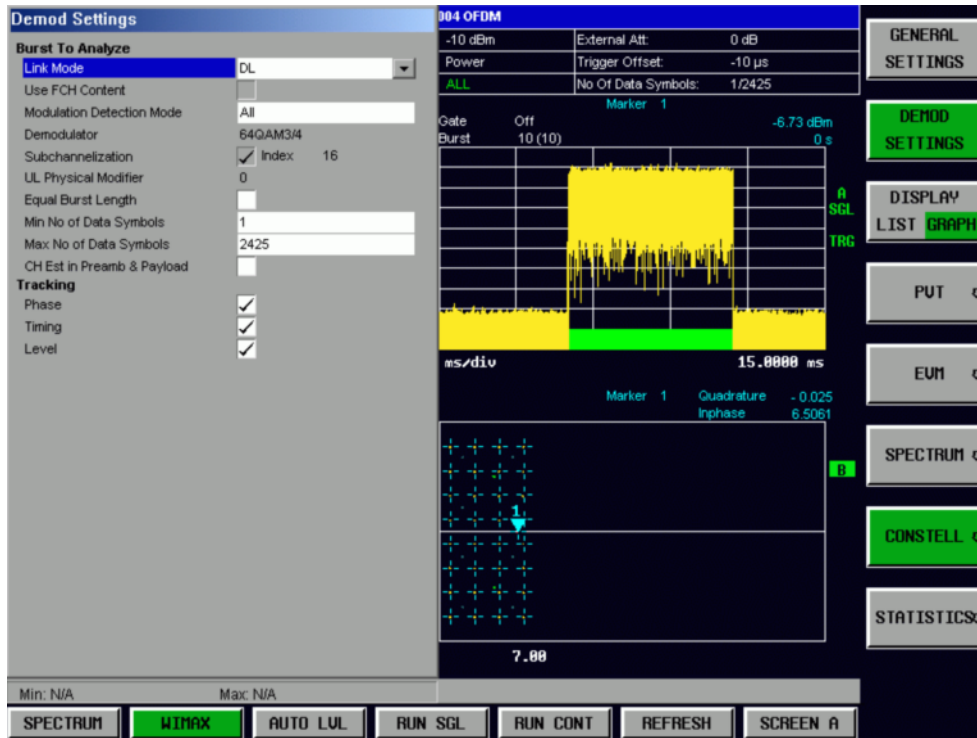
➢ Select the *Link Mode* of the Bursts to be analyzed.

➢ In case *Modulation Detection Mode* is set to *All* , All modulation formats of the bursts will be analyzed. This is useful, to get an overview of the signal content.
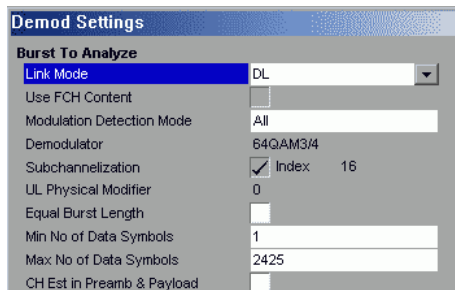
➢ Close the Demod Settings by pressing the *WIMAX* hotkey.

Performing Level Detection

➢ Connect the DUT to the RF input of the spectrum analyzer. (see Fig. 1)
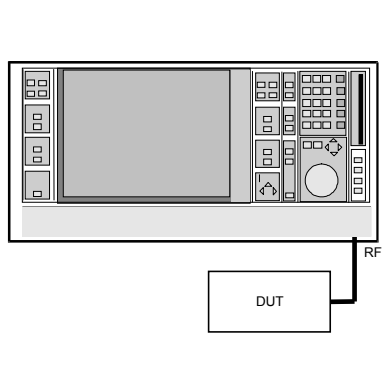
Fig. 1 Preparation for level detection

➢ Start the Level Detection measurement by pressing the *AUTO LVL* hotkey.

➢ 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 Bar will display "*Measurement Complete*", the signal level field for the selected input will be updated to show the detected signal level and the Magnitude Capture Buffer (Screen A) will be updated to show the zero span trace obtained during the measurement sequence.

Performing the main measurement

After level detection has been successfully completed the main measurement can be started. The set-up for the main measurement is the same as that for the level detection measurement.

➢ Start the measurement by pressing the *RUN SGL* hotkey.

➢ During the measurement, the text "*Running...*" is displayed in the Status Bar at the bottom of the screen.

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* Softkey.

Navigation

This section deals with navigation within the option. Navigation here is taken to mean all forms of interaction with the option except for remote control. The different methods of interacting with the option are:

• Hotkeys

• Softkeys

• Hardkeys

• Numeric Keypad

• Roll-key

• Cursor Keys

• External Keyboard

• Mouse

Hotkeys

Hotkeys are allocated to the seven keys at the bottom edge of the screen. On initial start-up of the R&S FSQ-K92/K93 option, the hotkeys provided are shown in Fig. 2. These hotkeys are present at all times once the option has been started.

SPECTRUM	WIMAX	AUTO LVL	RUN SGL	RUN CONT	REFRESH	SCREEN B
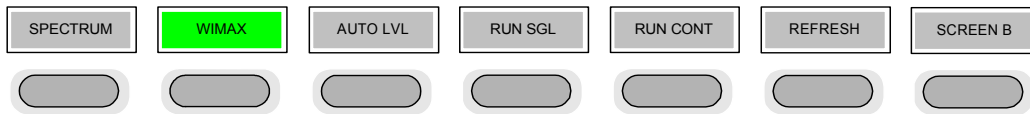
Fig. 2 Initial Hotkey menu

A keystroke activates the associated hotkey. An activated hotkey changes colour to green, as shown.
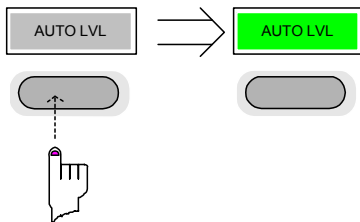
These hotkeys perform the following operations:

SPECTRUM

The *SPECTRUM* hotkey exits the R&S FSQ-K92/K93 option & returns to the spectrum analyzer with all previous settings restored.
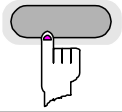
WIMAX

The *WIMAX* hotkey returns the user to the main measurement menu of R&S FSQ-K92/K93, where measurement results can be seen. All settings views and dialogs are removed from the display, and the default softkey menu is displayed
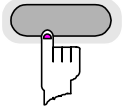
The *WIMAX* hotkey remains green whenever R&S FSQ-K92/K93 is active
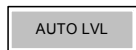
AUTO LVL

The *AUTO LVL* hotkey starts an automatic level detection measurement.
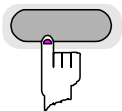
If another measurement is running then the running measurement will be aborted before the automatic level detection measurement is started. If a continuous measurement is running when the *AUTO LVL* hot-key is pressed then the continuous measurement shall resume after the automatic level detection has completed

Pressing the *AUTO LVL* hotkey whilst an automatic level detection measurement is running causes the measurement to be stopped (aborted).
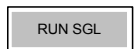
RUN SGL

The *RUN SGL* hotkey starts the selected measurement in single sweep mode.
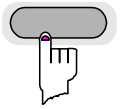
If another measurement is running, such as a continuous sweep measurement, the running measurement will be aborted before the single sweep measurement is started.

Pressing the *RUN SGL* hotkey whilst a single frequency range measurement is running causes the measurement to be stopped (aborted).
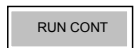
RUN CONT

The *RUN CONT* hotkey starts the selected measurement in continuous sweep mode
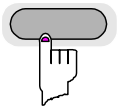
If another measurement is running then the running measurement will be aborted before the continuous sweep measurement is started.

Pressing the *RUN CONT* hotkey whilst a continuous sweep measurement is running causes the measurement to be stopped (aborted).
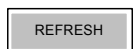
REFRESH

The *REFRESH* hotkey updates the current measurement results with respect to the current gate settings.
The *REFRESH* hotkey is only available for measurement results which are affected by the gate settings (Spectrum FFT, PVT and CCDF). The *REFRESH* hotkey only becomes available when the gate settings are modified after a measurement result has been obtained.
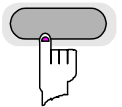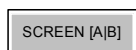
SCREEN [A|B]

The *SCREEN [A|B]* hotkey selects the specified screen as the active screen.
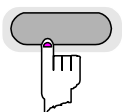
In full screen mode pressing the *SCREEN [A|B]* hotkey will display the specified screen.

After Pressing the *SCREEN [A|B]* hotkey the label displayed in the hotkey is changed e.g. after pressing the *SCREEN A* hotkey the label of the hotkey is changed to *SCREEN B.* The label indicates which screen will become the active screen after the hotkey is pressed.

Softkeys

Settings Softkeys

The softkeys are assigned to the nine keys on the right-hand side of the display. These enable quick access to all of the parameter settings and measurement screens of the R&S FSQ-K92/K93 option. Each of the top two softkeys, when pressed, brings up a settings view for a group of parameters. These softkeys are always available (except when using Save/Recall and Print manager or controlling markers) and are as follows:

General settings - Signal characteristics, Data Capture Trigger and IQ settings

Demod settings - specifies details about the type of burst to measure
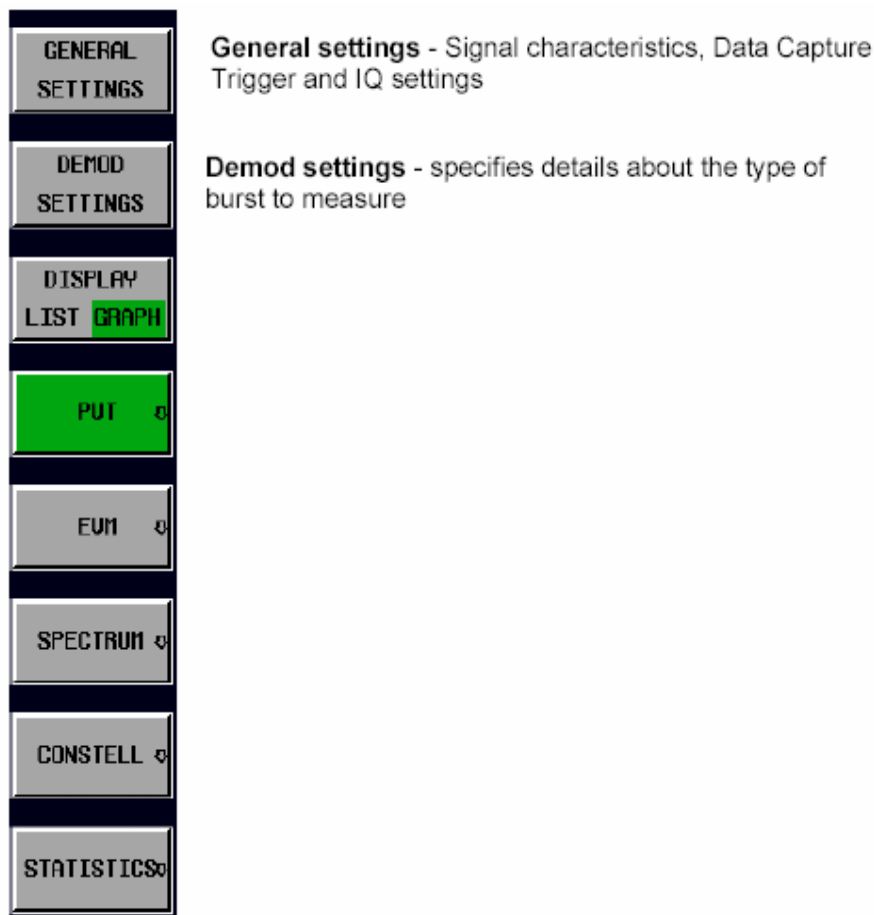
Fig. 3 Main Softkeys

Each of these groups of settings is described in detail in the Measurements & Settings section of this manual.

Other Softkeys

All other softkeys have different functions depending on the instrument state. Therefore, the labels (text) on the softkeys will vary to reflect their current function. The state of the softkeys is indicated by different appearances and colours, as follows:

SOFTKEY LABEL 1	– Softkey available (normal state)
SOFTKEY LABEL 2	
SOFTKEY LABEL 3	– Softkey active (green)
SOFTKEY LABEL 4	– Softkey active and dialog displayed (red)
	– No softkey available
SOFTKEY LABEL 5	– Softkey disabled => function not available (without 3D Frame)
SOFTKEY LABEL 6	
SOFTKEY LABEL 7	
SOFTKEY 8 VAL1 VAL2	– Toggle softkey (current value of parameter highlighted in green)

Fig. 4 Setup of the softkey area

A softkey in its normal state, where its function is available, is coloured grey with a 3D border.

A softkey that is disabled, because its function is <u>not</u> available, is coloured grey <u>without</u> a 3D border. Softkeys may become disabled because of the state of the instrument or because other settings disable the function associated with the softkey.

An active softkey (highlighted in green) is used when the softkey selects an item or view. For example, the *GATE SETTINGS* softkey will be highlighted green when the Gate Settings pop-up dialog is displayed.

A toggle softkey is used to change the value of a parameter that has only two states. Each press of the softkey toggles the value of the parameter. The current parameter value is highlighted in green in the lower half of the softkey label. For example, in the measurement results view, the *DISPLAY* softkey will have either *LIST* or *GRAPH* highlighted in green depending on whether the results are currently displayed as a list of measurement points or graphical trace(s).

When no function is assigned to a softkey then no softkey label will be shown.

Hardkeys

Hardkeys allow quick access to the desired parameter and various functions. The hardkeys supported by the R&S-FSQ-K92/K93 option are as follows (other hardkeys do nothing):

FREQ Hardkey	When the *FREQ* hardkey is pressed the General Settings view is displayed (if it is not already being displayed) and the *Frequency* parameter is selected.
AMPT Hardkey	When the AMPT hardkey is pressed the General Settings view is displayed (if it is not already being displayed) and the relevant *Signal Level* parameter for the selected signal input is selected.
MKR Hardkey	When the MKR hardkey is pressed the main Marker softkey menu is displayed (if it is not already being displayed).
MKR-> Hardkey	When the MKR-> hardkey is pressed the Marker extension softkey menu is displayed (if it is not already being displayed).
SWEEP Hardkey	When the SWEEP hardkey is pressed the General Settings view is displayed (if it is not already being displayed) and the *Capture Time* parameter is selected.
MEAS Hardkey	When the *MEAS* hardkey is pressed the Main softkey menu is displayed (if it is not already being displayed).
TRACE Hardkey	When the *TRACE* hardkey is pressed the General Settings view is displayed (if it is not already being displayed) and the *Burst Count* parameter is selected.
LINES Hardkey	When the *LINES* hardkey is pressed the Limit Lines softkey menu is displayed (if it is not already being displayed) and the first limit in the results summary is selected. Note this hard-key only functions when the results summary is displayed
DISP Hardkey	When the *DISP* hardkey is pressed the Display softkey menu is displayed (if it is not already being displayed).
FILE Hardkey	When the *FILE* hardkey is pressed, the Save & Recall softkey menu is displayed, allowing the save & recall of settings and/or measurement results of the R&S FSQ-K92/K93 option.
PRESET Hardkey	When the *PRESET* hardkey is pressed the R&S FSQ-option is exited and a preset will be performed. Note that all options (including R&S FSQ-K92/K93) shall also be preset.
HCOPY Hardkey	When the *HCOPY* hardkey is pressed the print manager softkey menu is displayed, allowing selection of the items to be printed.

External Keyboard

The external keyboard is optional. The keys on the external keyboard that can be used to interact with the R&S FSQ- option are as follows:

Number keys 0 to 9

Decimal point (".")	Inserts a decimal point "." at the cursor position.
Minus key	Changes the sign of the mantissa or exponent of a numeric parameter. A "-" is inserted at the cursor position in the case of an alphanumeric parameter.
ESC key	Aborts the entry before it has been terminated. The previous value is restored. Closes the entry field after termination of input. Closes pop-up dialogs.
ENTER key	Terminates the input of dimension quantities. The new value is set. Invokes the input of parameters or immediately sets the new value. Selects the highlighted item in drop-down menus.
Left and Right Cursor Keys are used to:	Navigate between individual parameters within the setting views and some of the pop-up dialogs. Navigate between the individual items within drop-down menus. Move the cursor left & right inside the entry window to reach a particular position in the string during alphanumeric entry.
Up and Down Cursor keys are used to:	Navigate between individual parameters within the setting views and some of the pop-up dialogs. Navigate between the individual items within drop-down menus. Increment or decrement the value of a parameter during numeric entry.
CTRL keys	Used to activate hotkeys. Each of the seven hotkeys is allocated a different function (F) key. To access these hotkeys press CTRL and the corresponding F key together (see Fig. 5):
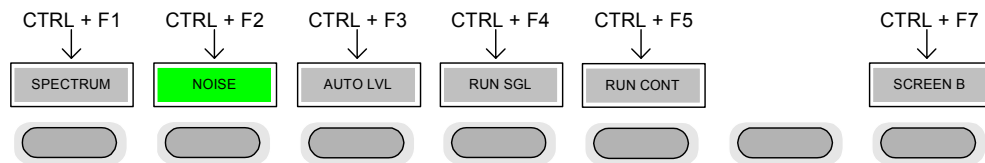
Fig. 5   Quick Access to Hotkeys

Function Keys	Used to activate softkeys. Each of the nine softkeys is allocated a different function (F) key. To access these softkeys the corresponding F key, as shown below:
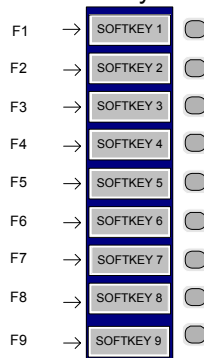
Fig. 6   Quick access to softkeys

Mouse

The mouse can be used to select individual parameters within the settings views or data entry dialogs and to activate hotkeys and softkeys. It can also be used to select values from a drop-down list.

Selecting & Editing Parameters

Parameters are set either by numeric or alphanumeric entry or by simple selection from a list of possible values (a drop-down list is used to select an "enumerated" value) or by using checkboxes to turn a parameter setting on and off.

In all cases, the parameter has to be selected by placing focus on it and then editing has to be enabled before its value can be changed.

The rollkey and cursor keys on the front panel are provided for navigation and selection of parameters.

The numeric keypad, rollkey and cursor keys on the front panel and an external keyboard (optional) are provided for the entry of parameter values.

Numeric Keypad

The numeric keypad is provided for entry of numeric parameters. It contains the following keys:

*   Number keys 0 to 9
    Starts editing of the selected parameter. This enables a new value to be entered for a parameter directly without having to press *ENTER* first. The digit will be displayed as the first digit of the newly entered value. Inserts a digit at the cursor position when editing an alphanumeric parameter.

*   Decimal point
    Inserts a decimal point "." at the cursor position.

*   Sign key ("-")
    Changes the sign of the mantissa or exponent of a numeric parameter. A "-" is inserted at the cursor position when editing an alphanumeric parameter.

*   Unit keys (GHz/-dBm, MHz/dBm, kHz/dB and Hz/dB)

*   Provides the numeric value entered with the selected unit and sets the parameter to that value.
    The unit keys are all assigned the value "1" for dimensionless quantities or for level entries (e.g. in dB). The unit keys thus assume the function of an *ENTER* key.

*   *BACK* key
    Deletes the character to the left of the cursor with alphanumeric entry.

*   *ESC/CANCEL* key
    Aborts the entry of a new parameter value. The previous value is restored.
    Closes pop-up dialogs.

*   *ENTER* key
    Enables editing of the selected parameter (using numeric keys or rollkey). Finishes the editing of a parameter value. The new value is set. For an alphanumeric value, the new value is set to that displayed (using the current unit if applicable).
    In a drop-down menu, the parameter is set to the currently selected value in the list.

Rollkey
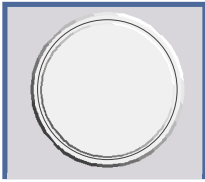
The rollkey has various functions:

*   In a settings view, the rollkey can be used to navigate between individual parameters (the parameter selected being highlighted).
*   In drop-down menus, the rollkey can be used to navigate between the individual values for the parameter.
*   During numeric entry, the parameter is incremented (by turning clockwise) or decremented (by turning counter-clockwise) at a defined step size (depending on the parameter).
*   In setting views and data entry dialogs pressing the rollkey invokes the input of parameters or immediately sets the new value, i.e. pressing the rollkey is like pressing the *ENTER* key.
*   In drop-down menus, pressing the rollkey selects the relevant item.

Cursor Keys
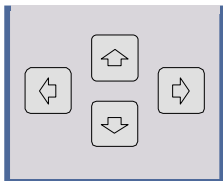
The keys ⇦ and ⇨ are used to:

*   Navigate between individual parameters within the setting views and some of the pop-up dialogs.
*   Navigate between the individual values within drop-down menus.
*   Move the cursor left & right inside the entry window to reach a particular position in the string during alphanumeric entry.

The keys ⇧ and ⇩ are used to:

*   Navigate between individual parameters within the setting views and some of the pop-up dialogs.
*   Navigate between the individual items within drop-down menus.
*   Increment or decrement the value of a parameter during numeric entry.

Selection of a parameter within a settings view

Selection using rollkey

➢ Press GENERAL SETTINGS softkey for example (General settings view is displayed).

➢ Rotate the rollkey until reaching the required parameter.
Turning the rollkey clockwise selects parameters in the upward direction, turning it counter-clockwise selects parameters in the downward direction.

Example: Selecting *Signal Level* (General settings)
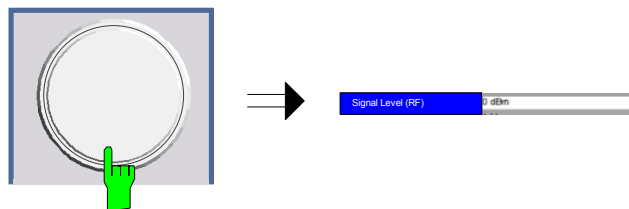
Note: *When the Signal Level parameter is selected its label is highlighted blue.*

When the desired parameter is reached press the rollkey to edit the parameter.

Selection using cursor keys

Cursor ⬆ , ⬇ , ⬅ or ➡ until obtaining the required parameter. Within a list of parameters, the *Down* and *Right* both move to the next item (down) in the list and the *Up* and *Left* keys both move to the previous item (up) in the list.
Within a table of parameters, the cursor keys move the cursor in the direction indicated.

To start editing the parameter, either press the *ENTER* key on the numeric keypad, or press the rollkey.

For numeric parameters, editing can also be started by entering the new value directly from the numeric keypad without pressing the *ENTER* key first.

Example: Selecting PDSU Modulation
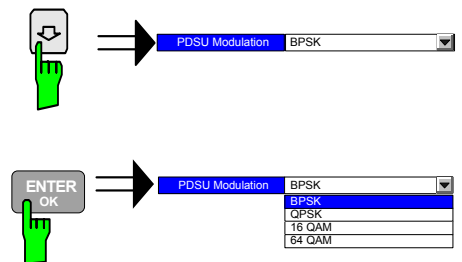
Note: *When ENTER is pressed, a drop-down menu is displayed, which contains all the available settings to which the Demodulator parameter can be set.*

Selection using mouse

➢ Use the mouse to move thursor to the parameter and press the left mouse button to select the parameter.

➢ To start editing the parameter, either press the ENTER key on the numeric keypad, or press the rollkey.

For numeric parameters, editing can also be started by entering the new value directly from the numeric keypad without pressing the *ENTER* key first.

Selection using external keyboard

➢ Select parameter using the cursor keys (in the same way as using the cursor keys on the front panel).

➢ To start editing the parameter, either press the ENTER key on the numeric keypad, or press the rollkey.

For numeric parameters, editing can also be started by entering the new value directly from the numeric keypad without pressing the *ENTER* key first.

Entry of a numeric value

Once a parameter has been selected (see above), a new value for a numeric parameter can be entered in a number of ways. With the exception of entry via the number keys, to start editing the parameter, either press the *ENTER* key on the numeric keypad, or press the rollkey before following the instructions below.

If an error occurs, for example, the entered value is out of range, then the new value will not be accepted for the parameter setting.

Entry using number keys (numeric keypad)

➢ Enter required value using the number keys.

Example: To enter 200 MHz

| 2 |
| 0 |
| 0 |
| MHz dBm | → | Frequency | 200 MHz |
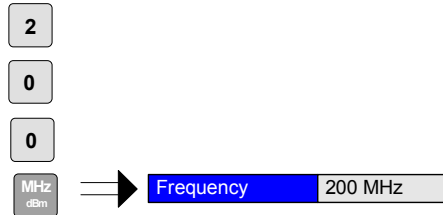
> *Note:* *The parameter is not set to the new value until either one of the unit keys on the numeric keypad, the ENTER or the rollkey is pressed.*

If the new value is not valid, then a message box is displayed and the entered value will be replaced with a valid value. For example, when a value above the maximum allowed is entered, then the maximum value allowed will be shown in the entry box. The parameter will still be ready for editing so that another value can be entered if desired.

Entry using cursor keys

➢ Cursor ⬆ or ⬇ until obtaining the required value.

The application prevents the minimum and maximum values of the parameter from being exceeded and displays an "Out of range" message box if attempted.
N.B The cursor keys increment/decrement a parameter value in large steps.

Example: Cursor down to 100MHz
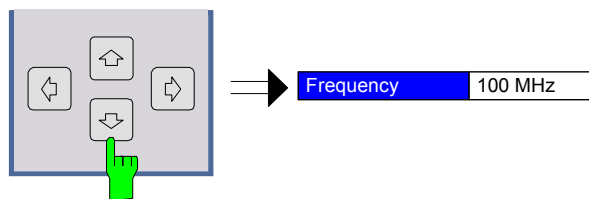
| Frequency | 100 MHz |

> *Note:* *Each change of the parameter value takes place immediately. No other keys need to be pressed.*

Entry using rollkey   ➢ Rotate the rollkey until reaching the required value.

                                   Turning the rollkey clockwise increases the value, turning it counter-clockwise decreases the value.

                                 The application prevents the minimum and maximum values of the parameter from being exceeded and displays an "Out of range" message box if attempted.
                                 N.B. The rollkey increment/decrement a parameter value in small steps
                                 Example: Rotate to 200 MHz
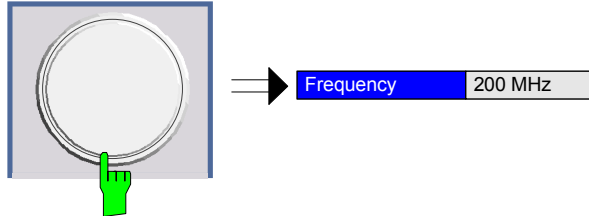
| Frequency | 200 MHz |

                                 Note: *Each change of the parameter value takes place immediately. No other keys need to be pressed.*

Entry using external   ➢ Enter value using number keys 0 – 9 in the same way as for using the
keyboard   number keys on the numeric keypad (see above).

Terminating the entry   ➢ Press one of the unit keys on the numeric keypad.

                                   The unit is entered in the parameter's edit box and the new parameter value is set immediately.

                                 ➢ Press the *ENTER* key (on numeric keypad or external keyboard) or press the rollkey.

                                   The new parameter value is set immediately.

                                 Note: *Pop-up dialogs, where used, do not close automatically. They can be closed by pressing the ESC key.*

                                 In both cases, if the new value is not valid, then a message box is displayed and the entered value will be replaced with a valid value. For example, when a value above the maximum allowed is entered, then the maximum value allowed will be shown in the entry box. The parameter will still be ready for editing so that another value can be entered if desired.

Correcting the entry   ➢ Position the cursor to the right of the digit which is to be deleted using the cursor keys ⬅ or ➡.

                                 ➢ Press the BACK key. The digit to the left of the cursor is deleted.

                                 ➢ Enter new digits. Each digit is inserted to the left of the cursor, the other digits are shifted right.

Aborting the entry   ➢ Press the *ESC* key during parameter editing.

                                   The original parameter value is restored. The new entry is deleted.

                                 ➢ If a pop-up dialog is displayed, press the *ESC* key again.

                                   The entry window is closed, the original value remains active.

Entry of an enumerated value

Once a parameter has been selected (see above), a new value for an enumerated parameter can be entered in a number of ways. To start editing the parameter, either press the *ENTER* key on the numeric keypad, press the rollkey or left click with the mouse on the drop down button before following the instructions below.

Note: *When the rollkey or ENTER is pressed, a drop-down menu is displayed, which contains all the available settings that may be selected for the parameter.*

Selection of setting using cursor keys

➢ Cursor ⬆ or ⬇ until obtaining the required setting.

➢ Press *ENTER* on external keyboard or numeric keypad, or press rollkey to select the desired setting of parameter.

Note: *Currently selected setting of the parameter is highlighted blue.*

Pressing ENTER sets the new setting of the parameter immediately.

Selection of setting using rollkey

➢ Rotate the rollkey until reaching the required setting.

➢ Press rollkey to select setting.

Example: Select *Mode* parameter.

Note: *Currently selected setting of the parameter is highlighted blue.*
Pressing the rollkey sets the new setting of the parameter immediately.

Selection of setting using mouse

➢ When the parameter is selected and ready for editing, select a new setting using the mouse by left-clicking on the new setting from the drop-down list. The new setting of the parameter is set immediately.

Selection of setting using external keyboard

➢ Select setting using cursor keys.

➢ Press *ENTER* to set the parameter to the new value.

Entry of a checkbox

A checkbox is used for parameter settings that are either On or Off (Boolean settings). A checkmark (✓) appears in the box when the setting is On; the checkbox is empty when the setting is Off.

Once a parameter has been selected (see above), a new value for a Boolean parameter can be entered in a number of ways. Because Boolean parameters are very simple, it is not necessary to press the *ENTER* key on the numeric keypad or to press the rollkey in order to edit them.

Toggle between the two states of a checkbox using rollkey

➢ Press the rollkey to toggle between the two states.

Example: Turn *Auto Level* setting to Off
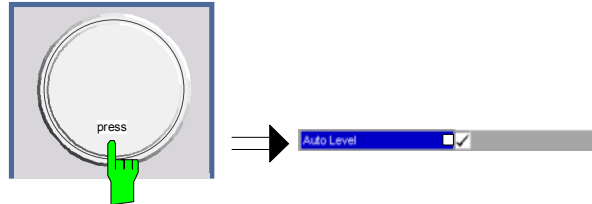
> *Note:* *The checkbox is empty when the settings is Off*

Toggle between the two states of a checkbox using numeric keypad

➢ Press the *ENTER* key to toggle between the two states.

Example: Turn *Auto Level* setting to On

Toggle between the two states of a checkbox using a mouse

➢ Left-click on the checkbox to toggle between the two states.

Toggle between the two states of a checkbox using external keyboard

➢ Press *ENTER* to toggle between the two states.

Status Bar & Title Bar

Title Bar

The title bar is visible at the very top of the display when R&S FSQ-K92/K93 is active and no settings views are displayed.

IEEE 802.16 - 2004

Fig. 7 Title Bar

The centre of the title bar shows the WiMAX standard applicable to the current measurement.

Status Bar

The main status bar is displayed at the bottom of the display, just above the hotkeys.

When a parameter in a settings view is selected, the status bar will display the minimum and maximum, settings for the selected parameter (see Fig. 8).

MIN:<XX.XX>   MAX:<XX.XX>
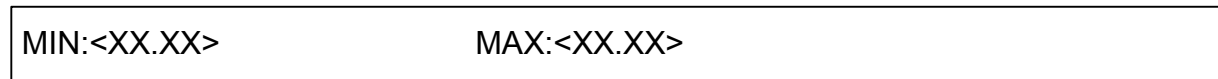
Fig. 8   Status Bar

When a parameter whose value is enumerated or Boolean in type is selected in any dialog, the status bar will show "N/A" displayed for the minimum and maximum, since the minimum and maximum values are "Not Applicable."

At other times, the status bar shows the current measurement status along with detailed information about the progress through any running measurement.

The status bar is also used to display warning and error messages to the user. In order to highlight these messages, warning messages are displayed with a blue background and error messages with a red background. Refer to Section 6 for a list of warning and error messages.

Save/Recall

This section of the user manual describes the Save/Recall facility of the option.
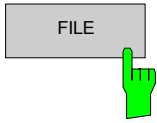
FILE

The *FILE* hardkey brings up the Save/Recall softkey menu. Any settings views on display when the save/recall softkey menu is displayed shall be closed.
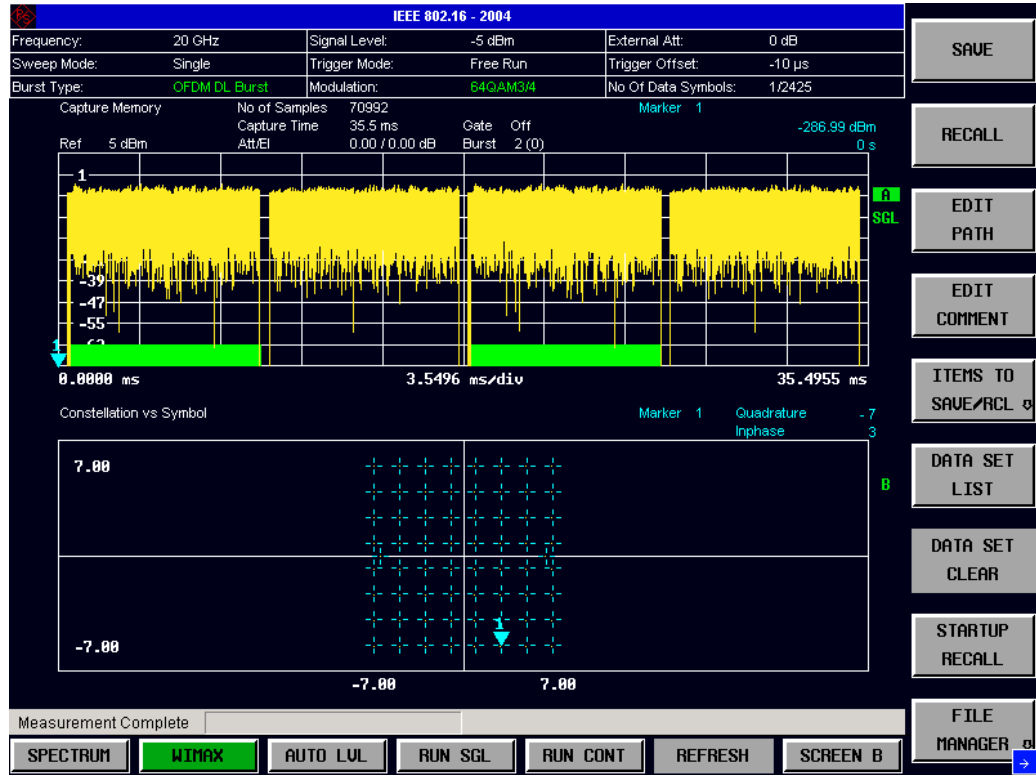
Fig. 9 Save/Recall softkey menu

The save/recall facility provided by R&S FSQ-K92/K93 is exactly the same as that provided by the host analyzer. Refer to the user manual for the spectrum analyzer for details of the save/recall facility operation.

The save/recall facility in R&S FSQ-K92/K93 provides the following items that can be saved and/or recalled:

- • Current Settings   All user settings provided by R&S FSQ-K92/K93
- • WIMAX Results   All current trace and table results
- • User Limits   All limit lines and table limit values.
- • IQ Data   Allows the raw IQ trace results to be stored. When recalled the data is reprocessed to generate results

To close the save/recall softkey menu and return to the main R&S FSQ-K92/K93 softkey menu, press the *WIMAX* hotkey.

Printing

This section of the user manual describes print facility of the option
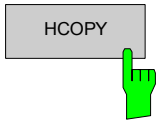
HCOPY

The *HCOPY* hardkey brings up the print softkey menu. Any settings views on display when the print softkey menu is displayed shall be closed.
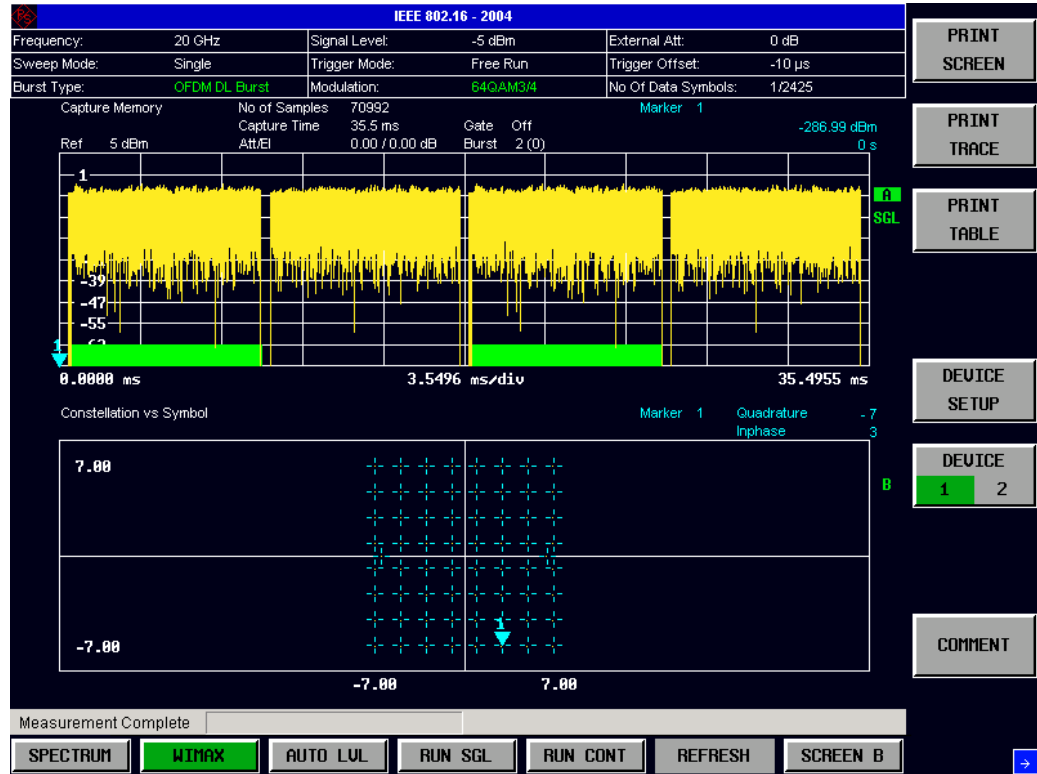
Fig. 10   Print softkey menu

The print facility provided by R&S FSQ-K92/K93 is exactly the same as that provided by the host analyzer. Refer to the user manual for the spectrum analyzer for details of the print facility operation.

To close the print softkey menu and return to the main R&S FSQ-K92/K93 softkey menu, press the *WIMAX* hotkey.

2 Measurements & Settings

This section contains a detailed description of all measurement modes, settings & results. It covers the following subjects:

- Measurement modes
- Running measurements
- Measurement results
- General settings
- Demodulation settings
- Gate settings
- Marker settings
- General hints about measurements

Measurements

This section contains a detailed description of all measurement modes, settings & results. It covers the following subjects:

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Measurements

R&S FSQ-K92/K93 provides two main measurement types:

- IQ Measurements
- Frequency Sweep Measurements

IEEE 802.16e-2005 OFDMA, WiBro Measurements

Current restrictions[3] to the IEEE802.16e-2005 OFDMA, WiBro Signal to be analyzed

1. Standard
   IEEE 16-2004, 1. Oct. 2004;
   IEEE 16e-2005 and IEEE 16-2004/Cor1-2005, 28. Feb. 2006.
   IEEE 16e-2005 and IEEE 16-2004/Cor1-2005, 28. Feb. 2006 based WiBro.
   IEEE 16-2004/Cor1-2005, IEEE 16e-2005 based WiBro.
2. FFT sizes
   The FFT sizes 128, 512, 1024 and 2048 are supported.
3. Subframes
   a. Either a DL-Subframe or a UL-Subframe can be anaylyzed at one point in time.
   b. One UL-PUSC zone per UL-Subframe is supported.
   c. The Subframes have to be separated by sufficient power off gaps.
4. Segments
   The first mandatory DL-PUSC zone must contain exclusively one segment. The assignment of subchannel groups to this segment is not restricted.
5. Currently supported frame structure
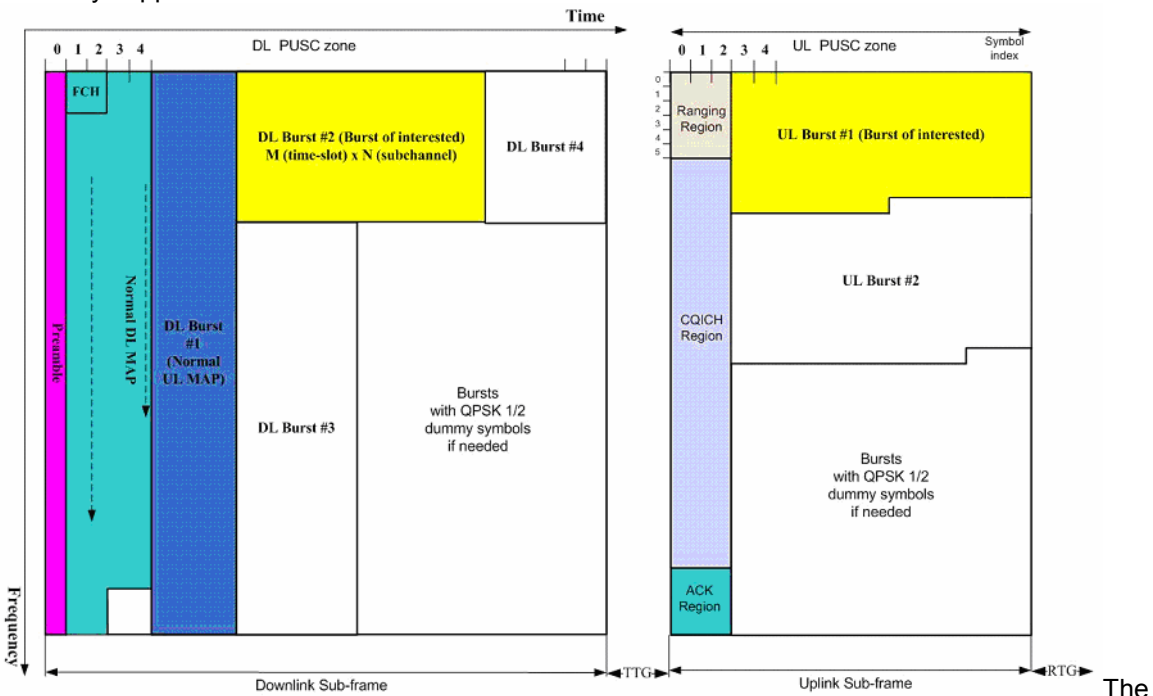
   control region is adjustable from 0,3,6,…,30 Symbols.
6. DL Subframes length
   The signal to be analyzed must contain at least two OFDMA data symbols. More OFDMA data symbols will improve the accuracy of the measurement results.
7. UL Subframe length
   It is recommended, that the UL-PUSC zone uses a length of at least 9 symbols [3 slots].
8. Burst
   Each OFDMA symbol of a zone must contain at least one active burst. I.e. each OFDMA Symbol of the zone must comprise subchannels belonging to an active burst. At the moment, the zone/segment must be covered by active bursts. I.e. no gaps at the beginning, mid or end of the zone/segment.

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[3] Most of these restrictions will be removed in future releases!

IEEE802.16e-2005 OFDMA, WiBro Measurement Results

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

- BER Pilots
  Deviation of the measured pilots from the expected pilots according to the standard in percent. Not available in UL with Demod Settings | Pilots for Tracking = According to Standard.

EVM measurements

- EVM Data and Pilots
  EVM over Data and Pilot Symbols for the analyzed zone or the analyzed segment.

- EVM Data
  EVM over Data Symbols for the analyzed zone or the analyzed segment.

- EVM Pilots
  EVM over Pilot Symbols of the analyzed zone or the analyzed segment.

- Unmodulated Subcarrier Error
  Accumulated power of the unmodulated subcarriers relative to the accumulated power of the modulated subcarriers.
  See IEEE Std 802.16e-2005 section "8.4.12.3.4 Unmodulated subcarrier errors for SS".

IQ constellation measurements

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

- Gain Imbalance
  Logarithm or percentage figure of the Q-Channel to I-Channel gain ratio.

- Quadrature Error
  Measure of the phase angle between Q-Channel and I-Channel deviating from the ideal 90 degree.

Power measurements for Result Summary of Analyzed Zone/Segment

- Power DL Preamble
  Power of the Preamble corresponding to the Zones/Segments to be analyzed.
  Relation between the TD Power DL Preamble and the FD Power DL Preamble measurement results:

$$P_{\text{TD,Preamble}} = P_{\text{FD,Preamble}} + 10\log 10\left(\frac{N_{used}}{N_{FFT}}\right) = P_{\text{FD,Preamble}} + 10\log 10\left(\frac{852/3}{1024}\right)$$

  in case N_{FFT} =1024 and on segment being used.

- Power Data
  Average power of the subcarriers belonging to the data parts of the zone weighted with N_{FFT}.

- Power Pilots
  Average power of the pilots belonging to the zone weighted with N_{FFT}.

- Power Data and Pilots
  Weighted average – according to the used number of subcarriers – between the 'Power Data' and 'Power Pilots' results.

- Center Frequency Error
  Difference between measured and reference center frequency

- Symbol Clock Error
  Difference between measured and reference symbol clock relative to the system sampling rate.

Power measurements for Result Summary of Analyzed Subframes

- TD Power DL Preamble
  Time domain power of the DL Preamble. I.e. a zero span measurement over the DL preamble will give the corresponding measurement result.

- TD Power Subframe
  Time domain power of the subframe [excluding the DL Preamble in case of DL]. I.e. a zero span measurement over the subframe will give the corresponding measurement result.

- TD Power Zone
  Time domain power of the zone to be analyzed. I.e. a zero span measurement over the zone will give the corresponding measurement result.

- Crest Factor
  Peak to average power ratio of the analyzed zone

RSSI and CINR measurements

- RSSI
  The Received Signal Strength Indicator is an estimate of the total received power of the DL preamble.
  Note the TD Preamble Power from the Result Summary deviates from the RSSI because the RSSI uses the mean over absolute amplitudes. The preamble power in contrary uses the mean over squared absolute amplitudes.

- RSSI Standard Deviation
  Standard deviation of the RSSI result.

- CINR
  Carrier Interference Noise Ratio is the ratio of the signal power and the noise power for the DL Preamble Symbol. See also section "Measurements in Detail".

- CINR Standard Deviation
  Standard deviation of the CINR result.

R&S FSQ-K93 Graphical OFDMA Measurement Results

Power vs Time measurements

- Capture Buffer
  Power profile of the capture buffer data being analyzed

- Full Subframe
  min mean max power profile of the subframe containing the zone to be analyzed.

- Rising / Falling
  min mean max profile of the rising respective falling edge of the subframe containing the zone to be analyzed.

EVM measurements

- EVM vs Symbol ALL
  EVM versus the symbols of the analyzed zone. In case the capture buffer contains more than one analyzed zones, the corresponding result graphs will be appended. The min mean max statistics is performed over carriers.

- EVM vs Carrier ALL
  EVM versus physical carriers. The min mean and max statistics is performed over the symbols of all analyzed zones in the capture buffer.

- Error Freq / Phase
  Relative Frequency Error vs Sample, and Phase Error vs Sample. The Frequency Error vs Sample measurement is relative to the Center Frequency Error.

Spectrum Measurements

- Spectrum Flatness
  Average energy of the constellations for the physical carriers. The limit lines are displayed according to the requirements of the standard. The min mean and max statistic is performed over the analyzed zones in the capture buffer.

- Spectrum Flatness Difference
  Absolute difference of adjacent carriers. The limit lines are displayed according to the requirements of the standard. The min mean and max statistic is performed over the analyzed zones in the capture buffer.

- Spectrum Mask
  Spectrum Emission Mask measurement according to the IEEE / ETSI standard, or user defined configuration.
  IEEE 802.16-2004 section "8.5.2 Transmit spectral Mask".
  ETSI EN 301 021 V1.6.1 (2003-07). Fixed radio systems; point-to-multipoint equipment; time division multiple access (TDMA); Point-to-multipoint digital radio systems in frequency bands in the range 3 GHz to 11 GHz

- Spectrum ACP ABS/REL

- Spectrum FFT

Constellation Measurements

- Constellation Diagram
  Complex Constellation Diagram of the modulation symbols. The modulation symbols belong to the Bursts of the analyzed zone. The different modulation formats are assigned unique colors. These colors are also used for the Bitstream measurement. With the [CONSTELL SELECTION] Softkey it is possible to suppress unwanted information.

Statistic Measurements

- CCDF Cumulative Complementary Distribution Function
  Complementary Probability Distribution for the capture buffer sample exceeding the average power.

- Bit Stream
  The modulation symbols define bit sequences. The mapping is defined in the standard. The modulation symbols of the bursts from the analyzed zone are displayed. The different modulation formats are assigned unique colors. These colors are also used for the Constellation Diagram Measurement. The selection panel allows select highlight the data the user is interested in.

- Burst Summary
  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.
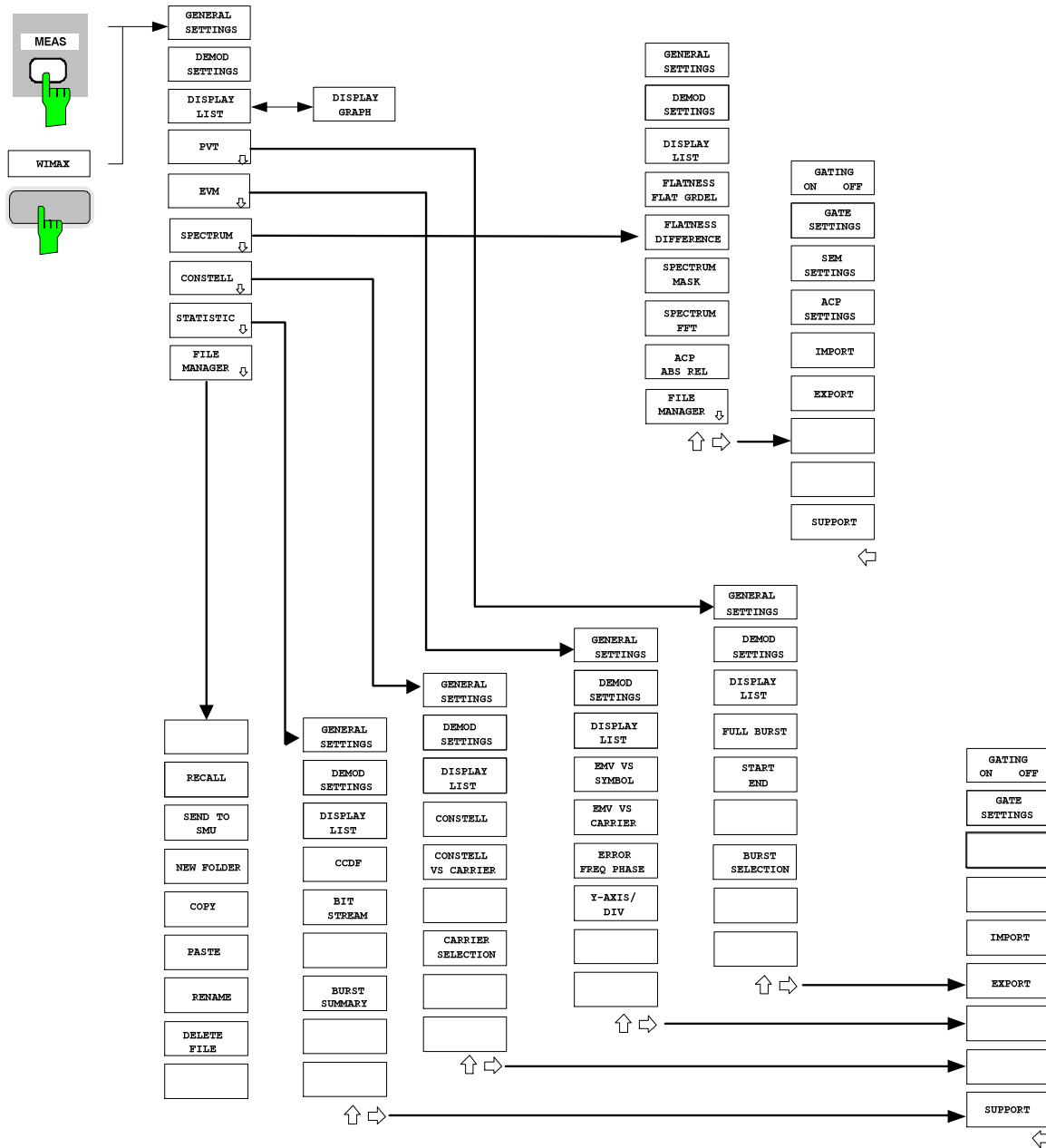
Fig. 11   IEEE 802.16-2004 OFDM menu
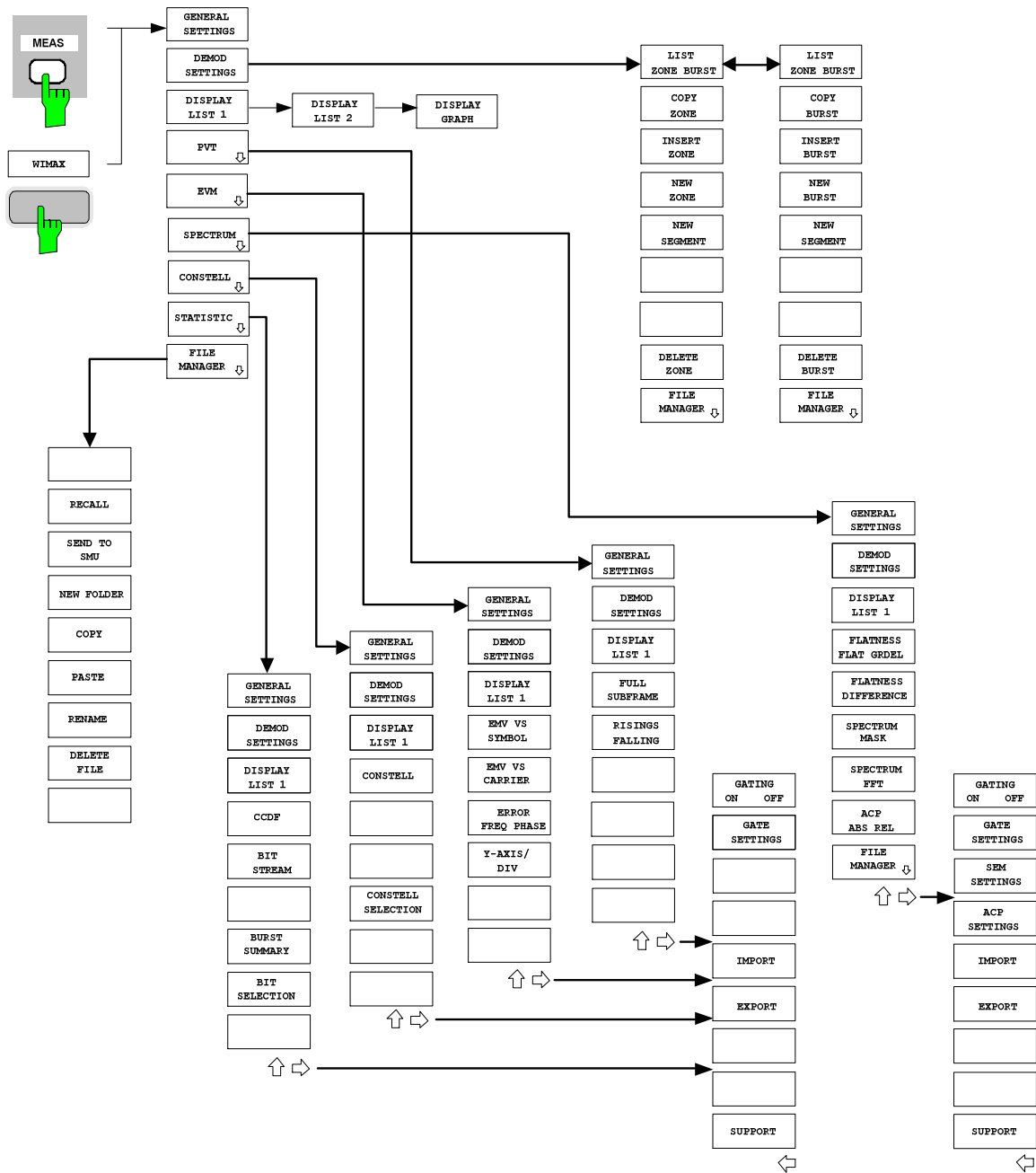
Fig. 12   IEEE 802.16e-2005 OFDMA / IEEE 802.16e-2005 WiBro menu

IQ measurements

The following measurements results are obtained in IQ measurement mode:

- Power vs Time (PVT)
- EVM vs Symbol
- EVM vs Carrier
- Phase vs Preamble
- Frequency vs Preamble
- Spectrum Flatness
- Spectrum Group Delay
- Spectrum Flatness Adjacent Carrier Power Difference
- Spectrum FFT
- Constellation vs Symbol
- Constellation vs Carrier (IEEE 802.16-2004 OFDM only)
- Conditional Cumulative Distribution Function (CCDF)
- Bit Stream

For each of the above results the Magnitude Capture Buffer display is available.

Fig. 13   Magnitude Capture Buffer Results

The Magnitude Capture buffer 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. Only those bursts which matched the required criteria are marked with a green bar.

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).

IQ measurements may be performed for RF or Baseband input.

Power vs Time (PVT)

| PVT |
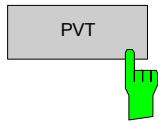
The PVT measurement results are selected by pressing the *PVT* softkey in the main measurement softkey menu.
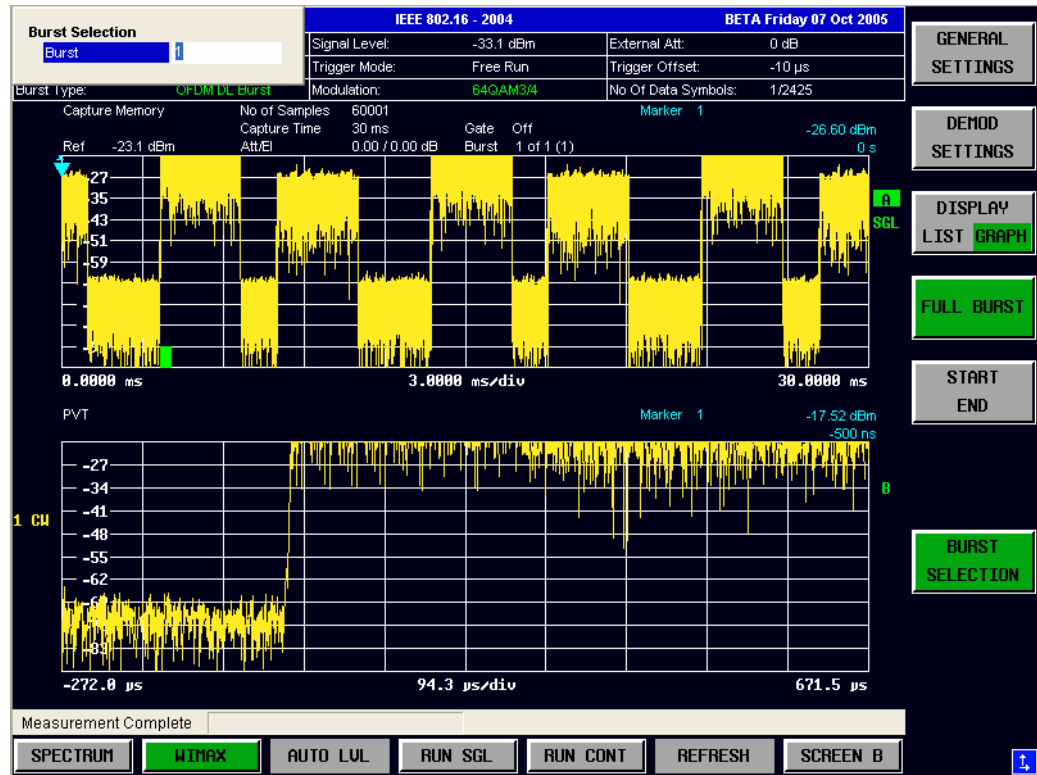
Fig. 14   PVT Results – Full Burst

The PVT results display shows measured input data, or over complete bursts displayed within the gating lines if gating is switched on. The results are displayed as a single burst.

IEC/IEEE-bus command: `CONF:BURS PVT:BUR`

IEEE 802.16-2004 OFDM
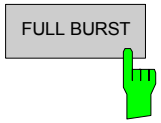
FULL BURST

Pressing the *FULL BURST* softkey displays the results in a single graph with all burst data being displayed.

IEC/IEEE-bus command: `CONF:BURS:PVT:SEL FULL`
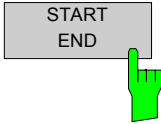
START END

Pressing the *START END* softkey 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.
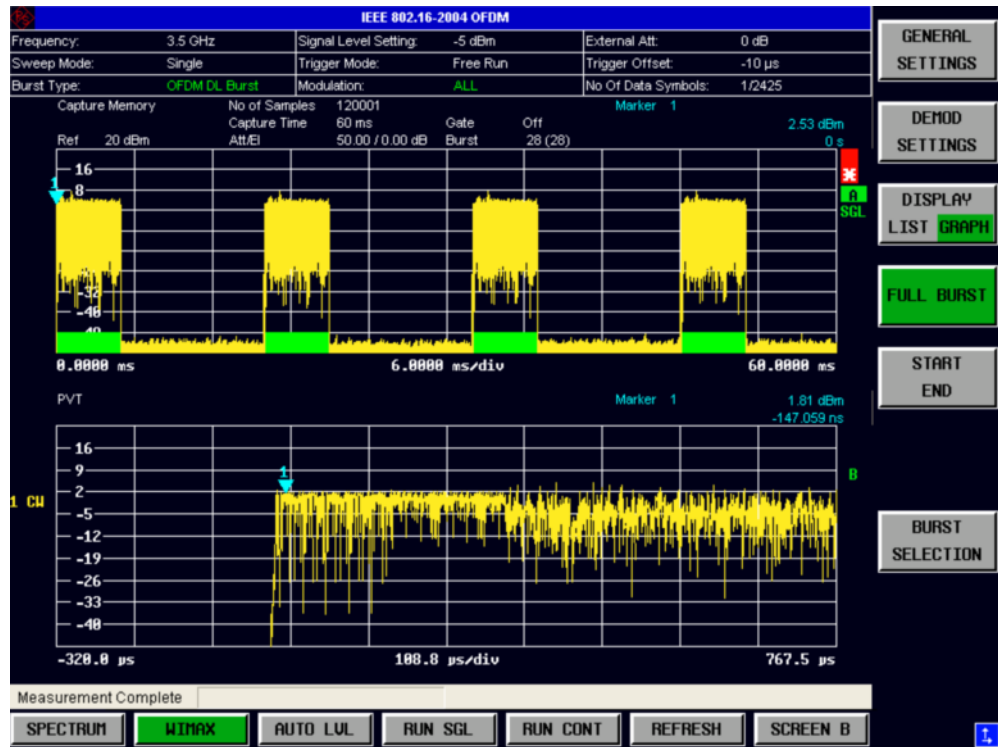
Fig. 15   PVT Results – Start and End
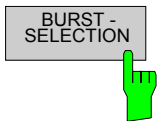
BURST - SELECTION

Pressing the *BURST SELECTION* softkey displays a pop-up dialog which allows the burst for data display to be selected.

IEC/IEEE-bus command: `CONF:BURS:PVT:SEL EDGE`

IEEE 802.16e-2005 OFDMA & WiBro
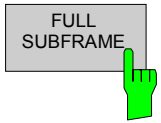
FULL
SUBFRAME

Pressing the *FULL SUBFRAME* softkey displays the results in a single graph with all subframe data being displayed.

Fig. 16   PVT Results – Full Subframe

IEC/IEEE-bus command: CONF:BURS:PVT:SEL FULL

RISING
FALLING

Pressing the *RSINING FALLING* softkey displays the results in two separate graphs, the left hand side showing the start and the right hand side showing the end of a subframe.

Fig. 17   PVT Results – Rising/Falling

IEC/IEEE-bus command: `CONF:BURS:PVT:SEL EDGE`

EVM vs Symbol
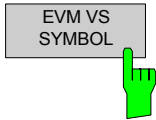
EVM VS
SYMBOL

The EVM vs Symbol measurement results are selected by pressing the *EVM* softkey in the main measurement softkey menu followed by the *EVM VS SYMBOL* Softkey:
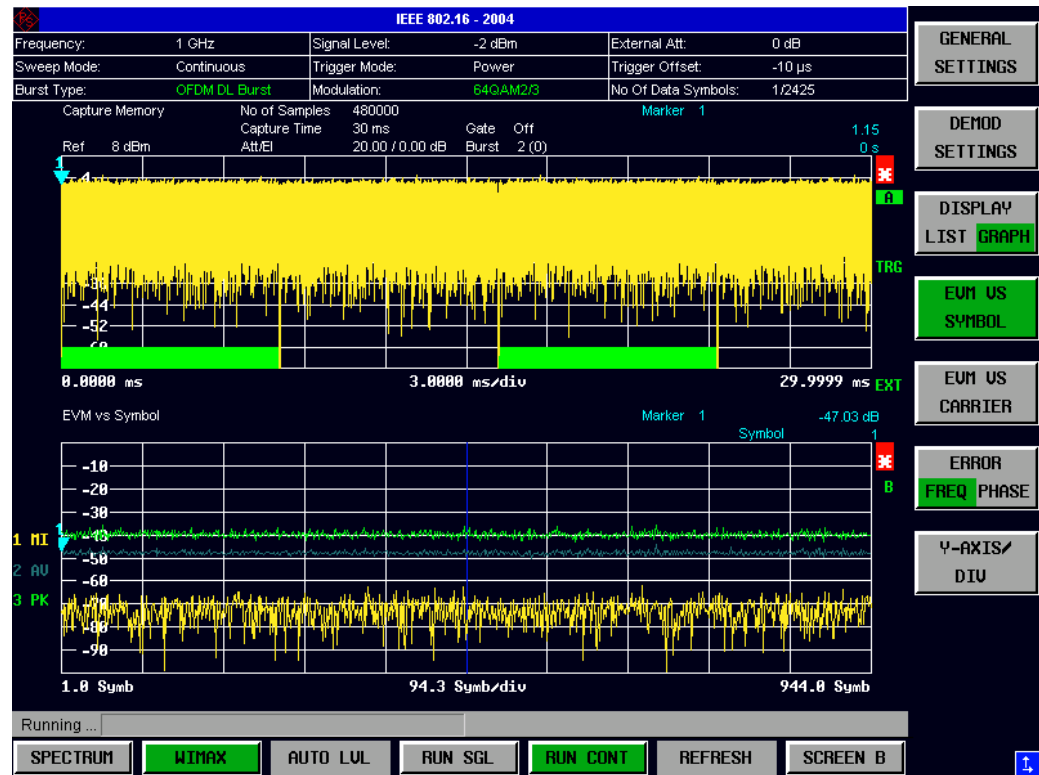
Fig. 18   EVM vs Symbol

The EVM vs Symbol results 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 labelled 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 measurements please refer to chapter 3.

IEC/IEEE-bus command: CONF:BURS:EVM:ESYM:IMM
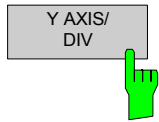
Y AXIS/
DIV

Pressing *Y AXIS/ DIV* softkey displays a pop-up dialog which allows the settings of the Y-Axis to be controlled.
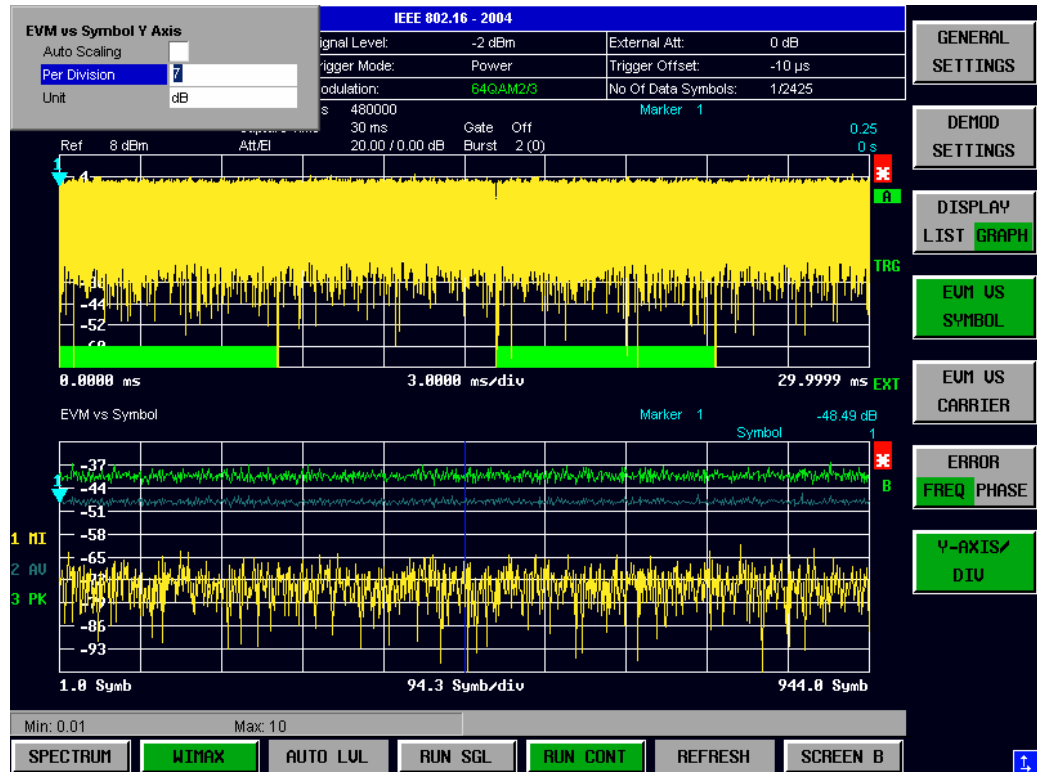
Fig. 19　　　EVM vs Symbol - Y-Axis Scaling

IEC/IEEE-bus command:　　`DISP2:TAC1:Y:SCAL:AUTO`
　　　　　　　　　　　　　　`DISP2:TRAC1:Y:SCAL:PDIV`

EVM vs Symbol Y Axis

Auto Scaling
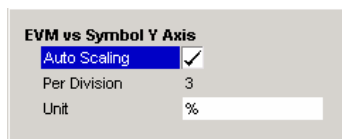
Auto Scaling specifies whether the Y-Axis scale should be calculated manually or automatically.

When the *Auto Scaling* parameter is switched OFF then the setting of the *Per Division* setting is used to calculate the Y-Axis scale.

IEC/IEEE-bus command: `DISP2:TAC1:Y:SCAL:AUTO`

Per Division
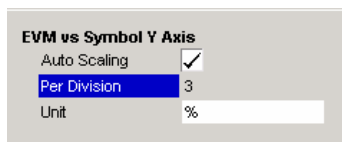
Per Division specifies the scaling is to be used when *Auto Scaling* is switched OFF.

IEC/IEEE-bus command: `DISP2:TRAC1:Y:SCAL:PDIV`

Unit
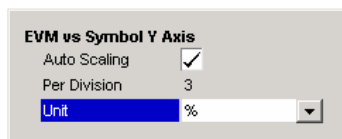
Unit allows Y-Axis unit to be specified.

EVM vs Carrier
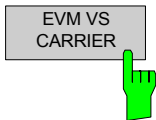
EVM VS
CARRIER

The EVM vs Carrier measurement results are selected by pressing the *EVM* softkey in the main measurement softkey menu followed by the *EVM vs CARRIER* softkey.

Fig. 20   EVM vs Carrier Results

The EVM vs Carrier results display shows the all EVM values recorded on a per-carrier basis over the full set of measured data. The minimum, average and maximum traces are displayed.

The scaling of the Y-Axis can be modified to allow the results to be scaled to an optimum level.

IEC/IEEE-bus command: `CONF:BURSt:EVM:ECAR:IMM`
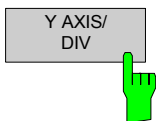
Y AXIS/
DIV

Pressing *Y AXIS/ DIV* softkey displays a pop-up dialog which allows the settings of the Y-Axis to be controlled. The settings provided are the same as for the EVM vs Symbol measurement screen.

IEC/IEEE-bus command: `DISP:WIND2:TRAC:Y:SCAL:AUTO ON`
                          `DISP:WIND2:TRAC1:Y:SCAL:PDIV 2`

Error vs Preamble (OFDM) / Error vs Sample (OFDMA/WiBro)
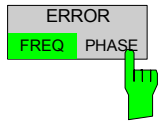
ERROR
FREQ PHASE

The Error vs Preamble results are selected by pressing the *EVM* softkey in the main measurement softkey menu followed by the *ERROR FREQ/PHASE* softkey. Subsequent presses of the *ERROR FREQ/PHASE* softkey toggle the Error measurement between Frequency Error vs Preamble and Phase Error vs Preamble.

For OFDMA/WiBro, the measurement results provided are Frequency Error vs Sample and Phase Error vs Sample.,

Fig. 21   Error vs Preamble Results

The Error vs Preamble results display shows the error values recorded over the preamble part of the burst. A minimum, average and maximum trace are displayed. The results display either relative frequency error or phase error.

The scaling of the Y-Axis can be modified to allow the results to be scaled to an optimum level.

IEC/IEEE-bus command: `CONF:BURS:PRE:SEL FREQ`
                                      `CONF:BURS:PRE:IMM`
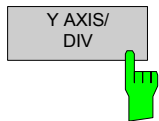
Y AXIS/
DIV

Pressing *Y AXIS/ DIV* softkey displays a pop-up dialog which allows the settings of the Y-Axis to be controlled. The settings provided are the same as for the EVM vs Symbol measurement screen.

IEC/IEEE-bus command: `DISP:WIND1:TAC1:Y:AUTO`
                                      `DISP:WIND1:TRAC1:Y:PDIV`

Spectrum Flatness/Spectrum Flatness Group Delay

FLATNESS
FLAT | GRDEL
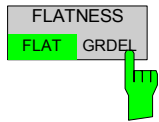
The Spectrum Flatness measurement results are selected by pressing the *SPECTRUM* softkey in the main measurement softkey menu followed by the *FLATNESS FLAT/GRDEL* softkey. Subsequent presses of the *FLATNESS FLAT/GRDEL* softkey toggle the Flatness measurement between Spectrum Flatness and Spectrum Flatness Group Delay.
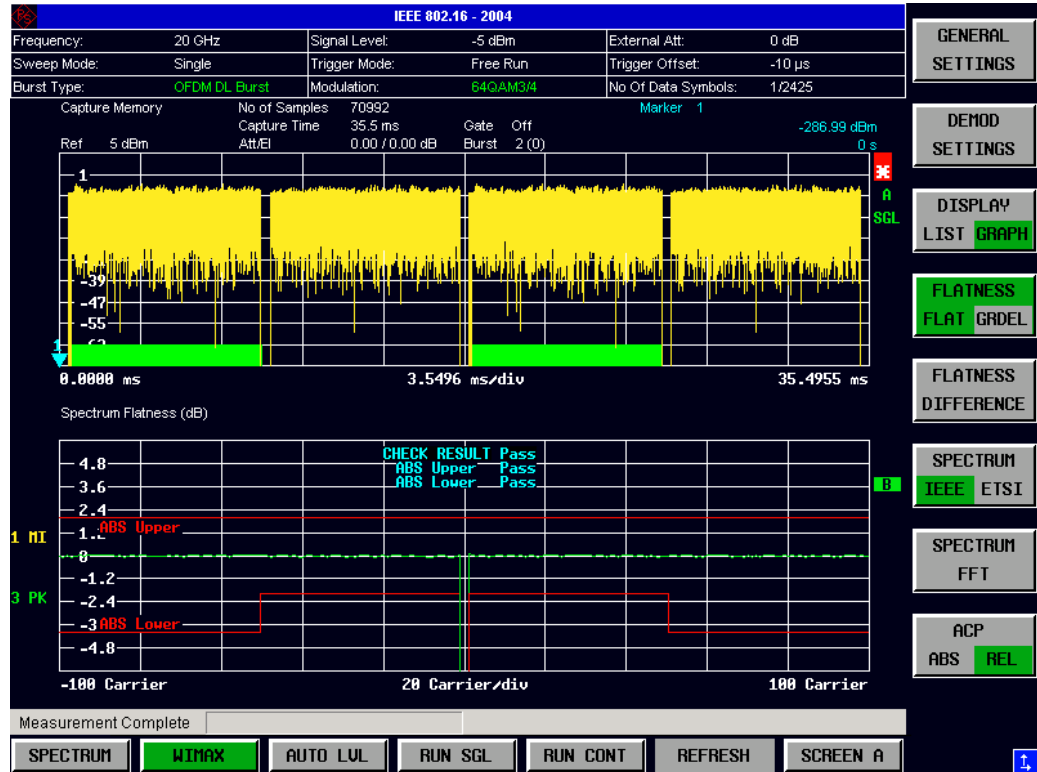
Fig. 22   Spectrum Flatness Results

The Spectrum Flatness results display shows either the Spectrum Flatness or the Group Delay values recorded on a per-carrier basis over the full set of measured data. A minimum, average and maximum trace are displayed for each of the result types. When Spectrum Flatness results are selected an upper and lower limit line representing the limits specified for the selected standard are displayed. An overall pass/fail status is displayed for the obtained (average) results against these limit lines.

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.

IEC/IEEE-bus command: CONF:BURS:SPEC:FLAT:SEL FLAT
                          CONF:BURS:SPEC:FLAT:IMM

Flatness Difference

FLATNESS
DIFFERENCE
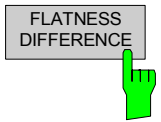
The Flatness Difference results are selected by pressing the *EVM* softkey in the main measurement softkey menu followed by the *FLATNESS DIFFERENCE* softkey.
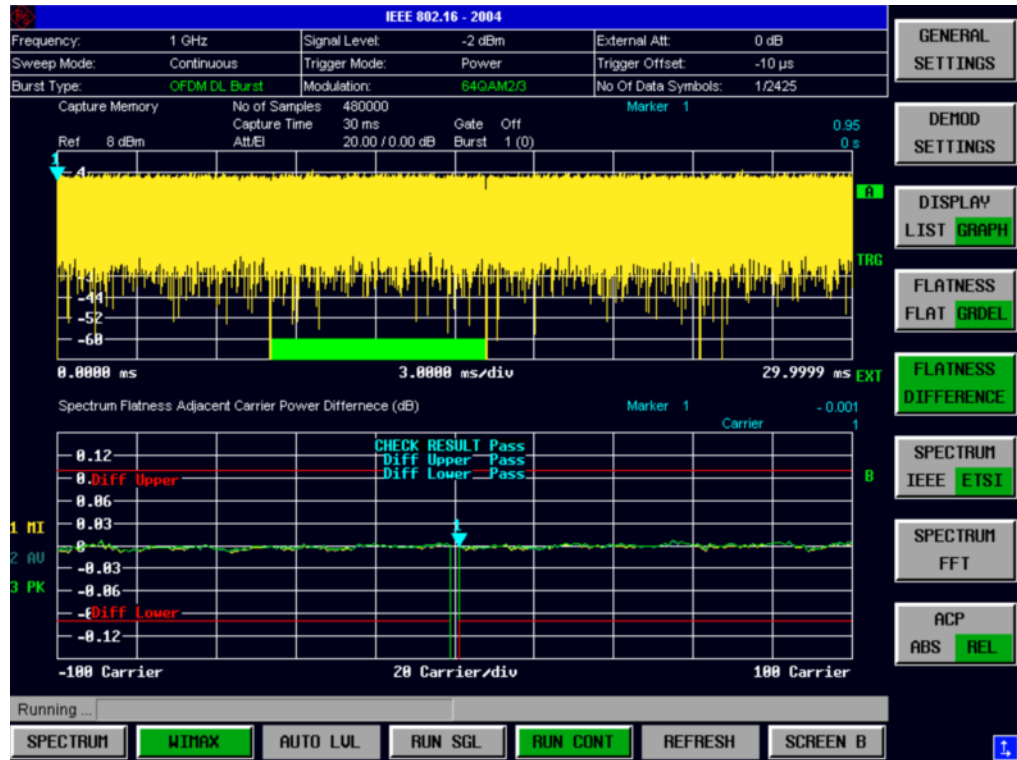
Fig. 23   Flatness Difference Results

The Flatness Difference results display shows the adjacent carrier power difference the preamble part of the burst. A minimum, average and maximum trace are displayed.

IEC/IEEE-bus command: CONF:BURS:SPEC:FLAT:SEL DIFF
                         CONF:BURS:SPEC:FLAT:IMM

Spectrum FFT
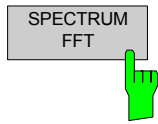
SPECTRUM FFT

The Spectrum FFT measurement results are selected by pressing the *SPECTRUM* softkey in the main measurement softkey menu followed by the *SPECTRUM FFT* softkey.
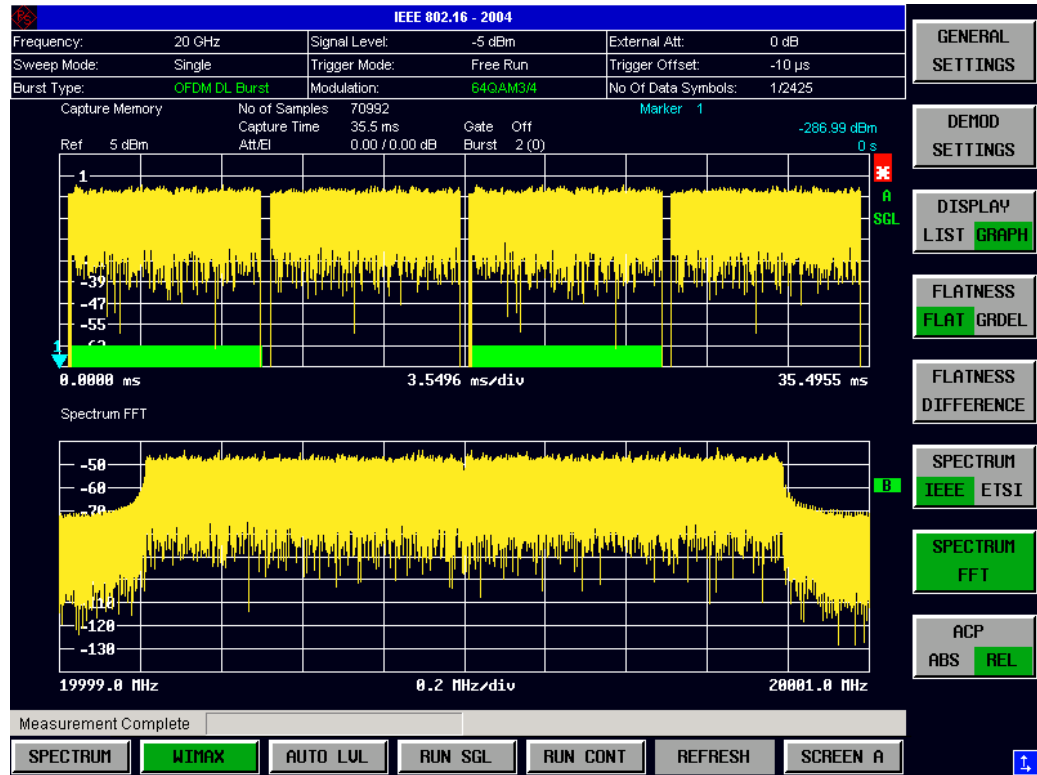
Fig. 24   Spectrum FFT Results (example)

The Spectrum FFT results 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* hotkey.

IEC/IEEE-bus command: `CONF:BURS:SPEC:FFT:IMM`

Constellation vs Symbol
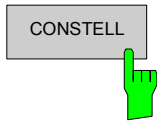
CONSTELL

The Constellation diagram is selected by pressing the *CONSTELL* softkey in the main measurement softkey menu.
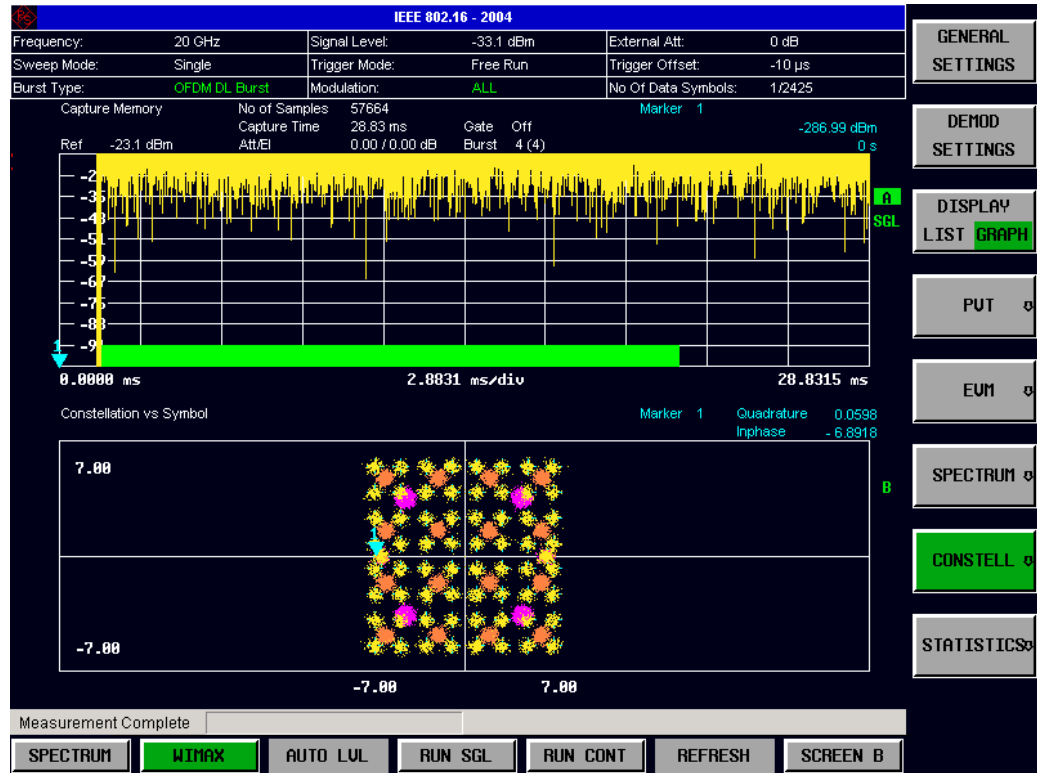
Fig. 25   Constellation vs Symbol Results (IEEE 802.16-2004)

The Constellation display shows the Inphase 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 results display can be reduced by selecting the carrier or carriers for which data is to be displayed.

IEC/IEEE-bus command: `CONF:BURS:CONS:CSYM:IMM`

IEEE 802.16-2004 OFDM
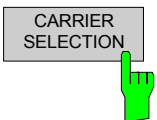
CARRIER SELECTION

Pressing *CARRIER SELECTION* softkey displays a pop-up dialog which allows the carrier for data display to be selected. Either a specific carrier number or pilots only can be selected. Selecting All Carriers allows all the results to be displayed.

IEC/IEEE-bus command: `CONF:BURSt:CONS:CARR:SEL`

IEEE 802.16e-2005 OFDMA & WiBro

CONSTELL
SELECTION
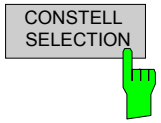
Pressing *CONSTELL SELECTION* softkey displays a pop-up dialog which allows the displayed results to be filtered. The results may be filtered by any combination of modulation, burst, symbol or carrier. The results will be updated as soon as any change to the constellation selection parameters are made.
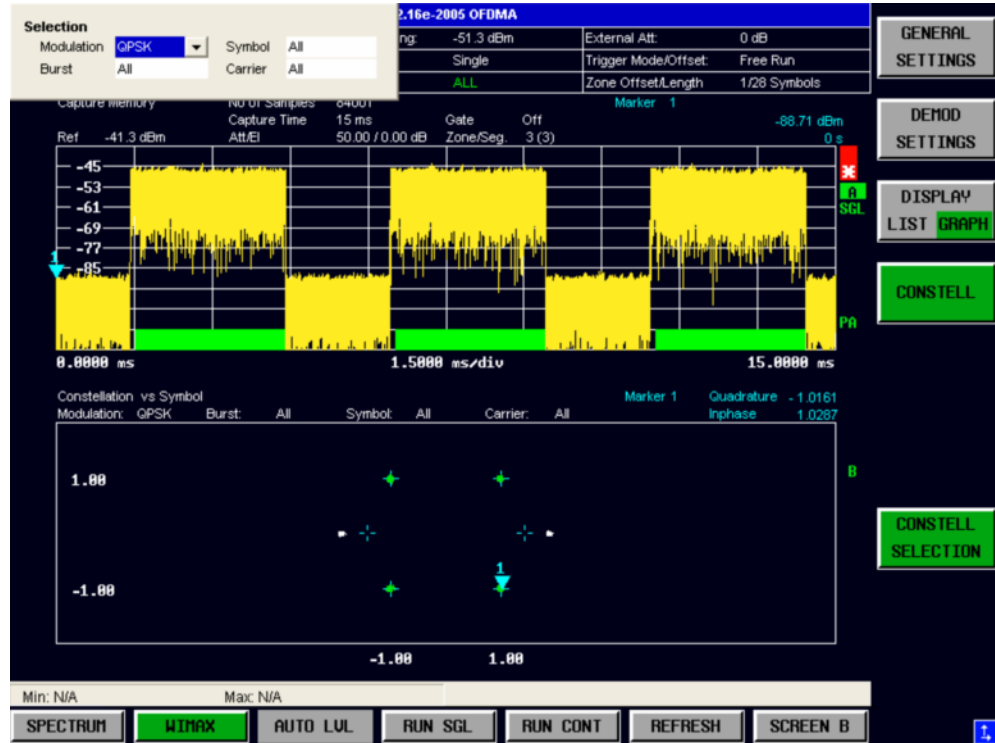
Fig. 26   Constellation vs Symbol - Constell Section

IEC/IEEE-bus command: `CONF:BURS:CONS:FORM:SEL ALL|QPSK|QAM16|QAM64`
                                      `CONF:BURS:CONS:BURS:SEL ALL|<value>`
                                      `CONF:BURS:CONS:SYMB:SEL ALL|<value>`
                                      `CONF:BURS:CONS:CARR:SEL ALL|<value>`

Constellation vs Carrier
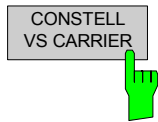
CONSTELL
VS CARRIER

The Constellation vs Carrier measurement results are selected by pressing the *CONSTELL* softkey in the main measurement softkey menu followed by the *CONSTELL VS CARRIER* softkey,
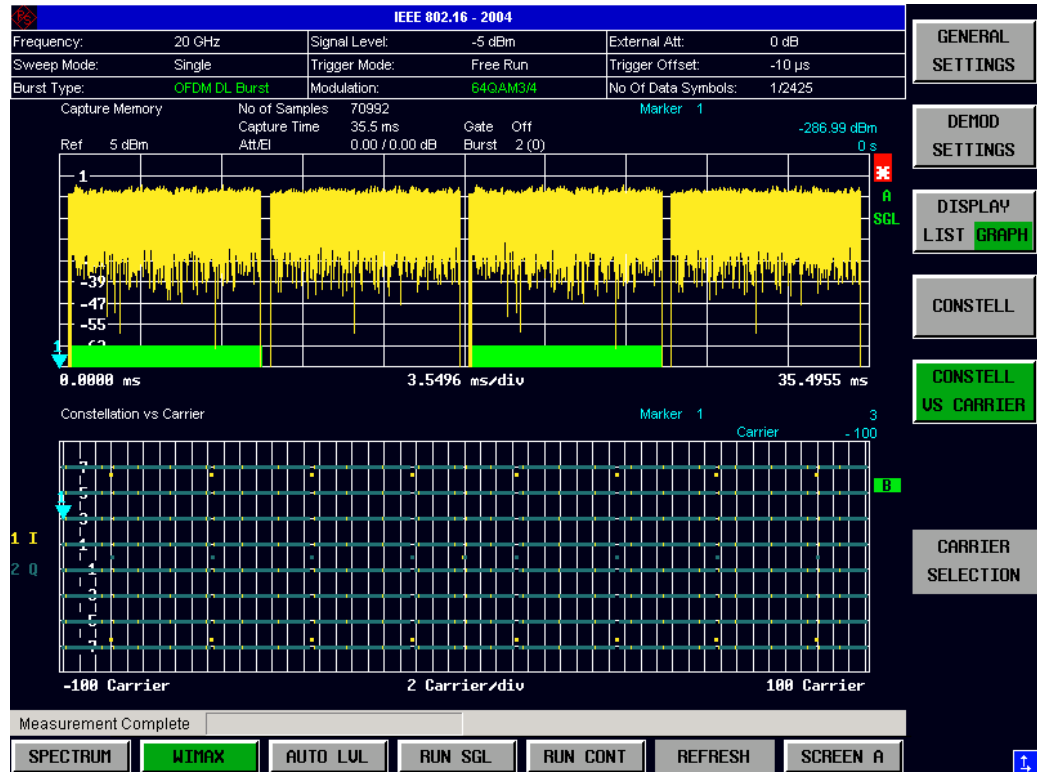
Fig. 27   Constellation vs Carrier Results

The Constellation vs Carrier results display shows the Inphase and Quadrature phase results over the full range of the measured input data plotted on a per-carrier basis. The magnitude of the Inphase and Quadrature part is shown on the Y-axis, both are displayed as separate traces (I-> trace 1, Q-> trace 2).

This measurement is not available when the IEEE 802.16e-2005 OFDMA or WiBro standards are selected.

IEC/IEEE-bus command: `CONF:BURSt:CONS:CCAR:IMM`

Conditional Cumulative Distribution Function (CCDF)
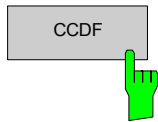
CCDF

The CCDF measurement results are selected by pressing the *STATISTICS* softkey in the main measurement softkey menu followed by the *CCDF* softkey.
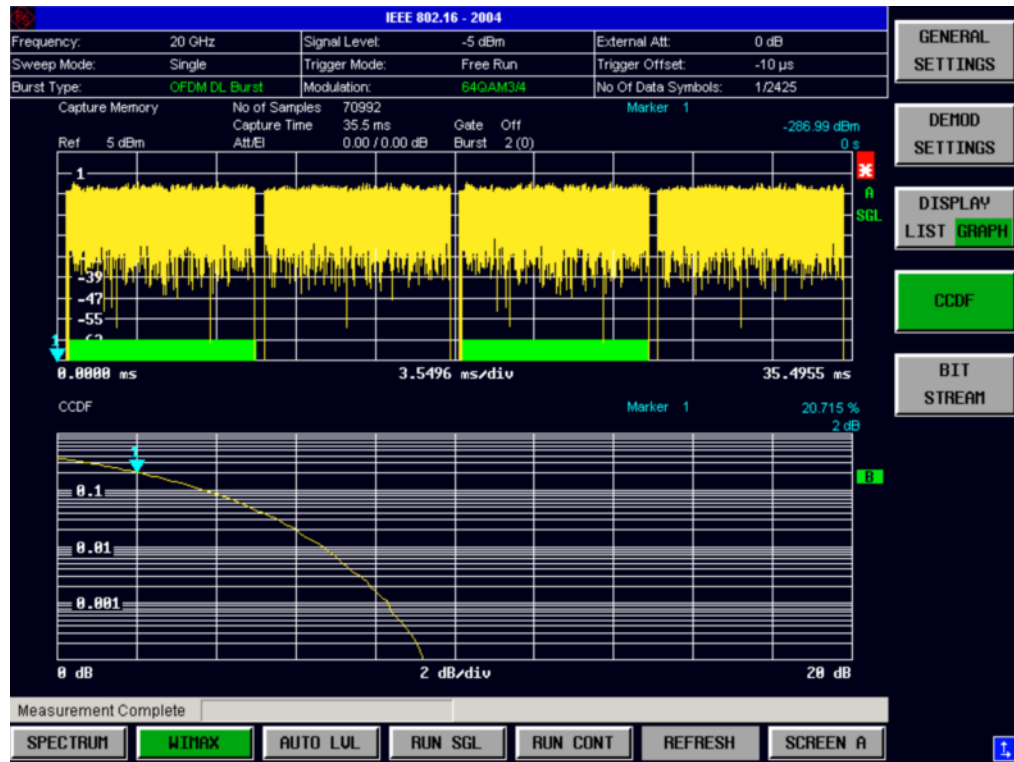
Fig. 28   CCDF Results

The CCDF results 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* hotkey.

IEC/IEEE-bus command: CONF:BURS:STAT:CCDF:IMM

Bit Stream

BIT
STREAM
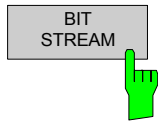
The Bit Stream measurement results are selected by pressing the *STATISTICS* softkey in the main measurement softkey menu followed by the *BIT STREAM* softkey.
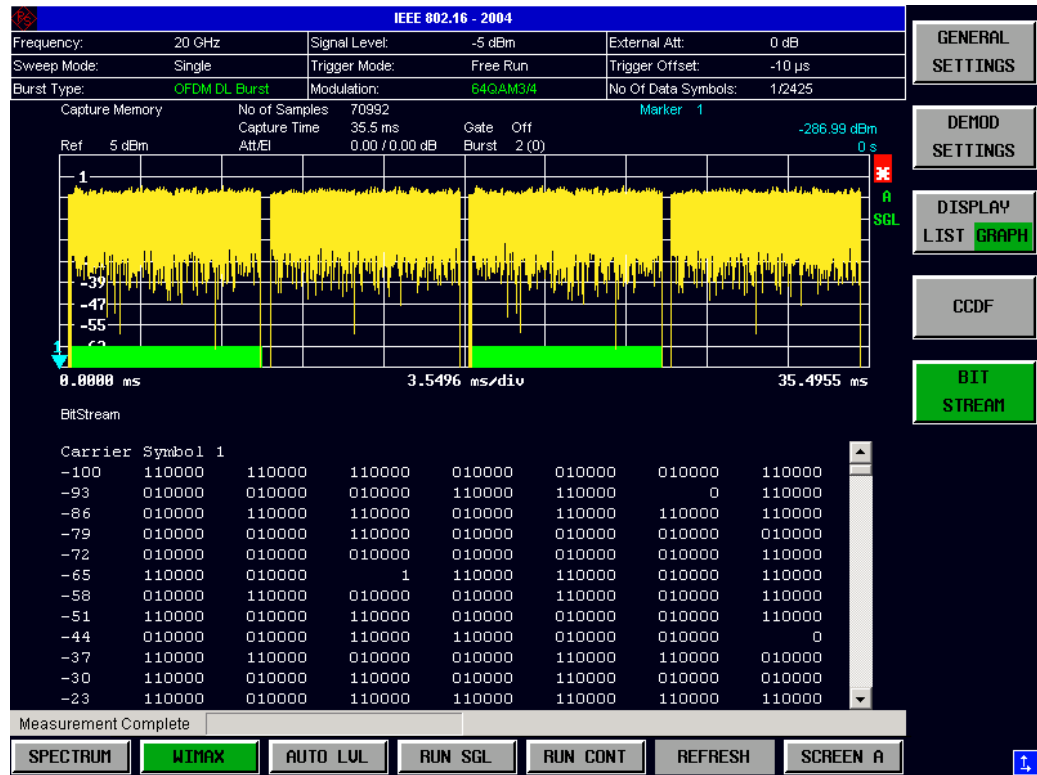
Fig. 29   Bit-Stream Results

The bit stream results display shows the demodulated data stream. These results are grouped by burst and symbol. When no other dialogs are on display the results can be scrolled through using the cursor keys or scroll wheel.

Pilot Errors (IEEE 802.16e-2005 OFDMA & WiBro)

If pilots errors are detected in the analysed signal, then they will be displayed with a red background in the Bit Stream (See Fig. 30).

Note that this behaviour is affected by the Pilots for Tracking setting in the DEMOD SETTINGS.

IEC/IEEE-bus command: CONF:BURS:STAT:BSTR:IMM

Bit Selection (IEEE 802.16e-2005 OFDMA & WiBro)

BIT
SELECTION
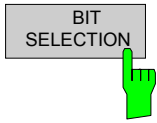
Pressing *BIT SELECTION* softkey displays a pop-up dialog which allows the displayed results to be filtered. The results may be filtered by any combination of modulation, symbol or burst. The results will be updated as soon as any change to the bit selection parameters are made.

Fig. 30   Bit-Stream for OFDMA, showing the Bit Selection dialog and highlighted pilot errors.

IEC/IEEE-bus command: ---

Burst Summary
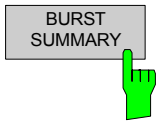
BURST
SUMMARY

The Burst Summary measurement results are selected by pressing the *STATISTICS* softkey in the main measurement softkey menu followed by the *BURST SUMMARY* softkey.

Fig. 31   Burst-Summary Results (OFDM)

The burst summary results display shows the summary data for the analyzed bursts. When no other dialogs are on display the results can be scrolled through using the cursor keys or scroll wheel.

IEC/IEEE-bus command: `CONF:BURS:STAT:BSUM:IMM`

Fig. 35   Burst-Summary Results (OFDMA)

Frequency sweep measurements

The following measurements results are obtained in frequency sweep mode:

- Spectrum Mask

- Spectrum ACP/ACPR

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

All frequency sweep measurements are run in full screen mode. Frequency sweep measurements are only available when RF input is selected.

Spectrum Emission Mask
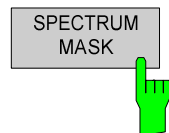
SPECTRUM MASK

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


Fig. 32   Spectrum Emission Mask Results

The Spectrum Mask results display shows power against frequency. The span of the results is related to the specified sample rate. 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. If the *Sweep Count (Mask/ACP)* parameter in the General Settings view is set to any value other than 1 then the measurement is performed over the specified number of sweeps. When the measurement is performed over multiple sweeps a max hold trace is displayed as well as an average trace.

The Spectrum Emission Mask measurement can be configured from the SEM

settings view:

SEM
SETTINGS
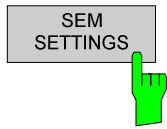
The *SEM SETTINGS* softkey brings up the SEM Settings view.
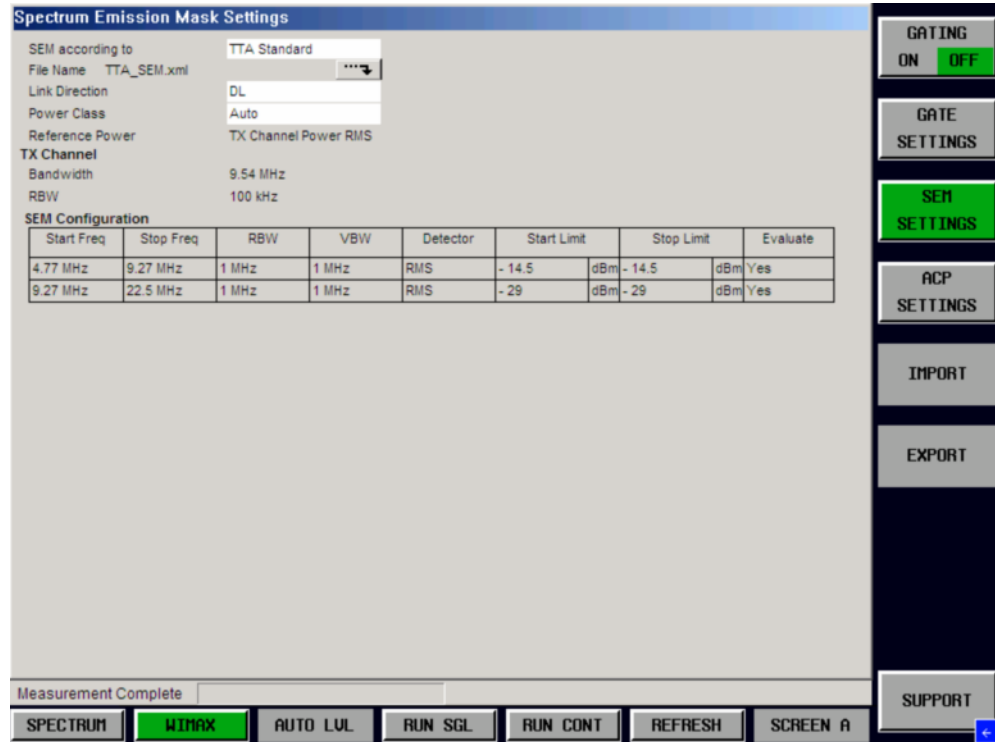
Fig. 33   ACP Settings view

IEC/IEEE-bus command: `SENS:POW:SEM:MODE UL|DL`
`SENS:POW:SEM USER|STANDARD|IEEE|ETSI`
`SENS:POW:SEM:CLASs`

SEM according to
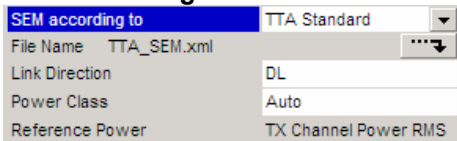
SEM according to specifies how the Spectrum Emission Mask settings and limits are applied. This parameter provides the following settings:

TTA Standard – Settings and limits are as specified in the standard (WiBro only)

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

IEEE – Settings and limits are as specified in the standard (OFDM/OFDMA only)

User – Settings and limits are configured via an XML file

File Name

When **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 TTA/ETSI/IEEE standards, *File Name* reflects the name of the built-in configuration.

Link Direction

Link Direction allows the settings and limits for the relevant link direction (Uplink or Downlink) to be displayed.

Power Class

The SEM settings allow different set of limits depending on the signal level. By default the *Power Class* is set to Auto, which selects the limits automatically based on the measured signal level. If required, the Power Class can be set by hand, to force a set of limits to be used.

SEM Configuration

The SEM configuration shows the settings and limits applied over specified frequency ranges around the TX channel. The settings displayed are dependent on the selected *Link Direction* and *Power Class*

SEM Configuration

Start Freq	Stop Freq	RBW	VBW	Detector	Start Limit	Stop Limit	Evaluate
4.77 MHz	9.27 MHz	1 MHz	1 MHz	Peak	- 14.5	- 14.5	Yes
9.27 MHz	22.5 MHz	1 MHz	1 MHz	Peak	- 29	- 29	Yes
...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...

Fig. 34   SEM Configuration

Spectrum ACP

ACP
REL   ABS
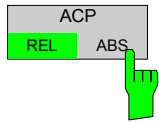
The Spectrum ACP measurement results are selected by pressing the *SPECTRUM* softkey in the main measurement softkey menu followed by the *ACP REL/ABS* softkey. Subsequent presses of the *ACP REL/ABS* softkey toggle the measurement between relative and absolute results display.


Fig. 35   Spectrum ACPR Results (example)

The Spectrum ACPR (Adjacent Channel Power (Relative)) 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. . If the *Sweep Count (Mask/ACP)* parameter in the General Settings view is set to any value other than 1 then the measurement is performed over the specified number of sweeps. When the measurement is performed over multiple sweeps a max hold trace is displayed as well as an average trace.

By default the ACP Settings are derived from the Channel Bandwidth setting of the General Settings Panel.

IEC/IEEE-bus command: `SENS:POW:ACH:MODE REL | ABS`
                        `CONF:BURS:SPEC:ACPR:IMM`

The Spectrum ACP measurement can be configured from the ACP settings view:

| ACP |
| SETTINGS |
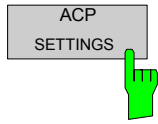
The *ACP SETTINGS* softkey brings up the ACP Settings view.

Fig. 36   ACP Settings view

Noise Correction

Noise Correction - when selected enables noise reduction to be performed on the signal.

IEC/IEEE-bus command: `SENS:POWer:NCOR`

No of Channels
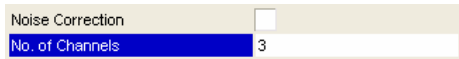
No of Channels specifies then number of channels adjacent to the transmit channel to be measured.

If *No of Channels* is set to 0 then only the transmit channel is measured.

IEC/IEEE-bus command: `SENS:POW:ACH:ACP`

TX/ACP Channel BW

The TX/ACP Channel BW settings specify the bandwidth of specific channels.

TX Channel Bandwidth

TX Channel Bandwidth specifies the bandwidth of the transmit channel to be measured by the ACP measurement.

IEC/IEEE-bus command: `SENS:POW:ACH:BAND:CHAN`

Adjacent Channel Bandwidth

Adjacent Channel Bandwidth specifies the bandwidth of the first channel before and after the transmit channel to be measured.

IEC/IEEE-bus command: `SENS:POW:ACH:BAND:ACH`

Alternate 1,2,3 & 4 Channel Bandwidth

Adjacent Channel Bandwidth specifies the bandwidth of the specified channel before and after the transmit channel to be measured.

IEC/IEEE-bus command:
`SENS:POW:ACH:BAND:ALT<1..11>`

ACP Channel Spacing

The ACP Channel Spacing settings specify the spacing of specific channels.

Adjacent Channel Spacing

Adjacent Channel Bandwidth specifies the spacing of the first channel before and after the transmit channel to be measured.

IEC/IEEE-bus command:
`SENS:POW:ACH:SPAC:ACH`

Alternate 1,2,3 & 4 Channel Spacing

Adjacent Channel Bandwidth specifies the spacing of the specified channel before and after the transmit channel to be measured.

IEC/IEEE-bus command:
`SENS:POW:ACH:SPAC:ALT<1..11>`

Automatic Level Detection

Automatic level detection allows the Signal Level and Reference Level settings to be calculated from the input signal.

Automatic level detection can be performed in one of two ways:

Pressing the *AUTO LVL* hot-key
Setting *Auto Level* in the General Settings view to ON.

Running the Automatic Level Detection by pressing the *AUTO LVL* hot-key allows the level detection to be run at any time. Once the Automatic Level Detection has completed the trace is displayed in the Magnitude Capture Buffer display.

Running the Automatic Level Detection by Setting *Auto Level* in the General Settings view to ON means that an Automatic Level Detection measurement is executed before each main measurement sweep. When running the Automatic Level Detection this way no trace for the Automatic Level Detection measurement is displayed. This way of running the Automatic Level Detection will cause measurements to run more slowly and as such it is recommended that Automatic Level Detection is only run in this way when the speed of measurement is not important or when running continuous measurements are being run with a signal which varies in level from one sweep to the next.

Running measurements

To start a measurement, press the *RUN SGL* hotkey (single) or *RUN CONT* hotkey (continuous).

A single measurement will complete once the requested number of bursts have been obtained or a single sweep has been completed, depending on the measurement settings. When a measurement is completed in continuous mode then a new measurement will be started.

Note that if one measurement is started whilst another measurement is in progress, for example, a single measurement is started whilst a continuous measurement is in progress, then the first measurement will be aborted and the new measurement started immediately.

During a measurement, the text "*Running...*" is displayed in the Status Bar at the bottom of the screen. After successful completion of a single measurement, the Status Bar will display "*Measurement Complete*".

Measurement results

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

IEEE 802.16-2004 OFDM					
Frequency:	20 GHz	Signal Level Setting:	-33.1 dBm	Ref. Level / Att:	-23.1 dBm / 0 dB
Sweep Mode:	Single	Trigger Mode:	Free Run	Trigger Offset:	-10 µs
Burst Type:	OFDM DL Burst	Modulation:	ALL	No Of Data Symbols:	1/2425

Fig. 37   Overall measurement settings summary for IEEE 802.16 – 2004 OFDM

IEEE 802.16e-2005 OFDMA					
Frequency:	20 GHz	Signal Level Setting:	-33.1 dBm	Ref. Level / Att:	-23.1 dBm / 0 dB
N_{FFT}:	1024	Sweep Mode:	Single	Trigger Mode / Offset:	Free Run
Zone / Seg:	DL-PUSC, ID=A, Seg=1	Modulation:	ALL	Zone Offset / Length:	1 / 14 Symbols

Fig. 38   Overall measurement settings summary for IEEE 802.16e – 2005 OFDMA and WiBro

The settings summary includes the following information:

- Frequency   The frequency of the measured input signal.

- Sweep Mode   Shows "Single" for a single measurement and "Continuous" for a continuous measurement.

- N_{FFT} Shows the FTT size. IEEE 802.16e – 2005 OFDMA and WiBro only

- 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 and WiBro only.

- Signal Level Setting The expected mean signal level for the input signal.

- Trigger Mode   The trigger source used to start the measurement sweep. IEEE 802.16 – 2004 OFDM only.

- Modulation   The *Demodulator* setting from the Demod Settings panel is shown. In case the *Modulation Analysis Scope* is set to *ALL*, *ALL* is displayed.

- Ref Level   The internal instrument reference level used for the measurement.

- 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 a 10 dB attenuator is used

                        External Att = -20 dB means that before the RF-connector of the R&S FSQ a amplifier with 20 dB gain is used

- Trigger Offset   The trigger delay (positive value) or pre-trigger time (negative value) applied to the trigger. IEEE 802.16 – 2004 OFDM only

- Trigger Mode/Offset   A combined display of the trigger source and any associated offset applied. IEEE 802.16e – 2005 OFDMA and WiBro only

- No Of Data Symbols   Shows the minimum and maximum number of data symbols that a burst may have if it is 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 and WiBro only.

Results Summary

The results summary table is displayed for IQ measurements when the display mode is set to List. This table shows the overall measurement results and provides limit checking for result values in accordance with the selected standard.

Fig. 39   Result Summary Table for OFDM

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).

The results for OFDMA and WiBro standards are displayed on two tables. The first table is displayed by pressing the DISPLAY LIST 1 softkey.
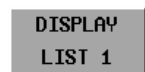
When this table is displayed then the softkey text changes to DISPLAY LIST 2. Pressing this softkey displays the second results table.
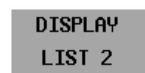
When this table is displayed the softkey text is changed to DISPLAY GRAPH. Pressing the softkey again will return the user back to the trace display.

First OFDMA/WiBro results table. This table displays results that are related to the subframes of the analysed signal.

IEEE 802.16e-2005 OFDMA

Frequency: 20 GHz   Signal Level Setting: -33.1 dBm   Ref. Level / Att: -23.1 dBm / 0 dB
N_FFT: 1024   Sweep Mode: Single   Trigger Mode / Offset: Free Run
Zone / Seg: DL-PUSC, ID=A, Seg=1   Modulation: ALL   Zone Offset / Length: 1 / 14 Symbols

Result Summary of Analyzed Subframes

No. of Subframes: 6

	Min	Mean	Limit	Max	Limit	Unit
Center Frequency Error	-69.83	-70.12	±40000	-70.52	±40000	Hz
Clock Error	-0.04	-0.07	±2	-0.08	±2	ppm
TD Power DL Preamble	-32.72	-32.72		-32.72		dBm
TD Power Subframe	-36.79	-36.79		-36.79		dBm
TD Power Zone	-37.06	-37.06		-37.06		dBm
Crest Factor	9.88	9.90		9.92		dB
RSSI	-33.33	-33.33		-33.33		dBm
RSSI Standard Deviation		-67.72				dBm
CINR	52.93	52.93		53.70		dB
CINR Standard Deviation		44.93				dB

Measurement Complete

SPECTRUM | WIMAX | AUTO LVL | RUN SGL | RUN CONT | REFRESH | SCREEN B

GENERAL SETTINGS | DEMOD SETTINGS | DISPLAY LIST 2 | PUT | EVM | SPECTRUM | CONSTELL | STATISTICS | FILE MANAGER

Fig. 40   Subframe Result Summary Table for OFDMA/WiBro

Second OFDMA/WiBro results table. This table displays results that are related to the Zones/Segments of the analysed signal.

IEEE 802.16e-2005 OFDMA

Frequency: 20 GHz   Signal Level Setting: -33.1 dBm   Ref. Level / Att: -23.1 dBm / 0 dB
N_FFT: 1024   Sweep Mode: Single   Trigger Mode / Offset: Free Run
Zone / Seg: DL-PUSC, ID=A, Seg=1   Modulation: ALL   Zone Offset / Length: 1 / 14 Symbols

Result Summary of Analyzed Zone/Segment

No. of Zones/Segments: 6

	Min	Mean	Limit	Max	Limit	Unit
BER Pilots	0.00	0.00	0.00	0.00	0.00	%
EVM Data and Pilots	-49.79	-49.68	-30.00	-49.56	-30.00	dB
EVM Data	-49.78	-49.64	-30.00	-49.50	-30.00	dB
EVM Pilots	-50.15	-49.87		-49.65		dB
Unmod. Subcarrier Error	-21.07	-21.04		-21.02		dB
IQ Offset	-61.64	-59.98	-15.00	-58.52	-15.00	dB
Gain Imbalance	-0.01	-0.01		-0.00		dB
Quadrature Error	-0.009	-0.003		0.010		°
Power DL Preamble	-27.15	-27.15		-27.15		dBm
Power Data and Pilots	-30.92	-30.92		-30.92		dBm
Power Data	-31.44	-31.44		-31.44		dBm
Power Pilots	-28.90	-28.90		-28.90		dBm

Measurement Complete

SPECTRUM | WIMAX | AUTO LVL | RUN SGL | RUN CONT | REFRESH | SCREEN B

GENERAL SETTINGS | DEMOD SETTINGS | DISPLAY GRAPH | PUT | EVM | SPECTRUM | CONSTELL | STATISTICS | FILE MANAGER

Fig. 41   Zone/Segment Result Summary Table for OFDMA/WiBro

For more details regarding how the results are calculated see section 3.

The limit values in the table of results can be modified.

LINES

Pressing the *LINES* hardkey allows limits to be selected and modified

IEEE 802.16 - 2004					
Frequency:	20 GHz	Signal Level:	-33.1 dBm	External Att:	0 dB
Sweep Mode:	Single	Trigger Mode:	Free Run	Trigger Offset:	-10 µs
Burst Type:	OFDM DL Burst	Modulation:	64QAM3/4	No Of Data Symbols:	1

Result Summary

No. of Bursts	1					
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	- 80.73	- 80.73	- 31.00	- 80.73	- 31.00	dB
EVM Data Carriers	- 80.73	- 80.73		- 80.73		dB
EVM Pilot Carriers	- 80.70	- 80.70		- 80.70		dB
IQ Offset	- 179.32	- 179.32		- 179.32		dB
Gain Imbalance	0.00	0.00		0.00		dB
Quadrature Error	- 0.000	- 0.000		- 0.000		°
Center Frequency Error	0.00	0.00	± 160000	0.00	± 160000	Hz
Clock Error	0.00	0.00	± 8	0.00	± 8	ppm
Burst Power	- 12.20	- 12.20		- 12.20		dBm
Crest Factor	8.11	8.11		8.11		dB
RSSI	- 9.16	- 9.16		- 9.16		dBm
RSSI Standard Deviation		- 32.36				dB
CINR	136.61	136.61		136.61		dB
CINR Standard Deviation		98.08				dB

Measurement Complete

SPECTRUM	WIMAX	AUTO LVL	RUN SGL	RUN CONT	REFRESH	SCREEN B

DEFAULT CURRENT

DEFAULT ALL

Fig. 42   Editing Limit Values

Limits are modified for the currently selected modulation scheme. Each modulation scheme may have its own set of user defined limits.
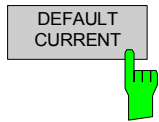
DEFAULT CURRENT

Pressing the *DEFAULT CURRENT* softey resets all limits for the current modulation scheme to those values specified in the selected standard.

IEC/IEEE-bus command:
```
CALC1:LIM1:BURS:ALL
CALC1:LIM1:BURS:ALL:RESULT?
CALC1:LIM1:BURS:FERR:AVER
CALC1:LIM1:BURS:FERR:AVER:RES?
CALC1:LIM1:BURS:FERR:MAX
CALC1:LIM1:BURS:FERR:MAX:RES
CALC1:LIM1:BURS:IQOF:AVER
CALC1:LIM1:BURS:IQOF:AVER:RES
CALC1:LIM1:BURS:IQOF:MAX
CALC1:LIM1:BURS:IQOF:MAX:RES
CALC1:LIM1:BURS:EVM:ALL[:AVER
CALC1:LIM1:BURS:EVM:ALL[:AVER:RES
CALC1:LIM1:BURS:EVM:ALL:MAX
CALC1:LIM1:BURS:EVM:ALL:MAX:RES
CALC1:LIM1:BURS:EVM:DATA:AVER
CALC1:LIM1:BURS:EVM:DATA:AVER:RES
CALC1:LIM1:BURS:EVM:DATA:MAX
CALC1:LIM1:BURS:EVM:DATA:MAX:RES
CALC1:LIM1:BURS:EVM:PIL:AVER
CALC1:LIM1:BURS:EVM:PIL:AVER:RES
CALC1:LIM1:BURS:EVM:PIL:MAX
CALC1:LIM1:BURS:EVM:PIL:MAX:RES
```
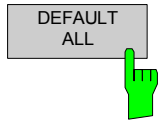
DEFAULT
ALL

Pressing the *DEFAULT ALL* softkey resets all limits for all modulation schemes to those values specified in the selected standard.

IEC/IEEE-bus command:
```
CALC1:LIM:BURS:ALL DEF
CALC1:LIM:BURS:BERP:AVER DEF
CALC1:LIM:BURS:BERB:MAX DEF
CALC1:LIM:BURS:EVM:ALL:AVER  DEF
CALC1:LIM:BURS:EVM:ALL:MAX DEF
CALC1:LIM:BURS:FERR:AVER DEF
CALC1:LIM:BURS:FERR:MAX DEF
CALC1:LIM:BURS:IQOF:AVER DEF
CALC1:LIM:BURS:IQOF:MAX DEF
CALC1:LIM:BURS:SYMB:AVER DEF
CALC1:LIM:BURS:SYMB:MAX DEF
```

The results displayed in this table are for the entire measurement. If a specific number of bursts has been requested which requires more than one sweep then the results summary update at the end of each sweep shows the results so far. The number of bursts measured and the number of bursts requested are displayed to show the progress through the measurement.

If more than one burst is evaluated (several analyzed bursts in the capture buffer or with the help of Overall Burst Count), the Min / Mean / Max columns show the minimum, mean or maximum values of the burst results.

General Settings

This section of the user manual describes the General Settings view where all settings related to the overall measurement can be modified, that is the Signal Characteristics, Data Capture, Trigger IQ, Input and Advanced settings.
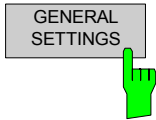
GENERAL
SETTINGS

The *GENERAL SETTINGS* softkey brings up the General Settings view.
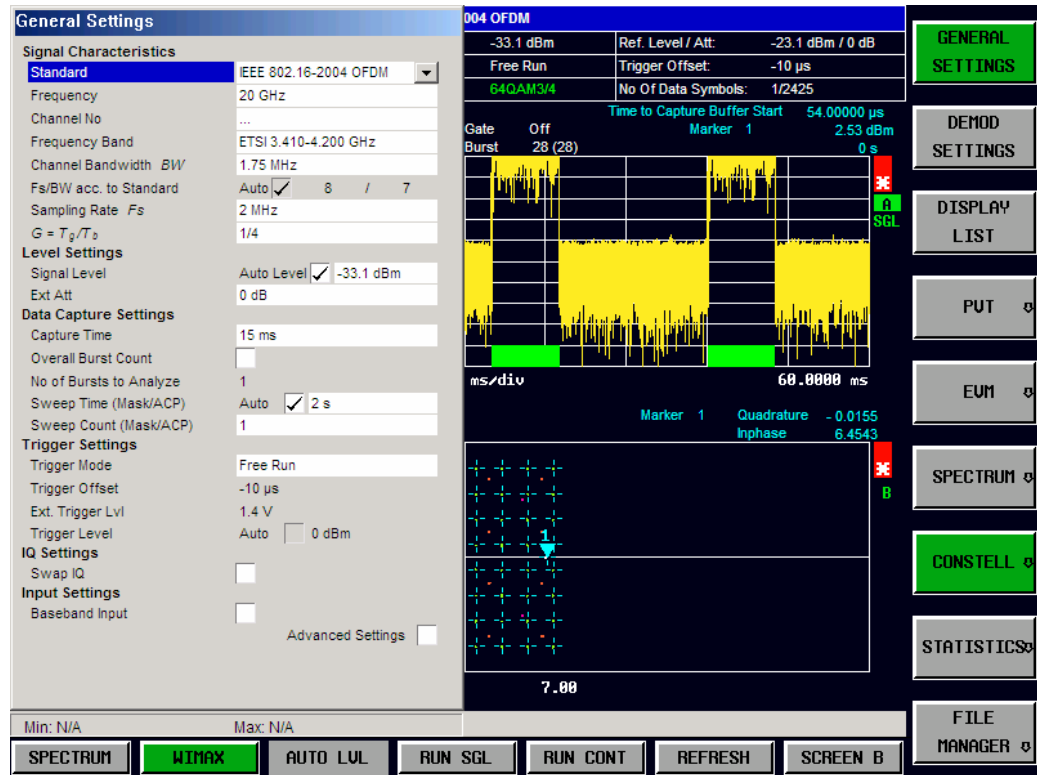
Fig. 43   General Settings view for OFDM standard
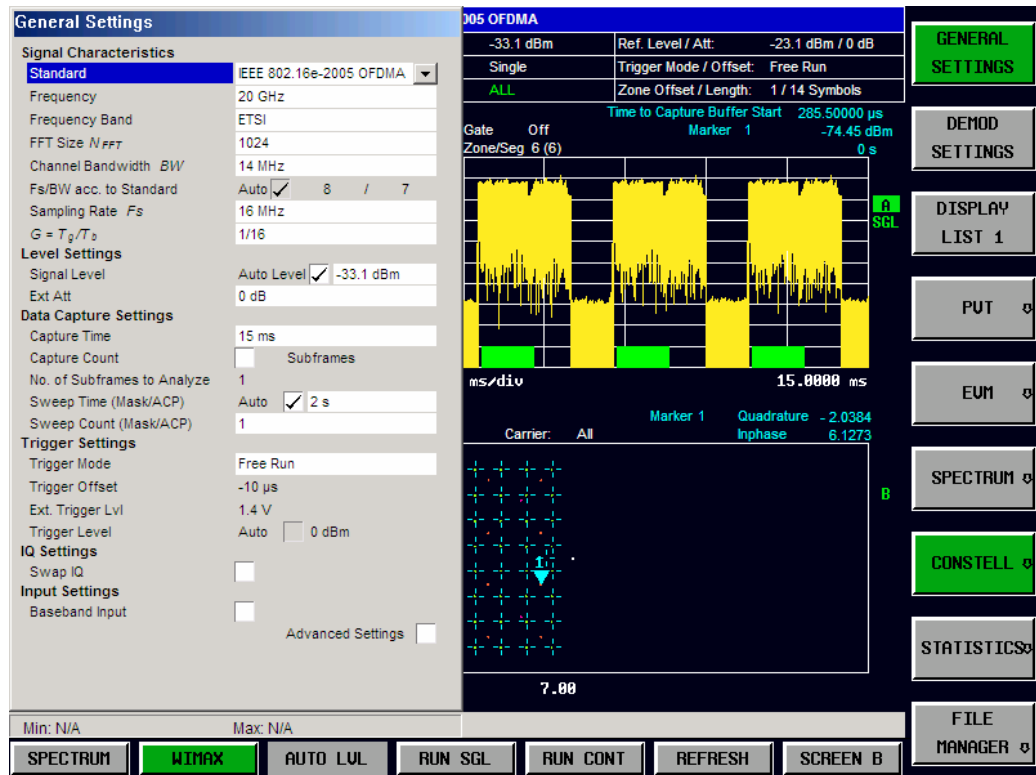
Fig. 44   General Settings view for OFDMA/WiBro standard

The parameters within the General settings view are logically grouped together into:

- Signal Characteristics
- Level Settings
- Data Capture Settings
- Trigger Settings
- IQ Settings
- Input Settings
- Advanced Settings

Any parameters that are not available for editing will have a grey background. This usually occurs when one parameter setting makes another parameter invalid, for example if the *Trigger Mode* is Free Run then none of the parameters below this (*Trigger Offset, Power Level* and *Auto Power Trigger Level*) have any meaning, so these parameters are greyed out.

When a particular parameter is selected within the General Settings view the status bar changes to display information about the valid settings for the selected parameter.

Signal Characteristics

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

Standard

Standard is used to select the WiMAX standard to be measured against. This is necessary to ensure that the measurements are performed according to the specified standard with the correct limit values and limit lines.

This parameter provides a list of settings. The list provided depends on the standards which have been installed:

IEEE 802.16-2004 OFDM (R&S FSQ-K92/K93)
IEEE 802.16e-2005 OFDMA (R&S FSQ-K93 only)
IEEE 802.16e-2005 WiBro (R&S FSQ-K93 only)

IEC/IEEE-bus command: `CONF:STAN`

Frequency

Frequency specifies the Center Frequency of the signal to be measured.

When the *Frequency* is modified and the Baseband input is not selected, the *Channel No* parameter is updated accordingly.

The *Frequency* parameter is editable when Baseband input is selected however the frequency range is limited according to the setting of the IQ Path paramerter as follows:

IQ Path = I or Q.   Range = 0 to 35 MHz
IQ Path = I + j*Q   Range = -35 to 35 MHz

IEC/IEEE-bus command: `SENS:FREQ:CENT`

Channel No (IEEE 802.16 – 2004 OFDM only)

Signal Characteristics	
Standard	IEEE 802.16-2004 OFDM
Frequency	3.412125 GHz
Channel No	5
Frequency Band	ETSI 3.410-4.200 GHz
Channel Bandwidth BW	1.75 MHz
Fs/BW acc. to Standard	Auto ✓ 8 / 7
Sampling Rate Fs	2 MHz
$G = T_g/T_b$	1/4

Channel No specifies the channel to be measured.

When the *Channel No* is modified the *Frequency* parameter is updated accordingly.

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". I.e. entering a Channel Number will derive the corresponding Center Frequency according to the section in the standard mentioned above.

For the License Exempt Bands {U-NII, CEPT} Channel Numbers are supported according to [IEEE Std 802.16-2004] "8.5.1 Channelization". I.e. entering a Channel Number will derive the corresponding Center Frequency according to the section in the standard mentioned above.

The *Channel No* parameter is not editable when Base band input is selected because *Channel No* only make sense for a RF signal.

IEC/IEEE-bus command: `CONF:CHAN`

Frequency Band

Signal Characteristics	
Standard	IEEE 802.16-2004 OFDM
Frequency	20 GHz
Channel No	...
Frequency Band	ETSI 3.410-4.200 GHz
Channel Bandwidth BW	1.75 MHz
Fs/BW acc. to Standard	Auto ✓ 8 / 7
Sampling Rate Fs	2 MHz
$G = T_g/T_b$	1/4

Frequency Band specifies the relationship between the *Channel Bandwidth* and the *Sample Rate* parameters.

The ratio of sample rate to channel bandwidth is shown to the side of the *Frequency Band* settings in the following format:
The Sampling Factor n is defined in the IEEE Std. 802.16-2004, section "8.3.2.1 Derived Parameter Definitions."

IEC/IEEE-bus command:
```
CONF:WIM:FBAN UNSP|ETSI|ETSI1|ETSI2|MMDS
|MMDS1|MMDS2|WCS|WCS1|WCS2|CEPT|CEPT1|CEPT2|
UNII|UNII1|UNII2
```

FFT Size N_{FFT} (IEEE 802.16e – 2005 OFDMA and WiBro only)

Signal Characteristics	
Standard	IEEE 802.16e-2005 OFDMA
Frequency	20 GHz
Frequency Band	ETSI
FFT Size N_{FFT}	1024
Channel Bandwidth BW	14 MHz
Fs/BW acc. to Standard	Auto ✓ 8 / 7
Sampling Rate Fs	16 MHz
$G = T_g/T_b$	1/16

FFT Size specifies the maximum number of carriers supported by the signal to be measured.

IEC/IEEE-bus command:
```
CONF:WIM:NFFT FFT128|FFT512|FFT1024|FFT2048
```

Channel Bandwidth

Channel Bandwidth specifies the bandwidth of the channel to be measured.

IEC/IEEE-bus command: `SENS:BAND:CHAN 1.75MHZ`

Fs/BW acc. to Standard

The *FS/BW* setting allows a user-defined Channel Bandwidth to Sampling Rate relationship. It is only available when the Frequency Band is "Unspecified".

When the setting is ticked, the relationship used is defined by the standard.

When the setting is unticked, the Fs and BW values can be modified with increased flexibility.

Initially the ratio takes the current Fs and BW values.

Changing the ratio updates Fs and vice versa. BW remains unchanged.

IEC/IEEE-bus command:
`CONF:WIM:FSBW:AUTO ON`
`CONF:WIM:FSBW:FS 2.5`
`CONF:WIM:FSBW:BW 1.5`

Sample Rate

Sample Rate specifies the sample rate used for IQ measurements.

IEC/IEEE-bus command: `TRAC:IQ:SRAT 20000HZ`

G = Tg/Tb

G = Tg/Tb specifies the guard time ratio

IEC/IEEE-bus command: `CONF:WIM:IGR 4`

Level Settings

The level settings are the general settings concerning the level and attenuation of the signal to be measured.

Auto Level

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

When *Auto Level* is set to ON, R&S FSQ-K92/K93 will measure the reference level automatically at the start of each measurement sweep. This ensures that the reference level is always set at the optimal level for obtaining accurate results but will result in slightly increased measurement times.

IEC/IEEE-bus command: `CONF:POW:AUTO ON`

Signal Level (RF)

Signal Level (RF) specifies the expected level of the RF input signal.

The *Signal Level (RF)* is updated after an automatic level detection measurement has been executed when RF input is selected.

The *Signal Level (RF)* parameter is not editable when Base band input is selected because *Signal Level (RF)* only make sense for an RF signal.

IEC/IEEE-bus command: `CONF:POW:EXP:RF -331`

Signal Level (Baseband)

Signal Level (Baseband) specifies the expected level of the Baseband input signal.

The *Signal Level (Baseband)* is updated after an automatic level detection measurement has been executed when Baseband input is selected.

The *Signal Level (Baseband)* parameter is not editable when RF input is selected because *Signal Level (Baseband)* only make sense for a Baseband signal.

IEC/IEEE-bus command:
`DISP:WIND:TRAC:Y:RLEV:IQ 1`

Ext Att

Ext Att specifies the external attenuation or gain applied to the RF signal. A positive value indicates attenuation, a negative value indicates gain.

All displayed power level values will be shifted by this value.

IEC/IEEE-bus command:
`DISP:WIND:TRAC:Y:RLEV:OFFS 0`

Data Capture Settings

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

Capture Time

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

A maximum of 1 MSamples can be captured for an IQ measurement, allowing up to 500ms capture time for a 2MHz Sample Rate (Fs).

IEC/IEEE-bus command: `SENS:SWE:TIME`

Overall Burst Count (OFDM only)

Overall Burst Count specifies whether a specified number of bursts are to be captured and analyzed.

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

IEC/IEEE-bus command: `SENS:BURS:COUN:STAT ON`

No of Burst to Analyze (OFDM only)

No of Burst to Analyze specifies the number of bursts to be measured.

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

The *No of Burst to Analyze* parameter is not editable when *Overall Burst Count* is set to OFF.

IEC/IEEE-bus command: SENS:BURS:COUN?

Capture Count (OFDMA/WiBro only)

Capture Count specifies whether a specified number of subframes are to be captured and analyzed.

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

IEC/IEEE-bus command: SENS:ZONE:COUN:STAT ON

No of Subframes to Analyze (OFDMA/WiBro only)

No of Subframes to Analyze specifies the number of subframes to be measured.

If the number of subframes specified 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.

The *No of Subframes to Analyze* parameter is not editable when *Capture Count* is set to OFF.

IEC/IEEE-bus command: SENS:ZONE:COUN?

Sweep Time (Mask/ACPR)

Sweep Time (ACP/Mask) specifies whether the sweep time for the spectrum ACP & Mask measurements should be calculated automatically or specified manually.

If the sweep time auto check box is switched off the sweep time to be used can be specified.

IEC/IEEE-bus command: SENS:SWE:ACPR:TIME 2s

Sweep Count (Mask/ACPR)

Sweep Count (ACP/Mask) specifies the number of sweeps which should be performed for Spectrum ACP/ACPR and Spectrum Mask measurements.

IEC/IEEE-bus command: SENS:SWE:COUNt 1

Trigger Settings

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

Trigger Mode

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

The possible values for the *Trigger Mode* are:

Free Run – the measurement sweep starts immediately.

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

Power - the measurement sweep starts when the signal power meets or exceeds the specified power trigger level.

IEC/IEEE-bus command: TRIG:SEQ:MODE IMM

Trigger Offset

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

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

IEC/IEEE-bus command: TRIG:SEQ:HOLD –10us

External Trigger Level

External Trigger Level specifies the trigger level when a external trigger is selected.

The *External Trigger Level* parameter is editable only when *Trigger Mode* is set to External.

IEC/IEEE-bus command: TRIG:SEQ:LEV 1.4V

Auto Power Trigger Level

Auto Power Trigger Level selects whether the level for the power trigger is measured automatically (ON) or entered manually by the user (OFF).

When *Auto Power Trigger Level* is set to ON, R&S FSQ-K92/K93 will measure and determine the power trigger level 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.

The *Auto Power Trigger Level* parameter is editable only when *Trigger Mode* is set to Power.

IEC/IEEE-bus command: `TRIG:SEQ:LEV:POW:AUTO ON`

Trigger Level (RF)

Trigger Level (RF) Specifies the trigger level when a power trigger is selected and Baseband input is not selected.

The *Trigger Level* parameter is editable only when *Trigger Mode* is set to Power.

The *Trigger Level (RF)* parameter is not editable when Baseband input is selected because *Trigger Level (RF)* only makes sense for an RF signal.

IEC/IEEE-bus command: `TRIG:SEQ:LEV:IFP 0DBM`

Trigger Level (Baseband)

Trigger Level (Baseband) Specifies the trigger level when a power trigger is selected and Baseband input is selected.

The *Trigger Level* parameter is editable only when *Trigger Mode* is set to Power.

The *Trigger Level (Baseband)* parameter is not editable when RF input is selected because *Trigger Level (Baseband)* only makes sense for a Baseband signal.

IEC/IEEE-bus command: `TRIG:SEQ:LEV:IFP 500mV`

Ext.Trigger Lvl

Ext. Trigger Lvl specifies the trigger level when an external trigger is selected.

The *Ext. Trigger Level* parameter is editable only when *Trigger Mode* is set to External.

IEC/IEEE-bus command: `TRIG:SEQ:MODE EXT 1.4V`

IQ Settings

The IQ settings contains settings related the Inphase and Quadrature phase of the input signal.

Swap IQ

Swap IQ allows selection between normal and inverted I/Q modulation. The settings for this parameter are:
OFF   Normal I/Q modulation.
ON   I and Q signals are interchanged.

The *Swap IQ* parameter is editable only when *IQ Path* is set to I + j*Q.

IEC/IEEE-bus command: `SWAP ON`

Input Settings

The Input settings group contains settings related to the input source of the signal to be measured. Note that this group is only available when the B71 option is installed.

Baseband Input

Baseband Input allows the selection between RF and Baseband inputs. The settings for this parameter are:
OFF RF Input.
ON   Baseband Input.

IEC/IEEE-bus command: `INPut:SEL AIQ | RF`

Advanced Settings

The Advanced Settings contains settings which control details of how the instrument operates and how measurements are performed.

The advanced settings are displayed on the right hand side of the general settings view, and are only displayed when the Advanced Settings checkbox is checked.

Fig. 45   Advanced Settings for OFDM

Fig. 46   Advanced Settings for OFDMA and WiBro

IQ Input
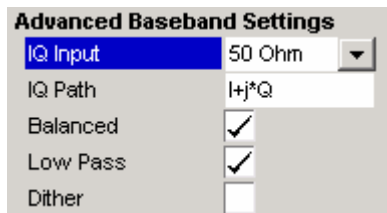
IQ Input allows the selection of the impedance of the Baseband inputs. The values that can be selected are 50 Ω and 1 kΩ/1 MΩ (depending on the instrument configuration).

The *IQ Input* parameter is editable only when Baseband input is selected.

IEC/IEEE-bus command: `INP:IQ:IMP LOW`

IQ Path
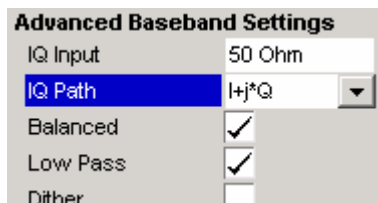
IQ Path allows the selection of the input path for Baseband inputs. Either a single input (either I or Q) may be used or both may be used. If only a single input is selected then the *Swap IQ* parameter is not used and becomes disabled.

The *IQ Path* parameter is editable only when baseband input is selected.

IEC/IEEE-bus command: `INP:IQ:TYPE IQ`

Balanced

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

The *Balanced* parameter is editable only when Baseband input is selected.

IEC/IEEE-bus command: `INP:IQ:BAL ON`

Low Pass

When switched on the *Low Pass* parameter specifies that a filter is applied from 36 MHz for the IQ inputs.

The *Low Pass* parameter is editable only when Baseband input is selected.

IEC/IEEE-bus command: `SENS:IQ:LPAS ON`

Dither

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

IEC/IEEE-bus command: `SENS:IQ:DITH 1`

Auto Level

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

The *Auto Level* advanced settings is the same as the *Auto Level* in the Signal Characteristics. It is repeated in the Advanced Settings for convenience.

IEC/IEEE-bus command:
`SENS:SWE:ACPR:TIME:AUTO OFF`

Auto Track Time

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

IEC/IEEE-bus command:
`CONF:POW:AUTO:SWE:TIME 100MS`

Ref Level

Ref Level specifies the reference level to use when running measurements.

When the *Ref Level* is modified the *Signal Level* parameter is updated accordingly (depending on the currently selected standard and measurement type).

The *Ref Level* is editable only when *Auto Level* is switched off.

IEC/IEEE-bus command:
DISP:[WIND]:TRAC:Y:[SCAL]:RLEV?

RF Att

Rf Att specifies the mechanical attenuation to be applied to the input RF signal.

IEC/IEEE-bus command: INP:ATT 5DB

El Att

The *El Att* parameters specify the settings for the electronic attenuator.

The *El Att* parameters are:

Mode　　Specifies whether the electronic attenuator should be controlled manually (Manual) or by the option (Auto)

State　　Specifies whether the electronic attenuator should be switched ON or OFF.

Settings　Specifies the attenuation value the electronic attenuator should be switched to.

When the mode is set to Auto then the state and settings fields will be automatically calculated by the option and so these fields will not be editable.

When the state is switched off the setting field is non-editable.

When the frequency is set such that the electronics attenuator cannot be used then all the Electronic Attenuator fields are read-only.

IEC/IEEE-bus command:　INP:EATT:AUTO ON

YIG Filter

The *YIG Filter* parameter specifies how the YIG filter is used during measurements.

The *YIG Filter* parameters are:

Mode – Specifies whether the YIG filter should be controlled manually (Manual) or by the option (Auto).

State – Specifies whether the YIG filter should be switched ON or OFF.

When the mode is set to Auto then the state field will be automatically calculated by the option and so this field will not be editable.

IEC/IEEE-bus command: `INP:FILT:YIG:AUTO ON`
`INP:FILT:YIG:STAT OFF`

High Dynamic

The *High Dynamic* parameter is only available when the B72 option is installed, and the sample rate is set between 20.4 MHz and 40.8 MHz.

When the *High Dynamic* parameter is set to ON then measurements are performed using a wide filter in the normal signal path rather than using the B72 option.

The advantage of setting the *High Dynamic* parameter ON is a higher resolution (because the "normal" signal path uses a 14 bit ADC). The disadvantage is that all signals left or right the spectrum of interest are folded into the spectrum itself.

IEC/IEEE-bus command: ---

RSSI, CINR avg parameter

RSSI, CINR avg parameter 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".

IEC/IEEE-bus command: `CONF:WIMAX:AVER`

List Results Unit (IEEE 802.16 – 2004 OFDM only)

List Results Unit specifies the units for the results in the results summary table.

IEC/IEEE-bus command: `UNIT:TABL DB | PCT`

SMU Address(IEEE 802.16e – 2005 OFDMA and WiBro only)

SMU Address specifies the IP address of an R&Sc SMU Signal generator. This can be used to upload or download settings in order to keep the SMU and FSQ synchronised.

IEC/IEEE-bus command: ---

Demod Settings(IEEE 802.16-2004 OFDM)

This section of the user manual describes the Demod (Short for Demodulation) Settings view for the IEEE 802.16-2004 OFDM standard where the settings associated with the signal modulation can be modified.
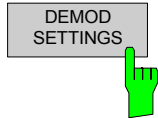
DEMOD
SETTINGS

The *DEMOD SETTINGS* softkey brings up the Demod Settings view.
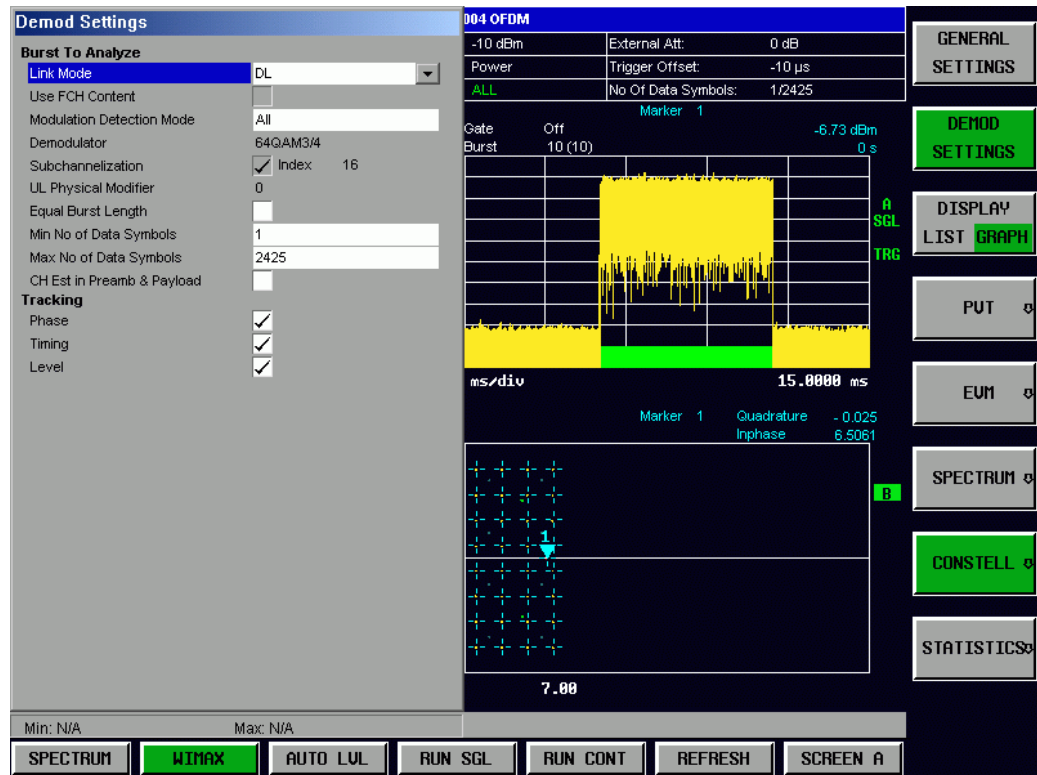
Fig. 47   Demod Settings view (IEEE 802.16-2004 OFDM standard)

The Demod settings are logically grouped together into:
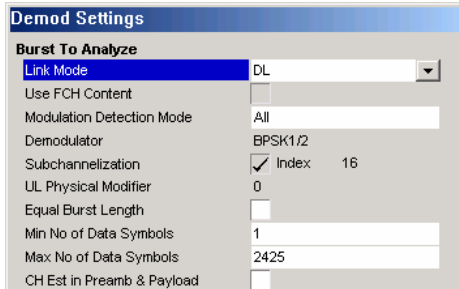
• Burst to analyze settings

• Tracking settings

When a particular parameter is selected within the Demod Settings view the status bar changes to display information about the valid settings for the selected parameter. The parameters available in the Demod setting view are dependent on the currently selected standard.

Burst To Analyze Settings

The burst to analyze settings specify the characteristics of the bursts to be considered in the measurement results. Only those burst which meet the criteria specified in this group will be included in measurement analysis

Link Mode
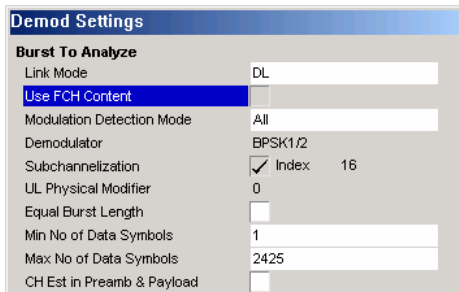
Link Mode specifies the Link Mode of burst which should be included in measurement analysis. The following Link Mode types are supported:

UL – Up Link
DL – Down Link

IEC/IEEE-bus command: `CONF:WIM:LMOD UL`

Use FCH Content

Use FCH Content specifies whether the FCH field of the captured burst data should be decoded.

When *Use FCH Content* is set to ON then only those bursts whose modulation format matches the modulation format specified in the *PDU Mod to Analyze* parameter are included in the results analysis.

Currently this parameter is always switched off and cannot be modified.

IEC/IEEE-bus command: ---

Modulation Detection Mode

Demod Settings	
Burst To Analyze	
Link Mode	DL
Use FCH Content	
Modulation Detection Mode	All
Demodulator	BPSK1/2
Subchannelization	✓ Index 16
UL Physical Modifier	0
Equal Burst Length	
Min No of Data Symbols	1
Max No of Data Symbols	2425
CH Est in Preamb & Payload	
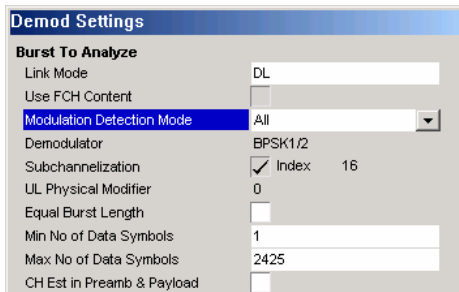
Modulation detection mode specifies how the signal should be demodulated. The following values are supported:

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 anaylzed according to the modulation format of the first data symbol. This setting supports multiple modulation formats in a subframe.

User — Only bursts matching the setting in the *Demodulator* setting are analyzed. This setting supports multiple modulation formats in a subframe.

ALL — All bursts individual payload modulations are analyzed accordingly.

When *Modulation detection mode* is set to First Symbol then the *Demodulator* setting is disabled and will automatically update with the modulation scheme detected in the first symbol.

IEC/IEEE-bus command:
`SENS:DEM:FORM:BCON:AUTO NON|FIRST|USER|ALL`

Demodulator

Demod Settings	
Burst To Analyze	
Link Mode	DL
Use FCH Content	
Modulation Detection Mode	All
Demodulator	BPSK1/2
Subchannelization	✓ Index 16
UL Physical Modifier	0
Equal Burst Length	
Min No of Data Symbols	1
Max No of Data Symbols	2425
CH Est in Preamb & Payload	
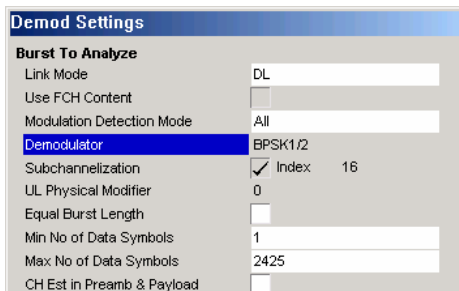
In case *Modulation detection mode* ∈ {*None, User*} *Demodulator* defines the modulation format according to which the signal will be analyzed.
Modulation detection mode = None: The measurement application will apply this modulation format onto the subframe to be analyzed. Therefore, the modulation format defined by this parameter must match with the modulation format of the subframe to be analyzed.
Modulation detection mode = User: The areas of the subframe with the modulation format defined by this parameter will be analyzed.

Important Note: *At the moment the R&S FSQ-K92/K93 measurement application can't distinguish between different coding rates for the same modulation format. I.e. 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:*
[A == C ⇒ B == D]
in order to produce correct measurement results.

IEC/IEEE-bus command: `SENS:DEM:FORM:BAN <String>`

Subchannelization

With link mode uplink Subchannelization can be enabled (ticked) this allows the subchannel index of uplink bursts to be analyzed.

IEC/IEEE-bus command: `SENS:SUB:STAT`

Subchannelization Index

The *Subchannelization index* of uplink bursts to be anlysed. Subchannel Index 16 is the default subchannel with full occupation.

IEC/IEEE-bus command: `SENS:SUB`

UL Physical Modifier

A common *UL Physical Modifier* for all uplink bursts must be chosen by the user.

IEC/IEEE-bus command: `SENSe:SUB:ULPH`

Equal Burst Length

Equal Burst Length allows burst with a range of data symbols/bytes or bursts with a specific number of data symbols/bytes to be selected for measurement analysis.

When *Equal Burst Length* is set to ON then the next parameter in the group becomes *No of Data Symbols* and only burst with exactly the number of symbols specified in *No of Data Symbols* are considered for measurement analysis.

When *Equal Burst Length* is set to OFF then the next parameter in the group becomes *Min No of Data Symbols* and bursts with a number of data symbols within the range specified by the *Min No of Data Symbols* and *Max No of Data Symbols* parameters take part in measurement analysis.

IEC/IEEE-bus command:
`SENS:DEM:FORM:BAN:SYM:EQU ON`

Min No of Data

Demod Settings	
Burst To Analyze	
Link Mode	UL
Use FCH Content	☐
Modulation Detection Mode	All
Demodulator	BPSK1/2
Subchannelization	✓ Index 16
UL Physical Modifier	0
Equal Burst Length	☐
Min No of Data Symbols	1
Max No of Data Symbols	2425
CH Est in Preamb & Payload	☐

Min No of Data Symbols specifies the minimum number of data symbols a burst must have for it to be considered in measurement analysis.

Min No of Data Symbols is only available when *Equal Burst Length* is set to OFF.

IEC/IEEE-bus command:
`SENS:DEM:FORM:BAN:SYM:MIN 1`

Max No of Data Symbols

Demod Settings	
Burst To Analyze	
Link Mode	UL
Use FCH Content	☐
Modulation Detection Mode	All
Demodulator	BPSK1/2
Subchannelization	✓ Index 16
UL Physical Modifier	0
Equal Burst Length	☐
Min No of Data Symbols	1
Max No of Data Symbols	2425
CH Est in Preamb & Payload	☐

Max No of Data Symbols specifies the maximum number of data symbols a burst must have for it to be considered in measurement analysis.

Max No of Data Symbols is only available when *Equal Burst Length* is set to OFF.

IEC/IEEE-bus command:
`SENS:DEM:FORM:BAN:SYM:MAX 2425`

Chan Est in Preamb and Payload

Chan Est in Preamb and Payload specifies how accurately the EVM results should be calculated.

When *Chan Est in Preamb and Payload* is set to OFF then the EVM results are calculated in accordance with the selected standard. In this case channel estimation is done in the preamble only.

When *Chan Est in Preamb and Payload* is set to ON then the EVM results are calculated more accurately. In this case channel estimation is done in both preamble and payload.

IEC/IEEE-bus command:
`SENS:DEM:FORM:BAN:SYM:MIN 1`

Tracking Settings

The tracking settings allow various errors in measurement results to be compensated for.

Phase

Phase is used to specify whether or not the measurement results should be compensated for phase error.
When *Phase* is set to ON then the measurement results will be compensated for phase error on a per-symbol basis.

IEC/IEEE-bus command: `SENS:TRACk:PHAS ON`

Timing

Timing is used to specify whether or not the measurement results should be compensated for timing error.
When *Timi*
ng is set to ON then the measurement results will be compensated for timing error on a per-symbol basis.

IEC/IEEE-bus command: `SENS:TRAC:TIME ON`

Level

Level is used to specify whether or not the measurement results should be compensated for level error.
When *Level* is set to ON then the measurement results will be compensated for level error on a per-symbol basis.

IEC/IEEE-bus command: `SENS:TRAC:LEV ON`

Demod Settings(IEEE 802.16e-2005 OFDMA & WiBro)

This section of the user manual describes the Demod (Short for Demodulation) Settings view for the IEEE 802.16e-2005 OFDMA & WiBro standard where the settings associated with the signal modulation can be modified.
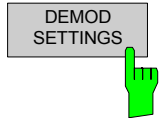
DEMOD
SETTINGS

The *DEMOD SETTINGS* softkey brings up the Demod Settings view.
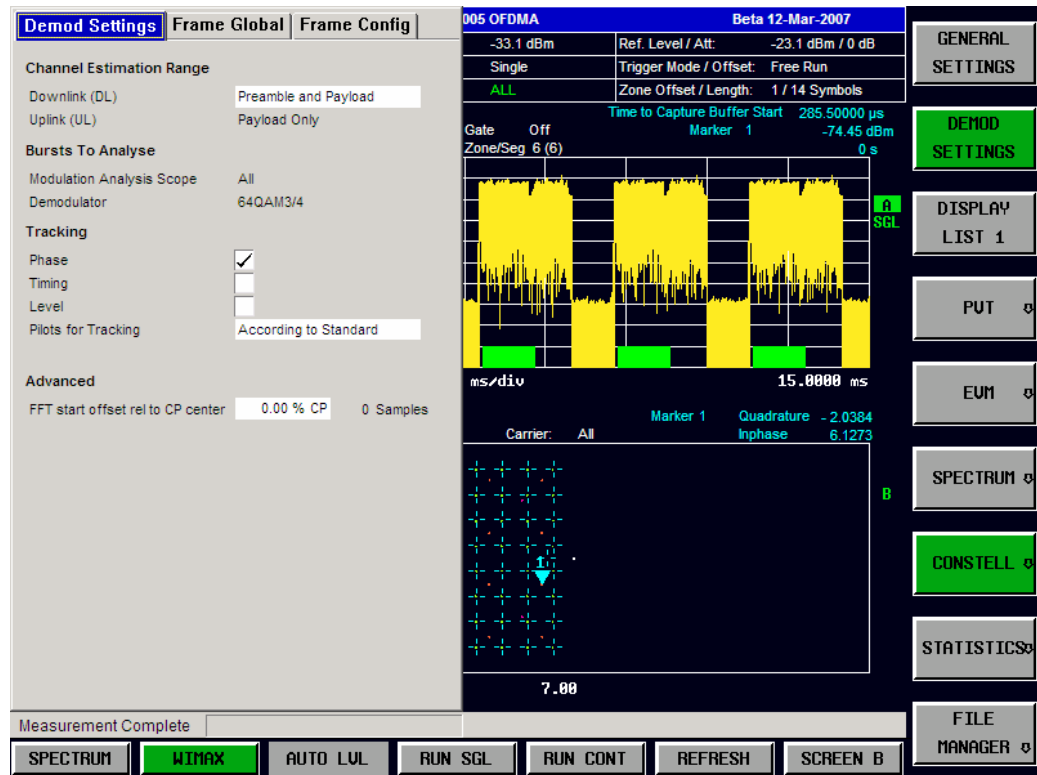
Fig. 48   Demod Settings view (IEEE 802.16e-2005 OFDMA & WiBro standard)

The Demod settings are logically grouped together into:

- Demod Settings – contains the demodulation settings which are used to analyse the signal.
- Frame Global – contains the general frame settings used in configuring and analysing the signal.
- Frame Config – contains the Zone and Burst setting that specifies a Frame.

When a particular parameter is selected within the Demod Settings view the status bar changes to display information about the valid settings for the selected parameter. The parameters available in the Demod setting view are dependent on the currently selected standard.

Channel Estimation Range

Allows that user to specify the Channel Estimation settings used in measuring a signal.

Downlink (DL)

Downlink (DL) specifies how channel estimation is performed for downlink signals. The following values are supported:

Preamble Only
Preamble and Payload [Payload comprises Pilots and Data]
Payload Only

IEC/IEEE-bus command: `SENS:DEM:CEST`

Uplink (DL)

Uplink (DL) specifies how channel estimation is performed for uplink signals. This parameter is read only and is for information purposes only as it indicates that channel estimation for uplink signals is always performed in payload [payload comprises pilots and data] only.

IEC/IEEE-bus command: ---

Bursts To Analyze

Displays the modulations to be analysed.

Modulation Analysis Scope

Modulation Analysis Scope specifies which modulation formats will be analyzed. This parameter is read only and is for information purposes only as it indicates that all detected modulation schemes will be analyzed.

IEC/IEEE-bus command: `SENS:DEM:FORM:[BCON]:AUT`

Demodulator

Demodulator is read only and is for information purposes only as it indicates the modulation scheme detected in the analyzed signal. For signals using multiple modulation schemes then the modulation scheme with the highest data rate is displayed. This parameter also indicates which limits are applied to the EVM results in the table or results.

IEC/IEEE-bus command:
`SENS:DEM:FORM:BAN 'QPSK1/2'`

Tracking Settings

The tracking settings allow various errors in measurement results to be compensated for.
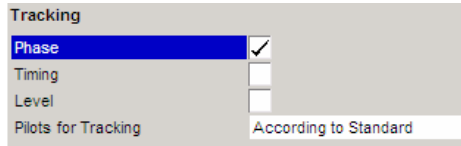
Phase

Phase is used to specify whether or not the measurement results should be compensated for phase error.
When *Phase* is set to ON then the measurement results will be compensated for phase error on a per-symbol basis.

IEC/IEEE-bus command: `SENS:TRAC:PHAS ON`

Timing
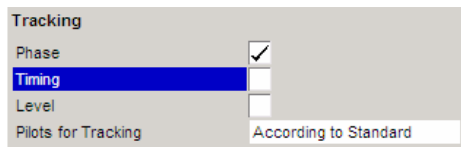
Timing is used to specify whether or not the measurement results should be compensated for timing error.
When Timing is set to ON then the measurement results will be compensated for timing error on a per-symbol basis.

IEC/IEEE-bus command: `SENS:TRAC:TIME ON`
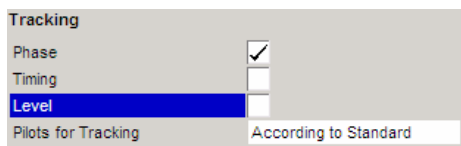
Level

Level is used to specify whether or not the measurement results should be compensated for changes in DUT gain over time.
When Timing is set to ON then the measurement results will be compensated for gain on a per-symbol basis.

IEC/IEEE-bus command: `SENS:TRAC:LEV ON`

Pilots for Tracking
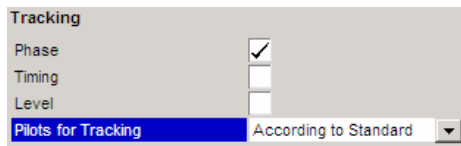
Pilots for Tracking is used to specify how the pilot sequence, for is determined for frame synchronisation. The following values are supported:

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

IEC/IEEE-bus command: `SENS:TRAC:PIL DET`

Advanced

This section contains the more advanced setting used in analysing the signal.

FFT Start offset rel to CP center

FFT start offset rel to CP center: The application determines the optimal FFT starting point. However this parameter allows you to add an offset to the optimal FFT starting point determined by the Application. The parameter ranges from -100 %, …, 100 % of the Cyclic Prefix [CP] length. The default setting is 0 %. In this case the optimal FFT starting point, determined by the application, is used.

IEC/IEEE-bus command: `SENS:FFT:OFFS`

Frame Global (IEEE 802.16e-2005 OFDMA & WiBro only)

This section of the user manual describes the Frame Global Settings view where the common settings associated with the frame to be analyzed can be modified.
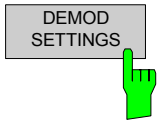
DEMOD
SETTINGS

The *DEMOD SETTINGS* softkey brings up the Demod Settings view. Selecting the Frame Global tab displays the Frame Global settings view. Use the left/right arrow to navigate between the tabs.
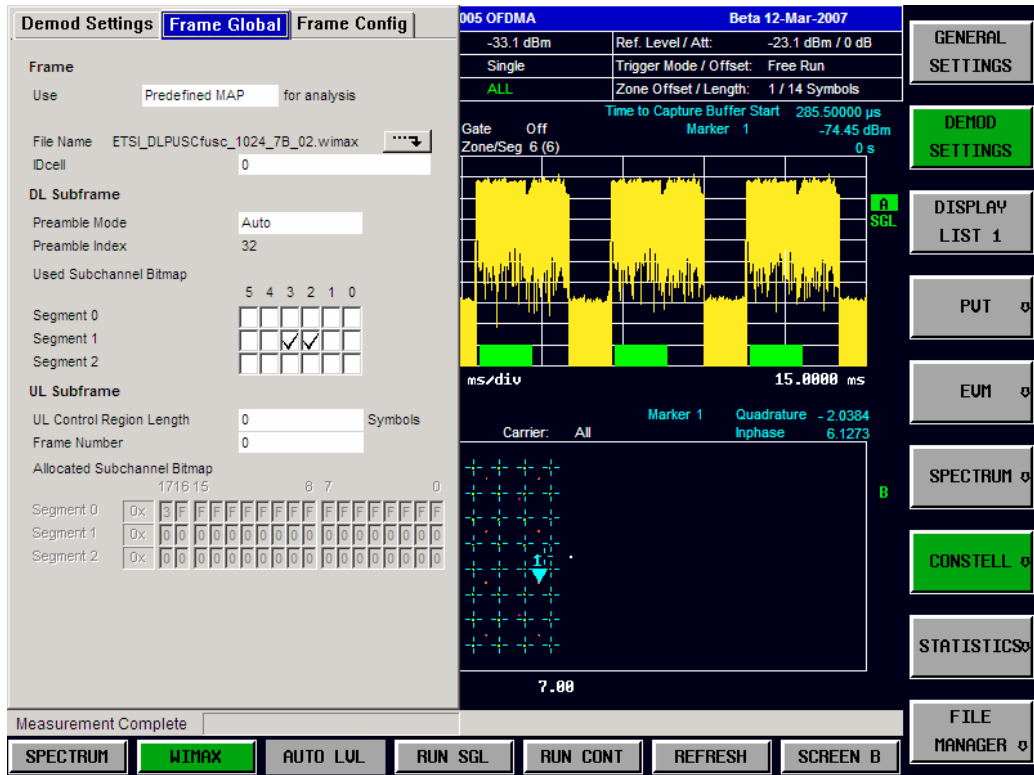
Fig. 49   Frame Global Settings view

Frame

Use … for analysis

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.

Predefined MAP   Uses the current user-defined configuration

Signal MAP   Performs an additional initial sweep to determine the configuration from the signal.

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

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

The current release supports Signal MAP determination for DL signals only.

Note: Loading a .WIMAX file automatically sets "Predefined MAP"

IEC/IEEE-bus command: `DEM:FORM:AUT PRED`

File Name
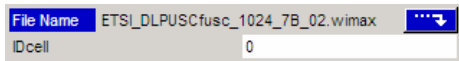
File Name indicates the name of the loaded .WIMAX settings file. If no file is loaded then '….' Is displayed. To load a setting file, select the parameter and press the icon displayed. The File Manager dialog is opened.

IEC/IEEE-bus command: `MMEM:LOAD:FRAM:STAT`

IDCell
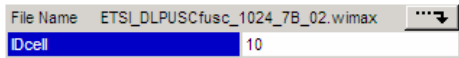
IDCell affects the definition of the Preamble sequence [in conjunction with the used segments according to the *Used Subchannel Bitmap* selection], the pilot sequence of the first zone and the subchannel definition of the first zone.

IEC/IEEE-bus command: `CONF:WIM:DLSF:IDC 0`

DL Subframe

Preamble Mode
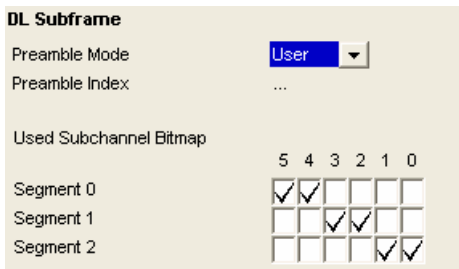
Preamble Mode determines whether how the preamble index is calculated. The values supported are:

Auto The Preamble index is automatically calculated according to the *IDcell* and *Used Subchannel Bitmap* settings

User The preamble index can be specified manually. I.e. the preamble pattern is chosen according to the standard using this setting.

IEC/IEEE-bus command:

`:CONF:WIM:DLSF:PMOD Preamble Mode`

Preamble Index

Preamble Index: The *Preamble mode* has been set to *User.* The *Preamble Index* defines the preamble pattern – according to the standard – to be used.

IEC/IEEE-bus command:
`:CONF:WIM:DLSF:PIND Preamble Index`

Used Subchannel Bitmap

Used Subchannel Bitmap assigns subchannel groups to segments. See [802.16e-2005].360 Table 268a Subchannel index of the six subchannel groups. This table defines how many subchannels will be available for the Burst List 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.

IEC/IEEE-bus command: `CONF:WIMAX:DLSF:SEG`

UL Subframe

UL Control Region Length

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.

IEC/IEEE-bus command: `CONF:WIM:ULSF:CRL`

Frame Number

Frame Number specifies the number of the frame to be analyzed. In case of UL-Subframe analysis, the Frame Number **must be constant for the signal to be analyzed**!

IEC/IEEE-bus command: `CONF:WIMAX:ULSF:SEG`

Allocated Subchannel Bitmap

Allocated Subchannel bitmap specifies which subchannels are to be analyzed. This parameter is read only and is for information purposes only as all subchannels are used in the UL-Subframe.

IEC/IEEE-bus command: ---

Frame Config (IEEE 802.16e-2005 OFDMA & WiBro only)

This section of the user manual describes the Frame Config Settings view where the settings associated with the frame configuration can be modified.

DEMOD SETTINGS

The *DEMOD SETTINGS* softkey brings up the Demod Settings view. Selecting the Frame Config tab displays the Frame Config settings view. Use the left/right arrow to navigate between the tabs.

Fig. 50   Frame Configuration Settings view

The Frame Configuration Settings view comprises three parts:

- the Zone/Segment List
- the Burst List
- a graphical panel which shows, depending on the current selection, either the Zone/Segments of the configuration, or the bursts of the current zone.

Zone/Segment List

Fig. 51   Definition of the Zone Offset [red arrows] and the Zone Length [green arrows] parameters
              from the Zone/Segment List

Zone/Segment List parameters:

1. *ID*
   Provides a unique ID for the zone. This parameter is read only. If there are any errors in the
   zone/segment configuration then the background of this item will be red.

2. *Bursts*
   Pressing the roll-key or ENTER on tyhis field causes the Burst List to become selected and the Burst
   Map to be displayed.

3. *Analyze*
   Defines the Zone/Segment to be analyzed. Note that only one sone/segment can be marked for
   analysis at any given time.

4. *Zone*
   Defines the zone type. The following types are supported:
   DL-PUSC
   DL-FUSC
   UL-PUSC

5. *Segment*
   Defines the segment for a DL-PUSC zone.
   Note: in case of DL-FUSC, this parameter has no effect.

6. *Length [Symb]*

Defines the length in OFDMA Symbols of the zone.
The zone *Length* must be a multiple of the number of symbols per slot. In case this condition is not hold a '*Zone/Burst configuration Error*' is displayed in the status bar and the measurement won't start.

7. **Offset [Symb]**
   Defines the offset in OFDMA Symbols from the start of the subframe.
   Note I: The first DL-PUSC zone starts with 1.
   Note II: The first UL-PUSC zone starts with 0.

8. **PermBase**
   This parameter is required for the computation of the subchannel – physical carrier assignment permutation.

9. **PRBS_ID**
   Is required for the computation of the pilot sequence.

Burst List
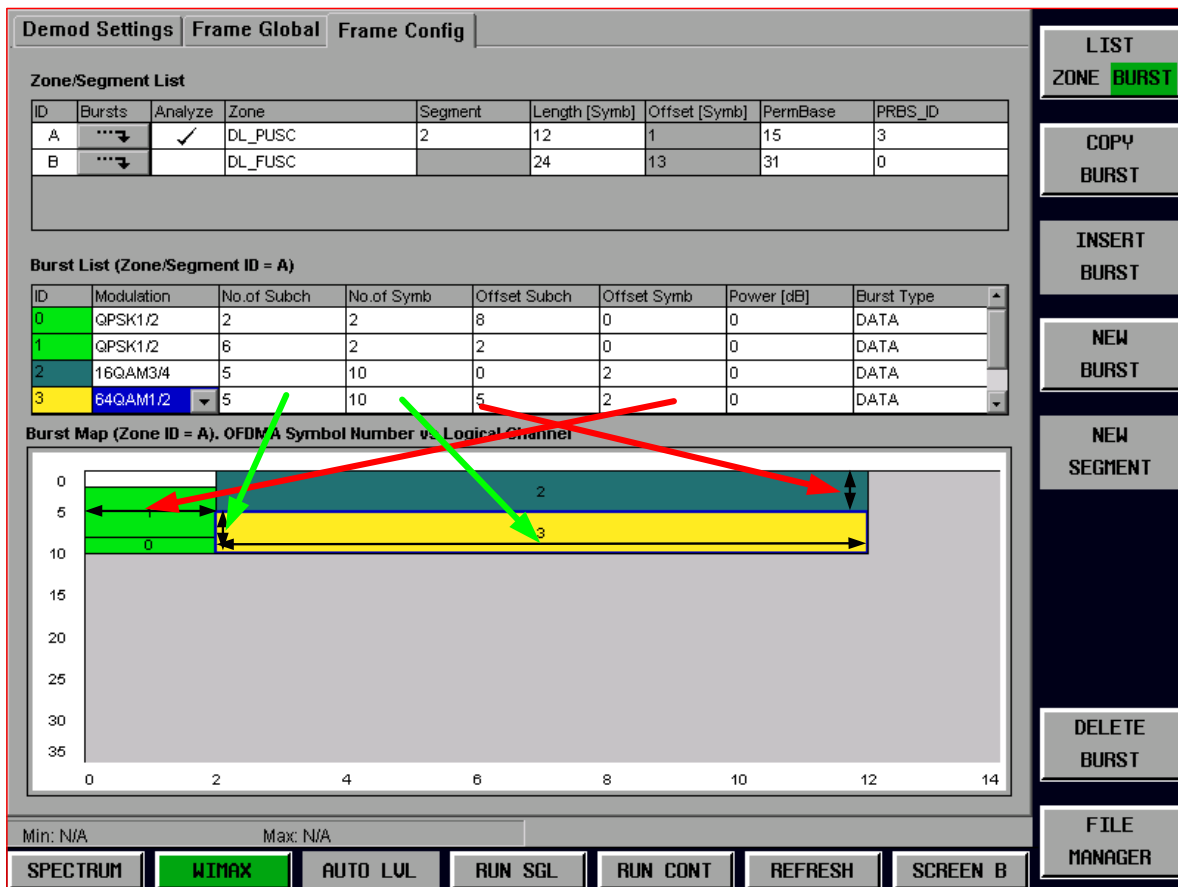
Fig. 52   Definition of the Burst Offset [red arrows] and the Burst Length [green arrows] parameters from the Burst List.

Burst List parameter:

1. **ID**
   Provides a unique ID for the burst. This parameter is read only. The background colour 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.

2. **Modulation**
   Defines the modulation format of the burst. Identical modulation formats use the same colour in the Burst Map.

3. **No. of Subch.**
   Defines the number of logical Subchannels occupied by the burst.

4. **No. of Symb.**
   Defines the number of OFDMA symbols occupied by the burst.
   The *No. of Symb.* must be a multiple of the number of symbols per slot. If this condition is not met a '*Zone/Burst configuration Error*' is displayed in the status bar and the measurement won't start.

5. **Offset Subch**
   Defines the offset in logical subchannels from subchannel 0.

6. **Offset Symb**
   Defines the offset in OFDMA symbols. The start of the zone defines symbol 0.
   The *Offset Symb.* must be a multiple of the number of symbols per slot. If this condition is not met a '*Zone/Burst configuration Error*' is displayed in the status bar and the measurement won't start.

7. **Power[dB]**
   Defines the boosting factor of the burst.

8. **Burst Type**
   Defines the burst type from the protocol layer perspective

Zone/Segment Map
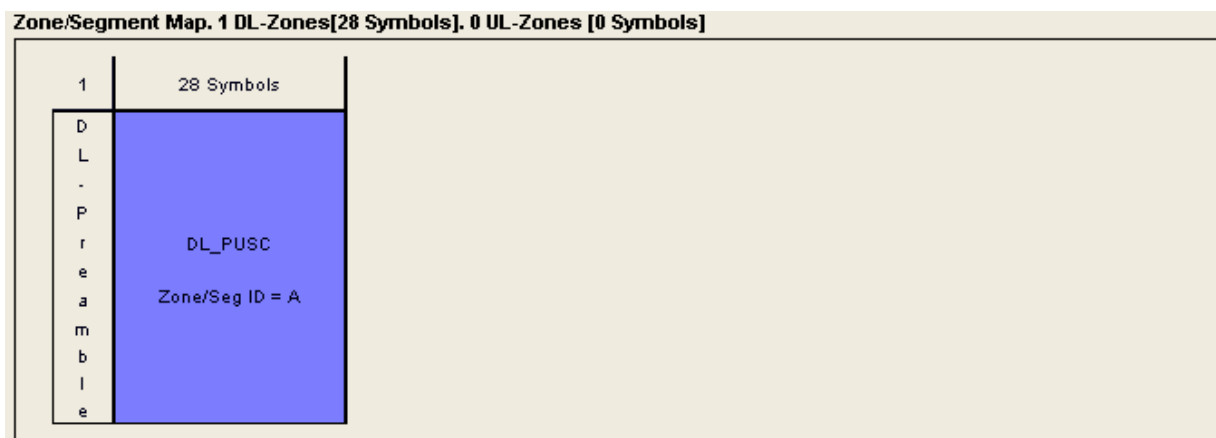
Fig. 53   Zone/Segment Map

The Zone/Segment map is displayed at the bottom of the Frame Config dialog when the zone/segment list has focus. The Zone/Segment map displays a graphical view of the Zone/Segment list. The currently selected zone/segement in the Zone/Segment list is highlighted in the Zone/Segment map.

Burst Map
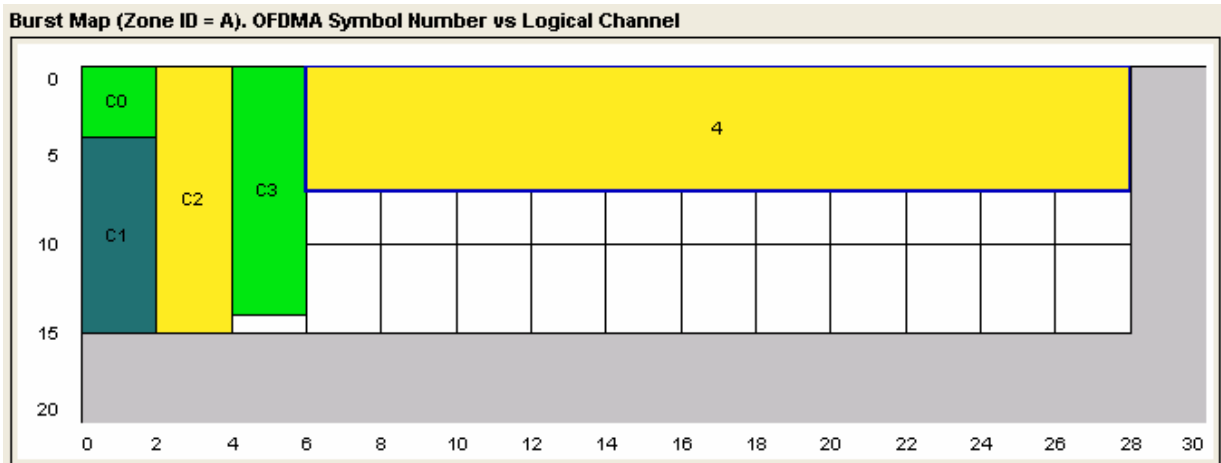
Fig. 54   Burst Map

The Burst map is displayed at the bottom of the Frame Config dialog when the burst list has focus. The Burst map displays a graphical view of the Burst list. The currently selected burst in the Zone/Segment list is highlighted in the Burst map. The background color of each burst in the diagram corresponds to the modulation format of the burst. Any burst that is incorrectly configured will be displayed with a red background. In example if the burst definition exceeds the available time x subchannel area [indicated white in the graphic above].
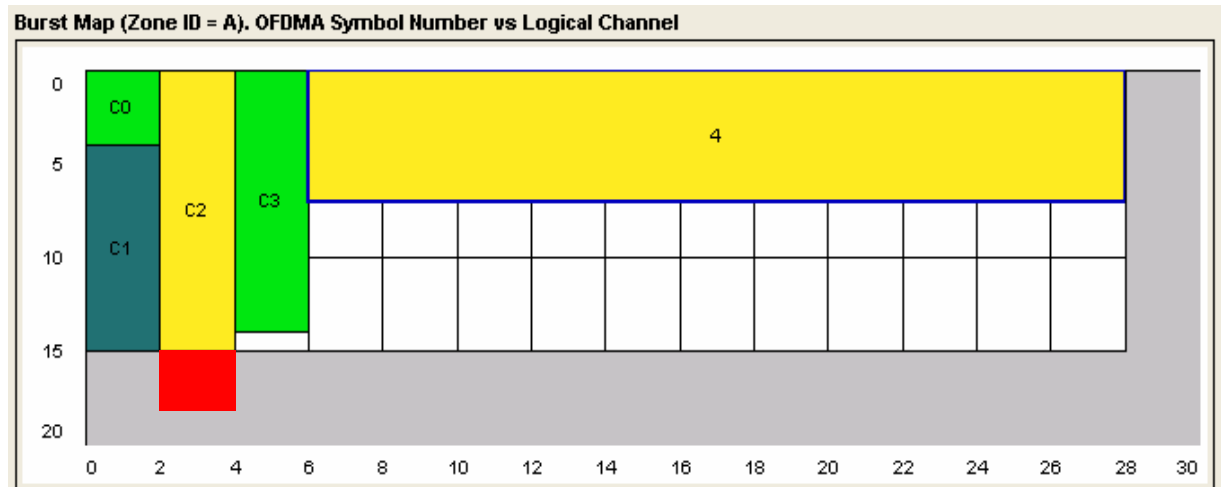
Fig. 55   Burst Map with Burst C2 exceeding the available amount of logical subchannels. The area causing the problem is highlighted red.

In this case the measurement won't start unless the frame definition is correct. In the example above this might be achived by.
a. reducing the number of subchannels for burst C2 in the Burst List or
b. assigning more subchannels to the zone/segment to which burst C2 belongs or
c. increase N_{FFT}.

The burst editing changes slightly when a burst is specified as DL_MAP. Instead of specifying the number of subchannels and symbols for the burst, the number of slots is specified.

Burst List (Zone/Segment ID = A)

ID	Modulation	No.of Subch	No.of Symb	Offset Subch	Offset Symb	Power [dB]	Burst Type
C0	64QAM2/3		14 Slots	2	0	0	DL_MAP
1	16QAM1/2	4	4	6	2	0	DATA
2	QPSK1/2	6	2	0	4	0	DATA
3	QPSK1/2	2	2	0	0	0	DATA

Burst Map (Zone ID = A). OFDMA Symbol Number vs Logical Channel
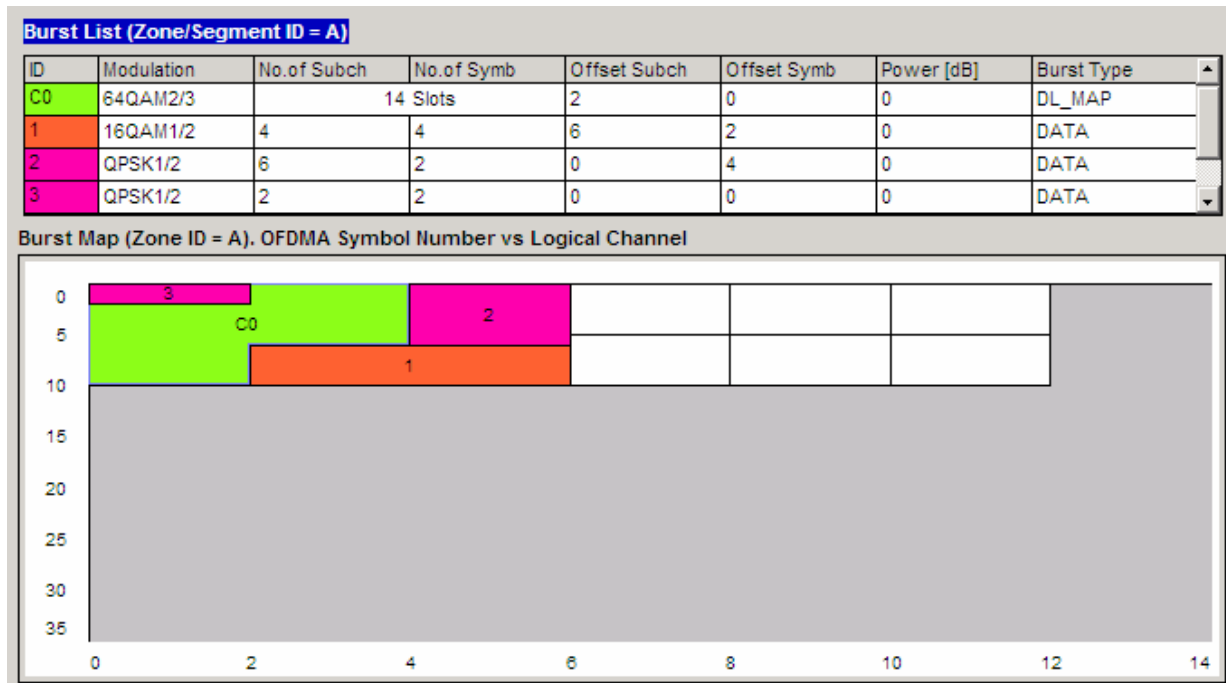
Fig. 56   Zone containing a wrapping DL_MAP burst (C0). Note the shape of the burst, which fills the available symbols in the first column (of two symbols), and then uses the second column.

Frame Config Softkeys

Zone Softkeys	Burst Softkeys	Description
LIST ZONE BURST	LIST ZONE BURST	Toggles between the Zone and Burst lists. The green highlight indicates which list is currently selected.
COPY ZONE	COPY BURST	Copies the currently selected Zone/Burst into the copy buffer.
INSERT ZONE	INSERT BURST	Inserts a Zone/Burst which has been copied into the copy buffer after the currently selected Zone/Burst. This softkey is disabled until a Zone/Burst has been copied.
NEW ZONE	NEW BURST	Creates a new Zone/Burst after the currently selected Zone/Burst.
NEW SEGMENT	NEW SEGMENT	If a DL_PUSC burst is selected then a new segment will be created for this Zone. The segment ID will be the next available ID after the last DL_PUSC segment in the Zone. If there are no free IDs available for the Zone a new DL_PUSC Zone is created and the segment ID is set to 0. If the selected Zone is not a DL_PUSC then a new Zone is created. Disabled when the Burst list is selected.
DELETE ZONE	DELETE BURST	Deletes the currently selected Zone/Burst. If a Zone is deleted then all of the Zones bursts are also deleted.
FILE MANAGER ⇩	FILE MANAGER ⇩	Navigates to the File Manager dialog. This dialog allows *.WiMax file to be loaded. These files are generated using the SMU.

File Manager

This section of the user manual describes the File Managerview, which provides the possibility to load WIMAX settings files saved from a R&S SMU signal generator, as well as providing some general file management support.

The File Manager is enabled for all standards, however .WIMAX files can only be loaded when in the IEEE 802.16e-2005 OFDMA or the WiBro standard.

Note: *The File Manager will write only*
               a. to the directory D:\USER\WMAN and its subdirectories or
               b. to a USB memory stick.

The *FILE MANAGER* softkey brings up the File Manager view.
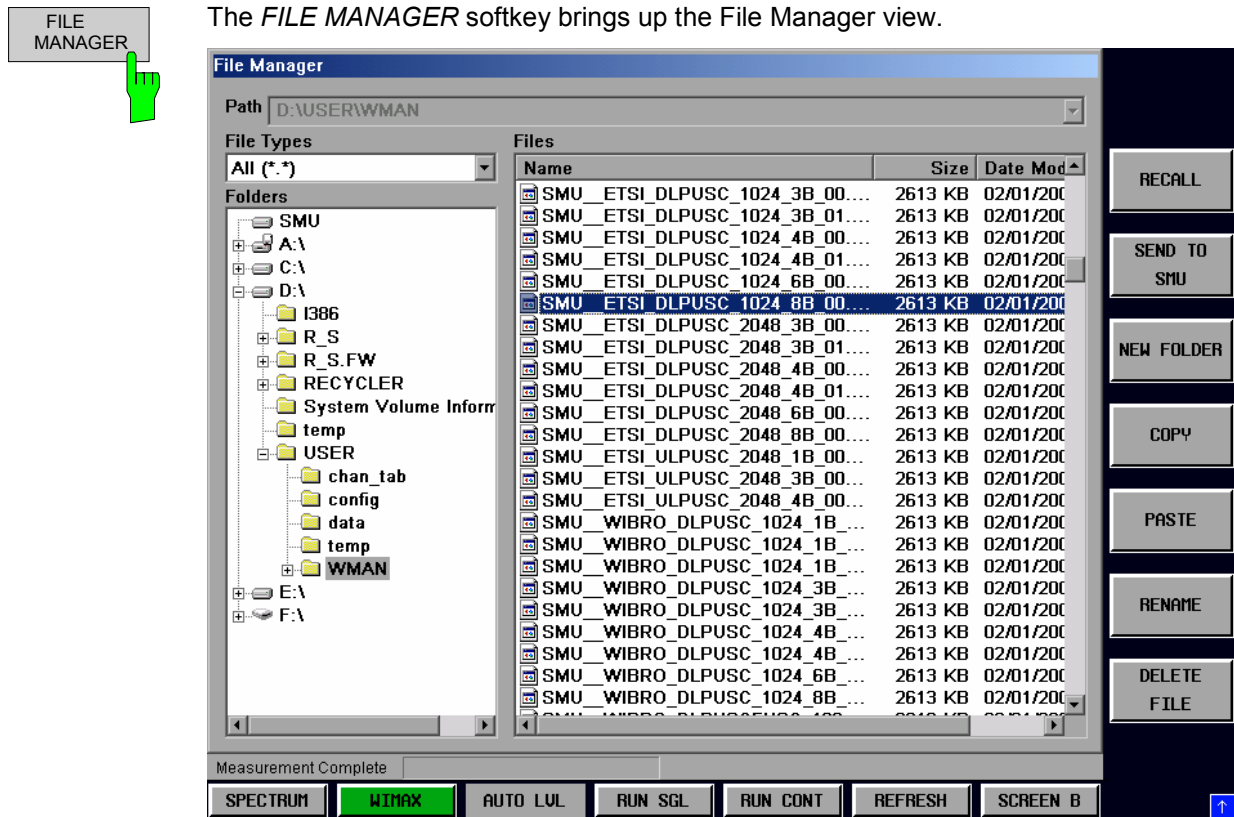
Fig. 57   File Manager view

The roll-key is used to navigate between the different sections of the file manager dialog. Pressing the roll key (or pressing the ENTER key) enters the selected section. To return back to navigating through the different sections of the File Manager dialog press the ESC key.

File Type

The *File Type* parameter applies filtering to the files view. The following selections are available:

- All (*.*)   – This selection allows all file types to be displayed. Use this selection when performing general file management tasks.

- SMU WiMax – This selection allows only files with the extension .wimax to be displayed. Use this selection when using the file manager to locate and load SMU signal files.

Loading settings from a file on the local instrument
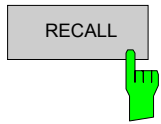
RECALL

Select a .WIMAX file and clicking the RECALL softkey. WiMax files can only be loaded in OFDMA or WiBro modes.

IEC/IEEE-bus command: `MMEM:LOAD:FRAM:STAT 1,'D:\USER\DATA.WiMax'"`

Transfer settings between R&S FSQ and R&S SMU

If an R&S SMU signal generator is connected via LAN then settings can be transferred between the R&S SMU and R&S FSQ. In order for settings to be transferred the R&S SMU and R&S FSQ must be networked and the TCP-IP address of the SMU must be specified in the General Settings – Advanced Settings panel. See description *SMU Address* above.

In order to access the SMU via LAN the SMU Windows Firewall has to be switched Off. See figure below.
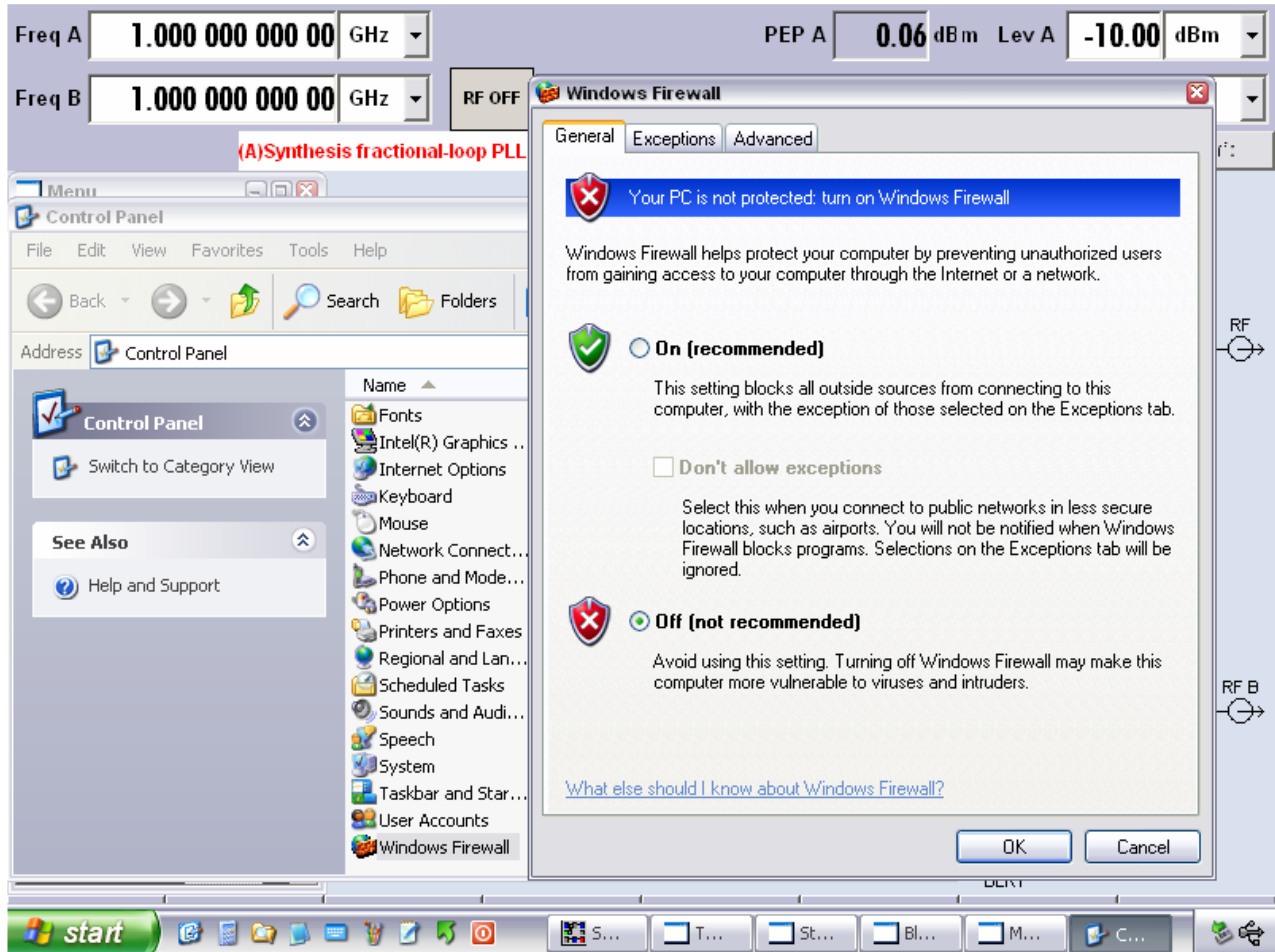
Fig. 58   SMU Windows Firewall setting, in order to access the SMU via LAN from the R&S FSQ.

Download from R&S FSQ to R&S SMU
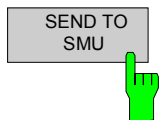
SEND TO
SMU

An SMU WIMAX settings file (.WIMAX) file can be downloaded from the FSQ to the SMU using the filemanager. Download is achieved by selecting the file to be downloaded then pressing the SEND TO SMU soft-key.

IEC/IEEE-bus command: `MMEM:STORE:FRAM:STAT 1,'D:\USER\DATA.WiMax'"`

Upload from R&S SMU to R&S FSQ
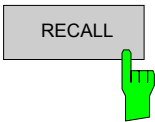
RECALL

The WIMAX settings active on the SMU can be uploaded to the FSQ using the filemanager. Upload is achieved by selecting the SMU entry in the *Folders* list then selecting *Current SMU WiMax Settings* in the *Files* list and the pressing the *RECALL* soft-key.
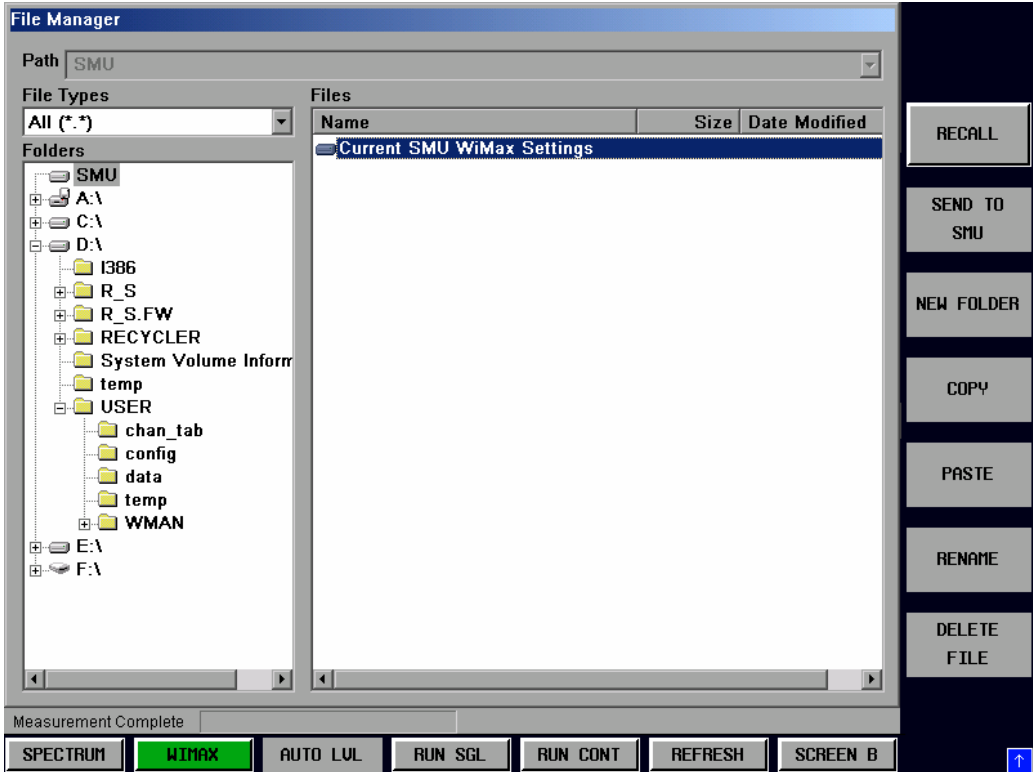
Fig. 59   File Manager view

IEC/IEEE-bus command: `MMEM:LOAD:FRAM:STAT 1,'SMU'"`

Gate Settings

This section of the user manual describes the Gate Settings. The gate settings allow the range of captured data used in results calculation to be specified.
When gating is switched on vertical lines are displayed in the Magnitude Capture trace. The two lines mark the area of data to be used in the calculation of results.
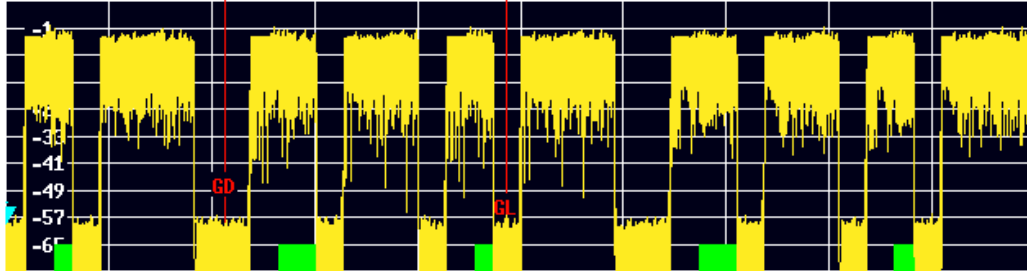
Fig. 60   Gate lines displayed in Magnitude Capture Buffer

The gate settings can be used to specify the region of input data to analyze for the following measurements:

- Spectrum FFT

- CCDF

- Spectrum Mask

- Spectrum ACP

The softkeys to access the gate settings are located from each of the measurement softkey menus. Press the NEXT hard-key to access the gate setting menu.
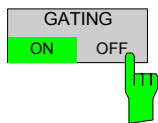
The *GATING* softkey allows gating to be switched on or off.

Fig. 61   Gate Settings menu view

When gating is switched off all the captured data is used in results calculation.

IEC/IEEE-bus command: SENS:SWE:EGAT ON|OFF
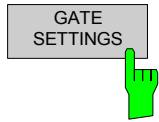
GATE
SETTINGS

The *GATE SETTINGS* softkey displays the Gate Settings pop-up dialog.

Fig. 62   Gate Settings Pop-up Dialog

Gate Settings

The gate settings specify the characteristics of the gate to be applied to the measurement. Note that when the gate settings dialog is displayed when a frequency sweep measurement is active (Spectrum Mask and Spectrum ACP) the measurement view automatically swaps to the Magnitude Capture buffer display in order to allow the gate to be set the correct part of the sweep.

Delay

Delay specifies the start point of captured data to be used in results calculation, i.e. the delay from the start of the captured data.

Delay can be specified in the following ways:

• Time
• Samples

When the delay is specified in one unit, the other unit field is updated accordingly.

When a value is supplied for the gate delay (in any unit) the gate delay line in the Magnitude Capture Buffer (marker with GD) is displayed in the new position.

IEC/IEEE-bus command:
```
SENS:SWE:EGAT:HOLD:TIME 129us
SENS:SWE:EGAT:HOLD:SAMP 2579
```

Length

Length specifies the amount of captured data to be used in results calculation.

Length can be specified in the following ways:

- Time
- Sample

When the length is specified in one unit, the other unit field is updated accordingly.

When a value is supplied for the gate length (in any unit) the gate length line in the Magnitude Capture Buffer (marker with GL) is displayed in the new position.

IEC/IEEE-bus command:
```
SENS:SWE:EGAT:LENG:TIME 196us
SENS:SWE:EGAT:LENG:SAMP 3920
```

Link Gate and Marker

Link Gate and Marker allows the position of the marker and the gate lines to be linked.

When *Link Gate and Marker* is switched ON the marker is positioned half way between the gate start and the gate end. The marker position alters when the gate is modified, and the gate lines move with the marker when the marker position is altered.

IEC/IEEE-bus command: `SENS:SWE:EGAT:LINK ON|OFF`

Import/Export of IQ Data

This section of the user manual describes the IQ Data Import/Export function, which allows the captured IQ data to be saved and recalled to and from an external file.

The softkeys for accessing the import/export IQ data settings are located in each of the measurement softkey menus. Press the NEXT hardkey to access the import/export softkeys.
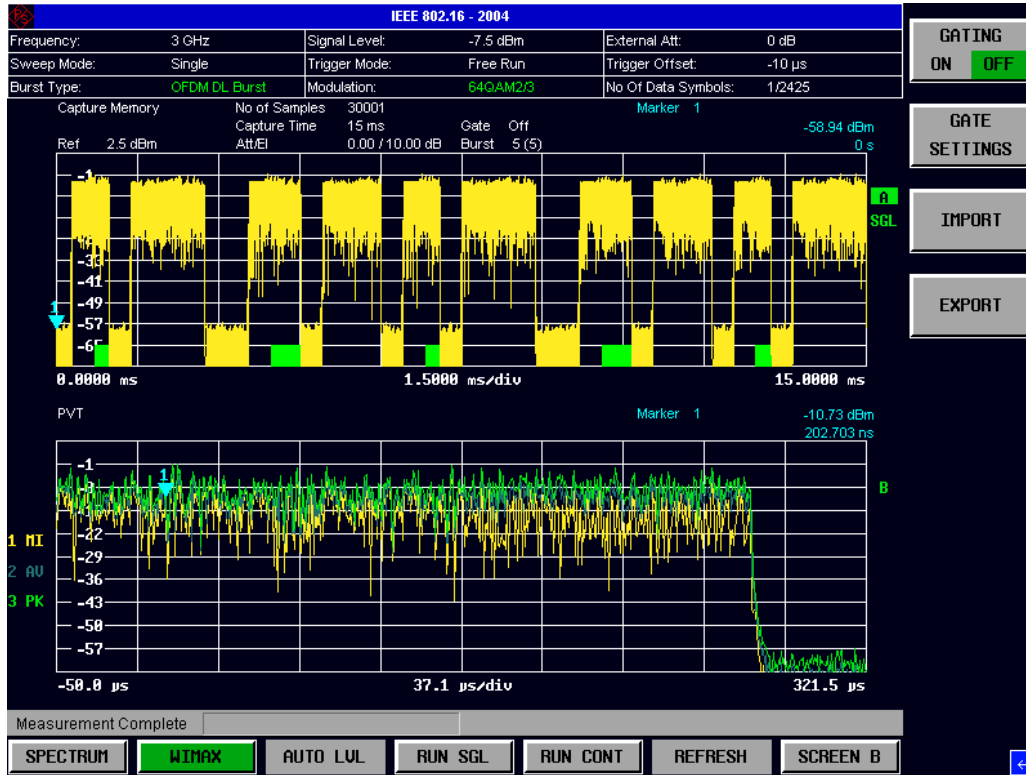
Fig. 63   Gate Settings pop-up dialog
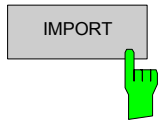
IMPORT

The *IMPORT* softkey displays the Import pop-up dialog.
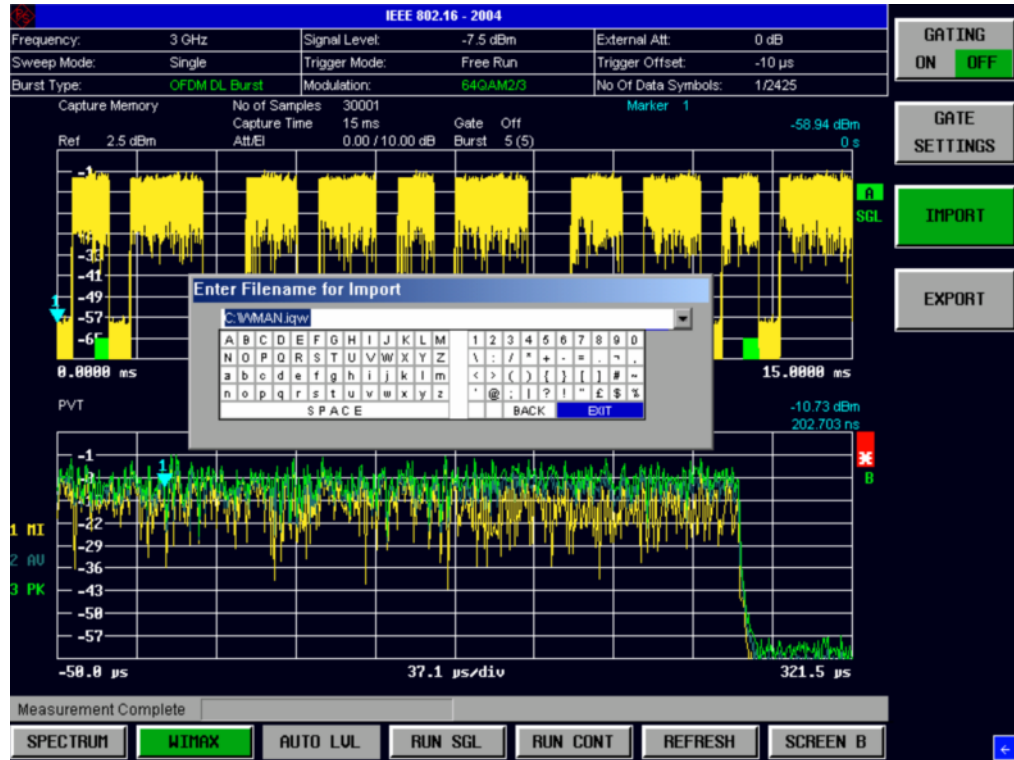
Fig. 64   Import pop-up dialog

The import pop-up dialog allows the full name and path of the IQ data file to be imported to be specified. Pressing ENTER causes the specified IQ data file to be loaded and the results displayed.

If the specified file cannot be found or is not a valid IQ data file, an error messge will be displayed indicating that the IQ data could not be imported.

IEC/IEEE-bus command: MMEM:LOAD:IQ:STAT 1,'D:\USER\DATA.iqw'
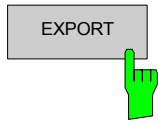
EXPORT

The EXPORT softkey displays the Export pop-up dialog.
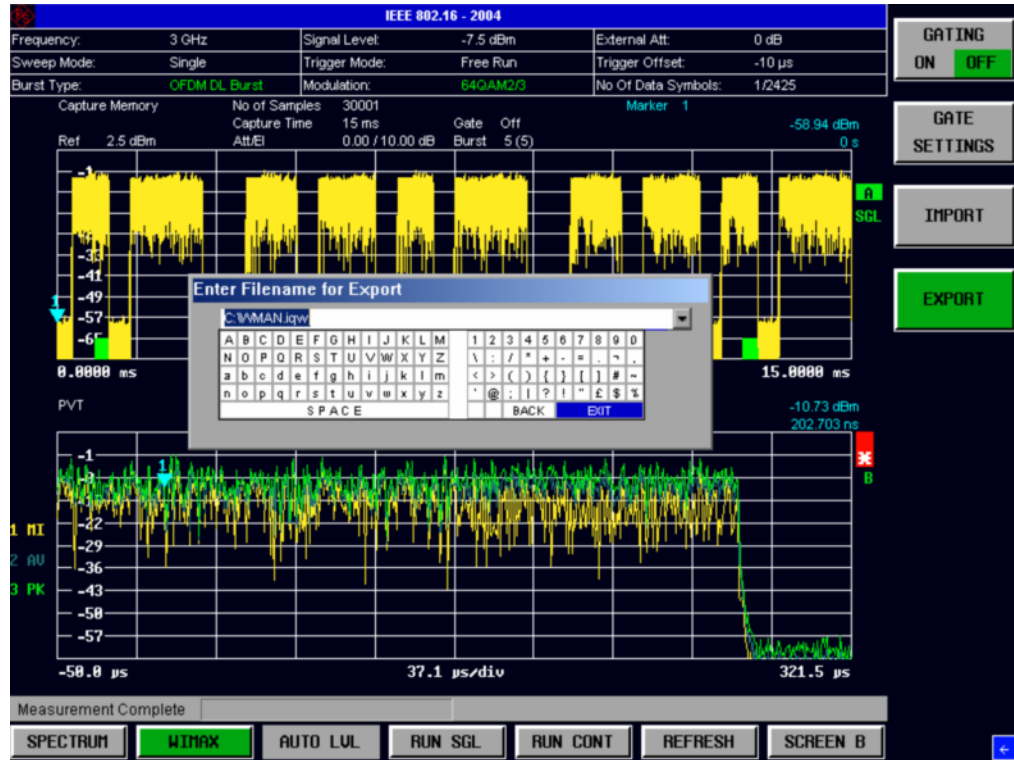
Fig. 65   Export pop-up dialog

The export pop-up dialog allows the full name and path of the IQ data file to be exported to be specified. Pressing ENTER causes the IQ data to be written to the specified file.

If the specified file cannot be created or if there is no valid IQ data to export (i.e. IQ measurement has not been executed), an error messge will be displayed indicating that the IQ data could not be exported.

IEC/IEEE-bus command: `MMEM:STOR:IQ:STAT 1,'D:\USER\DATA.iqw'`

Markers

This section of the user manual describes the Marker facility of the option.

MKR
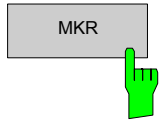
The *MKR* hardkey brings up the marker softkey menu. Any settings views on display when the marker softkey menu is displayed shall be closed.

Fig. 66   Marker Menu

From the marker menu it is possible to adjust the marker position, use the marker to zoom in & out and switch the marker display off.

Adjusting Markers

The marker can be adjusted by pressing the marker softkey in the marker softkey menu
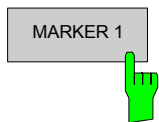
MARKER 1

The *MARKER 1* softkey displays the Marker pop-up dialog. The contents of the marker pop-up depend on the type of graph to which the marker being adjusted belongs.

As soon as a field in the marker pop-up dialog is adjusted then the marker position in the trace will update, along with the results displayed for the marker.

IEC/IEEE-bus command: CALC<1|2>:MARK<1>:X

Marker Zoom

A zoom facility is available for markers belonging to the following result traces:

- Magnitude Capture
- PVT
- Constellation vs Symbol
- Constellation vs Carrier

MARKER ZOOM	The *MARKER ZOOM* softkey displays the Marker Zoom pop-up dialog which contains the magnification factor for the zoom.

The maximum magnification depends on the type of results trace.

IEC/IEEE-bus command: ---

UNZOOM	The *UNZOOM* softkey cancels the marker zoom.

IEC/IEEE-bus command: ---

Toggle Marker Display

Markers can be toggled by pressing the Marker softkey as follows:

MARKER 1

Pressing the *MARKER* softkey when the marker is not displayed (softkey has grey background) causes the Marker pop-up to be displayed and the marker to be switched on.

IEC/IEEE-bus command: `CALC1:MARK:STAT ON`

Note: *Does not display popup.*

MARKER 1

Pressing the *MARKER* softkey when the Marker pop-up is displayed (softkey has red background) causes the marker to be switched off.

IEC/IEEE-bus command: `CALC1:MARK:STAT OFF`

Note: *Does not display popup.*

MARKER 1

Pressing the *MARKER* softkey when the Marker is displayed but the Marker pop-up is not displayed (softkey has green background) causes the Marker pop-up to be displayed.

IEC/IEEE-bus command: `CALC1:MARK:STAT ON`

Note: *Does not display popup.*

All markers in the active screen can be switched off by pressing the *MARKER OFF* softkey.

Assigning Markers to Traces

In result graphs which have more than one trace (e.g. PVT) the marker can be assigned to any of the displayed traces.

MKR->
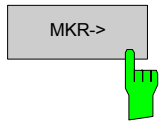
Pressing the *MKR->* hardkey displays the Marker Extension softkey menu.
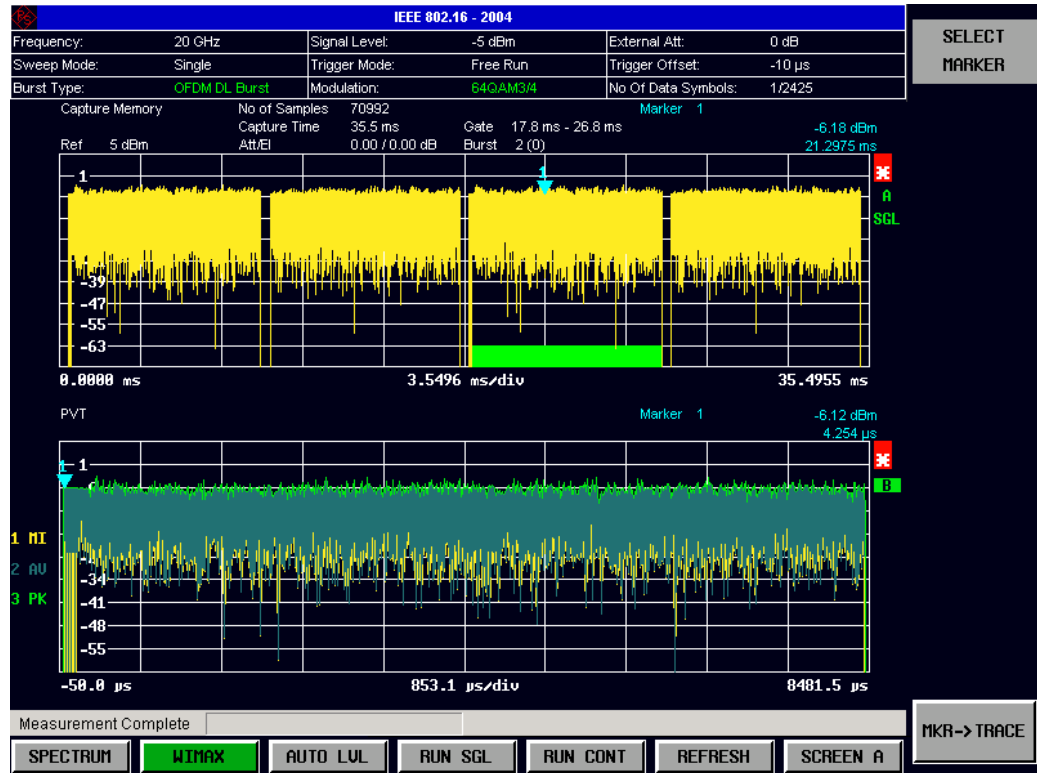
Fig. 67　　　　Marker Extension Softkey Menu
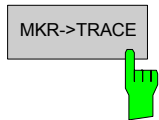
MKR->TRACE

Pressing the *MKR->TRACE* displays the Select Trace pop-up dialog. This allows the ID of the trace to which the marker is to be attached to be supplied.

IEC/IEEE-bus command:　`CALC2:MARK:TRAC 2`

Display Settings

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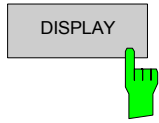
DISPLAY

The *DISPLAY* hardkey brings up the display softkey menu. Any settings views on display when the display softkey menu is displayed shall be closed.

Fig. 68   Display Menu

The display menu allows the display to be changed between split and full screen display for IQ measurement results. Note that for frequency sweep measurement results (Spectrum Mask and Spectrum ACPR) the display is always full screen.

The active screen can be selected by pressing the *SCREEN A/SCREEN B* hotkey. A screen needs to be made active in order to control the markers it displays.

In full screen mode the *SCREEN A/SCREEN B* hotkey also toggles which screen is displayed.

IEC/IEEE-bus command: `DISP:FORM SING|SPL`

3 Measurements in Detail

This section provides a more detailed explanation of the measurements provided by R&S FSQ-K92/K93 and provides help for using R&S FSQ-K92/K93 to measure the characteristics of specific types of DUT.

Signal Processing of the IEEE802.16-2004 OFDM Measurement Application

Abbreviations

$N_{FFT} = 256$	FFT length.
$a_{l,k}$	symbol from the alphabet at symbol-index l of subcarrier k
EVM_k	error vector magnitude of subcarrier k
EVM	error vector magnitude of current packet
g	signal gain
Δf	frequency deviation between Tx and Rx
l	symbol index $l = [1, nof\_Symbols]$
$nof\_symbols$	number of symbols of payload
H_k	channel transfer function of subcarrier k
k	channel index $k = [-128, 127]$
K_{mod}	modulation dependent normalization factor
ξ	relative clock error of reference oscillator
$r_{l,k}$	received symbol at symbol-index l of subcarrier k.

Pilots = {-88, -63, -38, -13, 13, 38, 63, 88}

This description gives a rough view of the IEEE802.16-2004 OFDM measurement application signal processing. Details are disregarded in order to get a concept overview.

A diagram of the interesting blocks is shown in Fig. 69. First the RF signal is downconverted 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 downconverter shifts the IF signal to the complex base band. In the next step the base band signal is filtered by a 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 downsampling. After filtering, the sequence is sampled down by the factor of 4. Thus the sampling rate of the downsampled sequence $r(i)$ is the Nyquist rate of $f_{s3} = 20$ MHz. Up to this point the digital part is implemented in an ASIC.
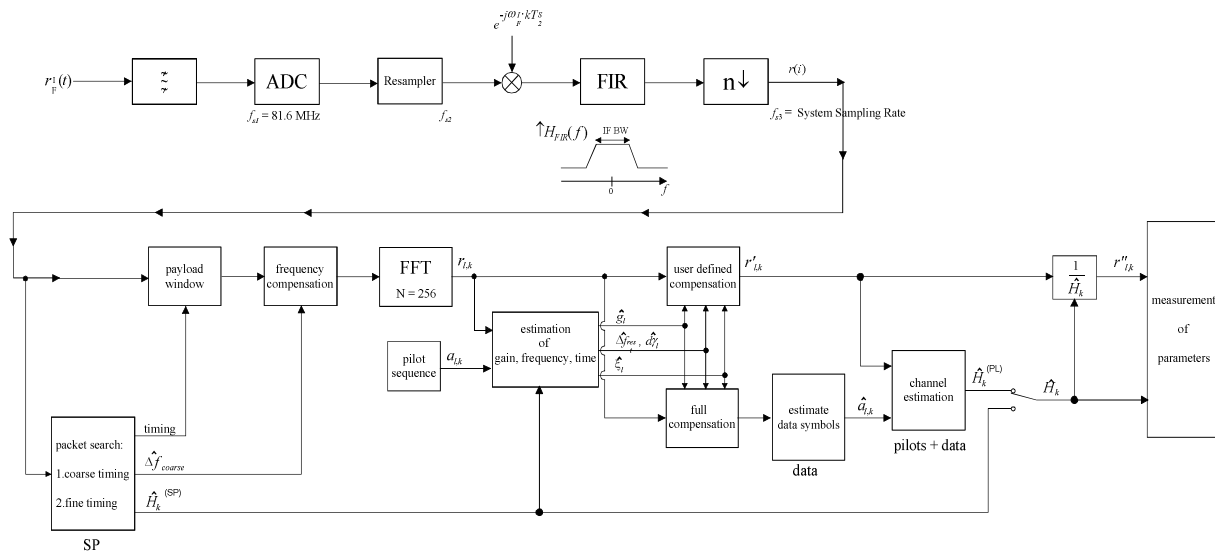
Fig. 69   Signal processing of the IEEE802.16 OFDM measurement application

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]-[3]. Furthermore a coarse estimate $\hat{\Delta f}_{coarse}$ [4] of the Rx-Tx frequency offset Δf is derived from the metric in [6]. This can easily be understood because the phase of $r(i) \cdot r^*(i+N)$ is determined by the mod 2π frequency offset. As the frequency deviation Δf can exceed several bins (distance between neighbour sub-carriers) the SP is further used to solve this n2π [offset over several bins] ambiguities.

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 $\hat{H}_k^{(SP)}$, with $k = [-100, 100]$ 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 every trial time. Afterwards the trail 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 $\hat{\Delta f}_{coarse}$. This is necessary because otherwise inter channel interference (ICI) would occur in the frequency domain.

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[4] In this paper the hat generally describes an estimate. Example: $\hat{x}$ is the estimate of x.

The transition to the frequency domain is achieved by an <u>FFT</u> of length 256. The FFT is performed symbol-wise for every of the *nof_symbols* symbols of the payload. The calculated FFTs are described by $r_{l,k}$ with

- the symbol index $l = [\,1\,,nof\_symbols\,]$ and

- the channel index $k = [\,-128\,,127\,]$.

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

$$r_{l,k} \; = \; K_{\text{mod}} \cdot a_{l,k} \cdot g_l \cdot H_k \cdot e^{j\left(phase_l^{(\text{commom})} + phase_{l,k}^{(\text{timing})}\right)} \quad + \quad n_{l,k} \tag{1}$$

with

- the modulation-dependent normalization factor K_{mod},

- the alphabet symbol $a_{l,k}$ at symbol-index l of sub-carrier k,

- the gain g_l at the symbol l in relation to the reference gain $g = 1$ at the Short Preamble (SP),

- the channel frequency response H_k at the Short Preamble (SP),

- the common phase drift $phase_l^{(\text{common})}$ of all sub-carriers at symbol l (see below),

- the phase $phase_{l,k}^{(\text{timing})}$ of sub-carrier k at symbol l caused by the timing drift (see below),

- the independent Gaussian distributed noise samples $n_{l,k}$.

The common phase drift in equation (1) is given by

$$phase_l^{(\text{common})} \; = \; 2\pi \cdot N_s / N \cdot \Delta f_{rest}\, T \cdot l \; + \; d\gamma_l \tag{2}$$

with

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

- $N = N_b = 256$ being the number of Nyquist samples of the useful part of the symbol,

- Δf_{rest} being the (not yet compensated) frequency deviation,

- $d\gamma_l$ being the phase jitter at the symbol l.

In general, the coarse frequency estimate $\Delta\hat{f}_{coarse}$ (see Fig. 69) is not error-free. Therefore the remaining frequency error Δf_{rest} represents the not yet compensated frequency deviation in $r_{l,k}$. Consequently the overall frequency deviation of the device under test (DUT) is calculated by $\Delta f \; = \; \Delta\hat{f}_{coarse} + \Delta f_{rest}$. Remark: The only motivation for dividing the common phase drift in equation (2) into two parts is to be able to calculate the overall frequency deviation of the DUT.

The reason for the phase jitter $d\gamma_l$ in equation (2) 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. Please note that besides the nonlinear part the phase jitter $d\gamma_l$ also contains a constant part. This constant part is caused by the not yet compensated frequency deviation Δf_{rest}. To understand this, please 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 H_k in equation (1) represents the channel at the Short Preamble of the preamble. Consequently the not yet compensated frequency deviation Δf_{rest} 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 $d\gamma_l$.

Referring to the IEEE802.16-2004 measurement standard *Chapter 8.3.10.1.2 "Transmitter constellation error and test method"* [6], the common phase drift $phase_l^{(\text{common})}$ must be estimated and compensated from the pilots. Therefore this "symbol wise phase tracking" (Tracking Phase) is activated as the default setting of the R&S FSQ-K92/K93.

Furthermore the timing drift in equation (1) is given by

$$phase_{l,k}^{(\text{timing})} = 2\pi \cdot N_s / N \cdot \xi \cdot k \cdot l \qquad (3)$$

with ξ being the relative clock deviation of the reference oscillator. Normally a symbol-wise timing jitter is negligible and thus not modelled in equation (3). 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 $\xi_{\max} = \pm 8$ ppm. Furthermore the maximal length of a frame $nof\_symbols = 2420$ symbols[5] is assumed. From equations (1) and (3), it results that the phase drift of the highest sub-carrier $k = 100$ in the last symbol $l = nof\_symbols$ is todo 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 IEEE802.16-2004 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 FSQ-K92/K93.

The time tracking option should rather be seen as a powerful analysing option.

In addition the tracking of the gain g_l in equation (1) 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 $\hat{H}_k^{(SP)}$ is calculated. This makes sense since the sequence $r'_{l,k}$ is compensated by the coarse channel transfer function $\hat{H}_k^{(SP)}$ 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 IEEE802.16-2004 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 FSQ-K92/K93.

The unknown deviations of gain, frequency and time are calculated by an optimum 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 for the decision of 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 choosen 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 IEEE802.16-2004 measurement standard [6], the coarse channel estimation $\hat{H}_k^{(SP)}$ (from the Short Preamble) has to be used for equalization. Therefore the default setting of the R&S FSQ-K92/K93 is equalization from the coarse channel estimate derived from the Short Preamble.

In the last block the <u>measurement variables</u> are calculated. The most important variable is the error vector magnitude

$$EVM_k = \sqrt{\tfrac{1}{nof\_Symbols} \cdot \sum_{l=1}^{nof\_Symbols} \left| r''_{l,k} - K_{\text{mod}} \cdot a_{l,k} \right|^2} \qquad (4)$$

of the sub-carrier k of the current packet. Furthermore the packet error vector magnitude

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[5] Assuming the maximal System Sampling Rate Fs = 32MHz.

$$EVM = \sqrt{\frac{1}{200} \cdot \sum_{\substack{k=-100 \\ (k \neq 0)}}^{100} EVM_k^2} \qquad (5)$$

is derived by averaging the squared EVM_k versus k. Finally the average error vector magnitude

$$\overline{EVM} = \sqrt{\frac{1}{nof\_packets} \sum_{counter=1}^{nof\_packets} EVM^2(counter)} \qquad (6)$$

is calculated by averaging the packet EVM of all $nof\_packets$ detected packets. This parameter is equivalent to the so-called "RMS average of all errors $Error_{RMS}$" of the IEEE802.16-2004 measurement commandment (see [6], *Chapter 8.3.10.1.2*).

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 if 'CH Est in Preamb & Payload' is not selected in 'Demod' settings.

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 channel estimation	Combined with the preamble channel estimation and used for equalization if 'CH Est in Preamb & Payload' is selected in 'Demod' settings.

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	

Subchannelization

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

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. Preanalysis 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.

Results influenced by Subchannelization

Channel Results

The standard requires an interpolation of order 0 for the channel estimation on unallocated subcarriers, i.e the estimated channel coefficient of the nearest allocated subcarrier shall be used for those subcarriers 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. 70   Spectrum flatness using subchannel index 4

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 don't 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.

EVM

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

$$\text{EVM(l,k)} = \sqrt{\frac{\left|r(l,k) - a(l,k)\right|^2}{\frac{1}{N_{\text{used}}} \sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2} \left|a(l,k)\right|^2}} \qquad . \tag{7}$$

where $r(l,k)$ is the received constellation point and $a(l,k)$ is the transmitted constellation point at the l th symbol and carrier number k .

In case of subchannelization, it is required by the standard to include the unallocated carriers k_{unalloc} by assuming $a(l,k_{\text{unalloc}}) = 0$ in the denominator of the EVM calculation.
Thus the 'EVM All Carriers' result for one burst in the result summary equals

$$\text{EVM\_All\_Carr} = \sqrt{\frac{\frac{1}{L}\sum_{l=1}^{L}\frac{1}{N_{\text{used}}}\sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2}\left|r(l,k) - a(l,k)\right|^2}{\frac{1}{L}\sum_{l=1}^{L}\frac{1}{N_{\text{used}}}\sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2}\left|a(l,k)\right|^2}} \qquad , \tag{8}$$

where L is the number of symbols in the burst.

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

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.

IQ Impairments

IQ imbalance in an OFDM transmitter or receiver leads to an interference of the symbols $a_{l,-k}$ with the symbols $a_{l,k}$. In case of subchannelization, the used subcarriers are always situated in such a way, that $a_{l,-k} = 0$, if $a_{l,k} \neq 0$. 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. 71   IQ imbalance influence on the unallocated carriers using subchannel index 4

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

RSSI Measurements

See [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:
   Statistic {min, mean, max} of the R[k]=RSSI[k].
   The mean value is $\hat{\mu}_{RSSI\ dBm}$[k] according to [6] formula (89).

2. RSSI Standard Deviation row:
   $\hat{\sigma}_{RSSI\ dB}$ according to [6] formula (91).

CINR Measurements

See [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 [6] (92).

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

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:
   Statistic {min, mean, max} of the CINR[k].
   The mean value is $\hat{\mu}_{CINR\ dB}$ [k] according to [6] formula (94).

2. CINR Standard Deviation row
   $\hat{\sigma}_{CINR\ dB}$ according to [6] formula (96).

Literature

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[6] IEEE802.16-2004, Part 16: Air Interface for Fixed Broadband Wireless Access Systems; 1 October 2004; Medium Access Control (MAC) and Physical Layer (PHY) specifications

Signal Processing of the IEEE802.16-2005 OFDMA & WiBro Measurement Application

Symbols and Abbreviations

$a_{l,k}, \hat{a}_{l,k}$	data symbol (actual, decided)
Δf_{res}	residual carrier frequency offset
$\Delta f, \Delta \hat{f}_{coarse}$	carrier frequency offset between transmitter and receiver (actual, coarse estimate)
ζ	relative sampling frequency offset
g_l	gain
$H_{l,k}, \hat{H}_{l,k}$	channel transfer function (actual, estimate)
i	time index
$\hat{i}_{coarse}, \hat{i}_{fine}$	timing estimate (coarse, fine)
$k, k_p, k_d, k_{ch\,n}$	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
Φ_l	common phase error
$\Delta Q, \Delta \hat{Q}$	I/Q-imbalance (actual, estimate)
$r(i)$	received sample in the time domain
$r_{l,k}, r'_{l,k}, r''_{l,k}, r'''_{l,k}$	received sample (uncompensated, fully compensated, partially compensated, equalized) in the frequency domain
T	useful symbol time
T_g	guard time
T_s	symbol time

AWGN	**A**dditive **W**hite **G**aussian **N**oise
BER	**B**it **E**rror **R**ate
CFO	**C**arrier **F**requency **O**ffset
CINR	**C**arrier to **I**nterference and **N**oise **R**atio
CIR	**C**hannel **I**mpuls **R**esponse
CP	**C**yclic **P**refix (Guard Interval)
CPE	**C**ommon **P**hase **E**rror
CTF	**C**hannel **T**ransfer **F**unction
DL	**D**own**l**ink
EVM	**E**rror **V**ector **M**agnitude
FFT	**F**ast **F**ourier **T**ransform
R&S FSQ	Rohde & Schwarz Signal Analyzer
IF	**I**ntermediate **F**requency
ISI	**I**nter**s**ymbol **I**nterference
OFDM	**O**rthogonal **F**requency **D**ivision **M**ultiplexing
OFDMA	**O**rthogonal **F**requency **D**ivision **M**ultiple **A**ccess
PAPR	**P**eak to **A**verage **P**ower **R**atio
RSSI	**R**eceived **S**ignal **S**trength **I**ndicator
SFO	**S**ampling **F**requency **O**ffset
UL	**U**p**l**ink

Introduction

The following description provides a brief overview of the digital signal processing used in the R&S FSQ's 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:

- Data capturing
- Synchronization
- Channel estimation / equalization ⎫ OFDMA measurement application
- Analysis   ⎭

The remainder of this description is structured accordingly.

Data Capturing

The block diagram in Fig. 72 shows the R&S FSQ hardware from the IF section to the processor running the OFDMA measurement application. The selectable IF filter bandwidth ranges from 300 kHz to 50 MHz. The A/D converter samples the IF signal at a rate of 81.6 MHz. The digital signal is converted down to the complex baseband, is lowpass filtered, and is resampled to the nearest multiple of the target sampling rate. The decimation filters suppress the IF image frequencies as well as the aliasing frequencies arising from the subsequent downsampling to the target rate. Up to 16 M samples of the now available I/Q-data can be stored in the so-called capture buffer.
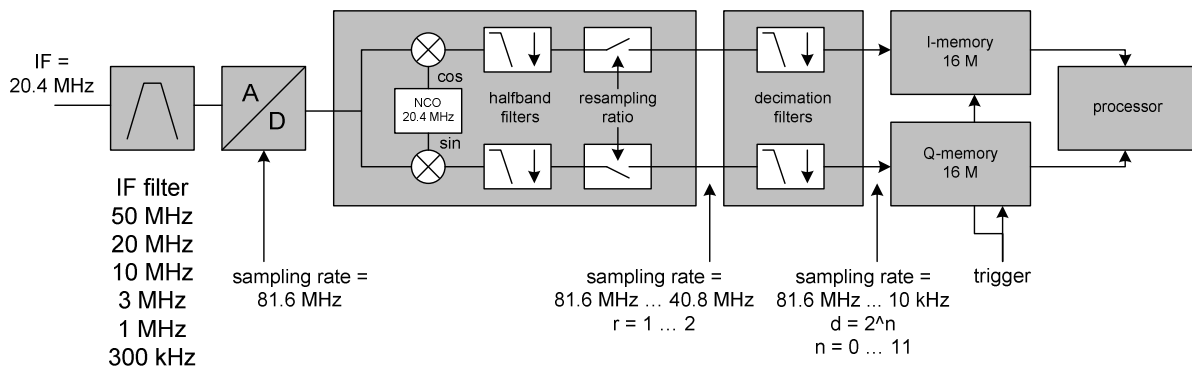
Fig. 72   Data capturing mechanism of the R&S FSQ.

The maximum allowable bandwidth of the measurement signal depends on the target sampling rate according to Table 1.

Table 1   Maximum bandwidth depending on the target sampling rate.

Sampling Rate	max. Bandwidth
10 kHz – 20.4 MHz	0.8 x sampling rate
20.4 MHz – 40.8 MHz	0.68 x sampling rate
40.8 MHz – 81.6 MHz	30 MHz

OFDMA Measurement Application

The block diagram in Fig. 73 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 $\hat{a}_{l,k}$ of the transmitted data symbols $a_{l,k}$. Depending on the user defined compensation, the received samples $r'''_{l,k}$ of the measurement path (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.

Synchronization

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 Fig. 73 have to be carried out twice. In the first iteration the timing estimate $\hat{i}_{\text{coarse}}$ is used to position the window of the FFT. Having found the pilot-based estimate of the CIR, the fine timing estimate $\hat{i}_{\text{fine}}$ is used in the second iteration.

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

- the relative sampling frequency offset ζ,

- the residual carrier frequency offset Δf_{res},

- the common phase error Φ_l,

- and the gain g_l.

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

$$r_{l,k} = g_l \cdot a_{l,k} \cdot H_{l,k} \cdot \underbrace{\text{e}^{\text{j}\Phi_l}}_{\text{CPE}} \cdot \underbrace{\text{e}^{\text{j}2\pi \cdot N_{\text{s}}/N_{\text{FFT}} \cdot \zeta \cdot k \cdot l}}_{\text{SFO}} \cdot \underbrace{\text{e}^{\text{j}2\pi \cdot N_{\text{s}}/N_{\text{FFT}} \cdot \Delta f_{\text{res}} \cdot T \cdot l}}_{\text{res. CFO}} + n_{l,k} \tag{9}$$

with

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

- the channel transfer function $H_{l,k}$,

- the number of Nyquist samples N_{s} within the symbol time T_{s},

- the useful symbol time $T = T_{\text{s}} - T_{\text{g}}$,

- as well as the 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.
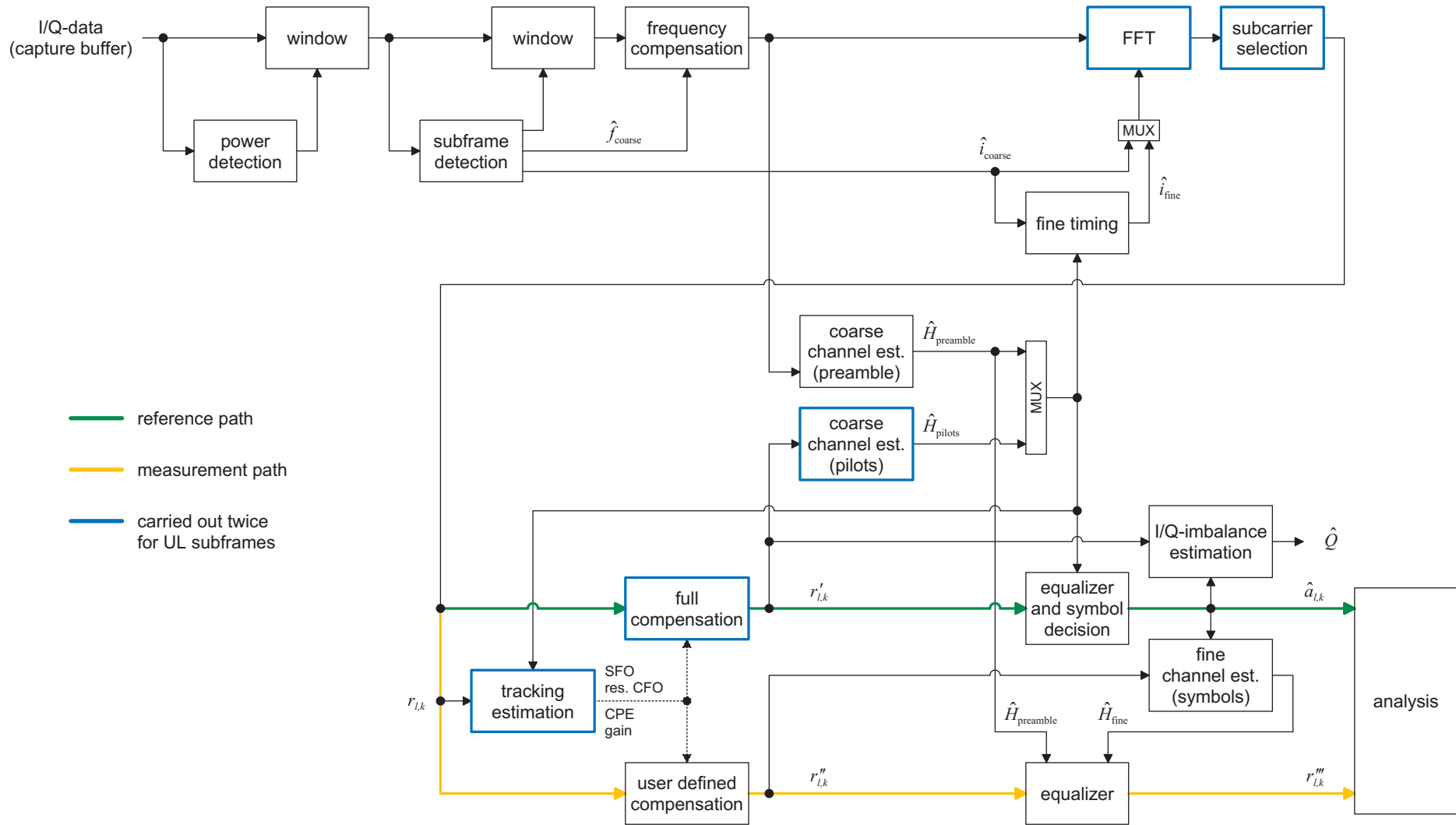
Fig. 73   OFDMA measurement application

Channel Estimation / Equalization

According to Fig. 73, 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.

Analysis

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

EVM

The most important variable is the error vector magnitude

$$EVM_{l,k} = \left| \frac{r'''_{l,k} - \hat{a}_{l,k}}{\hat{a}_{l,k}} \right| \tag{10}$$

on subcarrier k at OFDM symbol l. The subsequent average values can be derived from (8).

1. EVM of subchannel n at OFDM symbol l:

$$EVM_{l,\text{subchannel } n} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{k_{\text{ch } n}} EVM_{l,k_{\text{ch } n}}^2} \tag{11}$$

2. EVM of all pilot subcarriers:

$$EVM_{\text{pilots}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{l} \sum_{k_{\text{p}}} EVM_{l,k_{\text{p}}}^2} \tag{12}$$

3. EVM of all data subcarriers:

$$EVM_{\text{data}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{l} \sum_{k_{\text{d}}} EVM_{l,k_{\text{d}}}^2} \tag{13}$$

4. EVM of all used subcarriers:

$$EVM_{\text{all}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{l} \left[\sum_{k_{\text{p}}} EVM_{l,k_{\text{p}}}^2 + \sum_{k_{\text{d}}} EVM_{l,k_{\text{d}}}^2 \right]} \tag{14}$$

The number of subcarriers respectively taken into account is denoted by N_{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).

$$CINR(n) = \frac{\sum_l \sum_k |\hat{a}_{l,k} \cdot \hat{H}_k|^2}{\sum_l \sum_k |r_{l,k}'' - \hat{a}_{l,k} \cdot \hat{H}_k|^2} \tag{15}$$

Further CINR statistics are defined in the standard [5]

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

$$\hat{\mu}_{\text{CINR}}^{(\text{dB})}(n) = 10 \cdot \log \hat{\mu}_{\text{CINR}}(n)\,\text{dB} \tag{16}$$

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

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

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.

$$RSSI(n) \sim \overline{|r(i)|^2} \tag{17}$$

Further RSSI statistics are defined in the standard [5]

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

$$\hat{\mu}_{\text{RSSI}}^{(\text{dB})}(n) = 10 \cdot \log \hat{\mu}_{\text{RSSI}}(n)\,\text{dB} \tag{18}$$

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

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

I/Q-Imbalance

The I/Q-imbalance estimation block allows to evaluate the

$$modulator\ gain\ balance = |1 + \Delta Q| \tag{19}$$

and the

$$quadrature\ mismatch = \arg\{1 + \Delta Q\} \tag{20}$$

respectively based on the block's estimate $\Delta \hat{Q}$.

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

References

[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).

4 Remote Control

Description of commands

This section specifies all the remote control commands specific to the R&S FSQ-K92/K93 option. Only those commands provided for this option are specified. For details of remote control commands provided by the host analyzer please refer to the analyzer user manual.

Notation

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

Table of Comm

Command:	In the command column, the table provides an overview of the commands and their hierarchical arrangement (see indentations).
Parameter:	The parameter column indicates the requested parameters together with their specified range.
Unit:	The unit column indicates the basic unit of the physical parameters.
Comment:	In the comment column an indication is made on:

− whether the command does not have a query form,

− whether the command has only one query form

− whether the command is implemented only with a certain option of the instrument

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

Example: `SENSe:FREQuency:CENTer` is represented in the table as follows:

```
SENSe                  first level
   :FREQuency          second level
      :CENTer          third level
```

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

Upper/lower case notation   Upper/lower case letters are used to mark the long or short form of the key words of a command in the description (see Section 3.5.2). 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 1kHz:

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

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

Example: Selection of the parameters for the command

`DISPlay:FORMat FULL | SPLit`

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

[ ]   Key words in square brackets can be omitted when composing the header (cf. Section 3.5.2, Optional Keywords). The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards. Parameters in square brackets can be incorporated optionally in the command or omitted as well.

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

Description of parameters   Due to the standardisation, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<...>) and will be briefly explained in the following (see also Section 3.5.5, "Parameters").

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

<numeric value>

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

MINimum   This keyword sets the parameter to the smallest possible value.

MAXimum   This keyword sets the parameter to the largest possible value.

DEFault   This keyword is used to reset the parameter to its default value.

UP   This keyword increments the parameter value.

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

Example: `SENSe:FREQuency:CENTer? MAXimum`

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

<arbitrary block program data>

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

ABORt Subsystem

The ABORt subsystem provide a mechanism by which running measurements can be aborted.

COMMAND	PARAMETERS	UNIT	COMMENT
ABORt			

ABORt

This causes the current measurement, which is being performed, to be aborted.

Example:	"ABOR" **-**	The R&S FSQ-K92/K93 option will attempt to abort the current active measurement.
Characteristics:	*RST value: -- SCPI: conforming	
Mode:	OFDM, OFDMA	

CALCulate Subsystem

CALCulate:BURSt Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2>			
:BURSt	-	-	
[:IMMediate]			

CALCulate<1|2>:BURSt[:IMMediate]

This command forces the IQ measurement results to be recalculated according to the current settings.

Example: `"CALC:BURS"`   Forces an update of the IQ results.

Characteristics: *RST value: –
SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate:LIMit Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
:CALCulate<1|2>			
:LIMit<1 to 8>			
:BURSt			
:ALL	<numeric_value>		
:RESult?	--	--	query only
:BERPilot			
[:AVERage]	<numeric_value>	PCT	
:RESult?	--		query only
:MAXimum	<numeric_value>	PCT	
:RESult?	--		query only
:EVM			
:ALL			
[:AVERage]	<numeric_value>	DB | PCT	
:RESult?	--		query only
:MAXimum	<numeric_value>	DB | PCT	
:RESult?	--		query only
:DATA			
[:AVERage]	<numeric_value>	DB | PCT	
:RESult?	--		query only
:MAXimum	<numeric_value>	DB | PCT	
:RESult?	--		query only
:FERRor			
[:AVERage]	<numeric_value>	Hz | PCT	
:RESult?	--		query only
:MAXimum	<numeric_value>	Hz | PCT	
:RESult?	--		query only
:IQOFfset			
[:AVERage]	<numeric_value>	DB | PCT	
:RESult?	--		query only
:MAXimum	<numeric_value>	DB | PCT	
:RESult?	--		query only
:SYMBolerror			
[:AVERage]	<numeric_value>	PPM | PCT	
:RESult?	--		query only
:MAXimum	<numeric_value>	PPM | PCT	
:RESult?	--		query only
:USERror			
[:AVERage]	<numeric_value>	DB	query only
:RESult?	--		
:MAXimum	<numeric_value>	DB	query only
:RESult?	--		
:FAIL?	--		query only
:SPECtrum			
:Mask			
:CHECk			
:X?	--	HZ	query only
:Y?	--	DBM	query only

CALCulate<1|2>:LIMit<1>:BURSt:ALL <numeric value>, …

This command sets or returns all the limit values. The limits are set or returned as a list of values separated by ',' in the following (ASCII) format:

Query/Set OFDM:

<average EVM All Carriers>, <max EVM All Carriers>,
<average EVM Data>, <max EVM Data>,   -- Not used [1]
<average Frequency Error>, <max Frequency Error>,
<average Symbol Error>, <max Symbol Error>,
<average SS Timing>, <max SS Timing>,   -- Not used, uplink only [2]
<average IQ Offset>, <max IQ Offset>

[1] EVM Data values are no longer used for OFDM, but are kept to maintain positions for backward compatibility.

[2] SS Timing values are no longer used for OFDM, but are kept to maintain positions for backward compatibility. The SS Timing values are only used in UL (i.e. they are not returned, and should not be set, in DL).

Query/Set OFDMA:

<average EVM Data and Pilots >, <max EVM Data and Pilots >,
<average EVM Data>, <max EVM Data>,
<average Frequency Error>, <max Frequency Error>,
<average Symbol Error>, <max Symbol Error>,
<average IQ Offset>, <max IQ Offset>,
<average BER Pilots>, <max BER Pilots>   -- Optional when setting [3]
<average Unmod Subcarrier Error>, <max Unmod Subcarrier Error>   -- Optional when setting,
                                                         Returned in Uplink only [4]

[3] BER Pilots values do not have to be provided when setting OFDMA limits, unless the Unmod. Subcarrier Error values are following (in which case they are required to maintain the correct positions).

[4] Unmod Subcarrier Error values do not have to be provided when setting OFDMA limits. If provided, the values will be ignored unless an uplink zone is marked for analysis. When querying OFDMA limits, the Unmod. Subcarrier Error values are only returned when an uplink zone is marked for analysis.

Note: *Additional limits may be returned in future releases. However, the order and position of limits will be maintained for backward compatibility (e.g. SS Timing) and setting additional limits will be optional (e.g. BER Pilots). Remote command scripts that expect a fixed number of limits to be returned will fail. It may be preferable for scripts to expect the current number of limits, or more, to be returned.*

Value	Description
EVM All Carriers / EVM Data and Pilots / EVM Data	Returned in either dB or % depending on selected table display units (UNIT:TABLe).
Frequency Error	Returned in Hz.
Symbol Error	Returned in ppm.
IQ Offset	Returned in either dB or % depending on selected table display units (UNIT:TABLe).
BER Pilots	Returned in %.
Unmod Subcarrier Error	Returned in dB.

Example: "CALC:LIM:BURS:ALL?"   All limit values are returned

Characteristics: *RST value: mode-specific
                      SCPI: device-specific

Mode: OFDM, OFDMA
CALCulate<1|2>:LIMit<1>:BURSt:ALL:RESult?

This command returns all the limit results (PASSED | FAILED). The results are output as a list of result strings separated by ',' in the following (ASCII) format:

OFDM:
<average EVM All Carriers>, <max EVM All Carriers>,
<average EVM Data>, <max EVM data>,
<average Frequency Error>, <max Frequency Error>,
<average Symbol Error>, <max Symbol Error>,
<average SS Timing>, <max SS Timing>,
<average IQ Offset>, <max IQ Offset>,

Note: *SS Timing and EVM Data are maintained for backward compatibility.*

OFDMA:
<average EVM Data and Pilots>, <max EVM Data and Pilots>,
<average EVM Data>, <max EVM Data>,
<average Frequency Error>, <max Frequency Error>,
<average Symbol Error>, <max Symbol Error>,
<average IQ Offset>, <max IQ Offset>,
<average BER Pilots>, <max BER Pilots>
<average Unmod Subcarrier Error>,<max Unmod Subcarrier Error>   -- returned for UL zones

Note: *Unmodulated Subcarrier Error values are only returned for an analyzed Uplink zone.*

Example: "CALC:LIM:BURS:ALL:RES?" All limit values are returned.

Characteristics: *RST value: -
                  SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot[:AVERage]

This command sets the average the Bit Error Rate for pilot carriers limit result (PASSED | FAILED). If no units are specified then the value will be set to the currently selected units specified by :UNIT:TABLe. This is a combined figure that represents the pilot, data and the free carrier.

Example: :CALC:LIM:BURS:BERP -25dB Average Bit Error Rate for all carrier limit is
                                    set to -25.0 dB.

Characteristics: RST value: mode-specific
                  SCPI: device–specific

Mode: OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot[:AVERage]:RESult?

This command returns the Bit Error Rate for pilot carriers limit result (PASSED | FAILED).
This command is only a query and therefore has no *RST value.

Example:	`:CALC:LIM:BURS:BERP:RES?`	Average Bit Error Rate for all carrier limit result is returned.
Characteristics:	RST value: – SCPI: device–specific	
Mode:	OFDMA/WiBro	

CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot:MAXimum –1000000 to 1000000 %

This command sets the maximum Bit Error Rate Limit.

Example:	`CALC:LIM:BURS:BERB:MAX?`	Maximum Bit Error Rate for all carrier limit is returned.
Characteristics:	RST value: mode-specific SCPI: device–specific	
Mode:	OFDMA/WiBro	

CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot:MAXimum:RESult?

This command returns the maximum Bit Error Rate Limit result (PASSED | FAILED).
This command is only a query and therefore has no *RST value.

Example:	`CALC:LIM:BURS:BERB:MAX:RES?`	Maximum Bit Error Rate for all carrier limit result is returned.
Characteristics:	RST value: – SCPI: device–specific	
Mode:	OFDMA/WiBro	

CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL[:AVERage] <numeric value>

This command sets the average Error Vector Magnitude Limit in dB or %. If no units are specified then the value will be set to the currently selected units specified by :UNIT:EVM command. This is a combined figure that represents the pilot, data and the free carrier.

Example:	`"CALC:LIM:BURS:EVM:ALL –25.0dB"`	Average EVM for all carrier limit is set to -25.0 dB.
Characteristics:	*RST value: mode-specific SCPI: device-specific	
Mode:	OFDM, OFDMA	

CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL[:AVERage]:RESult?

This command returns the average Error Vector Magnitude Limit result (PASSED | FAILED). This is a combined figure that represents the pilot, data and the free carrier.

Example:	`"CALC:LIM:BURS:EVM:ALL:RES?"`	Average EVM for all carrier limit result is returned.
Characteristics:	*RST value: - SCPI: device-specific	
Mode:	OFDM, OFDMA	

CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL:MAXimum<numeric value>

This command sets the maximum Error Vector Magnitude Limit in dB or %. If no units are specified then the value will be set to the currently selected units specified by :UNIT:EVM command. This is a combined figure that represents the pilot, data and the free carrier.

Example:	"CALC:LIM:BURS:EVM:ALL:MAX?"	Maximum EVM limit for all carrier is returned.

Characteristics: *RST value: mode-specific
                    SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude Limit result (PASSED | FAILED). This is a combined figure that represents the pilot, data and the free carrier.

Example:	"CALC:LIM:BURS:EVM:ALL:MAX:RES?"	Maximum EVM for all carrier limit result is returned.

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA[:AVERage] <numeric value>

This command sets the average Error Vector Magnitude Limit for the data carrier in dB or PCT. If no units are specified then the value will be set to the currently selected units specified by :UNIT:TABLe.

Example:	"CALC:LIM:BURS:EVM:DATA –30dB"	Average EVM for data carrier limit is set to –30.0 dB

Characteristics: *RST value: mode-specific
                    SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA[:AVERage]:RESult?

This command returns the average Error Vector Magnitude limit result summary (PASSED | FAILED) for the data carrier in dB.

Example:	"CALC:LIM:BURS:EVM:DATA:RES?"	Average EVM for data carrier limit result is returned

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:MAXimum   <numeric value>

This command sets the maximum Error Vector Magnitude Limit for the data carrier in dB or %. If no units are specified then the value will be set to the currently selected units specified by :UNIT:TABLe.

Example:	"CALC:LIM:BURS:EVM:DATA:MAX?"	Maximum EVM limit for data burst is returned.
Characteristics:	*RST value: mode-specific SCPI: device-specific	
Mode:	OFDM, OFDMA	

CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude limit result summary (PASSED | FAILED) for the data carrier in dB.

Example:	"CALC:LIM:BURS:EVM:DATA:MAX:RES?"	Maximum EVM for data carrier limit result is returned.
Characteristics:	*RST value: - SCPI: device-specific	
Mode:	OFDM, OFDMA	

CALCulate<1|2>:LIMit<1>:BURSt:FERRor[:AVERage]   <numeric value>

This command sets the average frequency error limit in Hertz or PCT. If no unit is specified then the value will be set using the units depending on the current Up/Down Link mode. If in Down Link mode the units will be Hz and if in Up Link mode the units will be PCT. Note: there is no relationship between the Down Link and Up Link values so setting a Down Link value in Up Link mode will not cause the displayed limit value to change.

Example:	"CALC:LIM:BURS:FERR 10000"	The average frequency error limit is set to 10000 Hz (Down Link).
Characteristics:	*RST value: mode-specific SCPI: device-specific	
Mode:	OFDM, OFDMA	

CALCulate<1|2>:LIMit<1>:BURSt:FERRor[:AVERage]:RESult?

This command returns the average frequency error limit result (PASSED | FAILED).

Example:	"CALC:LIM:BURS:FERR:RES?"	Average frequency error limit result is returned.
Characteristics:	*RST value: - SCPI: device-specific	
Mode:	OFDM, OFDMA	

CALCulate<1|2>:LIMit<1>:BURSt:FERRor:MAXimum <numeric value>

This command sets the maximum frequency error limit in Hertz or %. If no unit is specified then the value will be set using the units depending on the current Up/Down Link mode. If in Down Link mode the units will be Hz and if in Up Link mode the units will be %. Note: there is no relationship between the Down Link and Up Link values so setting a Down Link value in Up Link mode will not cause the displayed limit value to change.

Example:	"CALC:LIM:BURS:FERR:MAX?"	Maximum frequency error limit is returned.

Characteristics: *RST value: mode-specific
　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:FERRor:MAXimum:RESult?

This command returns the maximum frequency error limit result (PASSED | FAILED).

Example:	"CALC:LIM:BURS:FERR:MAX:RES?"	Maximum frequency error limit result is returned.

Characteristics: *RST value: -
　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset[:AVERage] <numeric value>

This command sets the average IQ offset limit in dB or %. If no units are specified then the value will be set to the currently selected units specified by :UNIT:TABLe.

Example:	"CALC:LIM:BURS:IQOF –15dB"	The average IQ offset limit is set to -15 dB.

Characteristics: *RST value: mode-specific
　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset[:AVERage]:RESult?

This command returns the average IQ offset limit result (PASSED | FAILED).

Example:	"CALC:LIM:BURS:IQOF:RES?"	Average IQ offset error limit result is returned.

Characteristics: *RST value: –
　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset:MAXimum <numeric value>

This command sets the maximum IQ offset limit in dB or %. If no units are specified then the value will be set to the currently selected units specified by :UNIT:TABLe.

Example:	"CALC:LIM:BURS:IQOF:MAX?"	Maximum IQ offset limit is returned.

Characteristics: *RST value: -15 dB
　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset:MAXimum:RESult?

This command returns the maximum IQ offset limit result (PASSED | FAILED).

Example:	`"CALC:LIM:BURS:IQOF:MAX:RES?"`	Maximum IQ offset limit result is returned.

Characteristics: *RST value: –
                              SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:SYMBolerror[:AVERage]   <numeric value>

This command sets the average symbol error limit in ppm or %. If no unit is specified then the value will be set using the units depending on the current Up/Down Link mode. If in Down Link mode the units will be ppm and if in Up Link mode the units will be %.
Note: there is no relationship between the Down Link and Up Link values so setting a Down Link value in Up Link mode will not cause the displayed limit value to change.

Example:	"`CALC:LIM:BURS:SYMB 10`"	The average symbol error limit is set to 10 % (Up Link).

Characteristics: *RST value: mode-specific
                              SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:SYMBolerror[:AVERage]:RESult?

This command returns the average symbol error limit result (PASSED | FAILED)

Example:	"`CALC:LIM:BURS:SYMB:RES?`"	Average symbol error limit result is returned.

Characteristics: *RST value: -
                              SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:SYMBolerror:MAXimum   <numeric value>

This command sets the maximum symbol error limit in ppm or %. If no unit is specified then the value will be set using the units depending on the current Up/Down Link mode. If in Down Link mode the units will be ppm and if in Up Link mode the units will be %. Note: there is no relationship between the Down Link and Up Link values so setting a Down Link value in Up Link mode will not cause the displayed limit value to change.

Example:	"`CALC:LIM:BURS:SYMB:MAX?`"	Maximum symbol error limit is returned.

Characteristics: *RST value: mode-specific
                              SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:SYMBolerror:MAXimum:RESult?

This command returns the maximum symbol error limit result (PASSED | FAILED).

Example:	"`CALC:LIM:BURS:SYMB:MAX:RES?`"	Maximum symbol error limit result is returned.

Characteristics: *RST value: -
                              SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:USERror[:AVERage]

This command gets/sets the average Unmodulated Subcarrier Error limit in dB. This limit value is only valid for an Up Link zone.

Note: *An Up Link zone must be selected as the zone to be analysed before the limit can be set.*

Example: "CALC:LIM:BURS:USER?"   Unmodulated Subcarrier Error limit is returned

Characteristics: *RST value: –
                 SCPI: device-specific

Mode: OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:USERror[:AVERage]:RESult

This command returns the average Unmodulated Subcarrier Error limit result (PASSED | FAILED) for an analysed Up Link zone.

Example: "CALC:LIM:BURS:SYMB:USER:RES?" Unmodulated Subcarrier Error limit result is returned

Characteristics: *RST value: –
                 SCPI: device-specific

Mode: OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:USERror:MAXimum

This command gets/sets the maximum Unmodulated Subcarrier Error limit in dB. This limit value is only valid for an Up Link zone.

Note: An Up Link zone must be selected as the zone to be analysed before the limit can be set.

Example: "CALC:LIM:BURS:USER:MAX?"   Unmodulated Subcarrier Error limit is returned

Characteristics: *RST value: –
                 SCPI: device-specific

Mode: OFDMA

CALCulate<1|2>:LIMit<1>:BURSt:USERror:MAXimum:RESult

This command returns the Unmodulated Subcarrier Error limit result (PASSED | FAILED) for an analysed Up Link zone.

Example: "CALC:LIM:BURS:SYMB:USER:MAX:RES?" Unmodulated Subcarrier Error limit result is returned

Characteristics: *RST value: –
                 SCPI: device-specific

Mode: OFDMA

CALCulate<1|2>:LIMit<1>:FAIL?

This command queries the result of the limit check of the limit line indicated in the selected measurement window. It should be noted that a complete sweep must have been performed for obtaining a valid result. A synchronization with *OPC, *OPC? or *WAI should therefore be provided. The result of the limit check responds with 0 for PASS and 1 for FAIL.
Note that no limit lines are displayed in screen A and as such all CALCulate1:LIMit:FAIL? Command will return 0.
The index for LIMit for specific limit lines is as follows:

Index	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

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.

Characteristics: *RST value: -
                      SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:SPECtrum:MASK:CHECk:X?

This command returns the X-value at the maximum overstepping of the spectrum mask limits

Example: "CALC:LIM:SPEC:MASK:CHEC:X?"   Returns the frequency at the maximum overstepping.

Characteristics: *RST value: -
                      SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:LIMit<1>:SPECtrum:MASK:CHECk:Y?

This command returns the Y-value at the maximum overstepping of the spectrum mask limits

Example: "CALC:LIM:SPEC:MASK:CHEC:Y?"   Returns the power at the maximum overstepping.

Characteristics: *RST value: -
                      SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate:MARKer Subsystem

The CALCulate:MARKer subsystem checks the marker functions in the R&S FSQ-K92/K93 option.

CALCulate 1: Screen A
CALCulate 2: Screen B

Note: *Currently there is only 1 marker is available and it is always on.*

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2>			
MARKer<1>			
:MAXimum			
[:PEAK]			no query
:MINimum			
[:PEAK]			no query
:TRACe	<numeric value>		
:X	<numeric value>	HZ | S | DB	
:Y	<numeric value>	PCT | DB	
:BURSt	<numeric value>		
:SYMBol	<numeric value>		
:CARRier	<numeric value>		
:AOFF			
[:STATe]	<Boolean>		

CALCulate<1|2>:MARKer<1>:MAXimum[:PEAK]

This command sets the selected marker to the maximum peak value in the current trace.
This command is only available for the following result displays:Spectrum Flatness.

Example: "CALC2:MARK:MAX"   Set marker 1 in screen B to maximum value in trace

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:MARKer<1>:MINimum[:PEAK]

This command sets the selected marker to the minimum peak value in the current trace.
This command is only available for the following result displays:

Spectrum Flatness

Example: "CALC2:MARK:MIN"   Set marker 1 in screen B to minimum value in trace.

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:MARKer<1>:TRACe   <numeric value>

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 vs 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 - When Max Hold trace is displayed
Spectrum ACP/ACPR - When Max Hold trace is displayed

Example:	`"CALC2:MARK:TRAC 2"` Assigns marker 1 in screen B to trace 2.
	`"CALC2:MARK:TRAC 5"` Assigns marker 1 in screen B to trace 5.
Characteristics:	*RST value: 1
	SCPI: device-specific
Mode:	OFDM, OFDMA

CALCulate<1|2>:MARKer<1>:X   <numeric value>

This command positions the selected marker to the indicated inphase (constellation vs symbol), frequency (spectrum FFT, spectrum mask), 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

Example:	`"CALC:MARK:X 2ms"` Positions marker 1 in screen A to time 2ms.
Characteristics:	*RST value: -
	SCPI: device-specific
Mode:	OFDM, OFDMA

CALCulate<1|2>:MARKer<1>:Y   <numeric value>

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 FFT
CCDF

Example:	`"CALC2:MARK:Y -2"` Positions marker 1 in screen B to –2.
	`"CALC:MARK:Y?"` Outputs the measured value of marker 1 in screen A.
Characteristics:	*RST value: -
	SCPI: device-specific
Mode:	OFDM, OFDMA

CALCulate<1|2>:MARKer<1>:BURSt   <numeric value>

This command positions the selected marker to the indicated burst for Constellation vs Symbol. This command is valid only for the following result displays:

Constellation vs Symbol

Example:	`"CALC2:MARK:BURS 2"`	Positions marker 1 in screen B to burst 2.
	`"CALC2:MARK:BURS?"`	Outputs the symbol value of marker 1 in screen B.
Characteristics:	*RST value: -	
	SCPI:	device-specific
Mode:	OFDM, OFDMA	

CALCulate<1|2>:MARKer<1>:SYMBol   <numeric value>

This command positions the selected marker to the indicated symbol (Constellation vs Symbol and constellation vs Carrier). This command is valid only for the following result displays:

Constellation vs Cymbol

Constellation vs Carrier

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.
Characteristics:	*RST value: -	
	SCPI:	device-specific
Mode:	OFDM, OFDMA	

CALCulate<1|2>:MARKer<1>:CARRier   <numeric value>

This command positions the selected marker to the indicated carrier (constellation vs symbol and constellation vs carrier) This command is valid only for the following result displays:

constellation vs symbol
constellation vs carrier

Example:	`"CALC2:MARK:CARR –7"`	Positions marker 1 in screen B to carrier -7.
	`"CALC2:MARK:CARR?"`	Outputs the carrier value of marker 1 in screen B.
Characteristics:	*RST value: -	
	SCPI:	device-specific
Mode:	OFDM, OFDMA	

CALCulate<1|2>:MARKer<1>:AOFF

This command switches off all active markers in the specified measurement window. The window will either be "screen a" or "screen b" and will be determined by the numeric value that follows the "CALCulate" keyword.

Example:	`"CALC1:MARK:AOFF"`	'Switches off all markers in the screen A window.
	`"CALC2:MARK:AOFF"`	'Switches off all markers in the screen B window.
Characteristics:	*RST value: -	
	SCPI:	device-specific
Mode:	OFDM, OFDMA	

CALCulate<1|2>:MARKer<1>[:STATe]   <Boolean>   E-4

This command switches the markers on or off

| **Example:** | `"CALC1:MARK1:STATE ON"` | Switches the screen A marker ON. |
| | `"CALC2:MARK1:STATE OFF"` | Switches the screen B marker OFF. |

| **Characteristics:** | *RST value: ON |
| | SCPI: device-specific |

Mode: OFDM, OFDMA

CALCulate:MARKer:FUNCtion Subsystem

The measurement window is selected by CALCulate 1 (screen A) or 2 (screen B).

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1|2>			
:MARKer<1>			
:FUNCtion			
:POWer			
:RESult			
[:CURRent]		DB	Query only
:MAXHold		DB	Query only
:TTCapture			
:FRAMe	<numeric_value>		
[:TIMe]	<numeric_value>	S	Query only
:ZOOM	<numeric_value>		

CALCulate<1|2>:MARKer<1>: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 in the following order:

1. Power of main channel
2. Power of lower adjacent channel
3. Power of upper adjacent channel
4. Power of lower alternate adjacent channel 1
5. Power of upper alternate adjacent channel 1
6. Power of lower alternate adjacent channel 2
7. Power of upper alternate adjacent channel 2

Etc.

Adjacent channel power values are output in dB. The returned list is variable length depending on the number of channels specified to be measured, i.e. if the number of channels is set to 3 then the list will contain 7 results (main channel plus two results each for each adjacent channel specified).

Example: "CALC2:MARK:FUNC:POW:RES?″

Characteristics: *RST value: -
                  SCPI: device-specific

Mode: OFDM, OFDMA

CALCulate<1|2>:MARKer<1>: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, for there to be maximum summary data available.

Results are output separated by commas in the following order:
1. Power of main channel
2. Power of lower adjacent channel
3. Power of upper adjacent channel
4. Power of lower alternate adjacent channel 1
5. Power of upper alternate adjacent channel 1
6. Power of lower alternate adjacent channel 2
7. Power of upper alternate adjacent channel 2
Etc.

Adjacent channel power values are output in dB. The returned list is variable length depending on the number of channels specified to be measured, i.e. if the number of channels is set to 3 then the list will contain 7 results (main channel plus two results each for each adjacent channel specified).

Example:	"`CALC2:MARK:FUNC:POW:RES:MAXH?`"
Characteristics:	*RST value: - SCPI: device-specific
Mode:	OFDM, OFDMA

CALCulate<1|2>:MARKer<1>:FUNCtion:TTCapture[:TIMe]?

This command returns the time to the start of the first frame of the capture buffer. The frame that is returned is set by `CALC<1|2>:MARK<1>:FUNC:TTC:FRAM`

Example:	"`CALC:MARK:FUNC:TTC?`"
Characteristics:	*RST value: 1 SCPI: device-specific
Mode:	OFDM, OFDMA

CALCulate<1|2>:MARKer<1>:FUNCtion:ZOOM <numeric value>

This command defines the ratio 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 only available for the following result displays:
Constellation vs Carrier
Constellation vs Symbol
PVT Full Burst
PVT Rising / Falling
Magnitude Capture Buffer

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.
Characteristics:	*RST value: 1 SCPI: device-specific	
Mode:	OFDM, OFDMA	

CONFigure Subsystem

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

COMMAND	PARAMETERS	UNIT	COMMENT
:CONFigure			
:ADDRess			
:SMU	\<String>		
:BURSt			
:CONSt			
:BURSt			
:SELect	ALL | PILOTS | \<numeric value>		
:CCARrier			
[:IMMediate]			
:SELect	-100 to 100 | ALL | PILOTS		
:CSYMbol			
[:IMMediate]			
:FORMat			
:SELect	ALL | QPSK | QAM16 | QAM64		
:SYMBol			
:SELect	ALL | \<numeric value>		
:EVM			
:ECARrier			
[:IMMediate]			
:ESYMbol			
[:IMMediate]			
:PREamble			
:SELect	FREQ | PHASe		
[:IMMediate]			
:PVT			
:BURSt	\<numeric value>		
:SELect	EDGE | FULL		
[:IMMediate]			
:SPECtrum			
:ACPR			
:SELect	ABS | REL		
[:IMMediate]			
:FFT			
[:IMMediate]			
:FLATness			
:SELect	FLATness | GRDelay | DIFFerence		
[:IMMediate]			
:MASK			
:SELect			
[:IMMediate]			

COMMAND	PARAMETERS	UNIT	COMMENT
:STATistics			
:BSTReam			
[:IMMediate]			
:BURSt			
:SELect	ALL | <numeric_value>		
:FORMat			
:SELect	ALL | BPSK | QPSK | QAM16 | QAM64		
:SYMBol			
:SELect	<numeric_value>		
:BSUMmary			
[:IMMediate]			
:CCDF			
[:IMMediate]			
:CHANnel	<numeric value>		
:POWer			
:AUTO	<boolean> | ONCE		
:SWEep			
:TIME	<numeric value>	S	
:EXPected			
:RF	<numeric value>	DBM	
:IQ	<numeric value>	V	
:STANdard	<numeric value>		
:WIMax			
:AVERaging	<numeric value>		
:DLSFrame			
:IDCell	<numeric value>		
:PREamble			
:INDex	<numeric value>		
:MODE	AUTO | USER		
:SEGMent<1 to 3>	<numeric value>		
:FBANd	UNSPecified | ETSI | ETSI1 | ETSI2 | MMDS | MMDS1 | MMDS2 | WCS | WCS1 | WCS2 | CEPT | CEPT1 | CEPT2 | UNII | UNII1 | UNII2		
:IGRatio	<numeric value>		
:LMODe	DL | U8L		
:NFFT	FFT12 | FFT512 | FFT1024 | FFT2048| <numeric value>		
:TDDFrame			
:TTG			
:ULSFrame	<numeric value>		
:FRAMe			
:CRLength	<numeric value>		
:SEGMent<1 to 3>			
:BITMap<1 to 18>	<numeric value>		
:ZONE<1 to 26>			
[:ANALyze]			
:STATe	<boolean>		
:BURSt<1 to 32>			
:COUNt?			
:CONTrol			
[:DATA]	QPSK_1_2 | QPSK_3_4 | QAM16_1_2 | QAM16_3_4 | QAM64_1_2 | QAM64_2_3 | QAM64_3_4, <numeric value>,<numeric value>,<numeric value>, <numeric value>,<numeric value>,<numeric value>, FCH | DLMAP | ULMAP | DATA		
:DELete			
:FORMat	QPSK_1_2 | QPSK_3_4 | QAM16_1_2 | QAM16_3_4 | QAM64_1_2 | QAM64_2_3 |QAM64_3_4		

COMMAND	PARAMETERS	UNIT	COMMENT
:OFFSet			
:AUTO	<boolean>		
:POWer	<numeric value>		
:SLOT			
:DURation	<numeric value>		
:SUBChannel			
:COUNt	<numeric value>	DBM	
:OFFSet	<numeric value>		
:SYMBol			
:COUNt	<numeric value>		
:OFFSet	<numeric value>		
:RESet			
:TYPE	FCH | DLMAP | ULMAP | DATA		
:COUNt?			
:CONTrol			
[:DATA]	<boolean>,DLFUSC | DLPUSC | ULPUSC | <numeric value>,<numeric value>,<numeric value>, <numeric value>,<numeric value>		
:DELete			
:IDSegment	<numeric value>		
:PERMbase	<numeric value>		
:PRBS	<numeric value>		
:SYMBol			
:COUNt	<numeric value>		
:OFFSet	<numeric value>		
:TYPE	DLFUSC | DLPUSC | ULPUSC		

CONFigure: ADDRess:SMU

This remote control command is used to specify the IP address of the SMU to which WiMax settings can be uploaded or downloaded.

Example: `"CONF:ADDR:SMU '192.168.1.68'"`

Characteristics: *RST value: –
                SCPI: device-specific

Mode: OFDMA

CONFigure:BURSt:CONSt:BURSt:SELect ALL | PILOTS | <numeric value >

This remote control command is only available when Constellation vs Symbol measurement is selected. When the Constellation vs Symbol measurement is initiated, it will calculate the results of the selected burst.

Example: `"CONF:BURS:CONS:BURS:SEL 1"`   Burst 1 is selected.
               `"CONF:BURS:CONS:BURS:SEL ALL"`   All bursts are selecte
               `"CONF:BURS:CONS:BURS:SEL PILOTS"` Pilots only selected.

Characteristics: *RST value: -
                SCPI: device-specific

Mode: OFDMA

CONFigure:BURSt:CONSt:CCARrier[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Constellation vs Carrier. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example:	"CONF:BURS:CONS:CCAR"	R&S FSQ-K92/K93 option is configured to run a Constellation vs Carrier measurement.

Characteristics: *RST value: -
                SCPI: device-specific

Mode: OFDM

CONFigure:BURSt:CONSt:CARRier:SELect -100 to 100 | ALL | PILOTS

This remote control command is only available when Constellation vs Symbol measurement is selected. When the Constellation vs Symbol measurement is initiated, it will calculate the results of the selected carrier.

Example:	"CONF:BURS:CONS:CARR:SEL –26"	Carrier –26 is selected.
	"CONF:BURS:CONS:CARR:SEL 10"	Carrier 10 is selected.
	"CONF:BURS:CONS:CARR:SEL ALL"	All carriers are selected.
	"CONF:BURS:CONS:CARR:SEL PIL"	Pilots only.

Characteristics: *RST value: ALL
                SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:CONSt:CSYMbol[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Constellation vs Symbol. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command

Example:	"CONF:BURS:CONS:CSYM"	R&S FSQ-K92/K93 option is configured to run a Constellation vs Symbol measurement.

Characteristics: *RST value: -
                SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:CONSt:FORMat:SELect   ALL | QPSK | QAM16 | QAM64

This remote control command is only available when Constellation vs Symbol measurement is selected. When the Constellation vs Symbol measurement is initiated, it will calculate the results of the selected modulation format.

Example:	"CONF:BURS:CONS:FORM:SEL QPSK"	QPSK modulation formats.
	"CONF:BURS:CONS:FORM:SEL ALL"	All modulation formats.

Characteristics: *RST value: -
                SCPI: device-specific

Mode: OFDMA

CONFigure:BURSt:CONSt:SYMBol:SELect   ALL | <numeric value>

This remote control command is only available when Constellation vs Symbol measurement is selected. When the Constellation vs Symbol measurement is initiated, it will calculate the results of the selected symbol.

| **Example**: | `"CONF:BURS:CONS:SYMB:SEL 1"` | Symbol 1 is selected. |
| | `"CONF:BURS:CONS:SYMB:SEL ALL"` | All symbols are selected. |

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDMA

CONFigure:BURSt:EVM:ECARrier[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be EVM vs Carrier. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

| **Example**: | `"CONF:BURS:EVM:ECAR"` | R&S FSQ-K92/K93 option is configured to run a EVM vs Carrier measurement. |

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:EVM:ESYMbol[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be EVM vs Symbol. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

| **Example**: | `"CONF:BURS:EVM:ESYM"` | R&S FSQ-K92/K93 option is configured to run a EVM vs Symbol measurement. |

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:PREamble[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Phase or Frequency vs Preamble. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

| **Example**: | `"CONF:BURS:PRE"` | R&S FSQ-K92/K93 option is configured to run a Preamble measurement. |

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:PREamble:SELect   FREQ | PHASe

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Phase or Frequency vs Premable. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example: "CONF:BURS:PRE:SEL FREQ"   R&S FSQ-K92/K93 option is configured to run
                                                a Frequency Error vs Pre-amble measurement

Characteristics: *RST value: -
                       SCPI: device-specific
Mode: OFDM, OFDMA

CONFigure:BURSt:PVT:BURSt   <numeric value>

This remote control configures the PVT to use the specified burst for its measurement results.

Example: "CONF:BURS:PVT:BURS 1"   Option is will select burst 1 for the PVT
                                                measurement results.

Characteristics: *RST value: -
                       SCPI: device-specific
Mode: OFDM

CONFigure:BURSt:PVT[:IMMediate]

This remote control command configures R&S FSQ-K92/K93 measurement type to be Power Vs Time. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example: "CONF:BURS:PVT"   R&S FSQ-K92/K93 option is configured to run a
                                         Power Vs Time measurement.

Characteristics: *RST value: -
                       SCPI: device-specific
Mode: OFDM, OFDMA

CONFigure:BURSt:PVT:SELect   EDGE | FULL

This remote control configures how R&S FSQ-K92/K93 will interpret the Power vs Time measurement results.

Example: "CONF:BURS:PVT:SEL FULL"   R&S FSQ-K92/K93 option will interpret the
                                                  measurement results as full burst.

Characteristics: *RST value: FULL
                       SCPI: device-specific
Mode: OFDM, OFDMA

CONFigure:BURSt:SPECtrum:ACPR[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be ACPR (adjacent channel power relative) After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example:	"CONF:BURS:SPEC:ACPR"	R&S FSQ-K92/K93 option is configured to run a ACPR measurement.

Characteristics: *RST value: -
                       SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:SPECtrum:ACPR:SELect ABS | REL

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Spectrum ACPR. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example:	"CONF:BURS:SPEC:ACPR:SEL ABS"	R&S FSQ-K92/K93 option is configured to run a ACPR Absolute measurement

Characteristics: *RST value: -
                       SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:SPECtrum:FFT[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be FFT (Fast Fourier Transform). After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example:	"CONF:BURS:SPEC:FFT"	R&S FSQ-K92/K93 option is configured to run a FFT measurement.

Characteristics: *RST value: -
                       SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:SPECtrum:FLATness[:IMMediate]

This command configures the Spectrum Flatness measurement type. For settings for the Spectrum Flatness measurement see INITiate[:IMMediate] command.
This command is an event and therefore has no *RST value and no query.

Example:	"CONF:BURS:SPEC:FLAT"	Configures the Spectrum Flatness measurement type.
	INIT	Starts a Spectrum Flatness measurement.

Characteristics: RST value: –
                       SCPI: device–specific

Mode: OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:FLATness:SELect   FLATness | GRDelay | DIFFerence

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Spectrum Flatness, Spectrum Flatness Difference or Group Delay. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example: `"CONF:BURS:SPEC:FLAT:SEL FLAT"`   R&S FSQ-K92/K93 option is configured
                                                     to run a flatness measurement

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:SPECtrum:MASK[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Spectrum mask. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example: `"CONF:BURS:SPEC:MASK"`   R&S FSQ-K92/K93 option is configured
                                                 to run a Spectrum Mask measurement.

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:SPECtrum:MASK:SELect IEEE | ETSI

This remote control configures how R&S FSQ-K92/K93 will interpret the Spectrum MASK measurement results. This is either performed using the IEEE or ETSI standard.

Note: *This command is maintained for backward compatibility only. It has been replaced by [SENSe:]POWer:SEM.*

Example: `"CONF:BURS:SPEC:MASK:SEL ETSI"`   R&S FSQ-K92/K93 option is will
                                                       interpret the measurement results
                                                       using the ETSI standard

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:STATistics:BSTReam[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be bit stream. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example: `"CONF:BURS:STAT:BSTR"`   R&S FSQ-K92/K93 option is configured to run
                                                 a bit stream measurement.

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt: STATistics:BSTReam:SYMBol:SELect

This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected symbol.

Example: `"CONF:BURS:STAT:BST:SYMB:SEL 1"`   Symbol 1 is selected.

Characteristics: *RST value: 1
                        SCPI: device-specific

Mode: OFDMA

CONFigure:BURSt: STATistics:BSTReam:FORMat:SELect

This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected modulation format.

Example: `"CONF:BURS:STAT:BST:FORM:SEL QPSK"`   QPSK modulation formats.
                   `"CONF:BURS:STAT:BST:FORM:SEL ALL"`   All modulation formats.

Characteristics: *RST value: ALL
                        SCPI: device-specific

Mode: OFDMA

CONFigure:BURSt: STATistics:BSTReam:BURSt:SELect

This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected burst.

Example: `"CONF:BURS:STAT:BST:BURS:SEL 1"`   Burst 1 is selected.

                   `"CONF:BURS:STAT:BST:BURS:SEL ALL"`   All bursts are selected.

Characteristics: *RST value: ALL
                        SCPI: device-specific

Mode: OFDMA

CONFigure:BURSt:STATistics:BSUMmary[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Burst Summary. After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example: `"CONF:BURS:STAT:BSUM:IMM"`   R&S FSQ-K92/K93 option is configured to run
                                                 a Burst Summary measurement.

Characteristics: *RST value: -
                        SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:BURSt:STATistics:CCDF[:IMMediate]

This remote control command configures the R&S FSQ-K92/K93 measurement type to be CCDF (conditional cumulative distribution functions.). After this command has been executed, the specified measurement will only be started when the user issues the INITiate command.

Example:	"CONF:BURS:STAT:CCDF"	R&S FSQ-K92/K93 option is configured to run a CCDF measurement.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:CHANnel   <numeric value>

This remote control command is used to specify the input channel for which measurements are to be performed. This command will automatically cause the internal measurement frequency to be re-calculated.

Example:	"CONF:CHAN 9"	The R&S FSQ-K92/K93 option will perform measurements at the frequency represented by channel 9.

Characteristics: *RST value: 0
SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:POWer:AUTO   <boolean> | ONCE

This remote control command is used to switch on or off automatic power level detection. When switched on, power level detection is performed at the start of each measurement sweep.

Example:	"CONF:POW:AUTO ON"	The R&S FSQ-K92/K93 option will automatically detect the input power level

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:POWer:AUTO:SWEep:TIME   <numeric value>

This remote control command is used to specify the sweep time for the automatic power level detection.

Example:	"CONF:POW:AUTO:SWE:TIME 200MS"	The auto detect measurement will use a sweep time of 200 ms power level

Characteristics: *RST value: 100 ms
SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:POWer:EXPected:IQ <numeric value>

This remote control command is used to specify the input power level of the source signal as supplied to the Analyzer IQ inputs.

Example:　　　　　"CONF:POW:EXP:IQ 1"　The R&S FSQ-K92/K93 option assumes an input
　　　　　　　　　　　　　　　　　　　　signal strength of 1 Volt

Characteristics:　*RST value: -
　　　　　　　　　　SCPI:　　　　device-specific

Mode:　　　　　OFDM, OFDMA

CONFigure:POWer:EXPected:RF <numeric value>

This remote control command is used to specify the input power level of the source signal as supplied to the Analyzer RF input.

Example:　　　　　"CONF:POW:EXP:RF 9"　The R&S FSQ-K92/K93 option assumes an input
　　　　　　　　　　　　　　　　　　　　signal strength of 9 dBm

CONFigure:STANdard　　　　<numeric value>

This remote control command specifies which Wireless MAN standard the option is configured to measure. The values are as follows:

0　IEEE 802.16-2004 OFDM

1　IEEE 802.16e-2005 OFDMA

2　IEEE 802.16e-2005 WiBro

Example:　　　　　"CONF:STAN 0"　The R&S FSQ-K92/K93 option will perform measurements
　　　　　　　　　　　　　　　　　　　according to IEEE 802.16a.

Characteristics:　*RST value: 1
　　　　　　　　　　SCPI:　　　　device-specific

Mode:　　　　　OFDM, OFDMA

CONFigure:WIMax:AVERaging　　<numeric value>

This remote control command is used to specify the RSSI, CINR averaging parameter.

Example:　　　　　"CONF:WIM:AVER 0.1"　Sets the value to 0.1

Characteristics:　*RST value: –
　　　　　　　　　　SCPI:　　　　device-specific

Mode:　　　　　OFDM, OFDMA

CONFigure:WIMax:DLSFrame:IDCell　　<numeric value>

This remote control command can be used to specify the downlink IDCell number, which in turn is used as DL_PermBase parameter for the permutation equations to partly set the sub carrier randomizer initialisation vector.

Example:　　　　　"CONF:WIM:DLSF:IDC 0"

Characteristics:　*RST value: 0
　　　　　　　　　　SCPI:　　　　device-specific

Mode:　　　　　OFDMA

CONFigure:WIMax:DLSFrame:PREamble:INDex

This remote control command can be used to specify the Preamble Index, which is used in finding the subframe.

Example: `"CONF:WIM:DLSF:PRE:IND 0"`

Characteristics: *RST value: 0
                      SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:DLSFrame:PREamble:MODe

This remote control command can be used to specify whether the Preamble Index will be automatically calculated 'AUTO' or the 'USER' specified value will be used. The Preamble Index value is used in finding the subframe.

Example: `"CONF:WIM:DLSF:PRE:MOD AUTO"`

Characteristics: *RST value: AUTO
                               SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:DLSFrame:SEGMent<1..3>

This remote control command is used to specify the allowable logical sub channel usage of the transmission spectrum for one of the three downlink PUSC segments. Note that the indexes specified in the GUI are 0 based where as under remote control they a 1 based, i.e The first segment in the GUI is labelled segement 0 and would be accessed with the command CONFigure:WIMax:DLSFrame:SEGMent1.

Example: `"CONF:WIM:DLSF:SEG1 63"`

Characteristics: *RST value: 0
                      SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:FBANd   UNSPecified | ETSI | ETSI1 | ETSI2 | MMDS | MMDS1 | MMDS2 |
                              WCS | WCS1 | WCS2 | CEPT | CEPT1 | CEPT2 | UNII | UNII1 | UNII2

This remote control command configures the R&S FSQ-K92/K93 measurement type to be Phase or
Frequency vs Preamble. After this command has been executed, the specified measurement will
only be started when the user issues the INITiate command. The parameters with the suffix '1' are
equivalent to the parameters without the suffix, i.e. "ETSI" the same as ETSI1. When querying a
selected option that was set using the option with a suffix of '1' the returned value will be without the
suffix (see examples below).

The following table shows the relationship between the selection and the Frequency Band.

Selection	Value	Range in GHz	
UNSPECIFIED	UNSPecified		
ETSI or ETSI1	ETSI	3.410-4.200	Licensed Band
ETSI2	ETSI	10.000-10.680	Licensed Band
MMDS or MMDS1	MMDS	2.150-2.162	Licensed Band
MMDS2	MMDS	2.500-2.690	Licensed Band
WCS or WCS1	WCS	2.305-2.320	Licensed Band
WCS2	WCS	2.345-2.360	Licensed Band
CEPT or CEPT1	CEPT	5.470-5.725	License Exempt Band
CEPT2	CEPT	5.725-5.875	License Exempt Band
UNII or UNII1	U-NII	5.250-5.350	License Exempt Band
UNII2	U-NII	5.725-5.825	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

Characteristics: *RST value: -
                      SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:WIMax: FSBWratio:AUTo

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.

Example: "CONF:WIM:FSBW:AUTO ON"   Set to auto

Characteristics: *RST value:
                            SCPI: device-specific

Mode: OFDM, OFDMA

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.

Example: `CONF:WIM:FSBW:FS 2.5"`

Characteristics: *RST value:
                    SCPI: device-specific

Mode: OFDM, OFDMA

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.

Example: `"CONF:WIM:FSBW:BW 1.5"`

Characteristics: *RST value:
                    SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:WIMax:IGRatio <numeric value>

This remote control command is used to specify the number of Guard Sample. The valid range for the Guard Samples are:

$$\frac{T_g}{T_b} \in \{1/32, 1/16, 1/8, 1/4\}$$

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.

Value	Guard Samples (T_g/T_b)
4	1/4
8	1/8
16	1/16
32	1/32

Example: "`CONF:WIM:IGR 16`" Sets the Guard Samples to 1/16

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:WIMax:LMODe DL | UL

This remote control command configures the R&S FSQ-K92/K93 option to only analyze the Down Link (DL) or Up Link (UL) bursts during a measurement.

Example: "CONF:WIM:LMOD UL"   Sets the option to analyze only the Up Link bursts

Characteristics: *RST value: -
                        SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:WIMax:NFFT   FFT128 | FFT512 | FFT1024 | FFT2048 **|** <numeric value>

This remote control command allows the current FFT size to be specified.
This is supplied either by a numeric value or by using the predefined set of symbols:

FFT128   FFT size of 128 carriers
FFT512   FFT size of 512 carriers
FFT1024   FFT size of 1024 carriers
FFT2048   FFT size of 2048 carriers

Example: "CONF:WIM:NFFT FFT2048"

Characteristics: *RST value: FFT1024
                        SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:WIMax:TDDFrame:TTG <numeric value>

This remote control command can be used to specify the TDD frame Tx Transition Gap TTG.

Example: "CONF:WIM:TDDF:TTG 5uS"

Characteristics: *RST value: 5us
                        SCPI: device-specific

Mode: OFDM, OFDMA

CONFigure:WIMax:ULSFrame:CRLength

This remote control command is used to specify the Control Region length for the uplink frame.

Example: `"CONF:WIM:ULSF:CRL 0"`

Characteristics: *RST value: 0
                          SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ULSFrame:FRAMe   <numeric value>

This remote control command is used to select the frame number of the uplink frame in which the UL map that specifies the uplink burst was transmitted.

Example: `"CONF:WIM:ULSF:FRAM 0"`

Characteristics: *RST value: 0
                  SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ULSFrame:SEGMent<1...3>:BITMap<1...18> <numeric value>

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. Note that the indexes specified in the GUI are 0 based where as under remote control they a 1 based, i.e The first segment in the GUI is labelled segement 0 and would be accessed with the command CONFigure:WIMax:DLSFrame:SEGMent1.

Example: `"CONF:WIM:ULSF:SEG1:BITM1 15"`

Characteristics: *RST value: 0
                  SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>[:ANALyze]:STATe   <boolean>

This remote control command can be used to set a zone for analysis. This will be actioned when the next measurement is executed.

Example: `"CONF:WIM:ZONE1:ANAL ON"`

Characteristics: *RST value: -
                  SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:COUNt?

This remote control command returns the current count of user defined bursts within the specified zone.

Example: `"CONF:WIM:ZONE1:BURS1:COUN? "`

Characteristics: *RST value: -
                  SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:CONTrol[:DATA]

> QPSK_1_2 | QPSK_3_4 | QAM16_1_2 | QAM16_3_4 |
> QAM64_1_2 | QAM64_2_3 | QAM64_3_4, <numeric value>,
> <numeric value>, <numeric value>,<numeric value>, <numeric
> value>, <numeric value>, FCH | DLMAP | ULMAP | DATA

This remote control command can be used to enter a burst definition that is to be associated with a specific zone. It accepts eight arguments which make up all the input settings to create a new burst.

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.

The argument list must be defined as follows:

Modulation	Modulation scheme
Subchannels	Number of sub channels used by the burst (does not apply to downlink DL_MAP bursts and uplink bursts)
Symbols	Number of symbols used by the burst (does not apply to downlink DL_MAP bursts and uplink bursts)
Slot Duration	Slot duration (only applies to downlink DL_MAP bursts and uplink bursts)
SubChannel Offset	Sub channel offset of the burst
Symbol Offset	Symbol offset of the burst
Burst Power	Defines the boosting power of the burst
Burst Type	Burst type

Example: `"CONF:WIM:ZONE1:BURS1:CONT QAM16_1_2,5,10,20,0,0,0,DATA"`
To define a 16 QAM 1/2 burst using 5 sub channels and 10 symbols.

`"CONF:WIM:ZONE1:BURS1: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.

Characteristics: *RST value:
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:DELete

This remote control command is used to delete a specific burst from within the specified zone.

Example: `"CONF:WIM:ZONE1:BURS1:DEL"`

Characteristics: *RST value:
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:FORMat QPSK_1_2 | QPSK_3_4 | QAM16_1_2
| QAM16_3_4 | QAM64_1_2 |
QAM64_2_3 | QAM64_3_4

This remote control command can be used to specify the burst modulation format.

QPSK_1_2   QPSK code rate 1/2

QPSK_3_4   QPSK code rate 3/4

QAM16_1_2   16 QAM code rate 1/2

QAM16_3_4   16 QAM code rate 3/4

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

Example: `"CONF:WIM:ZONE1:BURS1:FORM QAM64_3_4"`

Characteristics: *RST value:
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:OFFSet:AUTO   <boolean>

This remote control command only applies to Uplink bursts. It allows the logical sub channel and symbol offsets to be automatically calculated so that they are contiguous.

Example: `"CONF:WIM:ZONE1:BURS1:OFFS:AUTO ON"`

Characteristics: *RST value: ON
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:POWer <numeric value>

This remote control command specifies the boosting power associated with the burst.

Example: `"CONF:WIM:ZONE1:BURS1:POW 0"`

Characteristics: *RST value:
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:SLOT:DURation <numeric value>

This remote control command defines the duration of an uplink burst in slots. The command has no effect on downlink bursts.

Example: `"CONF:WIM:ZONE1:BURS1:SLOT:DUR 10"`

Characteristics: *RST value: ON
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:SUBChannel:COUNt <numeric value>

This remote control command defines the number of logical sub channels used by the burst.

Example: `"CONF:WIM:ZONE1:BURS1:SUBC:COUN 5"`

Characteristics: *RST value: ON
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:SUBChannel:OFFSet <numeric value>

This remote control command defines the logical sub channels offset for the burst. This, together with the symbol offset, can be used to help specify the frequency bandwidth in use by specific bursts.

Example: `"CONF:WIM:ZONE1:BURS1:SUBC:OFFS 5"`

Characteristics: *RST value: OFF
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:SYMBol:OFFSet <numeric value>

This remote control command defines the symbol offset for the burst. This, together with the logical sub channel offset, can be used to help specify the frequency bandwidth in use by specific bursts.

Example: `"CONF:WIM:ZONE1:BURS1:SYMB:OFFS 5"`

Characteristics: *RST value:
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:BURSt<1...32>:TYPE FCH | DLMAP | ULMAP | DATA

This remote control command specifies the type of burst from a higher layer point of view. Ie if the burst contains signalling information or if it is just a data burst.

Example: `"CONF:WIM:ZONE1:BURS1:TYPE DATA"`

Characteristics: *RST value:
SCPI: device-specific

Mode: OFDMA

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:BURS1:RES?"`

Characteristics: *RST value: 0
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:COUNt?

This remote control command returns the current count of user defined zones.

Example: `"CONF:WIM:ZONE1:COUN?`

Characteristics: *RST value: 0
                      SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:CONTrol[:DATA]   <boolean>,DLFUSC | DLPUSC | ULPUSC |
                                                <numeric value>,<numeric value>,
                                                <numeric value>,<numeric value>,
                                                <numeric value>

This remote control command can be used to enter a new zone. It accepts only seven arguments which make up all the input settings to create 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.

The argument list must be defined as follows:

Analyze   Boolean to specify whether the zone is too be marked for analysis

Type,   DLFUSC | DLPUSC | ULPUSC are the only supported zone types

Segment,   downlink PUSC zone segment – 0|1|2

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"`   To enter a DL_PUSC
                                                                   zone, length of 10
                                                                   symbols.

Characteristics: *RST value: -
                      SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:IDSegment<numeric value>

This remote control command is used to specify the segment number associated with the zone. This is only valid for PUSC zones and will have no effect on other zone types. Segments can be defined as either 0, 1 or 2.

Example: `"CONF:WIM:ZONE1:IDS 0"`

Characteristics: *RST value: -
                      SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:PERMbase<numeric value>

This remote control command is used to specify the perm base which is used in the permutation equations.

Example: "CONF:WIM:ZONE1:PERM 0"

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:PRBS   <numeric value>

This remote control command is used to specify a known PRBS modulated data sequence (PRBS = pseudo random binary sequence) that is in use by the DUT.

Example: "CONF:WIM:ZONE1:PRBS 0"

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDMA

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:RES

Characteristics: *RST value: 0
                    SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:DELete

This remote control command is used to delete 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:SYMB:DEL"

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:SYMB:COUNt <numeric value>

This remote control command is used to specify the number of symbols defined to the zone.

Example: "CONF:WIM:ZONE1:SYMB:COUN 10"

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:SYMB:OFFSet   <numeric value>

This remote control command is used to specify the symbol offset associated with this zone. This is used to analyze signals which contain multiple zones and allows any zone in a sub frame to be set up for analysis.

Example: `"CONF:WIM:ZONE1:SYMB:OFFS 0"`

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDMA

CONFigure:WIMax:ZONE<1…26>:TYPE   DLFUSC | DLPUSC | ULPUSC |

This remote control command can be used to specify the zone type. The following zone types are currently available:

DLFUSC   Downlink FUSC zone
DLPUSC   Downlink PUSC zone
ULPUSC   Uplink PUSC

Example: `"CONF:WIM:ZONE1:TYPE DLPUSC"`

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDMA

DISPlay Subsystem

The DISPLay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display.

COMMAND	PARAMETERS	UNIT	COMMENT
:DISPlay			
:FORMat	SPLit | SINGle		
[:WINDow<1|2>]			
:SELect			
:SSELect			
:TABLe	<boolean>		
:UNIT	DB | PCT		
:TRACe<1…3>			
:Y			
[:SCALe]			
:AUTO	<boolean>		
:PDIVision	<numeric value>		
:RLEVel			
:IQ	<numeric value>	V	
:OFFSet	<numeric value>	DB	
[:RF]	<numeric value>	DB	

DISPlay:FORMat SPLit | SINGle

This command sets the visible screen display type to full or split screen.

Example: "`DISP:FORM SING`" Sets the R&S FSQ-K92/K93 display to full screen.

Characteristics: *RST value: SPLit
SCPI: device-specific

Mode: OFDMA

DISPlay[:WINDow<1|2>]:SELect

This command selects whether screen A or screen B is active.

Example: "`DISP:WIND1:SEL`" Sets the R&S FSQ-K92/K93 screen A active.

Characteristics: *RST value: 1
SCPI: device-specific

Mode: OFDMA

DISPlay[:WINDow<1|2>]:SSELect

This is an alias for DISPlay:[WINDow<1|2>]:SSELect. SSELect means Screen SELect.

Example: "`DISP:WIND1:SSEL`" Sets the R&S FSQ-K92/K93 screen A active.

Characteristics: *RST value: 1
SCPI: device-specific

Mode: OFDM, OFDMA

DISPlay[:WINDow<1|2>]:TABLe <boolean>

This command selects whether the results table is displayed.

Example: "`DISP:TABL OFF`"Hides the results table

Characteristics: *RST value: OFF
                      SCPI: device-specific

Mode: OFDM, OFDMA

DISPlay[:WINDow<1|2>]:TABLe:UNIT DB | PCT

This command specifies the Table of Results parameters that can be displayed as dB or degrees.
DB   results returned in dB
PCT   results returned in percent

Example: "`DISP:TABL:UNIT DB`" Results to be returned in dB.

Characteristics: *RST value: DB
                      SCPI: device-specific

Mode: OFDM, OFDMA

DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:AUTO <boolean>

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 currently only supported for EVM vs Carrier and EVM vs Symbol.

Example: "`DISP:WIND2:TRAC:Y:SCAL:AUTO ON`"   Switches on automatic scaling
                                                          of the Y-axis for the active trace.

Characteristics: *RST value: ON
                      SCPI: conforming

Mode: OFDM, OFDMA

DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:PDIVision   <numeric value>

This command sets the size of each Y scale division for the specified trace display. Note that this command has no affect if automatic scaling of the Y-axis is enabled. This command is currently only supported for EVM vs Carrier and EVM vs Symbol.

Example: "`DISP:WIND2:TRAC1:Y:SCAL:PDIV 2`" Sets the Y scale division to size to 2.

Characteristics: *RST value: 3
                      SCPI: conforming

Mode: OFDM, OFDMA

DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel?

This remote control command can be used to retrieve the current internal instrument reference level used when performing measurements. This command is for query only.
The numeric suffix at WINDow<1|2> and TRACe<1 to 3> are irrelevant.

Example: `"DISP:WIND:TRAC1:Y:RLEV?"` Returns the current reference level in use.

Characteristics: *RST value: -
                      SCPI: conforming

Mode: OFDM, OFDMA

DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel:IQ   <numeric value>

This remote control command specifies the reference level applied to a IQ measurements. The value is in volts.
The numeric suffix at WINDow<1|2> and TRACe<1 to 3> are irrelevant.

Example: `"DISP:TRAC:Y:RLEV:IQ 1"` Reference level of the analyzer is 1 V.

Characteristics: *RST value: 0 dB
                      SCPI   conforming

Mode: OFDM, OFDMA

DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel:OFFSet   <numeric value>

This remote control command specifies the external attenuation/gain applied to measurements.
The value corresponds to the reference level offset in spectrum analyzer mode.
The numeric suffix at WINDow<1|2> and TRACe<1 to 3> are irrelevant.

Example: `"DISP:TRAC:Y:RLEV:OFFS 10"` External attenuation (level offset) of
                                                   the analyzer is 10 dB.

                       `"DISP:TRAC:Y:RLEV:OFFS -10"` External attenuation of the analyzer is
                                                    -10 dB. i.e. a gain of 10 dB.

Characteristics: *RST value: 0 dB
                      SCPI: conforming

Mode: OFDM, OFDMA

DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel[:RF] <numeric value>

This remote control command specifies the reference level applied to an RF measurements.
The value is in dB.
The numeric suffix at WINDow<1|2> and TRACe<1 to 3> are irrelevant.

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.

Characteristics: *RST value: 0 dB
                      SCPI: conforming

Mode: OFDM, OFDMA

FETCh Subsystem

The FETCh subsystem contains commands for reading out results of complex measurement tasks. This subsystem is closely linked to the CONFigure and SENSe subsystems.

COMMAND	PARAMETERS	UNIT	COMMENT
FETCh			
:BURSt			
:ALL?		--	query only
:BERPilot			
:AVERage?		PCT	query only
:MINimum?		PCT	query only
:MAXimum?		PCT	query only
:CINR?			
:AVERage?		DB	query only
:MINimum?		DB	query only
:MAXimum?		DB	query only
:COUNt?			query only
:CRESt			
:AVERage?		DBM	query only
:MINimum?		DBM	query only
:MAXimum?		DBM	query only
:EVM			
:ALL			
:AVERage?		PCT | DB	query only
:MINimum?		PCT | DB	query only
:MAXimum?		PCT | DB	query only
:DATA			
:AVERage?		PCT | DB	query only
:MINimum?		PCT | DB	query only
:MAXimum?		PCT | DB	query only
:PILot			
:AVERage?		PCT | DB	query only
:MINimum?		PCT | DB	query only
:MAXimum?		PCT | DB	query only
:FERRor			
:AVERage?		PPM | HZ	query only
:MINimum?		PPM | HZ	query only
:MAXimum?		PPM | HZ	query only
:GIMBalance			
:AVERage?		PCT | DB	query only
:MINimum?		PCT | DB	query only
:MAXimum?		PCT | DB	query only
:IQOFfset			
:AVERage?		PCT | DB	query only
:MINimum?		PCT | DB	query only
:MAXimum?		PCT | DB	query only
:QUADoffset			
:AVERage?		DEG	query only
:MINimum?		DEG	query only
:MAXimum?		DEG	query only
:RMS			
:AVERage?		DBM	query only
:MINimum?		DBM	query only
:MAXimum?		DBM	query only

COMMAND	PARAMETERS	UNIT	COMMENT	E-4
FETCh				
:RMS				
:ALL				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:DATA				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:DLPReamble				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:PILot				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:RSSi				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:SDEViation?		DBM	query only	
:SSTiming				
:AVERage?		PCT	query only	
:MINimum?		PCT	query only	
:MAXimum?		PCT	query only	
:SYMBolerror				
:AVERage?		PPM	query only	
:MINimum?		PPM	query only	
:MAXimum?		PPM	query only	
:TDOMain				
:PREamble				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:SUBFrame				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:ZONE				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:USERror				
:AVERage?		DBM	query only	
:MINimum?		DBM	query only	
:MAXimum?		DBM	query only	
:SYMBol				
:COUNt?			query only	
:ZONE				
:COUNt?			query only	

FETCh:BURSt:ALL?

This command returns all the results. The results are output as a list of result strings separated by ','
in the following (ASCII) format:

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 SD>, <average RSSI SD>, <max RSSI SD>,
<min CINR>, <average CINR>, <max CINR>,
<min CINR SD>, <average CINR SD>, <max CINR SD>,

OFDMA 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>,
<min unmod. subcarrier error>, <average unmod. subcarrier error >, <max unmod. subcarrier error >,

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 SD>,

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

<CINR SD>

<min unmod. subcarrier error>, <average unmod. subcarrier error >, <max unmod. subcarrier error >,

Note that the units for the EVM results are specified with the UNITS:EVM command.

Example:	`"FETC:BURS:ALL?"` All calculated results are returned.
Characteristics:	*RST value: - SCPI: device-specific
Mode:	OFDM, OFDMA

FETCh:BURSt:BERPilot?

This command returns the minimum, average and maximum BER values for pilots. The result is returned in (ASCII) format:

Example:	`"FETC:BURS:BERP:MIN?"`
Characteristics:	*RST value: – SCPI: device-specific
Mode:	OFDMA

FETCh:BURSt:CINR?

This command returns all the CINR results as a comma separated string The results are output as a list of result strings separated by ',' in the following (ASCII) format:
<min CINR>, <average CINR>, <max CINR>,<CINR Standard Deviation>

Example:	`"FETC:BURS:CINR?"` The calculated CINR results from the most recen measurement is returned.
Characteristics:	*RST value: - SCPI: device-specific
Mode:	OFDM, OFDMA

FETCh:BURSt:CINR:AVERage?

This command returns the average CINR (carrier to interference and noise ratio) standard deviation value. The result is returned in (ASCII) format.

Example:　　　　`"FETC:BURS:CINR:AVER?"`

Characteristics:　*RST value: –
　　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

FETCh:BURSt:CINR:MINimum?

This command returns the minimum CINR (carrier to interference and noise ratio) standard deviation value. The result is returned in (ASCII) format.

Example:　　　　`"FETC:BURS:CINR:MIN?"`

Characteristics:　*RST value: –
　　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

FETCh:BURSt:CINR:MAXimum?

This command returns the maximum CINR (carrier to interference and noise ratio) standard deviation value. The result is returned in (ASCII) format:

Example:　　　　`"FETC:BURS:CINR:MAX?"`

Characteristics:　*RST value: –
　　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

FETCh:BURSt:COUNt?

This command returns the number of bursts analyzed in the last sweep.

Example:　　　　`"FETC:BURS:COUN?"`　　　The number of analyzed bursts in the most
　　　　　　　　　　　　　　　　　　　　　　　recent measurement is returned.

Characteristics:　*RST value: -
　　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM, OFDMA

FETCh:BURSt:CRESt:AVERage?
FETCh:BURSt:CRESt:MINimum?
FETCh:BURSt:CRESt:MAXimum?

This command returns the determined CREST factor (= ratio of peak power to average power) in dB.

Example:	"FETC:BURS:CRES:AVER?"	The average crest factor from the most recent measurement is returned.

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:EVM:ALL:AVERage?
FETCh:BURSt:EVM:ALL:MINimum?
FETCh:BURSt:EVM:ALL:MAXimum?

These commands return the Error Vector Magnitude measurement results summary in dB. This is a combined figure that represents the pilot, data and the free carrier.

Example:	"FETC:BURS:EVM:ALL:MAX?"	The maximum EVM recorded for all measurement carrier is returned.

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:EVM:DATA:AVERage?
FETCh:BURSt:EVM:DATA:MINimum?
FETCh:BURSt:EVM:DATA:MAXimum?

These commands return the Error Vector Magnitude measurement results summary for the data carrier in dB.

Example:	"FETC:BURS:EVM:DATA:MAX?"	The maximum EVM recorded for the data carrier is returned.

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:EVM:PILot:AVERage?
FETCh:BURSt:EVM:PILot:MINimum?
FETCh:BURSt:EVM:PILot:MAXimum?

These commands return 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.

Characteristics: *RST value: -
                    SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:FERRor:AVERage?
FETCh:BURSt:FERRor:MINimum?
FETCh:BURSt:FERRor:MAXimum?

These commands return the measured average, minimum or maximum frequency errors in Hertz.

Example:	"FETC:BURS:FERR:MAX?"	The maximum frequency error from the most recent measurement is returned.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:GIMBalance:AVERage?
FETCh:BURSt:GIMBalance:MINimum?
FETCh:BURSt:GIMBalance:MAXimum?

These commands return the measured average, minimum or maximum IQ Imbalance errors in dB or PCT.

Example:	"FETC:BURS:GIMB:MAX?"	The maximum IQ Imbalance error from the most recent measurement is returned.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:IQOFfset:AVERage?
FETCh:BURSt:IQOFfset:MINimum?
FETCh:BURSt:IQOFfset:MAXimum?

These commands return the measured average, minimum or maximum IQ Offset errors in dB or PCT.

Example:	"FETC:BURS:IQOF:MAX?"	The maximum IQ Offset error from the most recent measurement is returned.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:QUADoffset:AVERage?
FETCh:BURSt:QUADoffset:MINimum?
FETCh:BURSt:QUADoffset:MAXimum?

These commands return 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.

Characteristics: *RST value: -

SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:RMS:AVERage?
FETCh:BURSt:RMS:MINimum?
FETCh:BURSt:RMS:MAXimum?

These commands return the average, minimum or maximum RMS burst power in dBm measured during the measurement.
For OFDM, this command returns the average, minimum or maximum RMS burst power in dBm measured during the measurement.
For OFDMA, this command is an alias for FETch:BURST:RMS:DATA.

Example: `"FETC:BURS:RMS:MAX?"`   The maximum burst power recorded for the most recent measurement.

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:RMS:ALL:AVERage

This command returns the average RMS burst power in dBm for all carriers measured during the measurement.

Example: `"FETC:BURS:RMS:ALL:AVER?"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM

FETCh:BURSt:RMS:ALL:MINimum?

This command returns the minimum RMS burst power in dBm for all carriers measured during the measurement.

Example: `"FETC:BURS:RMS:ALL:MIN?"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM

FETCh:BURSt:RMS:ALL:MAXimum?

This command returns the maximum RMS burst power in dBm for all carriers measured during the measurement.

Example: `"FETC:BURS:RMS:ALL:MAX?"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM

FETCh:BURSt:RMS: DATA:AVERage?

This command returns the average RMS burst power in dBm for data carriers measured during the measurement.

Example: `"FETC:BURS:RMS:DATA:AVER?"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM

FETCh:BURSt:RMS:DATA:MINimum?

This command returns the minimum RMS burst power in dBm for data carriers measured during the measurement.

Example: `"FETC:BURS:RMS:DATA:MIN?"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM

FETCh:BURSt:RMS: DATA:MAXimum?

This command returns the maximum RMS burst power in dBm for data carriers measured during the measurement.

Example: `"FETC:BURS:RMS:DATA:MAX?"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM

FETCh:BURSt:RMS: DLPR:AVERage?

This command returns the average RMS burst power in dBm for the downlink preamble measured during the measurement.

Example: `"FETC:BURS:RMS:DLPR:AVER?"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM

FETCh:BURSt:RMS:DLPR:MINimum?

This command returns the minimum RMS burst power in dBm for the downlink preamble measured during the measurement.

Example: `"FETC:BURS:RMS:DLPR:MIN?"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM

FETCh:BURSt:RMS: DLPR:MAXimum?

This command returns the maximum RMS burst power in dBm for the downlink preamble measured during the measurement.

Example:	`"FETC:BURS:RMS:DLPR:MAX?"`
Characteristics:	*RST value: –
	SCPI: device-specific
Mode:	OFDM

FETCh:BURSt:RMS: PILot:AVERage?

This command returns the average RMS burst power in dBm for pilot carriers measured during the measurement.

Example:	`"FETC:BURS:RMS:PIL:AVER?"`
Characteristics:	*RST value: –
	SCPI: device-specific
Mode:	OFDM

FETCh:BURSt:RMS:PILot:MINimum?

This command returns the minimum RMS burst power in dBm for pilot carriers measured during the measurement.

Example:	`"FETC:BURS:RMS:PIL:MIN?"`
Characteristics:	*RST value: –
	SCPI: device-specific
Mode:	OFDM

FETCh:BURSt:RMS: PILot:MAXimum?

This command returns the maximum RMS burst power in dBm for pilot carriers measured during the measurement.

Example:	`"FETC:BURS:RMS:PIL:MAX?"`
Characteristics:	*RST value: –
	SCPI: device-specific
Mode:	OFDM

FETCh:BURSt:RSSI?

This command returns all the RSSI results as a comma separated string The results are output as a list of result strings separated by ',' in the following (ASCII) format:
<min RSSI>, <average RSSI>, <max RSSI>,< RSSI Standard Deviation>

Example:	`"FETC:BURS:RSSI?"`	The calculated RSSI results from the most recent measurement is returned.
Characteristics:	*RST value: -	
	SCPI: device-specific	
Mode:	OFDM, OFDMA	

FETCh:BURSt: RSSI:AVERage?

This command returns the average 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. The result is returned in (ASCII) format.

Example: `"FETC:BURS:RSSI:AVER?"`

Characteristics: *RST value: –
                SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt: RSSI:MINimum?

This command returns the minimum 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. The result is returned in (ASCII) format.

Example: `"FETC:BURS:RSSI:MIN?"`

Characteristics: *RST value: –
                SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt: RSSI:MAXimum?

This command returns the 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. The result is returned in (ASCII) format.

Example: `"FETC:BURS:RSSI:MAX?"`

Characteristics: *RST value: –
                SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:BURSt:SSTiming:AVERage
FETCh:BURSt:SSTiming:MINimum
FETCh:BURSt:SSTiming:MAXimum

This command is obsolete but retained for backward-compatibility with old scripts.

FETCh:BURSt:SYMBolerror:AVERage
FETCh:BURSt:SYMBolerror:MINimum
FETCh:BURSt:SYMBolerror:MAXimum

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.

Characteristics: *RST value: -
                SCPI: device-specific

Mode: OFDM, OFDMA

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:MIN?"`

Characteristics: *RST value: –
                      SCPI: device-specific

Mode: OFDMA

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:MIN?"`

Characteristics: *RST value: –
                      SCPI: device-specific

Mode: OFDMA

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:MIN?"`

Characteristics: *RST value: –
                      SCPI: device-specific

Mode: OFDMA

FETCh:BURSt:USERror:MINimum?

This command returns the minimum Unmodulate Subcarrier Error for the analysed zone.

Example: `"FETC:BURS:USER:MIN?"`   The minimum unmodulated subcarrier error.

Characteristics: *RST value: –
                      SCPI: device-specific

Mode: OFDMA

FETCh:BURSt:USERror:AVERage?

This command returns the average Unmodulate Subcarrier Error for the analysed zone.

Example: `"FETC:BURS:USER:AVER?"`   The average unmodulated subcarrier error.

Characteristics: *RST value: –
                              SCPI: device-specific

Mode: OFDMA

FETCh:BURSt:USERror:MAXimum?

This command returns the maximum Unmodulate Subcarrier Error for the analysed zone.

Example: `"FETC:BURS:USER:MAX?"` The maximum unmodulated subcarrier error.

Characteristics: *RST value: –
               SCPI: device-specific

Mode: OFDMA

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 ',' 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 recentmeasurement are returned.

Characteristics: *RST value: -
               SCPI: device-specific

Mode: OFDM, OFDMA

FETCh:ZONE:COUNt?

This remote control command returns the current number of zones found during measurement analysis.

Example: `"FETC:ZONE:COUN?"`   Returns the current number of zone found during analysis.

Characteristics: *RST value: –
               SCPI: device-specific

Mode: OFDMA

FORMat Subsystem

The FORMat subsystem provide specifies the data format of the data transmitted from and to the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
FORMat [:DATA]	ASCii|REAL|UINT[,<numeric value>]	-	

FORMat[:DATA]   ASCii | REAL| UINT [8 | 32]

This command specifies the data format for the data transmitted to from the instrument to the control PC. It controls whether the bitstream data is sent as ASCII or UINT8 binary format.

Example: "FORM UINT,8"   The R&S FSQ-K92/K93 option will send bitstream data
                                      equested by the TRACE:DATA? command as
                                      unsigned integers in binary format.

Characteristics: *RST value: ASCii
                      SCPI: conforming

Mode: OFDM, OFDMA

INITiate Subsystem

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.

COMMAND	PARAMETERS	UNIT	COMMENT
INITiate			
:CONTinuous	<Boolean>		
[:IMMediate]			no query
:REFResh			no query

INITiate:CONTinuous   <Boolean>

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

Example: "INIT:CONT OFF" The R&S FSQ-K92/K93 option will attempt a non continuous measurement when initiated.

Characteristics: *RST value: -
                SCPI: conforming

Mode: OFDM, OFDMA

INITiate[:IMMediate]

This remote control command requests the R&S FSQ- K92 option to start a new measurement sequence. If a measurement sequence is already in progress, then the command will be ignored.

Example: "INIT"   The R&S-K92 option will attempt to start a new measurement.

Characteristics: *RST value: -
                SCPI: conforming

Mode: OFDM, OFDMA

INITiate:REFResh

This command updates the current IQ measurement results to reflect the current measurement settings. Note no new IQ data is captured. I.e. the measurement settings apply to the IQ data being currently in the capture buffer. The command applies exclusively to IQ measurements. It requires available IQ data.

Example: "INIT:REFR"   The R&S FSQ-K92/K93 will update the IQ measurement results according to the current settings.

Characteristics: *RST value: -
                SCPI: conforming

Mode: OFDM, OFDMA

INPut Subsystem

The INPut subsystem controls the input characteristics of the RF inputs of the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
:INPut<1|2>			
:ATTenuation	< numeric_value >	DB	
:EATT	< numeric_value >	DB	
:AUTO	<Boolean>		
:STATe	<Boolean>		
:FILTer			
:YIG			
:AUTO	<Boolean>		
[:STATe]	<Boolean>		
:SELect	AIQ | RF		
:IQ			
:BALanced			
[:STATe]	<Boolean>		B71 Option only
:IMPedance	LOW | HIGH		B71 Option only
:TYPE	IQ | I | Q		B71 Option only

INPut<1|2>:ATTenuation   <numeric 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 command DEC.
The step width is 10 dB without the option electronic attenuator, the range 0 dB to 70 dB.
The input attenuation can be set in 5 dB steps between 0 dB and 75 dB with the option electronic attenuator.

Example: `"INP:ATT?"`   'Returns the current mechanical attenuator setting in use

Characteristics: ***RST value:**   10 dB
                             SCPI: conforming

Mode: OFDM, OFDMA

INPut<1|2>:EATT <numeric value>

This command programs the attenuation of the electronic input attenuator. The attenuation can be varied in 5 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value.
The electronic attenuator is switched off in the default state.

Example: `"INP:EATT?"` 'Returns the current electronic attenuator setting in use.

Characteristics: ***RST value:**   0 dB
                             SCPI: device-specific

Mode: OFDM, OFDMA

The command is only available with the electronic attenuator option B25.

INPut<1|2>:EATT:AUTO <Boolean>

This command automatically couples the electronic input attenuation to the reference level and the attenuation of the mechanical attenuator (state ON) or switches the input attenuation to manual entry (state OFF).

Example: `"INP:EATT:AUTO ON"` Couples the attenuation of the electronic
                                              attenuator to the reference level.

Characteristics: *RST value: ON

                      SCPI: device-specific

Mode: OFDM, OFDMA

The command is only available with the electronic attenuator option B25.

INPut<1|2>:EATT:STATe   <Boolean>

This command switches the electronic input attenuation into the signal path (state ON) or removes it from the signal path (state OFF).

Example: `"INP:EATT:STAT ON"` Switches the electronic attenuator into the signal path.

Characteristics: *RST value: OFF
                      SCPI: device-specific

Mode: OFDM, OFDMA

The command is only available with the electronic attenuator option B25.

INPut<1|2>:FILTer:YIG[:STATe]   <Boolean>

This command switches the YIG filter for image frequency suppression into the signal path (condition ON) and/or removes it from the signal path (condition OFF).

Example: `"INP:FILT:YIG:STAT OFF"` Switches the YIG filter off.

Characteristics: *RST value: ON
                      SCPI: device-specific

Mode: OFDM, OFDMA

INPut<1|2>:FILTer:YIG:AUTO <Boolean>

This command specifies whether automatic setting of the YIG filter to the optimum setting is performed by the application (ON), or wether the YIG filter settings is set manually (OFF).

Example: `"INP:FILT:YIG:AUTO ON"`   Switches automatic YIG filter setting ON.

Characteristics: *RST value: ON
                      SCPI: device-specific

Mode: OFDM, OFDMA

INPut:SELect   AIQ | RF

This remote control command specifies whether the baseband Inputs or RF input are the currently selected signal input. Note that baseband input requires option B71. When option B71 is not installed then only RF selection is allowed.

Example: "INP:SEL AIQ"   Select baseband Input.

Characteristics: *RST value: RF
                       SCPI: conforming

Mode: OFDM, OFDMA

INPut:IQ:BALanced[:STATe]   <Boolean>

This remote control command specifies whether the IQ inputs are symmetrical (balanced) or asymmetrical (unbalanced). Note that this command requires option B71.

Example: "INP:IQ:BAL ON"   Specifies symmetrical (balanced) IQ inputs.

Characteristics: *RST value: ON
                       SCPI: conforming

Mode: OFDM, OFDMA

INPut:IQ:IMPedance   LOW | HIGH

This remote control command specifies the input impedance for the IQ inputs. Note that this command requires option B71.

Example: "INP:IQ:IMP LOW"   Specifies low input impedance for IQ inputs.

Characteristics: *RST value: LOW
                       SCPI: conforming

Mode: OFDM, OFDMA

INPut:IQ:TYPE   IQ | I | Q

This remote control command specifies the input path for the Baseband input. The values which can be specified are as follows:

IQ: I + j*Q (=default)

I: I Only

Q: Q Only

Note that this command requires option B71.

Example: "INP:IQ:TYPE I"   Specifies only the I input is used for the Baseband path.

Characteristics: *RST value: IQ
                       SCPI: conforming

Mode: OFDM, OFDMA

INSTrument Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
: INSTrument			
:NSElect	<numeric value>		
:SELect	WIMAX		

INSTrument:SELect WIMAX

This remote control command selects active operation of the R&S FSQ-K92/K93 option by specifying its name.

Example: "INST:SEL WIMAX"   The R&S FSQ-K92/K93 option will be selected as the active option.

Characteristics: *RST value: SAN
                       SCPI: device-specific

Mode: OFDM, OFDMA

INSTrument:NSELect   <numeric value>

This remote control command selects active operation of the R&S FSQ-K92/K93 option by specifying its associated option number.

Example: "INST:NSEL 6"   The R&S FSQ-K92/K93 option will be selected as the active option.

Characteristics: *RST value: 1
                       SCPI: device-specific

Mode: OFDM, OFDMA

MMEMory Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
:MMEMory			
:LOAD			
:FRAMe			
:STATe	1,<file_name>		
:IQ			
:STATe	1,<file_name>		
:SEM			
:STATe	1,<file_name>		
:STORe			
:IQ			
:STATe	1,<file_name>		
:FRAME			
:STATe	1,<file_name>		

MMEMory:LOAD:FRAMe:STATe 1,<file_name>

The remote control command is used to load a K93 zone frame setup from an xml file created from a SMU signal generator, with support for the IEEE 80216e-2005 OFDMA/WiBro standard.

Using the special filename "SMU" will attempt to receive the current settings from a networked SMU. The IP address used is configured by `CONF:ADDR:SMU`.

Example: `"MMEM:LOAD:FRAM:STAT 1,'D:\USER\DATA.xml'"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDMA

MMEMory:LOAD:IQ:STATe1,<file_name>

The remote control command is used to load IQ data from the specified .iqw file.

Example: `"MMEM:LOAD:IQ:STAT 1,'D:\USER\DATA.iqw'"`
                                                          Loads IQ data from the specified file.

Characteristics: *RST value: -
                        SCPI: device-specific

Mode: OFDM, OFDMA

MMEMory:LOAD:SEM:STATe

The remote control command is used to load a K93 spectrum emission mask setup from an xml file

Example: `"MMEM:LOAD:SEM:STAT 1,'D:\USER\TTA_SEM.xml'"`

Characteristics: *RST value: –
                        SCPI: device-specific

Mode: OFDM, OFDMA

MMEMory:STORe:IQ:STATe 1,<file_name>

The remote control command is used to save IQ data to the specified .iqw file.

Example: `"MMEM:STOR:IQ:STAT 1,'D:\USER\DATA.iqw'"`

Stores IQ data to the specified file.

Characteristics: *RST value: -

SCPI: device-specific

Mode: OFDM, OFDMA

MMEMory:STORe:FRAMe:STATe

The remote control command is used to send a locally created and stored K93 zone frame file name, with support for the IEEE 80216e/D11 standard, to the SMU signal generator. If the command succeeds, the SMU will generate the waveform associated with the file sent.

Example: `"MMEM:STOR:FRAM:STAT 1,'D:\USER\WMAN\DATA.wimax'"`

Characteristics: *RST value: –

SCPI: device-specific

Mode: OFDM, OFDMA

SENSe Subsystem

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.

Example: SENS:FREQ 10 GHZ –   sets the frequency to 10 GHz
         SENS:FREQ?   –   response 10 GHZ – returns the current frequency

COMMAND	PARAMETERS	UNIT	COMMENT
[:SENSe]			
:BANDwidth			
:CHANnel	<numeric value>		
:BURSt			
:COUNt	<numeric value>		
:STATe	<Boolean>		
:DEMod			
:CESTimation	PREAMONLY|PREAMPAYL|PAYLONLY| <Boolean>		query only
:FORMat			
:BANalyze	<String>		
:BTYPe	OFDM		
:SYMBols			
:EQUal	<Boolean>		
:MIN	<numeric value>		
:MAX	<numeric value>		
[:BCONtent]			
:AUTO	NONE | FIRST | USER | ALL | SIGNal | PREDefined		
:FFT			
:OFFSet	<numeric value>	Hz	
:FREQuency			
:CENTer	<numeric value>	Hz	
:IQ			
:DITHer			
[:STATe]	<Boolean>		
:LPASs			
[:STATe]	<Boolean>		
:POWer			
:ACHannel			
:ACPairs	<numeric value>		
:BANDwidth		Hz	
[:CHANnel]	<numeric value>	Hz	
:ACHannel	<numeric value>	Hz	
:ALTernate<1...4>	<numeric value>		
:BWIDth		Hz	
[:CHANnel]	<numeric value>	Hz	
:ACHannel	<numeric value>	Hz	
:ALTernate<1...4>	<numeric value>		
:MODE	ABS | REL		
:SPACing		Hz	
[:ACHannel]	<numeric value>	Hz	
:ALTernate<1...4>	<numeric value>		
:NCORrection	<Boolean>		

COMMAND	PARAMETERS	UNIT	COMMENT
[:SENSe]			
POWER			
:SEM	USER | STANDARD | IEEE | ETSI		
:CLASs	<numeric_value>		
:MODE	UL | DL		
:TTA	USER | STANDARD		
:SUBChannel	<numeric value>		
:STATe	<Boolean>		
:ULPHysmod	<numeric value>		
:SWAPiq	<Boolean>		
:SWEep			
:ACPR			
:TIME	<numeric value>	S	
:AUTO	<Boolean>		
:TIME	<numeric value>		
:COUNt	<numeric value>	S	
:EGATe	<Boolean>		
:HOLDoff			
[:TIME]	<numeric value>		
:SAMPle	<numeric value>	S	
:LENgth			
[:TIME]	<numeric value>		
:SAMPle	<numeric value>	S	
:LINK	<Boolean>		
:TRACking			
:LEVel	<Boolean>		
:PHASe	<Boolean>		
:PILot	PRED | DET		
:TIME	<Boolean>		
:ZONe			
:COUNt	<numeric_count>		
:STATe	<Boolean>		

[SENSe:]BANDwidth:CHANnel　<numeric value>

The remote control command is used to specify the channel bandwidth of the signal to be measured.

Example:　　　　　"SENS:BAND:CHAN 7MHZ"　　The R&S FSQ-K92 option uses a channel bandwidth value of 7 MHz.

Characteristics:　*RST value: 1.75 MHz
　　　　　　　　　　SCPI:　　　conforming

Mode:　　　　　OFDM, OFDMA

[SENSe:]BURSt:COUNt <numeric value>

This command defines the number of bursts that will be analyzed by the measurement.

Example:　　　　　"SENS:BURS:COUN 16" Sets the number of bursts to 16.

Characteristics:　*RST value: 1
　　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　OFDM

[SENSe:]BURSt:COUNt:STATe   <Boolean>

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.

Example: "SENS:BURS:COUN:STAT ON" Sets the burst count state to ON.

Characteristics: *RST value: OFF
                       SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]DEMod:CESTimation   PREAMONLY | PREAMPAYL | PAYLONLY | <Boolean>

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.

Standard	Parameter	Description
IEEE 802.16–2004 OFDM	ON	Improved channel estimation is performed.
	OFF	Improved channel estimation is not performed.
IEEE 802.16e–2005 OFDMA	PAYLONLY	Channel estimation is performed in the payload only.
	PREAMONLY	Channel estimation is performed in the preamble only.
	PREAMPAYL	Channel estimation is performed in both the preamble and the payload.

Example: "SENS:DEMod:CEST ON"   Specifies that the IQ measurement results will use improved channel estimation.

Characteristics: *RST value: OFF
                       SCPI: conforming

Mode: OFDM, OFDMA

[SENSe:]DEMod:FORMat[:BCONtent]:AUTO NONE | FIRST | USER | ALL

The remote command is used to specify for OFDM how the DSP should use its demodulation and for OFDMA 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.

NONE, 'OFDM' demodulation off (Brute force mode) the specified modulation is used for all bursts.

FIRSt, 'OFDM' retrieve the first valid payload modulation and analyze all bursts with same modulation.

USER, 'OFDM' analyze all bursts carrying the modulation specified.

ALL, 'OFDM' analyze each burst with the first valid payload modulation found for that burst.

SIGNal, 'OFDMA' pre-analyze to determine the Zone, Burst and Downlink sub–Channel Map, prior to analyze for the first Zone results.

PREDefined, 'OFDMA' analyze using the predefined Zone, Burst and Downlink sub–Channel Map for the current captured signal for the specified Zone results

Example:	"SENS:DEM:FORM:AUTO FIRST"	Specifies that the first symbol field should be decoded.

Characteristics:	*RST value: ALL
	SCPI: device-specific:
Mode:	OFDM

[SENSe:]DEMod:FORMat:BANalyze <String>

The remote control command sets the analysis modulation format that will be assumed when the measurement is performed.
The supplied string can be one of the following:
'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
Note when the standard is IEEE 802.16e 2005 OFDMA or WiBro then this command is query only and returns the highest detected modulation format from the last measurement sweep.

Example:	"SENS:DEM:FORM:BAN '16QAM1/2'"	The R&S FSQ-K92/K93 option will only analyze bursts that are of the 16QAM modulation format.

Characteristics:	*RST value: '16QAM1/2'
	SCPI: device-specific
Mode:	OFDM, OFDMA

[SENSe:]DEMod:FORMat:BANalyze:BTYPe   OFDM

This command is maintained in R&S FSQ-K92/K93 for backward compatibility. The command may be issued in all standards with the argument OFDM. If queried, it always returns OFDM. Any other usage results in an error.

Example: "`SENS:DEM:FORM:BAN:BTYP?`"

Characteristics: *RST value: 'OFDM'
                             SCPI: device-specific

Mode: OFDM

[SENSe:]DEMod:FORMat:BANalyze:SYMbols:EQUal <Boolean>

When this command is set to ON then only bursts of equal length will take part in the PVT analyzis. When this command is set to true the value specified by the [SENSe:]DEMod:BANalyze:SYMbols:MIN command specifies the number of symbols that a burst must have in order to take part in PVT analyzis.

Example: "`SENS:DEM:FORM:BAN:SYM:EQU ON`"   Only bursts of equal length
                                                                will take part in the PVT analyzis.

Characteristics: *RST value: OFF
                             SCPI: device-specific

Mode: OFDM

[SENSe:]DEMod:FORMat:BANalyze:SYMbols:MIN <numeric value>

This command specifies the number of data symbols required for bursts to qualify for measurement analyzis. 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.

When the [SENSe:]DEMod:BANalyze:SYMbols:EQUal command has been set to true then this command specifies the exact number of symbols required for a burst to take part in measurement analyzis. When the [SENSe:]DEMod:BANalyze:SYMbols:EQUal command is set to false this command specifies the minimum number of symbols required for a burst to take part in measurement analysis.

Example: "`SENS:DEM:FORM:BAN:SYM:MIN 16`"   The R&S FSQ-K92/K93 option will only
                                                                   analyze bursts which contain a symbol
                                                                   count of 16.

Characteristics: *RST value: 1
                             SCPI: device-specific

Mode: OFDM

[SENSe:]DEMod:FORMat:BANalyze:SYMbols:MAX <numeric value>

This command specifies the maximum number of data symbols required for bursts to qualify for measurement analyzis. Only bursts with the specified number of symbols will be used in the measurement analyzis. 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:BANalyze:SYMbols:EQUal command has been set to true as in this case no range of symbols is allowed and only bursts with exactly the number of symbols specified by the [SENSe:]DEMod:BANalyze:SYMbols:MIN command shall take place in measurement analysis.

Example:	"SENS:DEM:FORM:BAN:SYM:MAX 1300"	The R&S FSQ-K92/K93 option will only analyze bursts which contain a maximum symbol count of 1300.

Characteristics: *RST value: 64
SCPI: device-specific

Mode: OFDM

[SENSe:]FFT:OFFSet   <numeric value>

The remote control command is used to specify the FFT start offset relative to the GP centre.

Example: "SENS:FFT:OFF 0"

Characteristics: *RST value: 0
SCPI: conforming

Mode: OFDMA

[SENSe]:FREQuency:CENTer <numeric value>

The remote control command is used to specify the frequency that the Analyzer will use to make measurements against the input signal.

Example:	"SENS:FREQ:CENT 50MHZ"	The R&S FSQ-K92/K93 option uses the specified frequency value to set the analyzer detection frequency.

Characteristics: *RST value: 5 GHz
SCPI: conforming

Mode: OFDM, OFDMA

[SENSe]:IQ:DITHer[:STATe]   <Boolean>

This instruction links a 2 MHz broad intoxication signal with 42.67 MHz into the signal path of the baseband inputs. Note that this command requires option B71.

Example: "SENS:IQ:DITH 1"   Switches on the 2 MHz broad intoxication signal.

Characteristics: *RST value: OFF
SCPI: conforming

Mode: OFDM, OFDMA

[SENSe]:IQ:LPASs[:STATe]   <Boolean>

This instruction switches a 36 MHz filter into the I and Q branch of the baseband inputs. Note that this command requires option B71.

Example: "SENS:IQ:LPAS 1" Switches on the low pass filter for the IQ inputs.

Characteristics: *RST value: OFF
                         SCPI: conforming

Mode: OFDM, OFDMA

SENSe:]POWer:ACHannel:ACPairs <numeric value>

This command sets the number of adjacent channels pairs (upper and lower channel pairs).The figure 0 stands for pure channel power measurement.

Example: "POW:ACH:ACP 3" Sets the number of adjacent channels to 3, ie the
                         adjacent channel and alternate adjacent channels 1 and 2
                         are switched on.

Characteristics: *RST value: -
                         SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel]   <numeric value>

This command sets the channel bandwidth of the system. The bandwidths of adjacent channels are not influenced by this modification.

Example: "POW:ACH:BAND 30kHz"   Sets the bandwidth of the TX channel to 30 kHz.

Characteristics: *RST value: -
                         SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ACHannel   <numeric value>

This command defines the channel bandwidth of the adjacent channel of the system.

Example: "POW:ACH:BAND:ACH 30kHz"   Sets the bandwidth of the adjacent channel to
                         30 kHz.

Characteristics: *RST value: -
                         SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe<1|2>:]POWer:ACHannel:BANDwidth|BWIDth:ALTernate<1…4> <numeric value>

This command defines the channel bandwidth of the first/second alternate adjacent channel of the system.

Example: "POW:ACH:BAND:ALT2 30kHz" Sets the bandwidth of the second alternate
                         channel to 30 kHz.

Characteristics: *RST value: -
                         SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:ACHannel:MODE ABS | REL

This command selects the ACP measurement to be measuresd as Absolute (ABS) or Relative (REL).

Example:	`"POW:ACH:MOD ABS"`	Switched to ACP measurement to Absolute.

Characteristics: *RST value: REL
SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:ACHannel:SPACing[:ACHannel] <numeric value>

This command defines the channel spacing of the adjacent channel to the TX channel.

Example: `"POW:ACH:SPAC 33kHz"`   Sets the spacing between the carrier signal and the adjacent channel to 33 kHz.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:ACHannel:SPACing:ALTernate<1…4> <numeric value>

This command defines the channel spacing of the alternate adjacent channel to the TX channel.

Example: `"POW:ACH:SPAC:ATL1 100kHz"` Sets the spacing between TX channel and alternate adjacent channel 1 to 100 kHz.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:NCORrection <Boolean>

This command sets the noise correction on/off for future spectrum ACP measurements.

Example: `"POW:NCOR ON"` Turn ON noise correction.

Characteristics: *RST value: –
SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:SEM USER|STANDARD|IEEE|ETSI

This command sets the behaviour of the Spectrum Emission Mask (SEM) analysis.

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)

Example: `"POW:SEM USER"`   set SEM analysis according to a user defined configuration.

Characteristics: *RST value: IEEE (OFDM/OFDMA), STANDARD (WiBro)
SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]POWer:SEM:TTA

This command sets the Spectrum Emission Mask (SEM) analysis for WiBro mode according to TTA standard or a user defined mask.

Note: *This command is maintained for backward compatibility only. It has been replaced by [SENSe:]POWer:SEM.*

Example: `"POW:SEM:TTA STANDARD"`   set SEM analysis according to TTA

Characteristics: *RST value: STANDARD
                         SCPI: device-specific

Mode: OFDMA

[SENSe:]POWer:SEM:CLASs

This command sets the Spectrum Emission Mask (SEM) power class index. The index represents the power classes to be applied. The index is directly related to the entries displayed in the power class drop down combo box, within the SEM settings configuration page.

Example: `"POW:SEM:CLASs 0"`   set SEM power class to automatic

Characteristics: *RST value: –0
                         SCPI: device-specific

Mode: WiBro

SENSe:]POWer:SEM:MODe   UL | DL

This command sets the Spectrum Emission Mask (SEM) analysis to be UL or DL (uplink or downlink).

Example: `"POW:SEM:MOD UL"`   set SEM analysis to uplink

Characteristics: *RST value: DL
                         SCPI: device-specific

Mode: WiBro

[SENSe:]POWer:SEM:TTA USER | STANDARD

This command sets the Spectrum Emission Mask (SEM) analysis according to TTA standard or a user defined mask.

Example: `"POW:SEM:TTA STANDARD"` set SEM analysis according to TTA

Characteristics: *RST value: –STANDARD
                         SCPI: device-specific

Mode: WiBro

[SENSe:]SUBChannel   <numeric value>

This command sets the sub-channel to be used in the measurement. This has a range of 1 to 31. This is only available in up link mode.

Example: `"SUBC 12"`   sets the sub-channel to 12.

Characteristics: *RST value: -
                         SCPI: device-specific

Mode: OFDMA

[SENSe:]SUBChannel:STATe <Boolean>

This command enables or disables the subchannelization used in the measurement. This is only available in up link mode.

Example: "SUBC:STAT 1"   Specifies that the measurement will be analyzed using the specified sub-channel.

Characteristics: *RST value: OFF
                   SCPI: conforming

Mode: OFDMA

[SENSe:]SUBChannel:ULPHysmod <numeric value>

This command sets the Up Link Physical Modifier to be used in the measurement. This has a range of 0 to 255. This is only available in up link mode.

Example: "SUBC:ULPH 1"   Sets the UL Physical Modifier to 1.

Characteristics: *RST value: -
                   SCPI: device-specific

Mode: OFDMA

[SENSe:]SWEep:ACPR:TIME <numeric value>

The remote control command is used to specify the sweep time for Spectrum ACP and .MASK measurements If this SCPI command is successfully entered, then the automatic setting is disabled.

Example: "SENS:SWE:ACPR:TIME 100mS"

Characteristics: *RST value: 2
                   SCPI: conforming

Mode: OFDM, OFDMA

[SENSe:]SWEep:ACPR:TIME:AUTO <Boolean>

The remote control command is used to specify automatic sweep time calculation for Spectrum ACPR and .MASK measurements.

Example: "SENS:SWE:ACPR:TIME:AUTO OFF"

Characteristics: *RST value: ON
                   SCPI: conforming

Mode: OFDM, OFDMA

[SENSe]:SWEep:COUNt<numeric value>

The remote control command is used to specify the number of sweeps for Spectrum Mask and Spectrum ACPR measurements.

Example: "SENS:SWEep:COUNt 64" Sets the number of sweeps to 64.

Characteristics: *RST value: 1
                   SCPI: conforming

Mode: OFDM, OFDMA

[SENSe:]SWEep:EGATe   <Boolean>

This command switches on/off the gating.

Example: "`SENS:SWE:EGAT ON`"   Switches on gating.

Characteristics: *RST value: OFF
                      SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]SWEep:EGATe:HOLDoff:SAMPle   <numeric value>

This command defines the gate delay in the capture buffer as a number of samples.

Example: "`SENS:SWE:EGAT:HOLD:SAMP 2500`" The R&S FSQ-K92/K93 option will
                                                        enforce a delay of 2500 samples in the
                                                        Capture buffer.

Characteristics: *RST value: 0
                      SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]SWEep:EGATe:HOLDoff[:TIME]   <numeric value>

This command defines the gate delay in the captue buffer in time units.

Example: "`SENS:SWE:EGAT:HOLD 125us`" The R&S FSQ-K92/K93 option will enforce
                                                    a delay of 125us in the Capture buffer.

Characteristics: *RST value: 0s
                      SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]SWEep:EGATe:LENGth:SAMPle <numeric value>

This command defines the gate time in the capture buffer as a number of samples.

Example: "`SENS:SWE:EGAT:LENG:SAMP 2000000`" The R&S FSQ-K92/K93 option will
                                                          enforce a gate length of 2000000
                                                          samples in the Capture buffer.

Characteristics: *RST value: 0
                      SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]SWEep:EGATe:LENGth[:TIME]   <numeric value>

This command defines the gate time in the capture buffer in time units.

Example: "`SENS:SWE:EGAT:LENG 100ms`" The R&S FSQ-K92/K93 option will enforce
                                                   a gate length of 100 milliseconds
                                                   between sweeps.

Characteristics: *RST value: 0
                      SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]SWEep:EGATe:LINK   <Boolean>

This command links together the movement of the gating lines and the capture buffer marker

Example:	"SENS:SWE:EGAT:LINK ON"	The R&S FSQ-K92/K93 option will move the capture buffer marker to the centre of the gating lines and update the gating delay as the capture buffer marker is updated and update the capture buffer marker so that it remains in the centre of the gating lines as the gating line delay and length are changed.

Characteristics: *RST value: 0
                        SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe]:SWEep:TIME   <numeric value>

The remote control command is used to specify the sweep acquisition period (capture time) for which the input signal is to be measured.

Example:	"SENS:SWEep:TIME 24 us"	The R&S FSQ-K92/K93 option uses the specified sweep acquisition period.

Characteristics: *RST value: 24 us
                        SCPI: conforming

Mode: OFDM, OFDMA

[SENSe:]SWAPiq <Boolean>

This command defines whether or not the recorded IQ pairs should be swapped (I<->Q) before being processed.

Example:	"SWAP ON"	Specifies that IQ values should be swapped.

Characteristics: *RST value: OFF
                        SCPI: device-specific

Mode: OFDM, OFDMA

[SENSe:]TRACking:LEVel <Boolean>

This command defines whether or not the measurement results should be compensated for level.

Note: *[SENSe] is not optional for this command when using the short form: "TRAC" as it conflicts with the "TRACe" command.*

Example:	"SENS:LEV ON"	Specifies that the measurement results should be compensated for level.

Characteristics: *RST value: OFF
                        SCPI: device-specific

Mode: OFDM

[SENSe:]TRACking:PHASe<Boolean>

This command defines whether or not the measurement results should be compensated for phase.

Note: *[SENSe] is not optional for this command when using the short form: "TRAC" as it conflicts with the "TRACe" command.*

Example:	"SENS:TRACk:PHAS ON" Specifies that the measurement results should be compensated for phase.

Characteristics:	*RST value: ON
	SCPI: device-specific

Mode:	OFDM, OFDMA

[SENSe:]TRACking:PILot PRED | DET

This command defines whether or not the measurement results should have predefined pilot tracking (PRED) or whether the tracking should be determined when the measurement is run (DET).

Note: *[SENSe] is not optional for this command when using the short form: "TRAC" as it conflicts with the "TRACe" command.*

Example:	"SENS:TRAC:PIL DET"

Characteristics:	*RST value: PRED
	SCPI: device-specific

Mode:	OFDMA

[SENSe:]TRACking:TIME <Boolean>

This command defines whether or not the measurement results should be compensated for time

Note: *[SENSe] is not optional for this command when using the short form: "TRAC" as it conflicts with the "TRACe" command.*

Example:	"SENS:TRACk:TIME 1" Specifies that the measurement results should be compensated for time

Characteristics:	*RST value: OFF
	SCPI: conforming

Mode:	OFDM, OFDMA

[SENSe:]ZONE:COUNt

This command defines the number of zones that will be analyzed by the measurement.

Example:	"ZONE:COUN 16" Sets the number of zones to 16.

Characteristics:	*RST value: 1
	SCPI: device-specific

Mode:	OFDMA

[SENSe:]ZONE:COUNt:STATe

When this command is set to on, the zone count parameter will be used by the measurement, otherwise the zone count parameter will be ignored.

Example:	"ZONE:COUN:STAT 1" Sets the zone count state to ON

Characteristics:	*RST value: 0
	SCPI: device-specific

Mode:	OFDMA

STATus Subsystem

The STATus subsystem contains the commands for the status reporting system (See Section Status reporting registers). *RST does not influence the status registers.

COMMAND	PARAMETERS	UNIT	COMMENT
:STATus			
:QUEStionable			
:LIMit<1|2>			
:CONDition?	--		
:ENABle	0 to 65535		
[:EVENt]?	--		
:NTRansition	0 to 65535	--	
:PTRansition	0 to 65535	--	
:POWer			
:CONDition?	--		
:ENABle	0 to 65535	--	
[:EVENt]?	--		
:NTRansition	0 to 65535	--	
:PTRansition	0 to 65535	--	
:SYNC			
:CONDition?	--		
:ENABle	0 to 65535	--	
[:EVENt]?	--		
:NTRansition	0 to 65535	--	
:PTRansition	0 to 65535	--	

STATus:QUEStionable:LIMit<1|2>:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:LIMit register for screen A and B. Readout does not delete the contents of the CONDition section.

Example:　　　　　"STAT:QUES:LIM:COND?"

Characteristics:　*RST value: -
　　　　　　　　　　SCPI:　　　conforming

Mode:　　　　　　OFDM, OFDMA

STATus:QUEStionable:LIMit<1|2>:ENABle　　0 to 65535

This command sets the bits of the ENABle section of the STATus:QUEStionable:LIMit register for screen A and B. The ENABle register selectively enables the individual events of the associated EVENt section for the summary bit.

Example:　　　　　"STAT:QUES:LIM:ENAB 65535"　　　All events bits will be represented in the LIMit summary bit.

Characteristics:　*RST value: -
　　　　　　　　　　SCPI:　　　device-specific

Mode:　　　　　　OFDM, OFDMA

STATus:QUEStionable:LIMit<1|2>[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:LIMit Register for screen A and B. Readout deletes the contents of the EVENt section.

Example: "STAT:QUES:LIM?"

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

STATus:QUEStionable:LIMit<1|2>:NTRansition 0 to 65535

This command determines what bits in the STATus:QUEStionable:LIMit Condition register of screen A or B will set the corresponding bit in the STATus:QUEStionable:LIMit Event register when that bit has a negative transition (1 to 0).The variable <number> is the sum of the decimal values of the bits that are to be enabled.

Example: "STAT:QUES:LIM:NTR 65535"   All condition bits will be summarised in
                                                      the Event register when a positive
                                                      transition occurs.

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

STATus:QUEStionable:LIMit<1|2>:PTRansition 0 to 65535

This command determines what bits in the STATus:QUEStionable:LIMit Condition register of screen A or B will set the corresponding bit in the STATus:QUEStionable:LIMit Event register when that bit has a positive transition (0 to 1).The variable <number> is the sum of the decimal values of the bits that are to be enabled.

Example: "STAT:QUES:LIMit:PTR 65535"-   All condition bits will be summarised in
                                                      the Event register when a positive
                                                      transition occurs.

Characteristics: *RST value: -
                     SCPI: device-specific

Mode: OFDM, OFDMA

STATus:QUEStionable:POWer:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:POWer register. Readout does not delete the contents of the CONDition section.

Example: "STAT:QUES:POW:COND?"

Characteristics: *RST value: -
                     SCPI: conforming

Mode: OFDM, OFDMA

STATus:QUEStionable:POWer:ENABle0 to 65535

This command sets the bits of the ENABle section of the STATus:QUEStionable:POWer register. The ENABle register selectively enables the individual events of the associated EVENt section for the summary bit.

Example:	"STAT:QUES:POW:ENAB 65535"	All events bits will be represented in the POWer summary bit.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

STATus:QUEStionable:POWer[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:POWer Register. Readout deletes the contents of the EVENt section.

Example: "STAT:QUES:POW?"

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

STATus:QUEStionable:POWer:NTRansition   0 to 65535

This command determines what bits in the STATus:QUEStionable:POWer Condition will set the corresponding bit in the STATus:QUEStionable:POWer Event register when that bit has a negative transition (1 to 0).The variable <number> is the sum of the decimal values of the bits that are to be enabled.

Example:	"STAT:QUES:POW:NTR 65535" -	All condition bits will be summarised in the Event register when a positive transition occurs.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

STATus:QUEStionable:POWer:PTRansition   0 to 65535

This command determines what bits in the STATus:QUEStionable:POWer Condition register will set the corresponding bit in the STATus:QUEStionable:POWer Event register when that bit has a positive transition (0 to 1).The variable <number> is the sum of the decimal values of the bits that are to be enabled.

Example:	"STAT:QUES:POWer:PTR 65535"	All condition bits will be summarised in the Event register when a positive transition occurs.

Characteristics: *RST value: -
SCPI: device-specific

Mode: OFDM, OFDMA

STATus:QUEStionable:SYNC:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:SYNC register. Readout does not delete the contents of the CONDition section.

Example: "STAT:QUES:SYNC:COND?"

Characteristics: *RST value: -
SCPI: conforming

Mode: OFDM, OFDMA

STATus:QUEStionable:SYNC:ENABle   0 to 65535

This command sets the bits of the ENABle section of the STATus:QUEStionable:SYNC register. The ENABle register selectively enables the individual events of the associated EVENt section for the summary bit.

Example: "STAT:QUES:SYNC:ENAB 65535" -   All events bits will be represented in the SYNC summary bit.

Characteristics: *RST value: -
                      SCPI: device-specific
Mode: OFDM, OFDMA

STATus:QUEStionable:SYNC[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:SYNC Register. Readout deletes the contents of the EVENt section.

Example: "STAT:QUES:SYNC?"

Characteristics: *RST value: -
                      SCPI: device-specific
Mode: OFDM, OFDMA

STATus:QUEStionable:SYNC:NTRansition   0 to 65535

This command determines what bits in the STATus:QUEStionable:SYNC Condition will set the corresponding bit in the STATus:QUEStionable:SYNC Event register when that bit has a negative transition (1 to 0).The variable <number> is the sum of the decimal values of the bits that are to be enabled.

Example: "STAT:QUES:SYNC:NTR 65535"   All condition bits will be summarised in the Event register when a positive transition occurs.

Characteristics: *RST value: -
                      SCPI: device-specific
Mode: OFDM, OFDMA

STATus:QUEStionable:SYNC:PTRansition   0 to 65535

This command determines what bits in the STATus:QUEStionable:SYNC Condition register will set the corresponding bit in the STATus:QUEStionable:SYNC Event register when that bit has a positive transition (0 to 1).The variable <number> is the sum of the decimal values of the bits that are to be enabled.

Example: "STAT:QUES:SYNC:PTR 65535"   All condition bits will be summarised in the Event register when a positive ransition occurs.

Characteristics: *RST value: -
                      SCPI: device-specific
Mode: OFDM, OFDMA

SYSTEM Subsystem

The SYSTEM specifies parameters.

COMMAND	PARAMETERS	UNIT	COMMENT
SYSTem			
:COMMunicate			
:TCPip			
:ADDRess	<String>		

SYSTem:COMMunicate:TCPip:ADDRess <String>

This command allows an external SMU signal generator to be connected via TCPIP to K93, so that frame zone setup can be downloaded directly to K93.

Example: `"SYST:COMM:TCP:ADDR 192.168.1.1"` Sets the lookup TCPIP address of the SMU to 192.168.1.1.

Characteristics: *RST value: –
                     SCPI: device-specific

Mode: OFDM, OFDMA

TRACe Subsystem

The TRACe subsystem controls access to the instrument's internal trace memory.

COMMAND	PARAMETERS	UNIT	COMMENT
TRACe			
[:DATA]	TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST		
:IQ			
:DATA:			
:MEMory?	\<numeric value\>,\<numeric value\>		Query only
:FILTer			
:FLATness	NORMal | WIDE		
:SRATe	\<numeric value\>	Hz	

TRACe[:DATA]   TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST

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.
If "All Carriers" is selected, it will return 52 per of I and Q data per symbol.
If "Pilots Only" is selected, it will return 4 per of I and Q per symbol in the following order: Carrier – 21, Carrier –7, Carrier 7, Carrier 21.
If a single carrier is selected, it will return 1 per of I and Q data per symbol.
For IEEE 802.16e-2005 OFDMA standard the following rules apply:

The results are retuned in repeating groups of the FFT size, for all symbols.

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 text "NAN".

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.

Power vs Time – Full Burst and Start / End data

This description applies to measurement results from the 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 to the user on a per sample basis. Each sample will in some way relate to an analyzis 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 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.

Power vs Time – Full Sub Frame and Rising/Falling Sub Frame

This description applies to measurement results from the IEEE 802.16e-2005standard.
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 to the user 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 sub frame, minimum frame data values.

TRACE2 – full sub frame, mean frame data values.

TRACE3 – full sub frame, 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.

Spectrum Flatness

There are six separate traces that are available with this measurement. Trace data for a particular
trace will only be returnable by querying the appropriate trace.
Spectrum flatness provides three basic graph types. These are an absolute power value graph
(ABS), an adjacent carrier power difference graph and a relative group delay graph, which are all
plotted on a per carrier basis. All carriers are drawn, in addition to the unused 0 carrier.
The number of carriers depends on the measured standard. For 802.16 2004 ODFM, the number of
carriers is 200 but for the IEEE 802.16e-2005 ODFMA standard the number of carriers is dependent
on the FFT size. 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 802.16 2004 ODFM
standard.

TRACE1 – ABS/Group delay   (minimum trace)
TRACE2 – ABS/Group delay   (average trace)
TRACE3 – ABS/Group delay   (maximum trace)

Absolute power results are returned in dB or dB difference and group delay results are returned in ns.

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.

Statistics Bitstream data

Data will be returned depends on the selected standard from which the measurement was executed.
For the 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, 2048 sub carriers. Unused carriers, including the zero carrier, are also retuned and these 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.

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 where:
        0 = Preamble
        1 = Data.

- 3rd value – Modulation where:
        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 – Sub Frame 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.

Data will be returned in ASCII printable hexadecimal character format. TRACE1 is used for this measurement results.

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.

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.

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

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

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 measurement.

Spectrum Mask

Result data will be returned as 625 trace points for R&S FSQ or 501 trace points for R&S FSP 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.

SEM summary results format:

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)

The returned values repeat for each row of the results table.

Spectrum ACPR

Result data will be returned as 625 trace points for R&S or 501 trace points for R&S FSP 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

Example:	"TRAC? TRACE2"	The measurement data for the selected graph is returned.
Characteristics:	*RST value: -	
	SCPI: conforming	
Mode:	OFDM, OFDMA	

TRACe:IQ:DATA:MEMory? <numeric value>,<numeric value>

Returns all the IQ data associated with the measurement acquisition timeThe result values are scaled linear in unit *Volt* 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 * number of samples, the first half being the I-values, the second half the Q-values.

Parameter:	<offset samples> Offset of the values to be read related to the start of the acquired data. Value range: 0 to <# of samples> - 1
	<# of samples> Number of measurement values to be read. Value range: 1 to <# of samples> - <offset samples>
Example:	"TRAC:IQ:DATA:MEM? 0,2000" Requests first 2000 samples.
Characteristics:	*RST value: - SCPI: device-specific
Mode:	OFDM, OFDMA

TRACe:IQ:FILTer:FLATness   NORMal | WIDE

This command determines whether the wideband detector filters are too be used in preference to the wideband detector board, (B72 option), for a specified sample rate. The use of the wideband filters is restricted to the 20.4MHz to 40.8MHz range. These filters are only switchable if the B72 option is available in the test instrument. An R&S FSQ which does not have the B72 option will automatically use the wideband filters where the sample rate is in the 20.4 MHz to 40.8 MHz range. This command only applies to the R&S FSQ instrument.

Example:	"TRACe:IQ:FILT:FLAT WIDE" Specifies the use of wideband detector filters.
Characteristics:	*RST value: NORMal SCPI: device-specific
Mode:	OFDM, OFDMA

TRACe:IQ:SRATe <numeric value>

This command allows the sample rate for IQ measurements to be specified.

Example:	"TRAC:IQ:SRAT 20000" Specifies a sample rate of 20 MHz.
Characteristics:	*RST value: - SCPI: device-specific
Mode:	OFDM, OFDMA

TRIGger Subsystem

The trigger subsystem is used to synchronize device action(s) with events.

COMMAND	PARAMETERS	UNIT	COMMENT
:TRIGger			
[:SEQUence]			
:HOLDoff	\<numeric value\>	S	
:LEVel			
[:EXTernal]	\<numeric value\>	V	
:POWer	\<numeric value\>	DBM | V	
:AUTO	\<Boolean\>		
:MODE	IMMediate | EXTernal | POWer		

TRIGger[:SEQuence]:HOLDoff   \<numeric value\>

This command defines the length of the trigger delay. A negative delay time (pretrigger) can be set in the time domain (span = 0 Hz) only.

Example: ”TRIG:HOLD 500us”   The R&S FSQ-K92/K93 option use a holdoff period of 500us after the trigger condition has been met.

Characteristics: *RST value: 0 s
                   SCPI: device-specific

Mode: OFDM, OFDMA

TRIGger[:SEQuence]:LEVel[:EXTernal]\<numeric value\>

This command accepts the level of the external trigger input for which triggering will occur.

Example: ”TRIG:LEV 1 V”

Characteristics: *RST value: 1.4 V
                   SCPI: device-specific

Mode: OFDM, OFDMA

TRIGger[:SEQuence]:LEVel:POWer \<numeric value\>

This command accepts the level of the input signal in dBm for which triggering will occur.

Example: ”TRIG:LEV:IFP 10 DBM”

Characteristics: *RST value: -20 DBM
                   SCPI: device-specific

Mode: OFDM, OFDMA

TRIGger[:SEQuence]:LEVel:POWer:AUTO   <Boolean>

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 TRIGger[:SEQuence]:MODE is not POWer.

Example:	˝TRIG:LEV:POW:AUTO ON˝	Specifies that an automatic power trigger level calculation should be performed before the start of each main measurement.

Characteristics: *RST value: ON
                         SCPI: device-specific

Mode: OFDM, OFDMA

TRIGger[:SEQuence]:MODE   IMMediate | EXTernal | POWer

This command configures how triggering is to be performed.

IMMediate   no triggering is performed. This is the free run setting.

EXTernal   the next measurement is triggered by the signal at the external
            trigger input e.g. a Gated trigger.

POWer   triggering of the measurement via signals which are outside
            the measurement channel.

Example: ˝TRIG:SEQ:MODE IMM˝ sets trigger to free run.

Characteristics: *RST value: IMMediate
                         SCPI: device-specific

Mode: OFDM, OFDMA

UNIT Subsystem

The unit subsystem specifies the units for specific result types.

COMMAND	PARAMETERS	UNIT	COMMENT
:UNIT			
:EVM	DB | PCT		
:PREamble	HZ | PTC		
:TABLe	DB | PCT		

UNIT:EVM　　DB | PCT

This command specifies the units for EVM results.

Parameter:	DBEVM results returned in dB
	PCT　EVM results returned in %
Example:	"UNIT:EVM PCT"　　　EVM results to be returned in %.
Characteristics:	*RST value: DB
	SCPI:　　　device-specific
Mode:	OFDM, OFDMA

UNIT:PREamble　　HZ | PTC

This command specifies the units for Preamble error results.

Parameter:	HZPreamble error results returned in Hz
	PTC　Preamble error results returned in %
Example:	"UNIT:PRE PCT"　　　Preamble error results to be returned in %.
Characteristics:	*RST value: DB
	SCPI:　　　device-specific
Mode:	OFDM, OFDMA

UNIT:TABLe　　DB | PCT

This command specifies the Table of Results parameters that can be displayed as dB or percentage.

Parameter:	DBresults returned in dB
	PCT　results returned in %
Example:	"UNIT:TABL DB"　　　results to be returned in dB.
Characteristics:	*RST value: DB
	SCPI:　　　device-specific
Mode:	OFDM, OFDMA

Status Reporting Registers

The status reporting system (see Fig. 74) stores all information on the present operating state of the instrument, e.g. that the instrument presently carries out a calibration and on errors 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.

The information is of a hierarchical structure. The register status byte (STB) defined in IEEE 488.2 and its associated mask register service request enable (SRE) form the uppermost level. The STB receives its information from the standard event status register (ESR) which is also defined in IEEE 488.2 with the associated mask register standard event status enable (ESE) and registers STATus:OPERation and STATus:QUEStionable which are defined by SCPI and contain detailed information on the instrument.

The IST flag ("Individual STATus") and the parallel poll enable register (PPE) allocated to it are also part of the status reporting system. The IST flag, like the SRQ, combines the entire instrument status in a single bit. The PPE fulfils the same function for the IST flag as the SRE for the service request.

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB and thus is represented in Fig. 74.
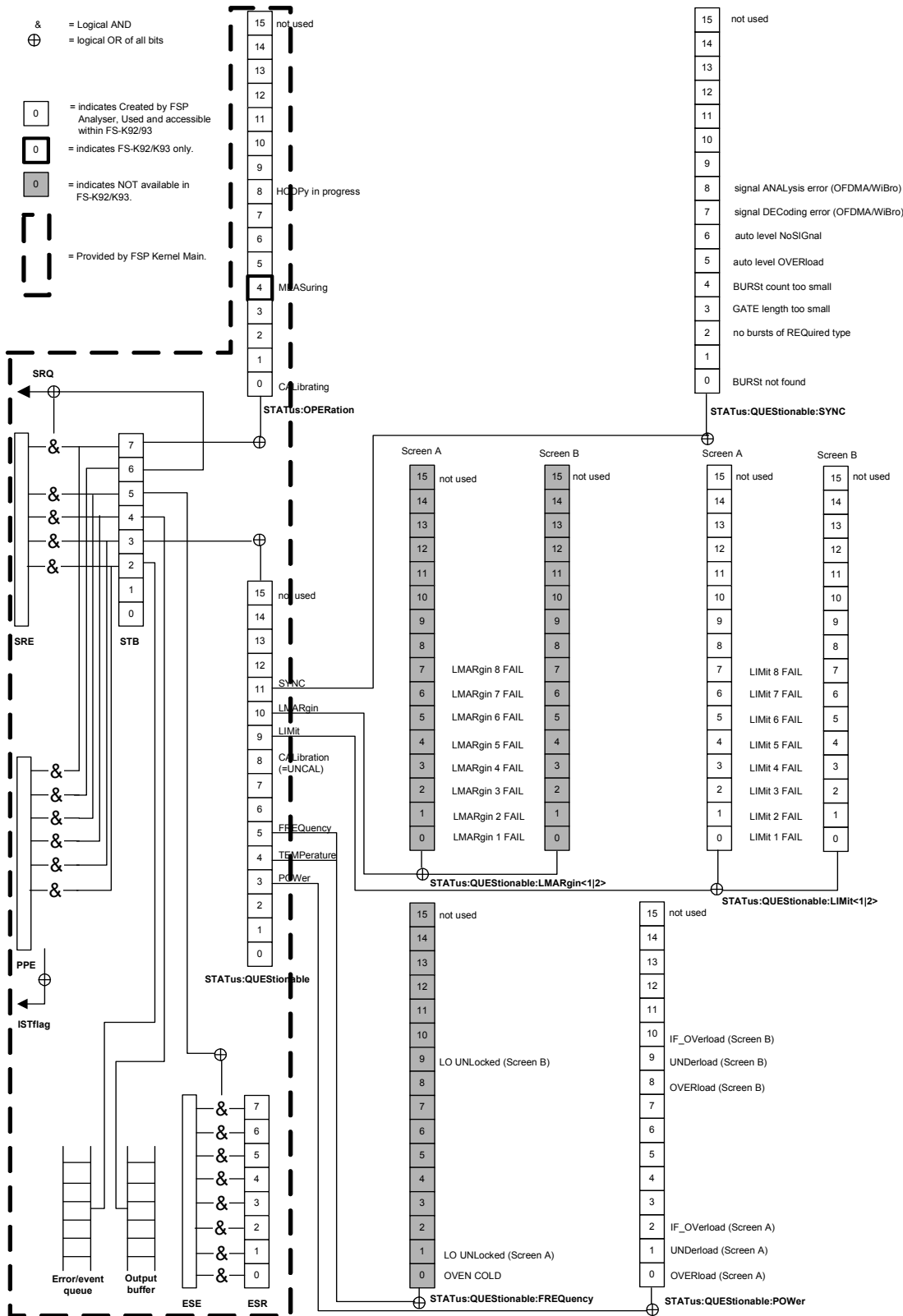
Fig. 74   Overview of the status registers

Description of the Status Registers

All the status registers shown in Fig. 74 are the same as those provided by the base system, with the exception of the following:

STATus:OPERation	Although this register is provided by R&S FSP Kernel main, R&S FSQ-K92/K93 makes use of bits 4 & 7 in this register which are not used within R&S FSP Kernel main
STATus:QUESTionable:ACPLimit	This register is provided by the analyzer and is not available from the R&S FSQ-K92/K93 command tree.
STATus:QUESTionable:LIMit2	This register is provided by the analyzer and is not available from the R&S FSQ-K92/K93 command tree.
STATus:QUESTionable:LMARgin<1|2>	These registers are provided by the analyzer and are not available from the R&S FSQ-K92/K93 command tree.

The deviations from the status register structure of the base system are detailed below.

STATus:OPERation Register

In the CONDition part, this register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last reading. It can be read using commands "STATus:OPERation:CONDition?" or "STATus:OPERation[:EVENt]?".

Bit No	Meaning
0	CALibrating This bit is set as long as the instrument is performing a calibration.
1 to 3	These bits are not used
4	MEASuring A '1' in this bit position indicates that a measurement is in progress. R&S FSQ-K92/K93 only
5 to 7	These bits are not used
8	HardCOPy in progress This bit is set while the instrument is printing a hardcopy.
9 to 14	These bits are not used
15	This bit is always 0

STATus:QUEStionable Register

This register comprises information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be queried by commands "`STATus:QUEStionable:CONDition?`" and "`STATus:QUEStionable[:EVENt]?`".

Bit No	Meaning
0 to 2	These bits are not used
3	POWer This bit is set if a questionable power occurs (cf. also section "STATus:QUEStionable:POWer Register").
4	TEMPerature This bit is set if a questionable temperature occurs.
5	FREQuency The bit is set if a frequency is questionable (cf. section "STATus:QUEStionable:FREQuency Register").
6 to 7	These bits are not used
8	CALibration The bit is set if a measurement is performed uncalibrated (status information "UNCAL")
9	**LIMit** (device-specific) This bit is set if a limit value is violated (see also section STATus:QUEStionable:LIMit Register). Note: Limit 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 also section STATus:QUEStionable:LMARgin Register)
11	**SYNC** (device-dependent) 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 also "STATus:QUEStionable:SYNC Register").
13 to 14	These bits are not used
15	This bit is always 0

STATus:QUEStionable:LIMit Register

This register comprises information about the observance of limit lines in the corresponding measurement window (LIMit 1 corresponds to Screen A, LIMit 2 to Screen B). It can be queried with command "`STATus:QUEStionable:LIMit<1|2>:CONDition?`" and "`STATus:QUEStionable:LIMit<1|2>[:EVENt]?`".
Note that no limit lines are displayed in screen A and as such all bits in the LIMit1 register will always be set to 0.

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
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

STATus:QUEStionable:SYNC Register

This contains information about sync and bursts not found, and about pre-measurement results exceeding or falling short of expected values.
The bits can be queried with commands "`STATus:QUEStionable:SYNC:CONDition?`" and "`STATus:QUEStionable:SYNC[:EVENt]?`".

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 DECoding 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 to 14	These bits are not used
15	This bit is always 0

Error Reporting

Error reporting for the R&S FSQ-K92/K93 option is carried out using the Service Request (SRQ) interrupt in the GPIB interface. When an error occurs a Service Request interrupt will be generated. The master can then query the slave instrument for the error that triggered the interrupt Errors are queried through the "SYSTem:ERRor" command.

Table of softkeys with assignment of IEC/IEEE bus commands

Key MEAS or Hotkey WIMAX

GENERAL SETTINGS	`[SENSe:]BURSt:COUNt`
	`[SENSe:]BURSt:COUNt:STATe`
	`[SENSe:]FREQuency:CENTer`
	`[SENSe:]IQ:DITHer[:STATe]`
	`[SENSe:]IQ:LPASs[:STATe]`
	`[SENSe:]SWAPiq`
	`[SENSe:]SWEep:COUNt`
	`[SENSe:]SWEep:TIME`
	`CONFigure:CHANnel`
	`CONFigure:POWer:AUTO`
	`CONFigure:POWer:AUTO`
	`CONFigure:POWer:EXPected:IQ`
	`CONFigure:POWer:EXPected:RF`
	`CONFigure:STANdard`
	`CONFigure:WIMax:FBANd`
	`CONFigure:WIMax:IGRatio`
	`DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel`
	`DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel:OFFSet`
	`INPut:IQ:BALanced[:STATe]`
	`INPut:IQ:IMPedance`
	`INPut:SELect`
	`INPut1:ATTenuation`
	`INPut1:EATT`
	`INPut1:EATT:AUTO`
	`INPut1:EATT:STATe`
	`INPut1:FILTer:YIG:AUTO`
	`INPut1:FILTer:YIG:STATe`
	`SENSe:BANDwidth:CHANnel`
	`TRACe:IQ:SRATe`
	`TRIGger[:SEQuence]:HOLDoff`
	`TRIGger[:SEQuence]:LEVel:POWer`
	`TRIGger[:SEQuence]:LEVel:POWer:AUTO`
	`TRIGger[:SEQuence]:MODE`
	`UNIT:TABLe`

DEMOD SETTINGS	`[SENSe:]DEMod:FORMat:BANalyze:BTYPe`
	`CONFigure:WIMax:LMODE`
	`[SENSe:]DEMod:FORMat:AUTO`
	`[SENSe:]DEMod:FORMat:BANalyze`
	`[SENSe:]DEMod:BANalyze:SYMbols:EQUal`
	`[SENSe:]DEMod:BANalyze:SYMbols:MIN`
	`[SENSe:]DEMod:BANalyze:SYMbols:MAX`
	`[SENSe:]DEMod:CESTimation`
	`SENSe:TRACking:PHASe`
	`SENSe:TRACking:TIME`
	`SENSe:TRACking:LEVel`

DISPLAY LIST GRAPH	`DISPlay[:WINDow<1|2>]:TABLe`
	`Result query:`
	`FETCh:BURSt:ALL?`
	`FETCh:BURSt:PREamble?`
	`FETCh:BURSt:PAYLoad?`
	`FETCh:BURSt:RMS?`
	`FETCh:BURSt:PEAK?`
	`FETCh:BURSt:CRESt?`
	`FETCh:BURSt:FERRor?`
	`FETCh:BURSt:SYMBolerror?`
	`FETCh:BURSt:IQOFfset?`
	`FETCh:BURSt:GIMBalance?`
	`FETCh:BURSt:QUADoffset?`
	`FETCh:BURSt:EVM:ALL?`
	`FETCh:BURSt:EVM:DATA?`
	`FETCh:BURSt:EVM:PILot?`

PVT	`CONFigure:BURSt:PVT[:IMMediate]`

GENERAL SETTINGS	`CONFigure:STANdard`
	`[SENSe:]FREQuency:CENTer`
	`CONFigure:CHANnel`
	`CONFigure:WIMax:FBANd`
	`SENSe:BANDwidth:CHANnel`
	`TRACe:IQ:SRATe`
	`CONFigure:WIMax:IGRatio`
	`CONFigure:POWer:AUTO`
	`DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel:OFFSet`
	`CONFigure:POWer:EXPected:RF`
	`CONFigure:POWer:EXPected:IQ`
	`[SENSe:]SWEep:TIME`
	`[SENSe:]BURSt:COUNt:STATe`
	`[SENSe:]BURSt:COUNt`
	`[SENSe:]SWEep:COUNt`
	`TRIGger[:SEQuence]:MODE`
	`TRIGger[:SEQuence]:HOLDoff`
	`TRIGger[:SEQuence]:LEVel:POWer`
	`TRIGger[:SEQuence]:LEVel:POWer:AUTO`
	`[SENSe:]SWAPiq`
	`INPut:SELect`
	`INPut:IQ:IMPedance`
	`INPut:IQ:BALanced[:STATe]`
	`[SENSe:]IQ:LPASs[:STATe]`
	`[SENSe:]IQ:DITHer[:STATe]`
	`CONFigure:POWer:AUTO`
	`DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel`
	`INPut1:ATTenuation`
	`INPut1:EATT:STATe`
	`INPut1:EATT:AUTO`
	`INPut1:EATT`
	`INPut1:FILTer:YIG:AUTO`
	`INPut1:FILTer:YIG:STATe`
	`UNIT:TABLe`

DEMOD SETTINGS	`[SENSe:]DEMod:FORMat:BANalyze:BTYPe`
	`CONFigure:WIMax:LMODE`
	`[SENSe:]DEMod:FORMat:AUTO`
	`[SENSe:]DEMod:FORMat:BANalyze`
	`[SENSe:]DEMod:BANalyze:SYMbols:EQUal`
	`[SENSe:]DEMod:BANalyze:SYMbols:MIN`
	`[SENSe:]DEMod:BANalyze:SYMbols:MAX`
	`[SENSe:]DEMod:CESTimation`
	`SENSe:TRACking:PHASe`
	`SENSe:TRACking:TIME`
	`SENSe:TRACking:LEVel`

DISPLAY LIST GRAPH	`DISPlay[:WINDow<1|2>]:TABLe`

FULL SUBFRAME	`CONFigure:BURSt:PVT:SELect FULL`
RISING FALLING	`CONFigure:BURSt:PVT:SELect EDGE`
FULL BURST	`CONFigure:BURSt:PVT:SELect FULL`
START END	`CONFigure:BURSt:PVT:SELect EDGE`
GATING ON OFF	`[SENSe:]SWEep:EGATe`

GATE SETTINGS	`[SENSe:]SWEep:EGATe:HOLDoff[:TIME]`
	`[SENSe:]SWEep:EGATe:HOLDoff:SAMPle`
	`[SENSe:]SWEep:EGATe:LENGth[:TIME]`
	`[SENSe:]SWEep:EGATe:LENGth:SAMPle`
	`[SENSe:]SWEep:EGATe:LINK`

ACP SETTINGS	`[SENSe:]POWer:NCOR`
	`[SENSe:]POWer:ACHennel:ACP`
	`[SENSe:]POWer:ACHennel:BANDwith:CHANnel`
	`[SENSe:]POWer:ACHennel:BANDwith:ALernateT<1..4>`
	`[SENSe:]POWer:ACHennel:SPACing:ACHennel`
	`[SENSe:]POWer:ACHennel:SPACing:ALTernate<1..4>`

IMPORT	`MMEMory:LOAD:IQ:STATe`
EXPORT	`MMEMory:STORe:IQ:STATe`
SUPORT	`---`
EVM	`---`

GENERAL SETTINGS	`CONFigure:STANdard`
	`[SENSe:]FREQuency:CENTer`
	`CONFigure:CHANnel`
	`CONFigure:WIMax:FBANd`
	`SENSe:BANDwidth:CHANnel`
	`TRACe:IQ:SRATe`
	`CONFigure:WIMax:IGRatio`
	`CONFigure:POWer:AUTO`
	`DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel:OFFSet`
	`CONFigure:POWer:EXPected:RF`
	`CONFigure:POWer:EXPected:IQ`
	`[SENSe:]SWEep:TIME`
	`[SENSe:]BURSt:COUNt:STATe`
	`[SENSe:]BURSt:COUNt`
	`[SENSe:]SWEep:COUNt`
	`TRIGger[:SEQuence]:MODE`
	`TRIGger[:SEQuence]:HOLDoff`
	`TRIGger[:SEQuence]:LEVel:POWer`
	`TRIGger[:SEQuence]:LEVel:POWer:AUTO`
	`[SENSe:]SWAPiq`
	`INPut:SELect`
	`INPut:IQ:IMPedance`
	`INPut:IQ:BALanced[:STATe]`
	`[SENSe:]IQ:LPASs[:STATe]`
	`[SENSe:]IQ:DITHer[:STATe]`
	`CONFigure:POWer:AUTO`
	`DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel`
	`INPut1:ATTenuation`
	`INPut1:EATT:STATe`
	`INPut1:EATT:AUTO`
	`INPut1:EATT`
	`INPut1:FILTer:YIG:AUTO`
	`INPut1:FILTer:YIG:STATe`
	`UNIT:TABLe`

DEMOD SETTINGS	`[SENSe:]DEMod:FORMat:BANalyze:BTYPe`
	`CONFigure:WIMax:LMODE`
	`[SENSe:]DEMod:FORMat:AUTO`
	`[SENSe:]DEMod:FORMat:BANalyze`
	`[SENSe:]DEMod:BANalyze:SYMbols:EQUal`
	`[SENSe:]DEMod:BANalyze:SYMbols:MIN`
	`[SENSe:]DEMod:BANalyze:SYMbols:MAX`
	`[SENSe:]DEMod:CESTimation`
	`[SENSe:]TRACking:PHASe`
	`SENSe:TRACking:TIME`
	`SENSe:TRACking:LEVel`

DISPLAY LIST GRAPH	`DISPlay[:WINDow<1|2>]:TABLe`
EVM VS SYMBOL	`CONFigure:BURSt:EVM:ESYMbol[:IMMediate]`
EVM VS CARRIER	`CONFigure:BURSt:EVM:ECARrier[:IMMediate]`
ERROR FREQ PHASE	`CONFigure:BURSt:PREamble:SELect FREQ	PHASe` `CONFigure:BURSt:PREamble [:IMMediate]`
Y AXIS/ DIV	`DISPlay[:WINDow<1|2>]:TACe1:Y[:SCALe]:AUTO` `DISPlay[:WINDow<1|2>]:TRACe1:Y[:SCALe]:PDIVision`
GATING ON OFF	`[SENSe:]SWEep:EGATe`

GATE SETTINGS	`[SENSe:]SWEep:EGATe:HOLDoff[:TIME]`
	`[SENSe:]SWEep:EGATe:HOLDoff:SAMPle`
	`[SENSe:]SWEep:EGATe:LENGth[:TIME]`
	`[SENSe:]SWEep:EGATe:LENGth:SAMPle`
	`[SENSe:]SWEep:EGATe:LINK`

IMPORT	*MMEMory:LOAD:IQ:STATe*
EXPORT	*MMEMory:STORe:IQ:STATe*
SUPORT	---
SPECTRUM	---
GENERAL SETTINGS	*CONFigure:STANdard* *[SENSe:]FREQuency:CENTer* *CONFigure:CHANnel* *CONFigure:WIMax:FBANd* *SENSe:BANDwidth:CHANnel* *TRACe:IQ:SRATe* *CONFigure:WIMax:IGRatio* *CONFigure:POWer:AUTO* *DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel:OFFSet* *CONFigure:POWer:EXPected:RF* *CONFigure:POWer:EXPected:IQ* *[SENSe:]SWEep:TIME* *[SENSe:]BURSt:COUNt:STATe* *[SENSe:]BURSt:COUNt* *[SENSe:]SWEep:COUNt* *TRIGger[:SEQuence]:MODE* *TRIGger[:SEQuence]:HOLDoff* *TRIGger[:SEQuence]:LEVel:POWer* *TRIGger[:SEQuence]:LEVel:POWer:AUTO* *[SENSe:]SWAPiq* *INPut:SELect* *INPut:IQ:IMPedance* *INPut:IQ:BALanced[:STATe]* *[SENSe:]IQ:LPASs[:STATe]* *[SENSe:]IQ:DITHer[:STATe]* *CONFigure:POWer:AUTO* *DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel* *INPut1:ATTenuation* *INPut1:EATT:STATe* *INPut1:EATT:AUTO* *INPut1:EATT* *INPut1:FILTer:YIG:AUTO* *INPut1:FILTer:YIG:STATe* *UNIT:TABLe*
DEMOD SETTINGS	*[SENSe:]DEMod:FORMat:BANalyze:BTYPe* *:CONFigure:WIMax:LMODE* *[SENSe:]DEMod:FORMat:AUTO* *[SENSe:]DEMod:FORMat:BANalyze* *[SENSe:]DEMod:BANalyze:SYMbols:EQUal* *[SENSe:]DEMod:BANalyze:SYMbols:MIN* *[SENSe:]DEMod:BANalyze:SYMbols:MAX* *[SENSe:]DEMod:CESTimation* *SENSe:TRACking:PHASe* *SENSe:TRACking:TIME* *SENSe:TRACking:LEVel*
DISPLAY LIST GRAPH	*DISPlay[:WINDow<1|2>]:TABLe*
FLATNESS FLAT GRDEL	CONFigure:BURSt:SPECtrum:FLATness:SELect FLATness | GRDelay *CONFigure:BURSt:SPECtrum:FLATness[:IMMediate]*
FLATNESS DIFFERENCE	CONFigure:BURSt:SPECtrum:FLATness:SELect DIFFerence *CONFigure:BURSt:SPECtrum:FLATness[:IMMediate]*

SPECTRUM IEEE ESTI	`CONFigure:BURSt:SPECtrum:MASK:SELect IEEE	ETSI` `CONFigure:BURSt:SPECtrum:MASK[:IMMediate]`
SPECTRUM FTT	`CONFigure:BURSt:SPECtrum:FFT[:IMMediate]`
ACP ABS REL	`[SENSe:]POWer:ACHannel:MODE REL	ABS` `CONFigure:BURSt:SPECtrum:ACPR[:IMMediate] ..`
GATING ON OFF	`[SENSe:]SWEep:EGATe`

GATE SETTINGS	`[SENSe:]SWEep:EGATe:HOLDoff[:TIME]`
	`[SENSe:]SWEep:EGATe:HOLDoff:SAMPle`
	`[SENSe:]SWEep:EGATe:LENGth[:TIME]`
	`[SENSe:]SWEep:EGATe:LENGth:SAMPle`
	`[SENSe:]SWEep:EGATe:LINK`

ACP SETTINGS	
IMPORT	`MMEMory:LOAD:IQ:STATe`
EXPORT	`MMEMory:STORe:IQ:STATe`
SUPORT	`---`
CONSTELL	`---`

GENERAL SETTINGS	`CONFigure:STANdard`
	`[SENSe:]FREQuency:CENTer`
	`CONFigure:CHANnel`
	`CONFigure:WIMax:FBANd`
	`SENSe:BANDwidth:CHANnel`
	`TRACe:IQ:SRATe`
	`CONFigure:WIMax:IGRatio`
	`CONFigure:POWer:AUTO`
	`DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel:OFFSet`
	`CONFigure:POWer:EXPected:RF`
	`CONFigure:POWer:EXPected:IQ`
	`[SENSe:]SWEep:TIME`
	`[SENSe:]BURSt:COUNt:STATe`
	`[SENSe:]BURSt:COUNt`
	`[SENSe:]SWEep:COUNt`
	`TRIGger[:SEQuence]:MODE`
	`TRIGger[:SEQuence]:HOLDoff`
	`TRIGger[:SEQuence]:LEVel:POWer`
	`TRIGger[:SEQuence]:LEVel:POWer:AUTO`
	`[SENSe:]SWAPiq`
	`INPut:SELect`
	`INPut:IQ:IMPedance`
	`INPut:IQ:BALanced[:STATe]`
	`[SENSe:]IQ:LPASs[:STATe]`
	`[SENSe:]IQ:DITHer[:STATe]`
	`CONFigure:POWer:AUTO`
	`DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel`
	`INPut1:ATTenuation`
	`INPut1:EATT:STATe`
	`INPut1:EATT:AUTO`
	`INPut1:EATT`
	`INPut1:FILTer:YIG:AUTO`
	`INPut1:FILTer:YIG:STATe`
	`UNIT:TABLe`

DEMOD SETTINGS	`[SENSe:]DEMod:FORMat:BANalyze:BTYPe`
	`CONFigure:WIMax:LMODE`
	`[SENSe:]DEMod:FORMat:AUTO`
	`[SENSe:]DEMod:FORMat:BANalyze`
	`[SENSe:]DEMod:BANalyze:SYMbols:EQUal`
	`[SENSe:]DEMod:BANalyze:SYMbols:MIN`
	`[SENSe:]DEMod:BANalyze:SYMbols:MAX`
	`[SENSe:]DEMod:CESTimation`
	`SENSe:TRACking:PHASe`
	`SENSe:TRACking:TIME`
	`SENSe:TRACking:LEVel`

DISPLAY LIST GRAPH	`DISPlay[:WINDow<1|2>]:TABLe`
CONSTELL	`CONFigure:BURSt:CONStellation:CSYMbol[:IMMediate]`
CONSTELL VS CARRIER	`CONFigure:BURSt:CONStellation:CCARrier[:IMMediate]`
CARRIER SELECTION	`CONFigure:BURSt:CONStellation:CARRier:SELect`
CONSTELL SELECTION	
GATING ON OFF	`[SENSe:]SWEep:EGATe`

GATE SETTINGS	`[SENSe:]SWEep:EGATe:HOLDoff[:TIME]`
	`[SENSe:]SWEep:EGATe:HOLDoff:SAMPle`
	`[SENSe:]SWEep:EGATe:LENGth[:TIME]`
	`[SENSe:]SWEep:EGATe:LENGth:SAMPle`
	`[SENSe:]SWEep:EGATe:LINK`

IMPORT	`MMEMory:LOAD:IQ:STATe`
EXPORT	`MMEMory:STORe:IQ:STATe`
SUPORT	---
STATISTICS	---

GENERAL SETTINGS	*CONFigure:STANdard*
	[SENSe:]FREQuency:CENTer
	CONFigure:CHANnel
	CONFigure:WIMax:FBANd
	SENSe:BANDwidth:CHANnel
	TRACe:IQ:SRATe
	CONFigure:WIMax:IGRatio
	CONFigure:POWer:AUTO
	DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel:OFFSet
	CONFigure:POWer:EXPected:RF
	CONFigure:POWer:EXPected:IQ
	[SENSe:]SWEep:TIME
	[SENSe:]BURSt:COUNt:STATe
	[SENSe:]BURSt:COUNt
	[SENSe:]SWEep:COUNt
	TRIGger[:SEQuence]:MODE
	TRIGger[:SEQuence]:HOLDoff
	TRIGger[:SEQuence]:LEVel:POWer
	TRIGger[:SEQuence]:LEVel:POWer:AUTO
	[SENSe:]SWAPiq
	INPut:SELect
	INPut:IQ:IMPedance
	INPut:IQ:BALanced[:STATe]
	[SENSe:]IQ:LPASs[:STATe]
	[SENSe:]IQ:DITHer[:STATe]
	CONFigure:POWer:AUTO
	DISPlay[:WINDow<1|2>]:TRACe<1…3>:Y[:SCALe]:RLEVel
	INPut1:ATTenuation
	INPut1:EATT:STATe
	INPut1:EATT:AUTO
	INPut1:EATT
	INPut1:FILTer:YIG:AUTO
	INPut1:FILTer:YIG:STATe
	UNIT:TABLe
DEMOD SETTINGS	*[SENSe:]DEMod:FORMat:BANalyze:BTYPe*
	CONFigure:WIMax:LMODE
	[SENSe:]DEMod:FORMat:AUTO
	[SENSe:]DEMod:FORMat:BANalyze
	[SENSe:]DEMod:BANalyze:SYMbols:EQUal
	[SENSe:]DEMod:BANalyze:SYMbols:MIN
	[SENSe:]DEMod:BANalyze:SYMbols:MAX
	[SENSe:]DEMod:CESTimation
	SENSe:TRACking:PHASe
	SENSe:TRACking:TIME
	SENSe:TRACking:LEVel
DISPLAY LIST GRAPH	*DISPlay[:WINDow<1|2>]:TABLe*
CCDF	*CONFigure:BURSt:STATistics:CCDF[:IMMediate]*
BIT STREAM	*CONFigure:BURSt:STATistics:BSTReam[:IMMediate]*
BURST SUMMARY	*CONFigure:BURSt:STATistics:BSUMmary[:IMMediate]*
GATING ON OFF	*[SENSe:]SWEep:EGATe*
GATE SETTINGS	*[SENSe:]SWEep:EGATe:HOLDoff[:TIME]*
	[SENSe:]SWEep:EGATe:HOLDoff:SAMPle
	[SENSe:]SWEep:EGATe:LENGth[:TIME]
	[SENSe:]SWEep:EGATe:LENGth:SAMPle
	[SENSe:]SWEep:EGATe:LINK
IMPORT	*MMEMory:LOAD:IQ:STATe*

EXPORT	`MMEMory:STORe:IQ:STATe`
SUPORT	`---`
FILE MANAGER	`---`
RECAL	`MMEMory:LOAD:FRAMe:STATe`
NEW FOLDER	`---`
COPY	`---`
PASTE	`------`
RENAME	`---`
DELETE FILE	`---`

Key DISP

FULL SCREEN	`DISPlay:FORMat SINGle`
SPLIT SCREEN	`DISPlay:FORMat SPLit`

Key LINES

DEFAULT CURRENT	`CALCulate<1|2>:LIMit<1>:BURSt:ALL`
	`CALCulate<1|2>:LIMit<1>:BURSt:ALL:RESULT`
	`CALCulate<1|2>:LIMit<1>:BURSt:FERRor[:AVERage]`
	`CALCulate<1|2>:LIMit<1>:BURSt:FERRor[:AVERage]:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:FERRor:MAXimum`
	`CALCulate<1|2>:LIMit<1>:BURSt:FERRor:MAXimum:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset[:AVERage]`
	`CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset[:AVERage]:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset:MAXimum`
	`CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset:MAXimum:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL[:AVERage]`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL[:AVERage]:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL:MAXimum`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL:MAXimum:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA[:AVERage]`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA[:AVERage]:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:MAXimum`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:MAXimum:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILot[:AVERage]`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILot[:AVERage]:RESult`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILot:MAXimum`
	`CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILot:MAXimum:RESult`

DEFAULT ALL	

Key MKR

MARKR 1	*CALCulate<1|2>:MARKer<1>:STATe* *CALCulate<1|2>:MARKer<1>:X* *CALCulate<1|2>:MARKer<1>:Y* *CALCulate<1|2>:MARKer<1>:SYMBol* *CALCulate<1|2>:MARKer<1>:CARRier* *CALCulate<1|2>:MARKer<1>:FUNCtion:ZOOM 1*
UNZOOM	
MARKER ZOOM	*CALCulate<1|2>:MARKer<1>:FUNCtion:ZOOM <numeric value>*
MARKER OFF	*CALCulate<1|2>:MARKer<1>:AOFF*

Key MKR->

SELECT MARKER	`---`
MKR->TRACE	`CALCulate<1|2>:MARKer<1>:TRACe`

Hotkeys

SPECTRUM	`INSTrument:SELect SANalyzer` `INSTrument:NSELect 1`
WIMAX	`---`
AUTO LVL	`---`
RUN SGL	`INITiate:CONTinuous OFF; INITiate[:IMMediate]`
RUN CONT	`INITiate:CONTinuous ON; INITiate[:IMMediate]`
REFRESH	`---`
SCREEN A/B	`DISPlay[:WINDow<1|2>]:SELect` `DISPlay[:WINDow<1|2>]:SSELect`

5 Remote Control - Programming Examples

The following section provides some examples of commonly performed operations when using R&S FSQ-K92/K93. For more general remote control examples please refer to the programming examples chapter in the instrument user manual.

Synchronization Entry of Option

The following example shows how to synchronize entering the R&S FSQ-K92/K93 option.

```
analyzer% = 20,Instrument address
CALL IBWRT(analyzer%, "INST:SEL WIMAX;*OPC?") ,waits for 1 from *OPC?
```

Selecting Measurements

Measurements are selected using the command CONFigure:BURSt:<Meas Type> where <Meas Type> is as follows.

<Meas Type>	Measurement Type
PVT	Power vs Time (PVT)
PVT:SELect:EDGE	PVT Start and End
PVT:SELect:FULL	PVT full burst
EVM:ECARrier	EVM vs Carrier
EVM:ESYMbol	EVM vs Symbol
SPECtrum:MASK	Spectrum Mask
SPECtrum:MASK:SELect:IEEE	Spectrum Mask IEEE
SPECtrum:MASK:SELect:ETSI	Spectrum Mask ETSI
SPECtrum:FLATness	Spectrum Flatness
SPECtrum:FLATness:SELect FLATNESS	Spectrum Flatness
SPECtrum:FLATness:SELect GRDELAY	Spectrum Flatness – Group Delay
SPECtrum:FLATness:SELect DIFFERENCE	Spectrum Flatness – Difference
SPECtrum:FFT	Spectrum FFT
SPECtrum:ACPR	Spectrum ACPR
SPECtrum:ACPR:SELect ABS	Spectrum ACPR (Absolute)
SPECtrum:ACPR:SELect REL	Spectrum ACPR (Relative)
CONSt:CCARrier	Constellation vs Carrier
CONSt:CSYMbol	Constellation vs Symbol
STATistics:CCDF	CCDF
STATistics:BSTReam	Bit Steam
STATistics:BSUMmary	Burst Summary
PREamble	Preamble Error
PREamble:SELect FREQ	Frequency Error vs Preamble
PREamble:SELect PHASE	Phase Error vs Preamble

The following example shows how to select a Spectrum Mark ETSI measurement:

```
REM select Spectrum Mask Select ETSI
CALL IBWRT(analyzer%, "SPECtrum:MASK:SELect:ETSI")
```

Running Synchronized Measurements

The following examples show how measurements can be synchronized. Synchronization is necessary to ensure that the measurement has completed before the measurement results and markers are requested.

```
PUBLIC SUB SweepSync()

REM The command INITiate[:IMMediate] starts a single sweep if the
REM command INIT:CONT OFF was previously sent. It should be ensured that
REM the next command is only then executed when the entire sweep is
REM complete.
CALL IBWRT(analyzer%, "INIT:CONT OFF")

REM ------ First possibility: Use of *WAI ----------------------------
CALL IBWRT(analyzer%, "INIT:IMM; *WAI")

REM ------ Second possibility: Use of *OPC? --------------------------
OpcOk$ = SPACE$(2) 'Space for *OPC? - Provide response
CALL IBWRT(analyzer%, "INIT:IMM; *OPC?")

REM ------ here the controller can service other instrument-----------
CALL IBRD(analyzer%, OpcOk$) 'Wait for "1" from *OPC?

REM ------- Third possibility: Use of *OPC ---------------------------
REM In order to be able to use the service request function in
REM conjugation with a National Instruments GPIB driver, the setting
REM "Disable Auto Serial Poll" must be changed to "yes" by means of
REM IBCONF!
CALL IBWRT(analyzer%, "*SRE 32")  'Permit service request for ESR
CALL IBWRT(analyzer%, "*ESE 1")   'Set event-enable bit for
                                  'operation-complete bit

CALL IBWRT(analyzer%, "INIT:IMM; *OPC")'Start sweep and
                                       'synchronize with OPC

CALL WaitSRQ(boardID%,result%)    'Wait for service request

REM ------- Fourth possibility: Use of INIT:IMM ----------------------
REM In order to be able to use the service request function in
REM conjugation with a National Instruments GPIB driver, the setting
REM "Disable Auto Serial Poll" must be changed to "yes" by means of
REM IBCONF!
CALL IBWRT(analyzer%, "*SRE 128") 'Permit service request for ESR
CALL IBWRT(analyzer%, "*ESE 0")   'Set event-enable bit for
                                  'operation-complete bit

CALL IBWRT(analyzer%, "STATus:OPERation:ENABle 16")  'Enable bit 4 of status
                                                     'operation register'
CALL IBWRT(analyzer%, "STAT:OPERation:NTRansition 16") 'Set Negative
                                                       'transition to 1
CAL IBWRT(analyzer%, "STATus:OPERation:PTRansition 0") 'Set Positive
                                                       'transition to 0
CALL IBWRT(analyzer%, "INIT:IMM") 'Start sweep and synchronize with OPC

CALL WaitSRQ(boardID%,result%)  'Wait for service request

REM Continue main program here.

END SUB
REM ****************************************************************************
```

6 List of Warnings & Error Messages

The list of possible warning & error messages are shown below:

Status Bar Message	Description
Gate length too small - must be greater than 1	This message is only displayed for the FFT measurement. This message indicates that there are no samples contained within the gating lines. Increase the Gate length and then press the *REFRESH* hotkey to remove this error.
No valid analyzed bursts within gating lines	This message is only displayed for the PVT measurement. This message indicates that there are no complete & valid bursts contained within the gating lines. Increase the Gate length and then press the *REFRESH* hotkey to remove this error.
No bursts found	This message is displayed if no valid burst was detected in the input data. To correct this problem check the following: The connections between the DUT and analyzer are correct The input signal is of a sufficient level The capture time is long enough to capture at least one complete burst. If running with a Free Run trigger then the capture time must be greater than the burst length (ideally at least twice the burst length) to ensure that a complete burst is recorded. Check that the demod settings are correct
No bursts of desired type to analyze	This message is displayed if bursts are found, but none of desired type to analyze. Check that the setting for Burst Type is correct.
No signal found	This message is displayed when an automatic level detection measurement is executed and the measured signal level is lower the permitted minimum value.
Signal overload detected	This message is displayed when the OVLD enhancement label is displayed and indicates that the input mixer is overloaded. If this message is displayed then try increasing the setting for the Signal Level parameter (or settings Auto Level). If this does not clear the problem then an external attenuation may need to be applied.
Zone/Burst configuration error	This message is displayed when there are configuration errors in the frame setup. Check the zone/segment map and burst map for any highlighted errors
No TX Area found	There is insufficient power over specified subframe length. Resolution is as per "No Bursts Found".
No subframe found	The DSP cannot synchronize with the received signal.
No maximum found	Not currently in use.
Signal Map analysis failed	The auto-demodulation failed to determine the frame configuration (zone/segment map and burst map). There are several critical parameters that must be provided by the user for auto-demodulation to succeed: Frequency, Sample Rate / Channel Bandwidth, FFT size, Guard Time, IDCell and Preamble Index (if not in range 0 - 96)
First Zone must be PUSC with all Subchannels used	The Err Freq vs Phase measurement for OFDMA/WiBro has the listed restriction.
DSP error returned: 0xnnnnnnnn	One of these three error messages is displayed when an unexpected DSP error occurs while analyzing a signal. Contact your R&S support representative for assistance.
Analysis error	
Error processing DSP results	

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