R&S®FSW
Signal and Spectrum Analyzer
User Manual

ROHDE & SCHWARZ

This manual applies to the following R&S®FSW models with firmware version 1.70 and higher:

- R&S®FSW8 (1312.8000K08)
- R&S®FSW13 (1312.8000K13)
- R&S®FSW26 (1312.8000K26)
- R&S®FSW43 (1312.8000K43)
- R&S®FSW50 (1312.8000K50)

In addition to the base unit, the following options are described:

- R&S FSW-B10 (1313.1622.02)
- R&S FSW-B13 (1313.0761.02)
- R&S FSW-B17 (1313.0784.02)
- R&S FSW-B21 (1313.1100.26)
- R&S FSW-B24 (1313.0832.13/26)
- R&S FSW-B25 (1313.0990.02)
- R&S FSW-B28 (1313.1645.02)
- R&S FSW-B40 (1313.0861.02) / R&S FSW-U40 (1313.52505.02)
- R&S FSW-B80 (1313.0878.02) / R&S FSW-U80 (1313.5211.02)
- R&S FSW-B160 (1313.1668.02) / R&S FSW-U160 (1313.3754.02)
- R&S FSW-B71 (1313.1651.13/26, 1313.6547.02,)

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

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

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

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.
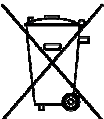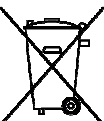
Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories. For product-specific information, see the data sheet and the product documentation.

Safety labels on products

The following safety labels are used on products to warn against risks and dangers.

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

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

Signal words and their meaning

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

	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	Indicates information considered important, but not hazard-related, e.g. messages relating to property damage. In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

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

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency, overvoltage category 2, pollution severity 2.

2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or even death.

3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or even death.

Electrical safety

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

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

2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with a protective conductor contact and protective conductor.

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

4. If there is no power switch for disconnecting the product from the AC supply network, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the AC supply network. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 m. Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, the disconnecting device must be provided at the system level.

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

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

7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.

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

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

10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.

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

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

13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.

15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.

16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.

17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.

18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

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

2. Before you move or transport the product, read and observe the section titled "Transport".

3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.

4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal/Environmental protection", item 1.

5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.

6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.

7. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

8. EMC classes (in line with EN 55011/CISPR 11, and analogously with EN 55022/CISPR 22, EN 55032/CISPR 32)
   – Class A equipment:
   Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings
   Note: Class A equipment is intended for use in an industrial environment. This equipment may cause radio disturbances in residential environments, due to possible conducted as well as radiated disturbances. In this case, the operator may be required to take appropriate measures to eliminate these disturbances.
   – Class B equipment:
   Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.

2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

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

1. Cells must not be taken apart or crushed.

2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.

3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.

4. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.

5. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.

6. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.

7. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

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

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

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

Waste disposal/Environmental protection

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

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

3. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

4. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

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

Instrucciones de seguridad elementales

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

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

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

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos técnicos y ciertos conocimientos del idioma inglés. Por eso se debe tener en cuenta que el producto solo pueda ser operado por personal especializado o personas instruidas en profundidad con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de Rohde & Schwarz, encontr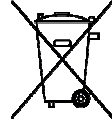aría la información debida en la documentación del producto en el capítulo correspondiente. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.
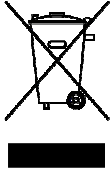
Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. Deberán tenerse en cuenta todas las demás informaciones de seguridad, como p. ej. las referentes a la protección de personas, que encontrarán en el capítulo correspondiente de la documentación del producto y que también son de obligado cumplimiento. En las presentes informaciones de seguridad se recogen todos los objetos que distribuye el grupo de empresas Rohde & Schwarz bajo la denominación de "producto", entre ellos también aparatos, instalaciones así como toda clase de accesorios. Los datos específicos del producto figuran en la hoja de datos y en la documentación del producto.

Señalización de seguridad de los productos

Las siguientes señales de seguridad se utilizan en los productos para advertir sobre riesgos y peligros.

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

Instrucciones de seguridad elementales

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

Palabras de señal y su significado

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

⚠ PELIGRO	Indica una situación de peligro que, si no se evita, causa lesiones graves o incluso la muerte.
⚠ ADVERTENCIA	Indica una situación de peligro que, si no se evita, puede causar lesiones graves o incluso la muerte.
⚠ ATENCIÓN	Indica una situación de peligro que, si no se evita, puede causar lesiones leves o moderadas.
AVISO	Indica información que se considera importante, pero no en relación con situaciones de peligro; p. ej., avisos sobre posibles daños materiales. En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

Estados operativos y posiciones de funcionamiento

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

Instrucciones de seguridad elementales

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal. Categoría de sobrecarga eléctrica 2, índice de suciedad 2.

2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, se pueden causar lesiones o, en determinadas circunstancias, incluso la muerte.

3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.

2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.

3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.

4. Si el producto no está equipado con un interruptor para desconectarlo de la red, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión.
   El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m).
   Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se integran productos sin interruptor en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.

5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.

Instrucciones de seguridad elementales

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

7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.

8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.

9. En las mediciones en circuitos de corriente con una tensión U_{eff} > 30 V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.

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

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.

14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.

15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.

16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.

17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.

18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Instrucciones de seguridad elementales

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.

2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".

3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados —los llamados alérgenos (p. ej. el níquel)—. Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.

4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación/protección del medio ambiente", punto 1.

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.

6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.

7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
   – Aparato de clase A:
     Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
     Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.
   – Aparato de clase B:
     Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

Instrucciones de seguridad elementales

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.

2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.

2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.

3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.

4. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

5. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.

6. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).

7. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.

3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación/protección del medio ambiente

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.

2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado.
Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, diríjase a su servicio de atención al cliente de Rohde & Schwarz.

3. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.

4. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

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

Quality management and environmental management

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde & Schwarz Produktes entschieden. Sie erhalten damit ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unserer Qualitäts- und Umweltmanagementsysteme entwickelt, gefertigt und geprüft. Rohde & Schwarz ist unter anderem nach den Managementsystemen ISO 9001 und ISO 14001 zertifiziert.

Der Umwelt verpflichtet

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

Dear customer,

You have decided to buy a Rohde & Schwarz product. This product has been manufactured using the most advanced methods. It was developed, manufactured and tested in compliance with our quality management and environmental management systems. Rohde & Schwarz has been certified, for example, according to the ISO 9001 and ISO 14001 management systems.

Environmental commitment

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

Cher client,

Vous avez choisi d'acheter un produit Rohde & Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests de ce produit ont été effectués selon nos systèmes de management de qualité et de management environnemental. La société Rohde & Schwarz a été homologuée, entre autres, conformément aux systèmes de management ISO 9001 et ISO 14001.

Engagement écologique

- Produits à efficience énergétique
- Amélioration continue de la durabilité environnementale
- Système de management environnemental certifié selon ISO 14001

ROHDE & SCHWARZ

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Customer Support

Technical support – where and when you need it

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

Up-to-date information and upgrades

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

Europe, Africa, Middle East	Phone +49 89 4129 12345 customersupport@rohde-schwarz.com
North America	Phone 1-888-TEST-RSA (1-888-837-8772) customer.support@rsa.rohde-schwarz.com
Latin America	Phone +1-410-910-7988 customersupport.la@rohde-schwarz.com
Asia/Pacific	Phone +65 65 13 04 88 customersupport.asia@rohde-schwarz.com
China	Phone +86-800-810-8228 / +86-400-650-5896 customersupport.china@rohde-schwarz.com

ROHDE & SCHWARZ

Contents

1 Preface

1.1 About this Manual

This User Manual describes general instrument functions and settings common to all applications and operating modes in the R&S FSW. Furthermore, it provides all the information specific to **RF measurements in the Spectrum application**. All other operating modes and applications are described in the specific application manuals.

The main focus in this manual is on the measurement results and the tasks required to obtain them. The following topics are included:

- **Welcome to the R&S FSW**
  Introduction to and getting familiar with the instrument

- **Operating Modes and Applications**
  The concept of using multiple operating modes

- **Measurements**
  Descriptions of the individual measurements in the Spectrum application, including result types and configuration settings.

- **Common Measurement Settings**
  Description of the measurement settings common to all measurement types with their corresponding remote control commands

- **Common Measurement Analysis and Display Functions**
  Description of the settings and functions provided to analyze results independantly of the measurement type with their corresponding remote control commands

- **Data Management**
  Description of general functions to handle data files (configuration and result data, not I/Q data)

- **General Instrument Setup**
  Description of general instrument settings and functions that are independant of the current operating mode

- **Network and Remote Operation**
  Information on setting up the instrument in a network and operating it remotely.

- **Remote Commands**
  Remote commands required to configure and perform measurements in a remote environment, sorted by tasks
  Remote commands required to set up the environment and to perform common tasks on the instrument, sorted by tasks
  Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes

- **Maintenance**
  Information on tasks required to maintain operability of the instrument

- **Troubleshooting**
  Hints and tips on how to handle errors

- **List of Commands**

Alpahabetical list of all remote commands described in the manual

● **Index**

1.2 Documentation Overview

The user documentation for the R&S FSW consists of the following parts:

● "Getting Started" printed manual

● Online Help system on the instrument

● Documentation CD-ROM with:
  – Getting Started

  – User Manuals for base unit and options

  – Service Manual

  – Release Notes

  – Data sheet and product brochures

Online Help

The Online Help is embedded in the instrument's firmware. It offers quick, context-sensitive access to the complete information needed for operation and programming. Online help is available using the ⍰ icon on the toolbar of the R&S FSW.

Getting Started

This manual is delivered with the instrument in printed form and in PDF format on the CD. It provides the information needed to set up and start working with the instrument. Basic operations and handling are described. Safety information is also included.

The Getting Started manual in various languages is also available for download from the R&S website, on the R&S FSW product page at http://www2.rohde-schwarz.com/product/FSW.html.

User Manuals

User manuals are provided for the base unit and each additional (software) option.

The user manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In the user manuals, all instrument functions are described in detail. Furthermore, they provide a complete description of the remote control commands with programming examples.

The user manual for the base unit provides basic information on operating the R&S FSW in general, and the Spectrum application in particular. Furthermore, the software functions that enhance the basic functionality for various applications are described here. An introduction to remote control is provided, as well as information on maintenance, instrument interfaces and troubleshooting.

In the individual application manuals, the specific instrument functions of the application are described in detail. For additional information on default settings and parameters,

refer to the data sheets. Basic information on operating the R&S FSW is not included in the application manuals.

All user manuals are also available for download from the R&S website, on the R&S FSW product page at http://www2.rohde-schwarz.com/product/FSW.html.

Service Manual

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

Release Notes

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

The most recent release notes are also available for download from the R&S website, on the R&S FSW product page at http://www2.rohde-schwarz.com/product/FSW.html > Downloads > Firmware.

1.3 Conventions Used in the Documentation

1.3.1 Typographical Conventions

The following text markers are used throughout this documentation:

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

1.3.2 Conventions for Procedure Descriptions

When describing how to operate the instrument, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is

described. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the instrument or the on-screen keyboard is only described if it deviates from the standard operating procedures.

The term "select" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the instrument or on a keyboard.

2 Welcome to the R&S FSW

The R&S FSW is a new high-performance R&S®FSW signal and spectrum analyzer developed to meet demanding customer requirements. Offering low phase noise, wide analysis bandwidth and straightforward and intuitive operation, the analyzer makes measurements fast and easy.

This user manual contains a description of the functionality that the instrument provides, including remote control operation. The latest version is available for download at the product homepage (http://www2.rohde-schwarz.com/product/FSW.html).

3 Getting Started

Note: the following chapters are identical to those in the printed R&S FSW Getting Started manual.

3.1 Preparing for Use

3.1.1 Putting into Operation

This section describes the basic steps to be taken when setting up the R&S FSW for the first time.

⚠ **WARNING**

Risk of injury and instrument damage

The instrument must be used in an appropriate manner to prevent electric shock, fire, personal injury, or damage.

- Do not open the instrument casing.
- Read and observe the "Basic Safety Instructions" at the beginning of this manual or on the documentation CD-ROM, in addition to the safety instructions in the following sections. Notice that the data sheet may specify additional operating conditions.

NOTICE

Risk of instrument damage

Note that the general safety instructions also contain information on operating conditions that will prevent damage to the instrument. The instrument's data sheet may contain additional operating conditions.

NOTICE

Risk of electrostatic discharge

Protect the work area against electrostatic discharge to avoid damage to electronic components in the modules. For details, refer to the safety instructions at the beginning of this manual.

NOTICE

Risk of instrument damage during operation

An unsuitable operating site or test setup can cause damage to the instrument and to connected devices. Ensure the following operating conditions before you switch on the instrument:

● All fan openings are unobstructed and the airflow perforations are unimpeded. The minimum distance from the wall is 10 cm.
● The instrument is dry and shows no sign of condensation.
● The instrument is positioned as described in the following sections.
● The ambient temperature does not exceed the range specified in the data sheet.
● Signal levels at the input connectors are all within the specified ranges.
● Signal outputs are correctly connected and are not overloaded.

EMI impact on measurement results

Electromagnetic interference (EMI) may affect the measurement results.

To suppress generated electromagnetic interference (EMI):

● Use suitable shielded cables of high quality. For example, use double-shielded RF and LAN cables.
● Always terminate open cable ends.
● Note the EMC classification in the data sheet.

3.1.1.1 Unpacking and Checking the Instrument

Check the equipment for completeness using the delivery note and the accessory lists for the various items. Check the instrument for any damage. If there is damage, immediately contact the carrier who delivered the instrument. Make sure not to discard the box and packing material.

Packing material

Retain the original packing material. If the instrument needs to be transported or shipped at a later date, you can use the material to protect the control elements and connectors.

NOTICE

Risk of damage during transportation and shipment

Insufficient protection against mechanical and electrostatic effects during transportation and shipment can damage the instrument.

● Always make sure that sufficient mechanical and electrostatic protection is provided.

● When shipping an instrument, the original packaging should be used. If you do not have the original packaging, use sufficient padding to prevent the instrument from moving around inside the box. Pack the instrument in antistatic wrap to protect it from electrostatic charging.

● Secure the instrument to prevent any movement and other mechanical effects during transportation.

The **carrying handles** at the front and side of the casing are designed to lift or carry the instrument. Do not apply an excessive external force to the handles.

Observe the information on transporting heavy instruments in the basic safety instructions included at the front of the printed manual and on the supplied CD ROM.

3.1.1.2 Accessory List

The instrument comes with the following accessories:

● Power cable

● "Getting Started" printed manual

● "R&S FSW User Documentation" CD-Rom

3.1.1.3 Placing or Mounting the Instrument

The R&S FSW is designed for use under laboratory conditions, either on a bench top or in a rack.

Bench Top Operation

If the R&S FSW is operated on a bench top, the surface should be flat. The instrument can be used in horizontal position, standing on its feet, or with the support feet on the bottom extended.

⚠ **CAUTION**

Risk of injury if feet are folded out

The feet may fold in if they are not folded out completely or if the instrument is shifted. This may cause damage or injury.

● Fold the feet completely in or completely out to ensure stability of the instrument. Never shift the instrument when the feet are folded out.

● When the feet are folded out, do not work under the instrument or place anything underneath.

● The feet can break if they are overloaded. The overall load on the folded-out feet must not exceed 500 N.

F < 500 N
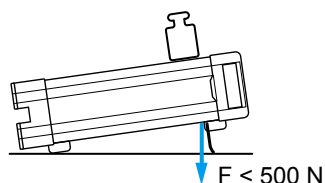
⚠ **CAUTION**

Risk of injury and instrument damage if stacking instruments

A stack of instruments may tilt over and cause injury. Furthermore, the instruments at the bottom of the stack may be damaged due to the load imposed by the instruments on top.

Observe the following instructions when stacking instruments:

● Never stack more than three instruments. If you need to stack more than three instruments, install them in a rack.

● The overall load imposed on the lowest instrument must not exceed 500 N.

● All instruments must have the same dimensions (width and length).

● If the instruments have foldable feet, fold them in completely.

Correct — Too many instruments — Different dimensions — Feet folded out
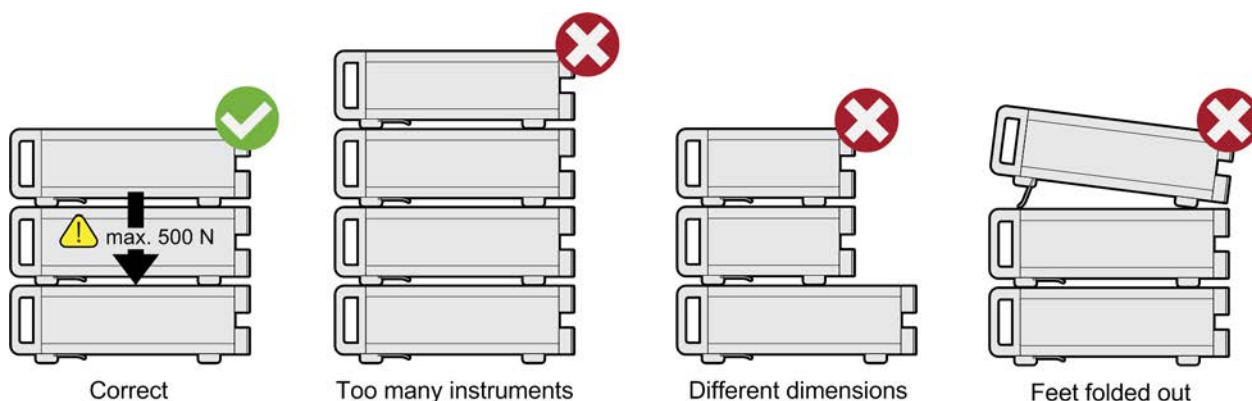
Rackmounting

The R&S FSW can be installed in a rack using a rack adapter kit (Order No. see data sheet). The installation instructions are part of the adapter kit.

NOTICE

Risk of instrument damage in a rack

An insufficient airflow can cause the instrument to overheat, which may disturb the operation and even cause damage.

Make sure that all fan openings are unobstructed, that the airflow perforations are unimpeded, and that the minimum distance from the wall is 10 cm.

3.1.1.4   Connecting the AC Power

In the standard version, the R&S FSW is equipped with an AC power supply connector. The R&S FSW can be used with different AC power voltages and adapts itself automatically to it. Refer to the datasheet for the requirements of voltage and frequency. The AC power connector is located on the rear panel of the instrument.

For details on the connector refer to chapter 3.2.2.2, "AC Power Supply Connection and Main Power Switch", on page 47.

► Connect the R&S FSW to the AC power supply using the supplied power cable. Since the instrument is assembled in line with the specifications for safety class EN61010, it may only be connected to an outlet that has a ground contact.

3.1.1.5   Switching the Instrument On and Off

Switching the instrument on

► Press the AC power switch on the rear panel to position "I".

The instrument is supplied with AC power. After booting, the instrument is ready for operation. A green LED above the POWER key indicates this.

Warm-up time for OCXO

When the instrument is switched on, the OCXO requires an extended warm-up time (see data sheet). No warm-up time is required when starting from standby mode.

Switching the instrument off

1. Press the POWER key on the front panel.

2. Change the AC power switch on the rear panel to position "O", or disconnect the instrument from the AC power supply.

   The R&S FSW changes into off mode.

NOTICE

Risk of losing data

If you switch off the running instrument using the rear panel switch or by disconnecting the power cord, the instrument loses its current settings. Furthermore, program data may be lost.

Always press the POWER key first to shut down the application properly.

3.1.1.6 Performing a Self Alignment and a Self Test

During instrument start, the installed hardware is checked against the current firmware version to ensure the hardware is supported. If not, an error message is displayed ("WRONG_FW") and you are asked to update the firmware. Until the firmware version is updated, self-alignment fails.

(For details refer to the R&S FSW User Manual).

Furthermore, it may be necessary to align the data to a reference source by performing a self alignment when strong temperature changes occur.

Operating temperature

Before performing this functional test, make sure that the instrument has reached its operating temperature (for details, refer to the data sheet).

A message in the status bar ("Instrument warming up...") indicates that the operating temperature has not yet been reached.

Performing a self alignment

1. Press the SETUP key.

2. Press the "Alignment" softkey.

3. Select the "Start Self Alignment" button in the "Alignment" dialog box.

   Once the system correction values have been calculated successfully, a message is displayed.

To display the alignment results again later

- Press the SETUP key.
- Press the "Alignment" softkey.

Performing a self test

The self test does not need to be repeated every time the instrument is switched on. It is only necessary when instrument malfunction is suspected.

1. Press the SETUP key.

2. Press the "Service" softkey.

3. Switch to the "Selftest" tab in the "Service" dialog box.

4. Select the "Start Selftest" button.

   Once the instrument modules have been checked successfully, a message is displayed.

3.1.1.7 Checking the Supplied Options

The instrument may be equipped with both hardware and firmware options. In order to check whether the installed options correspond to the options indicated on the delivery note, proceed as follows.

1. Press the SETUP key.

2. Press the "System Config" softkey.

3. Switch to the "Versions + Options" tab in the "System Configuration" dialog box.

   A list with hardware and firmware information is displayed.

4. Check the availability of the hardware options as indicated in the delivery note.

3.1.2 Windows Operating System

The instrument contains the Windows 7 operating system which has been configured according to the instrument's features and needs. To ensure that the instrument software functions properly, certain rules must be adhered to concerning the operating system.

> **NOTICE**
>
> **Risk of causing instrument unusability**
>
> The instrument is equipped with the Windows 7 operating system. Additional software can therefore be installed on the instrument. The use and installation of additional software may impair instrument function. Thus, run only programs that Rohde & Schwarz has tested for compatibility with the instrument software.
>
> The drivers and programs used on the instrument under Windows 7 have been adapted to the instrument. Existing instrument software must always be modified using only update software released by Rohde & Schwarz.

The following program packages have been tested:

- R&S Power Viewer Plus - virtual power meter for displaying results of the Power Sensor R&S NRP-Zxx (install only this component!)
- Symantec Endpoint Security – Virus-protection software

3.1.2.1 Virus Protection

Users must take appropriate steps to protect their instruments from infection. Beside the use of strong firewall settings and regularly scanning any removable storage device used with a R&S instrument, it is also recommended that anti-virus software be installed on the instrument. While Rohde & Schwarz does NOT recommend running anti-virus software in the background ("on- access" mode) on Windows-based instruments, due to potentially degrading instrument performance, it does recommend running it during non-critical hours.

For details and recommendations, see the R&S White Paper "Malware Protection" available at http://www.rohde-schwarz.com/appnote/1EF73.

3.1.2.2 Service Packs and Updates

Microsoft regularly creates security updates and other patches to protect Windows-based operating systems. These are released through the Microsoft Update website and associated update server. Instruments using Windows, especially those that connect to a network, should be updated regularly.

For more details and information on configuring automatic updates see the R&S White Paper "Malware Protection" (available at http://www.rohde-schwarz.com/appnote/1EF73).

Changes in the system setup are only required when peripherals like keyboard or a printer are installed or if the network configuration does not comply with the default settings. After the R&S FSW is started, the operating system boots and the instrument firmware is started automatically.

3.1.2.3 Login

Windows 7 requires that users identify themselves by entering a user name and password in a login window. You can set up two types of user accounts, either an administrator account with unrestricted access to the computer/domain or a standard user account with limited access. The instrument provides an auto-login function for the administrator account, i.e. login with unrestricted access is carried out automatically in the background. By default, the user name for the administrator account is "Instrument", and the user name for the standard user account is "NormalUser". In both cases the initial password is "894129". You can change the password in Windows 7 for any user at any time via "Start > Control Panel > User Accounts". Some administrative tasks require administrator rights (e.g. the configuration of a LAN network). Refer to the description of the basic instrument setup (SETUP menu) to find out which functions are affected.

For information on how to deactivate the automatic login, refer to "Deactivating the auto-matic login mechanism" on page 26.

The Automatic Login Mechanism

Deactivating the automatic login mechanism

When shipped, the instrument is already configured to automatically log on under Win-dows 7. To deactivate the automatic login mechanism, perform the following steps:

1. In the "Start" menu, select "Run".
    The "Run" dialog box is displayed.

2. Enter the command `C:\R_S\INSTR\USER\NO_AUTOLOGIN.REG`.

3. Press the ENTER key to confirm.
    The automatic login mechanism is deactivated. The next time you switch on the instrument, you are prompted to enter your user name and password before the firm-ware is started.

Reactivating the automatic login mechanism

1. In the "Start" menu, select "Run".
    The "Run" dialog box is displayed.

2. Enter the command `C:\R_S\INSTR\USER\AUTOLOGIN.REG`.

3. Press the ENTER key to confirm.
    The automatic login mechanism is reactivated. It will be applied the next time the instrument is switched on.

3.1.2.4 Accessing the Start Menu

The Windows 7 "Start" menu provides access to the Windows 7 functionality and installed programs. To open the "Start" menu, select the "Windows" icon on the toolbar, or press the "Windows" key or the CTRL + ESC key combination on your keyboard.

All necessary system settings can be defined in the "Start > Control Panel" menu (for required settings refer to the Windows documentation and to the hardware description).

3.1.2.5 Accessing the Windows Task Bar

The Windows task bar also provides quick access to commonly used programs, for example Paint or Wordpad, but also IECWIN, the auxiliary remote control tool provided free of charge and installed by R&S.

For details on the IECWIN tool, see the "Network and Remote Control" chapter of the R&S FSW User Manual.

To open the task bar, select the "Windows" icon on the R&S FSW toolbar, or press the "Windows" key or the CTRL + ESC key combination on your keyboard.

3.1.3 Connecting USB Devices

The USB interfaces on the front and (optionally) rear panels of the R&S FSW allow you to connect USB devices directly to the instrument. This number can be increased as necessary by using USB hubs. Due to the large number of available USB devices, there is almost no limit to the expansions that are possible with the R&S FSW.

The following list shows various USB devices that can be useful:

- Memory stick for easy transfer of data to/from a computer (e.g. firmware updates)
- CD-ROM drives for easy installation of firmware applications
- Keyboard or mouse to simplify the entry of data, comments, file names, etc.
- Printer for printing out measurement results
- Power sensors, e.g. of the NRP Zxy family

Installing USB devices is easy under Windows 7, because all USB devices are plug&play. After a device is connected to the USB interface, Windows 7 automatically searches for a suitable device driver.

If Windows 7 does not find a suitable driver, it will prompt you to specify a directory that contains the driver software. If the driver software is on a CD, connect a USB CD-ROM drive to the instrument before proceeding.

When a USB device is subsequently disconnected from the R&S FSW, Windows 7 immediately detects the change in hardware configuration and deactivates the corresponding driver.

All USB devices can be connected to or disconnected from the instrument during operation.

Connecting a memory stick or CD-ROM drive

If installation of a memory stick or CD-ROM drive is successful, Windows 7 informs you that the device is ready to use. The device is made available as a new drive ("D:") and is displayed under Windows Explorer. The name of the drive is manufacturer-dependent.

Connecting a keyboard

The keyboard is detected automatically when it is connected. The default input language is English – US.

However, you can also connect foreign language keyboards; currently the following languages are supported for the R&S FSW:

- German
- Swiss
- French
- Russian

Select "Start > Control Panel > Clock, Language, and Region > Change keyboards or other input methods" to configure the keyboard properties. To access the Windows operating system, press the Windows key on the external keyboard.

Connecting a mouse

The mouse is detected automatically when it is connected.

Select "Start > Control Panel > Hardware and Sound > Devices and Printers > Mouse" to configure the mouse properties. To access the Windows operating system, press the Windows key on the external keyboard.

Connecting a printer

When printing a file, the instrument checks whether a printer is connected and turned on and whether the appropriate printer driver is installed. If required, printer driver installation is initiated. A printer driver needs to be installed only once.

To install a printer, select "Start > Control Panel > Devices and Printers > Add a printer". To access the Windows operating system, press the Windows key on the external keyboard.

You can load updated and improved driver versions or new drivers from an installation disk, USB memory stick or another external storage medium. If the instrument is integrated in a network, you can also install driver data stored in a network directory. Select "Start > Control Panel > Devices and Printers > Device Manager > Update Device drivers" to install the driver.

3.1.4　Connecting an External Monitor

You can connect an external monitor (or projector) to the DVI or DISPLAY PORT connector on the instrument's rear panel (see also chapter 3.2.2.3, "DISPLAY PORT and DVI", on page 48).

Screen resolution and format

The touch screen of the R&S FSW is calibrated for a 16:10 format. If you connect a monitor or projector using a different format (e.g. 4:3), the calibration will not be correct and the screen will not react to your touch actions properly.

The touch screen has a screen resolution of 1280x800 pixels. Most external monitors have a higher screen resolution. If the screen resolution of the monitor is set higher than the instrument's resolution, the application window uses an area of 1280x800 pixels on the monitor display. For full screen display, adjust the monitor's screen resolution.

The R&S FSW supports a minimum resolution of 1280x768 pixels.

1. Connect the external monitor to the R&S FSW.

2. Press the SETUP key.

3. Press the "Display" softkey.

4. Select the "Configure Monitor" tab in the "Display" dialog box.

The standard Windows "Screen Resolution" dialog box is displayed.
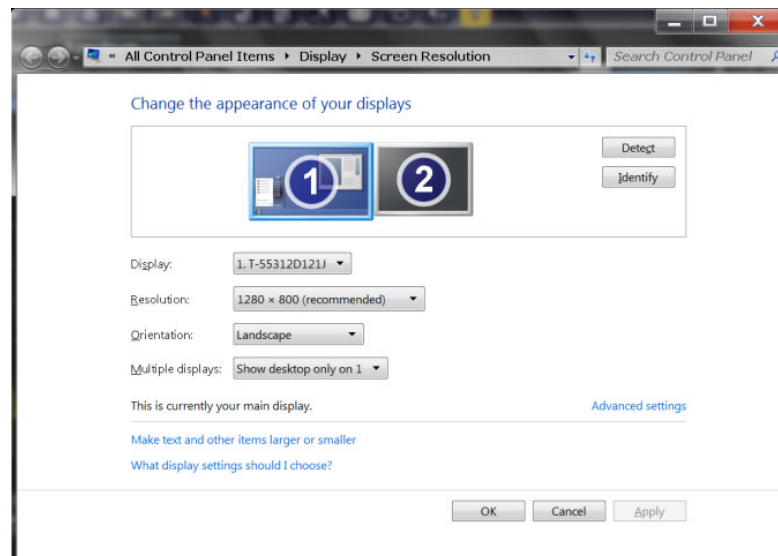
5. If necessary, change the screen resolution to be used. Consider the information in the note above.

6. Select the instrument to be used for display:
    - "Display 1": internal monitor only
    - "Display 2": external monitor only
    - "Duplicate": both internal and external monitor

7. Tap "Apply" to try out the settings before they are accepted permanently, then you can easily return to the previous settings, if necessary.

8. Select "OK" if the settings are suitable.

3.1.5 Setting Up a Network (LAN) Connection

The R&S FSW is equipped with a network interface and can be connected to an Ethernet LAN (local area network). Provided the appropriate rights have been assigned by the network administrator and the Window 7 firewall configuration is adapted accordingly, the interface can be used, for example:

- To transfer data between a controller and the tester, e.g. in order to run a remote control program. See chapter "Remote Control"
- To access or control the measurement from a remote computer using the "Remote Desktop" application (or a similar tool)
- To connect external network devices (e.g. printers)
- To transfer data from a remote computer and back, e.g. using network folders

This section describes how to configure the LAN interface. It includes the following topics:

- chapter 3.1.5.1, "Connecting the Instrument to the Network", on page 30
- chapter 3.1.5.2, "Assigning the IP Address", on page 31

Note that only user accounts with administrator rights can configure LAN networks.

LXI

The R&S FSW complies with LXI Class C. LXI gives you direct access to the LAN settings described below.

For further information on the LXI interface refer to chapter 10.4.4, "LXI Settings", on page 597.

3.1.5.1 Connecting the Instrument to the Network

There are two methods to establish a LAN connection to the instrument:

- A non-dedicated network (Ethernet) connection from the instrument to an existing network made with an ordinary RJ-45 network cable. The instrument is assigned an IP address and can coexist with a computer and with other hosts on the same network.

- A dedicated network connection (Point-to-point connection) between the instrument and a single computer made with a (crossover) RJ-45 network cable. The computer must be equipped with a network adapter and is directly connected to the instrument. The use of hubs, switches, or gateways is not required, however, data transfer is still performed using the TCP/IP protocol. An IP address has to be assigned to the instrument and the computer, see chapter 3.1.5.2, "Assigning the IP Address", on page 31.
  Note: As the R&S FSW uses a 1 GBit LAN, a crossover cable is not necessary (due to Auto-MDI(X) functionality).

NOTICE

Risk of network failure

Before connecting the instrument to the network or configuring the network, consult your network administrator. Errors may affect the entire network.

► To establish a non-dedicated network connection, connect a commercial RJ-45 cable to one of the LAN ports.
  To establish a dedicated connection, connect a (crossover) RJ-45 cable between the instrument and a single PC.

If the instrument is connected to the LAN, Windows 7 automatically detects the network connection and activates the required drivers.

The network card can be operated with a 1 GBit Ethernet IEEE 802.3u interface.

3.1.5.2 Assigning the IP Address

Depending on the network capacities, the TCP/IP address information for the instrument can be obtained in different ways.

- If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), all address information can be assigned automatically.

- If the network does not support DHCP, or if the instrument is set to use alternate TCP/IP configuration, the addresses must be set manually.

By default, the instrument is configured to use dynamic TCP/IP configuration and obtain all address information automatically. This means that it is safe to establish a physical connection to the LAN without any previous instrument configuration.

NOTICE

Risk of network errors

Connection errors can affect the entire network. If your network does not support DHCP, or if you choose to disable dynamic TCP/IP configuration, you must assign valid address information before connecting the instrument to the LAN. Contact your network administrator to obtain a valid IP address.

Assigning the IP address on the instrument

1. Press the SETUP key.

2. Press the "Network + Remote" softkey.

3. Select the "Network" tab.

4. In the "Network + Remote" dialog, toggle the "DHCP On/Off" setting to the required mode.
   If DHCP is "Off", you must enter the IP address manually, as described in the following steps.
   Note: When DHCP is changed from "On" to "Off", the previously set IP address and subnet mask are retrieved.
   If DHCP is "On", the IP address of the DHCP server is obtained automatically. The configuration is saved, and you are prompted to restart the instrument. You can skip the remaining steps.
   Note: When a DHCP server is used, a new IP address may be assigned each time the instrument is restarted. This address must first be determined on the instrument itself. Thus, when using a DHCP server, it is recommended that you use the permanent computer name, which determines the address via the DNS server (see "Using a DNS server to determine the IP address" on page 32 and chapter 3.1.5.3, "Using Computer Names", on page 33).

5. Enter the "IP Address", for example *10.0.0.10*. The IP address consists of four number blocks separated by dots. Every block contains 3 numbers in maximum.

6. Enter the "Subnet Mask", for example *255.255.255.0*. The subnet mask consists of four number blocks separated by dots. Every block contains 3 numbers in maximum.

7. Select "Configure Network".

   If you have entered an invalid IP address or subnet mask, the message "out of range" is displayed in the status line. If the settings are correct, the configuration is saved, and you are prompted to restart the instrument.

8. Confirm the displayed message ("Yes" button) to restart the instrument.

Using a DNS server to determine the IP address

If a DNS server is configured on the R&S FSW, the server can determine the current IP address for the connection using the permanent computer name.

1. Obtain the name of your DNS domain and the IP addresses of the DNS and WINS servers on your network.

2. Press the SETUP key and then the "Network + Remote" softkey.

3. In the "Network" tab, select the "Open Dialog 'Network Connections'" button.

4. Double-tap the "Local Area Network" icon.

5. In the "Local Area Connection Status" dialog box, select the "Properties" button.

   The items used by the LAN connection are displayed.

6. Tap the entry named "Internet Protocol Version 4 (TCP/IPv4)" to highlight it.
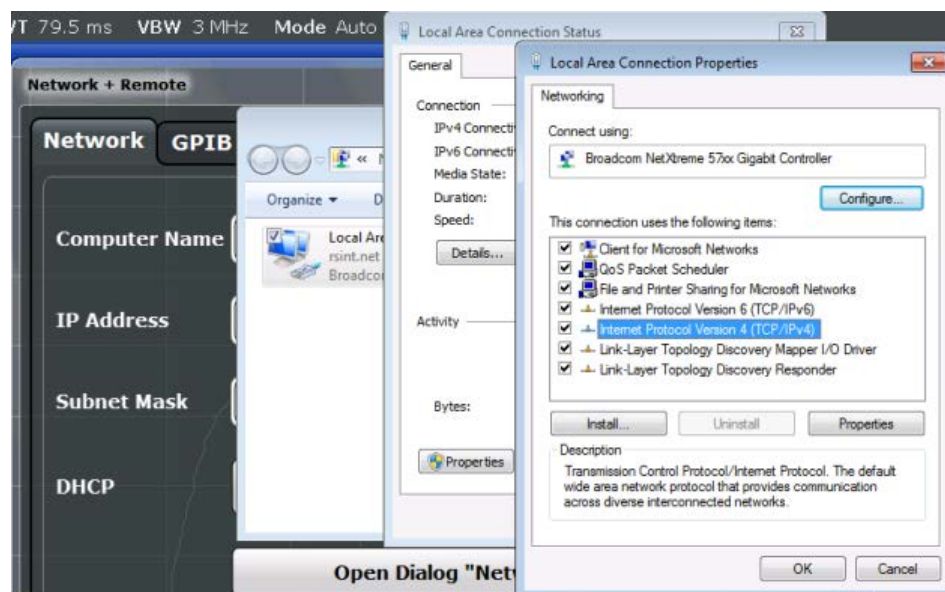
7. Select the "Properties" button.

8. On the "General" tab, select "Use the following DNS server addresses" and enter your own DNS addresses.

   For more information refer to the Windows operating system Help.

3.1.5.3 Using Computer Names

In a LAN that uses a DNS server (Domain Name System server), each PC or instrument connected in the LAN can be accessed via an unambiguous computer name instead of the IP address. The DNS server translates the host name to the IP address. This is especially useful when a DHCP server is used, as a new IP address may be assigned each time the instrument is restarted.

Each instrument is delivered with an assigned computer name, but this name can be changed.

To change the computer name

1. Press the SETUP key and then the "Network + Remote" softkey.
   The current "Computer Name" is displayed in the "Network" tab.

2. Enter the new computer name and close the dialog box.

3.1.5.4 Changing the Windows Firewall Settings

A firewall protects an instrument by preventing unauthorized users from gaining access to it through a network. Rohde & Schwarz highly recommends the use of the firewall on your instrument. R&S instruments are shipped with the Windows firewall enabled and preconfigured in such a way that all ports and connections for remote control are enabled. For more details on firewall configuration see the R&S White Paper "Malware Protection" (available at http://www.rohde-schwarz.com/appnote/1EF73) and the Windows 7 help system.

Note that changing firewall settings requires administrator rights.

3.1.6 Configuring the Initial Instrument Settings

This section describes how to setup the R&S FSW initially. For further basic instrument settings see the R&S FSW User Manual.

3.1.6.1 Setting the Date and Time

Users with administrator rights can set the date and time for the internal real time clock as follows:

Opening the Date and Time Properties dialog box

1. Press the SETUP key.

2. Press the "Display" softkey.

3. Select the "General" tab in the "Display" dialog box.

4. Press the "Set Date and Time" button to open the standard Windows "Date and Time Properties" dialog box.

5. If necessary, toggle the "Date and Time Format" between German (de) and US.

   After you have made a change and closed the dialog box, the new date and time is also adopted by the instrument.

3.2　Instrument Tour

3.2.1　Front Panel View

This chapter describes the front panel, including all function keys and connectors.
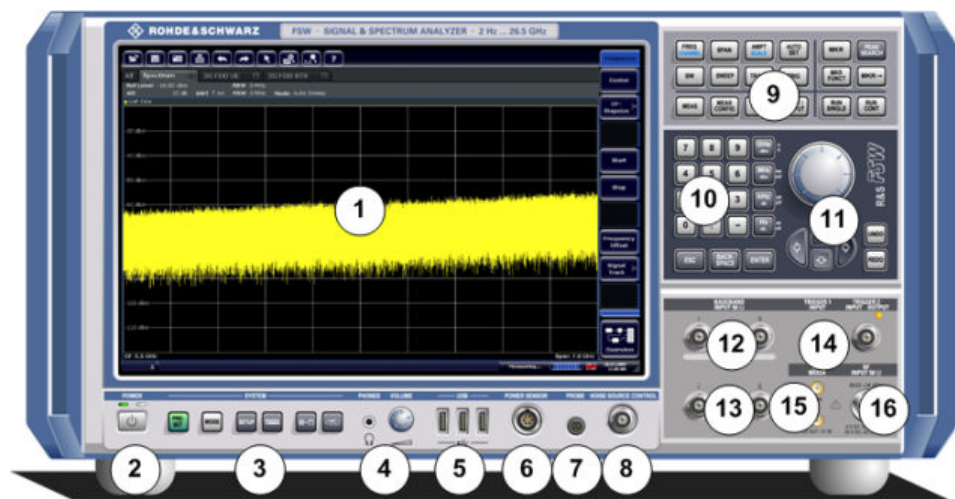
Fig. 3-1: Front panel view

1 = Touch screen
2 = POWER key
3 = SYSTEM keys
4 = Headphones connector and volume control
5 = USB connectors
6 = POWER SENSOR connector
7 = PROBE connector
8 = NOISE SOURCE CONTROL
9 = Function keys
10 = Keypad
11 = Navigation controls
12 = (Analog) Baseband Input 50Ω connectors for I/Q signal or Rohde&Schwarz active probes (optional)
13 = (Analog) Baseband Input 50Ω connectors for inverse part of differential I/Q signal (optional)
14 = TRIGGER INPUT/OUTPUT connectors
15 = EXT MIXER connector (optional)
16 = RF Input 50 Ω connector

> ## NOTICE
>
> **Instrument damage caused by cleaning agents**
>
> Cleaning agents contain substances that may damage the instrument, for example cleaning agents that contain a solvent may damage the front panel labeling, plastic parts, or the display.
>
> Never use cleaning agents such as solvents (thinners, acetone, etc), acids, bases, or other substances.
>
> The outside of the instrument can be cleaned sufficiently using a soft, lint-free dust cloth.

3.2.1.1 Touch screen

All measurement results are displayed on the screen on the front panel. Additionally, the screen display provides status and setting information and allows you to switch between various measurement tasks. The screen is touch-sensitive, offering an alternative means of user interaction for quick and easy handling of the instrument.
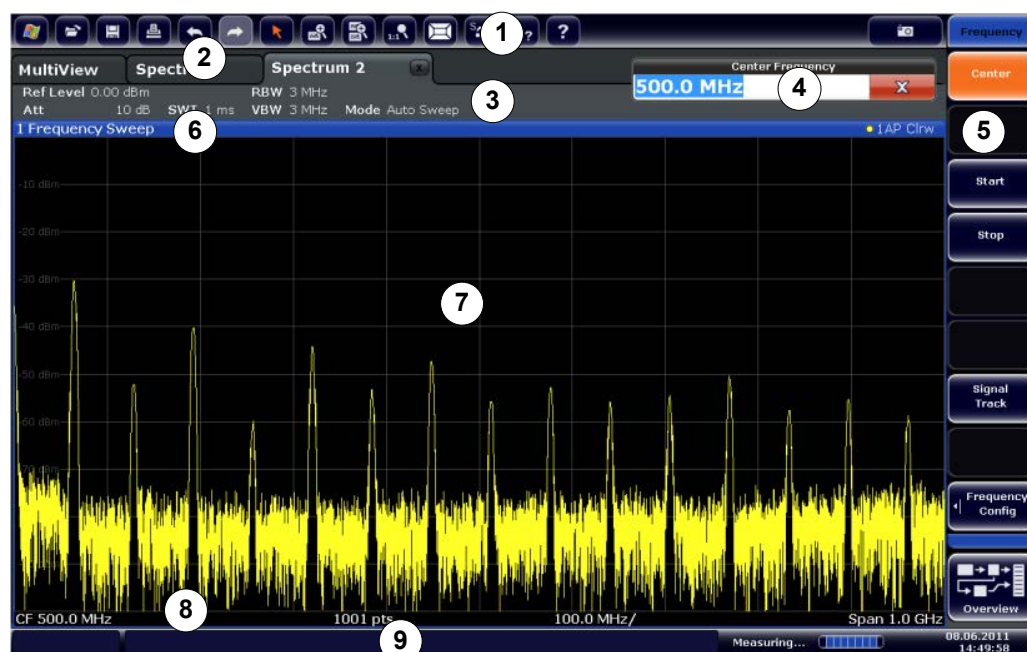
Fig. 3-2: Touch screen elements

1 = Toolbar with standard application functions, e.g. print, save/open file etc.
2 = Tabs for individual measurement channels
3 = Channel bar for firmware and measurement settings
4 = Input field for measurement setting
5 = Softkeys for function access
6 = Window title bar with diagram-specific (trace) information
7 = Measurement results area
8 = Diagram footer with diagram-specific information, depending on application
9 = Instrument status bar with error messages, progress bar and date/time display

A touch screen is a screen that is touch-sensitive, i.e. it reacts in a specified way when a particular element on the screen is tapped by a finger or a pointing device, for example. Any user interface elements that can be clicked on by a mouse pointer can also be tapped on the screen to trigger the same behavior, and vice versa. Using the touch screen, the following tasks (among others) can be performed by the tap of your finger (see also chapter 3.3, "Trying Out the Instrument", on page 51):

- Changing a setting
- Changing the display
- Moving a marker
- Zooming into a diagram
- Selecting a new evaluation method
- Scrolling through a result list
- Saving or printing results and settings

To imitate a right-click by mouse using the touch screen, for example to open a context-sensitive menu for a specific item, press the screen for about 1 second.

Toolbar

Standard functions can be performed via the icons in the toolbar at the top of the screen.

You can hide the toolbar display, e.g. when using remote control, in order to enlarge the display area for the measurement results ("Setup > Display > Displayed Items"). See the R&S FSW User Manual for details.

The following functions are available:

Table 3-1: Standard Application Functions in the Toolbar

Icon	Description
	Windows: displays the Windows "Start" menu and task bar
	Open: opens a file from the instrument ("Save/Recall" menu)
	Store: stores data on the instrument ("Save/Recall" menu)
	Print: defines print settings ("Print" menu)
	Undo: reverts last operation
	Redo: repeats previously reverted operation
	Selection mode: the cursor can be used to select (and move) markers in a zoomed display

Icon	Description
	Zoom mode: displays a dotted rectangle in the diagram that can be expanded to define the zoom area
	Multiple zoom mode: multiple zoom areas can be defined for the same diagram
	Zoom off: displays the diagram in its original size
	SmartGrid: activates "SmartGrid" mode to configure the screen layout
	Sequencer: opens the "Sequencer" menu to perform consecutive measurements
	Help (+ Select): allows you to select an object for which context-specific help is displayed
AL	Analysis line (MSRA mode only): opens a dialog box to display and position an analysis line in MSRA measurements (see R&S FSW MSRA User Manual)
	Help: displays context-sensitive help topic for currently selected element
	Print immediately: prints the current display (screenshot) as configured
In "SmartGrid" mode only:	
	Exit "SmartGrid" mode

Softkeys

Softkeys are virtual keys provided by the software. Thus, more functions can be provided than those that can be accessed directly via the function keys on the instrument. Softkeys are dynamic, i.e. depending on the selected function key, a different list of softkeys is displayed on the right side of the screen.

A list of softkeys for a certain function key is also called a menu. Softkeys can either perform a specific function or open a dialog box.

The "More" softkey indicates that the menu contains more softkeys than can be displayed at once on the screen. When pressed, it displays the next set of softkeys.

Recognizing the softkey status by color

A softkey is highlighted orange when its associated dialog box is open. If it is a toggle softkey, the current state is highlighted blue. If an instrument function is not available temporarily due to a specific setting, the associated softkey is deactivated and its text is colored gray.

Some softkeys belong to a certain (firmware) option. If this option is not installed in your instrument, the associated softkeys are not displayed.

You can hide the softkey display, e.g. when using remote control, in order to enlarge the display area for the measurement results ("Setup > Display > Displayed Items"). See the User Manual for details.

Context-sensitive Menus

Markers and traces in the display, as well as the information in the channel bar, have context-sensitive menus. If you right-click on a marker or trace in the display, or information in the channel bar (or tap it for about 1 second), a menu is displayed which contains the same functions as the corresponding softkey. This is useful, for example, when the softkey display is hidden.
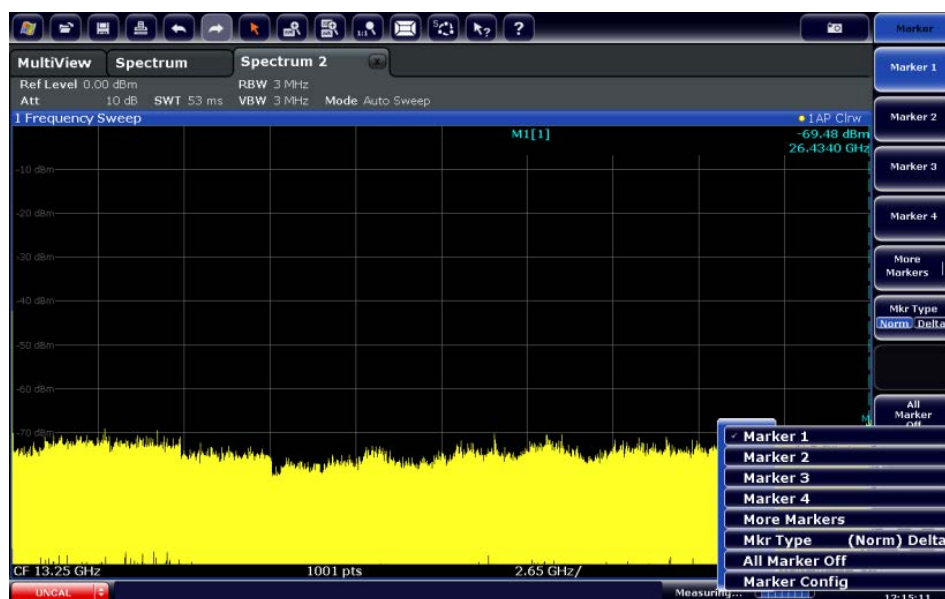
On-screen Keyboard

The on-screen keyboard is an additional means of interacting with the instrument without having to connect an external keyboard.

The on-screen keyboard display can be switched on and off as desired using the "On-Screen Keyboard" function key beneath the screen.

When you press this key, the display switches between the following options:

- Keyboard displayed at the top of the screen
- Keyboard displayed at the bottom of the screen
- No keyboard displayed

You can use the TAB key on the on-screen keyboard to move the focus from one field to another in dialog boxes.

3.2.1.2 POWER Key

The POWER key is located on the lower left corner of the front panel. It starts up and shuts down the instrument.

See also chapter 3.1.1.5, "Switching the Instrument On and Off", on page 22.

3.2.1.3 SYSTEM Keys

SYSTEM keys set the instrument to a defined state, change basic settings, and provide print and display functions.

A detailed description of the corresponding functions is provided in the User Manual.

Table 3-2: SYSTEM keys

SYSTEM key	Assigned functions
PRESET	Resets the instrument to the default state.
MODE	Provides the selection between applications
SETUP	Provides basic instrument configuration functions, e.g.:
	Reference frequency (external/internal), noise source
	Date, time, display configuration
	LAN interface
	Self-alignment
	Firmware update and enabling of options
	Information about instrument configuration incl. firmware version and system error messages
	Service support functions (self test etc.)
	Switches between the on-screen keyboard display:
	at the top of the screen
	at the bottom of the screen
	off
	Switches between maximized and split display of focus area.
	Switches focus area between windows.

3.2.1.4 PHONES and VOLUME

Headphones equipped with a miniature jack plug can be connected to the PHONES female connector. The internal impedance is 10 Ω. The output voltage can be set by using the VOLUME control to the right of the female connector. If a plug is connected, the internal loudspeaker is automatically switched off.

To use the PHONES connector, in the "Output" dialog box (INPUT/OUTPUT key), select "Video Output" = "Video". The output voltage (volume) is 1V.

> ⚠ **CAUTION**
>
> **Risk of hearing damage**
> To protect your hearing, make sure that the volume setting is not too high before putting on the headphones.

3.2.1.5 USB

The front panel provides three female USB connectors (USB-A) to connect devices like a keyboard (recommended: R&S PSL-Z2, order number 1157.6870.03) or a mouse (recommended: R&S PSL-Z10, order number 1157.7060.03). In addition, a memory stick can be connected to store and reload instrument settings and measurement data.

> ⓘ The rear panel provides further USB connectors, including a male (USB-B) connector. See chapter 3.2.2.5, "USB", on page 48.

3.2.1.6 POWER SENSOR

The LEMOSA female connector is used to connect power sensors of the R&S NRP-Zxy family. For a detailed list of supported sensors see the data sheet.

For details on configuring and using power sensors, see chapter 6.2.3, "Power Sensors", on page 282.

3.2.1.7 PROBE

The R&S FSW provides a connector for supply voltages of +15 V to -12 V and ground for active probes and preamplifiers. A maximum current of 140 mA is available. This connector is suitable as power supply for high-impedance probes from Agilent.

3.2.1.8 NOISE SOURCE CONTROL

The noise source control female connector is used to provide the supply voltage for an external noise source, e.g., to measure the noise figure and gain of amplifiers and frequency converting devices.

Conventional noise sources require a voltage of +28 V in order to be switched on and 0 V to be switched off. The output supports a maximum load of 100 mA.

3.2.1.9 Function Keys

Function keys provide access to the most common measurement settings and functions.

A detailed description of the corresponding functions is provided in the User Manual.

Table 3-3: Function keys

Function key	Assigned functions
Basic measurement settings	
FREQ	Sets the center frequency as well as the start and stop frequencies for the frequency range under consideration. This key is also used to set the frequency offset and the signal track function.
SPAN	Sets the frequency span to be analyzed.
AMPT	Sets the reference level, the displayed dynamic range, the RF attenuation and the unit for the level display.
	Sets the level offset and the input impedance.
	Activates the preamplifier (option RF Preamplifier, R&S FSW-B22).
AUTO SET	Enables automatic settings for level, frequency or sweep type mode.
BW	Sets the resolution bandwidth and the video bandwidth.
SWEEP	Sets the sweep time and the number of measurement points.
	Selects continuous measurement or single measurement.
TRACE	Configures the measured data acquisition and the analysis of the measurement data.
TRIG	Sets the trigger mode, the trigger threshold, the trigger delay, and the gate configuration in the case of gated sweep.
Marker functions	
MKR	Sets and positions the absolute and relative measurement markers (markers and delta markers).
PEAK SEARCH	Performs a peak search for active marker. If no marker is active, normal marker 1 is activated and the peak search is performed for it.
MKR FUNC	Provides additional analysis functions of the measurement markers:
	Frequency counter (Sig Count)
	Fixed reference point for relative measurement markers (Ref Fixed)
	Noise marker (Noise Meas)
	Phase noise (Phase Noise)
	n dB down function
	AM/FM audio demodulation
	Peak list

Function key	Assigned functions
MKR->	Used for search functions of the measurement markers (maximum/minimum of the trace).
	Assigns the marker frequency to the center frequency, and the marker level to the reference level.
	Restricts the search area (Search Limits) and characterizes the maximum points and minimum points (Peak Excursion).
Measurement and evaluation functions	
MEAS	Provides the measurement functions.
	Measurement of multicarrier adjacent channel power (Ch Power ACLR)
	Carrier to noise spacing (C/N C/No)
	Occupied bandwidth (OBW)
	Spectrum emission mask measurement (Spectrum Emission Mask)
	Spurious emissions (Spurious Emissions)
	Measurement of time domain power (Time Domain Power)
	Signal statistics: amplitude probability distribution (APD) and cumulative complementary distribution function (CCDF)
	Third-order intercept point (TOI)
	AM modulation depth (AM Mod Depth)
MEAS CONFIG	Used to define measurement configuration.
LINES	Configures display lines and limit lines.
INPUT/OUTPUT	Displays softkeys for input/output functions.
Measurement start functions	
RUN SINGLE	Starts a single new measurement (Single Sweep Mode).
RUN CONT	Starts a continuous measurement (Continuous Sweep Mode).
Function execution (in navigation controls area)	
UNDO	Reverts last operation
REDO	Repeats previously reverted operation.

3.2.1.10 Keypad

The keypad is used to enter alphanumeric parameters, including the corresponding units (see also chapter 3.4.4, "Entering Data", on page 76). It contains the following keys:

Table 3-4: Keys on the keypad

Type of key	Description
Alphanumeric keys	Enter numbers and (special) characters in edit dialog boxes.
Decimal point	Inserts a decimal point "." at the cursor position.
Sign key	Changes the sign of a numeric parameter. In the case of an alphanumeric parameter, inserts a "-" at the cursor position.

Type of key	Description
Unit keys (GHz/-dBm MHz/dBm, kHz/dB and Hz/dB)	These keys add the selected unit to the entered numeric value and complete the entry.
	In the case of level entries (e.g. in dB) or dimensionless values, all units have the value "1" as multiplying factor. Thus, they have the same function as an ENTER key.
ESC key	Closes all kinds of dialog boxes, if the edit mode is not active. Quits the edit mode, if the edit mode is active. In dialog boxes that contain a "Cancel" button it activates that button.
	For "Edit" dialog boxes the following mechanism is used: • If data entry has been started, it retains the original value and closes the dialog box. • If data entry has not been started or has been completed, it closes the dialog box.
BACKSPACE key	If an alphanumeric entry has already been started, this key deletes the character to the left of the cursor.
ENTER key	• Concludes the entry of dimensionless entries. The new value is accepted. • With other entries, this key can be used instead of the "Hz/dB" unit key. • In a dialog box, selects the default or focussed element.

3.2.1.11 Navigation Controls

The navigation controls include a rotary knob, navigation keys, and UNDO / REDO keys. They allow you to navigate within the display or within dialog boxes.

Rotary Knob

The rotary knob has several functions:

• Increments (clockwise direction) or decrements (counter-clockwise direction) the instrument parameter at a defined step width in the case of a numeric entry.

• Shifts the selection bar within focussed areas (e.g. lists).

• Shifts markers, limit lines, etc on the screen.

• Moves the scroll bar vertically, if the scroll bar is focussed.

• Acts like the ENTER key, when it is pressed.

Navigation Keys

The navigation keys can be used alternatively to the rotary knob to navigate through dialog boxes, diagrams or tables.

UP/DOWN Keys

The UP or DOWN keys do the following:

- In a numeric edit dialog box, increase or decrease the instrument parameter.
- In a list, scroll forward and backward through the list entries.
- In a table, move the selection bar vertically.
- In windows or dialog boxes with vertical scroll bar, move the scroll bar.

LEFT/RIGHT Keys

The LEFT or RIGHT keys do the following:

- In an alphanumeric edit dialog box, move the cursor.
- In a list, scroll forward and backward through the list entries.
- In a table, move the selection bar horizontally.
- In windows or dialog boxes with horizontal scroll bar, move the scroll bar.

UNDO/REDO keys

- The UNDO key reverts the previously performed action, i.e. the status before the previous action is retrieved.
  The undo function is useful, for example, if you are performing a zero span measurement with several markers and a limit line defined and accidentally click the "ACP" softkey. In this case, very many settings would be lost. However, if you press UNDO immediately afterwards, the previous status is retrieved, i.e. the zero span measurement and all settings.
- The REDO key repeats the previously reverted action, i.e. the most recently performed action is repeated.

The UNDO function is not available after a PRESET or "RECALL" operation. When these functions are used, the history of previous actions is deleted.

The UNDO/REDO functions are not available for some applications; see Release Notes for details.

3.2.1.12 (Analog) Baseband Input 50Ω Connectors (optional)

The R&S FSW Analog Baseband Interface option (R&S FSW-B71) provides 4 BASEBAND INPUT BNC connectors on the front panel of the instrument for analog I and Q signals.

The upper BNC connectors BASEBAND INPUT I and BASEBAND INPUT Q are used to input single-ended signals, the positive signal input for differential signals, as well as input from active **Rohde & Schwarz probes** (R&S RT-ZSxx and differential probes RT-ZDxx).

The lower BNC connectors Ī and Q̄ are used to input the negative signal for differential signals.

For complex signal input (I+jQ), always use two identical cables for the I and Q connectors (same length, same type, same manufacturer). Otherwise, time delay or gain imbalance may occur between the different cables, which cannot be calibrated.

All connectors have a fixed impedance of 50Ω and may receive a maximum input level of $4V_{pp}$ each.

NOTICE

Risk of instrument damage

Do not overload the BASEBAND INPUT connectors. An input voltage of 4 V must never be exceeded. Noncompliance will destroy the Analog Baseband Interface components.

The device that provides analog baseband input (or the probe) must be connected to the R&S FSW accordingly.

Input via the Analog Baseband Interface can be enabled in the I/Q Analyzer, the Analog Demulation application, or in one of the optional applications that process I/Q data (where available).

3.2.1.13 TRIGGER INPUT / OUTPUT

The female TRIGGER INPUT connector for external trigger or gate input is used to control the measurement by means of an external signal. The voltage levels can range from 0.5 to 3.5 V. The default value is 1.4 V. The typical input impedance is 10 kΩ.

The female BNC TRIGGER INPUT / OUTPUT connector can be used to receive a second external signal or to provide a signal to another device. The signal is TTL compatible (0 V / 5 V). You can control the connector usage in the "Trigger" settings (TRIG key).

The rear panel provides a third TRIGGER INPUT / OUTPUT connector, see chapter 3.2.2.9, "TRIGGER 3 INPUT/ OUTPUT", on page 49.

3.2.1.14   EXT MIXER Connector (optional)

External mixers can be connected at the EXT MIXER LO OUT/IF IN and IF IN female connectors to increase the available frequency range. This connector is optional and only available with R&S FSW-B21.

If no external mixers are connected to the R&S FSW, cover the two front connectors LO OUT / IF IN and IF IN with the supplied SMA caps.

3.2.1.15   RF INPUT 50Ω

A device under test (DUT) can be connected to the R&S FSW to provide RF input which is then analyzed. The DUT is connected to the instrument's RF INPUT via a cable equipped with an appropriate connector.

NOTICE

Risk of instrument damage

Do not overload the input. For maximum allowed values, see the data sheet. For AC-coupling, a DC input voltage of 50 V must never be exceeded. For DC-coupling, DC voltage must not be applied at the input. In both cases, noncompliance will destroy the input mixers.

3.2.2   Rear Panel View

This figure shows the rear panel view of the R&S FSW. The individual elements are described in more detail in the subsequent sections.
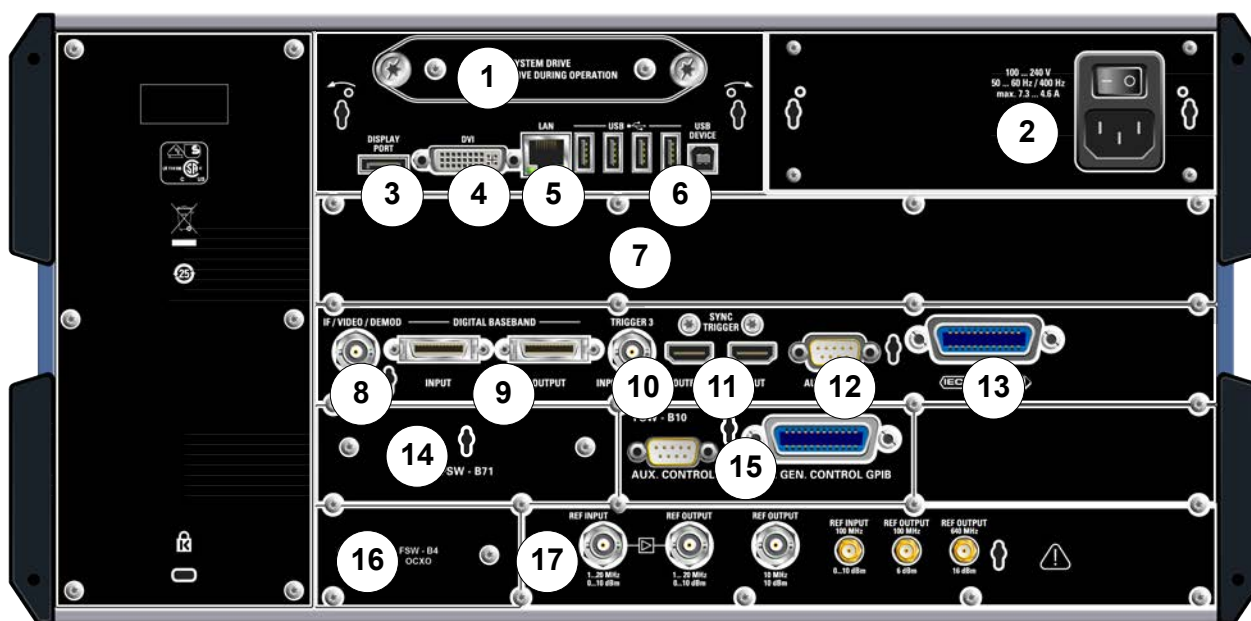
Fig. 3-3: Rear panel view

1 = Removable system hard drive
2 = AC Power Supply Connection and Main Power Switch
3 = DISPLAY PORT for external display
4 = DVI connector for external display
5 = LAN connector
6 = USB (DEVICE) connectors
7 = Bandwidth Extension 160 MHz/ 320 MHz with IF WIDE OUTPUT connector (option B160/ B320)
8 = IF/VIDEO/DEMOD connector
9 = DIGITAL BASEBAND INPUT/OUTPUT connectors (option B17)
10 = TRIGGER 3 INPUT/OUTPUT connector
11 = SYNC TRIGGER OUTPUT/INPUT
12 = AUX PORT
13 = GPIB interface
14 = Analog baseband interface (option B71)
15 = External generator control (option B10)
16 = OCXO external reference (option B4)
17 = REF INPUT/OUTPUT connectors

3.2.2.1   Removable System Hard Drive

The removable system hard drive contains all measurement data from the R&S FSW, allowing you to store the data securely in an external location.

3.2.2.2   AC Power Supply Connection and Main Power Switch

An AC power supply connector and main power switch are located in a unit on the rear panel of the instrument.

Main power switch function:

Position 1: The instrument is in operation.

Position O: The entire instrument is disconnected from the AC power supply.

For details refer to chapter 3.1.1.4, "Connecting the AC Power", on page 22.

3.2.2.3 DISPLAY PORT and DVI

You can connect an external monitor or other display device to the R&S FSW to provide an enlarged display. Two different types of connectors are provided for this purpose:

● DISPLAY PORT

● DVI (Digital visual interface)

For details see chapter 3.1.4, "Connecting an External Monitor", on page 28.

3.2.2.4 LAN

The LAN interface can be used to connect the R&S FSW to a local network for remote control, printouts and data transfer. The assignment of the RJ-45 connector supports twisted-pair category 5 UTP/STP cables in a star configuration (UTP stands for *unshielded twisted pair*, and STP for *shielded twisted pair*).

For details see chapter 3.1.5, "Setting Up a Network (LAN) Connection", on page 29.

For details see chapter 10, "Network and Remote Operation", on page 553.

3.2.2.5 USB

The rear panel provides four additional female USB (USB-A) connectors to connect devices like a keyboard, a mouse or a memory stick (see also chapter 3.2.1.5, "USB", on page 40).

Furthermore, a male USB DEVICE connector (USB-B) is provided, for example for a printer.

3.2.2.6 Bandwidth Extension 160 MHz/ 320 MHz with IF WIDE OUTPUT Connector (R&S FSW-B160/-B320)

The signal analysis bandwidth of the R&S FSW can be extended by a hardware option (R&S FSW-B160/-B320). The bandwidth extension allows for a linear bandwidth up to a maximum of 160 MHz (with option B160) / 320 MHz (with option B320) with an output sample rate of up to 10 GHz. While the extension can be activated or deactivated manually in the R&S FSW base unit (I/Q Analyzer application), it is activated automatically in some applications that also support I/Q data analysis. See the application-specific documentation for details.

Together with the bandwidth extension an additional IF output connector is provided (IF WIDE OUTPUT). As opposed to the default IF/VIDEO/DEMOD OUTPUT connector, the IF output frequency of the optional connector cannot be defined manually, but is determined automatically depending on the center frequency. For details on the used frequencies see the data sheet. The IF WIDE OUTPUT connector is used automatically when the bandwidth extension is activated (i.e. for bandwidths > 80 MHz).

3.2.2.7 IF/VIDEO/DEMOD OUTPUT

The female BNC connector can be used for various outputs:

- Intermediate frequency (IF) output of approximately 20 MHz
- Video output (1V)

Which output is provided is defined in the software (INPUT/OUTPUT key). For details see the User Manual.

3.2.2.8 Digital Baseband Interface (R&S FSW-B17) and R&S EX-IQ-BOX

The R&S FSW Digital Baseband Interface option (R&S FSW-B17) provides an online digital I/Q data interface on the rear panel of the instrument for input and output. The digital input and output can be enabled in the base unit or in one of the applications (where available).

Optionally, an R&S EX-IQ-BOX can be connected to the Digital Baseband Interface to convert signal properties and the transmission protocol of the R&S FSW into user-defined or standardized signal formats and vice versa.

For more information on the Digital Baseband Interface (R&S FSW-B17) and typical applications see the R&S FSW I/Q Analyzer User Manual.

3.2.2.9 TRIGGER 3 INPUT/ OUTPUT

The additional female BNC TRIGGER INPUT / OUTPUT connector can be used to receive a third external signal or to provide a signal to another device. The signal is TTL compatible (0 V / 5 V). You can control the connector usage in the "Trigger" settings (TRIG key).

3.2.2.10 SYNC TRIGGER OUTPUT/INPUT

The SYNC TRIGGER OUTPUT/INPUT connectors allow you to synchronize several devices (e.g. two R&S FSWs) with respect to the trigger signal, but also the reference frequency. A 100 MHz signal can be output as a trigger or reference signal to another device, and an external trigger or reference signal can be received at the input connector by the R&S FSW.

3.2.2.11 AUX PORT

The 9 pole SUB-D male connector provides control signals for controlling external devices. The voltage levels are of the TTL type (max. 5 V).

Pin	Signal	Description
1	+5 V / max. 250 mA	Supply voltage for external circuits
2 to 7	I/O	Control lines for user ports (see User manual)

Pin	Signal	Description
8	GND	Ground
9	READY FOR TRIGGER	Signal indicating that the instrument is ready to receive a trigger signal (Low active = 0 V)

NOTICE

Short-circuit hazard

Always observe the designated pin assignment. A short-circuit may damage the instrument.

3.2.2.12   GPIB Interface

The GPIB interface is in compliance with IEEE488 and SCPI. A computer for remote control can be connected via this interface. To set up the connection, a shielded cable is recommended. For more details refer to "Setting Up Remote Control" in the User Manual.

3.2.2.13   External Generator Control Option (R&S FSW-B10)

The external generator control option provides an additional GPIB connector and AUX port.

The GPIB connector can be used to connect the external generator to the R&S FSW.

The AUX port is required for TTL synchronization, if supported by the generator. It is identical to the standard AUX port (see chapter 3.2.2.11, "AUX PORT", on page 49).

For details on connecting an external generator see the "External Generator Control" section of the R&S FSW User Manual.

3.2.2.14   OCXO Option (R&S FSW-B4)

This option generates a 10 MHz reference signal with a very precise frequency. If installed, and if no external signal is used, this signal is used as an internal reference. It can also be used to synchronize other connected devices via the REF OUTPUT 10 MHz connector.

> **Warm-up time for OCXO**
>
> When the instrument is switched on, the OCXO requires an extended warm-up time (see data sheet). No warm-up time is required when starting from standby mode.

3.2.2.15 REF INPUT / REF OUTPUT

The REF INPUT connectors are used to provide an external reference signal to the R&S FSW.

The REF OUTPUT connectors can be used to provide an external reference signal (or the optional OCXO reference signal) from the R&S FSW to other devices that are connected to this instrument.

Various connectors are provided for different reference signals:

Connector	Reference signal	Usage
REF INPUT	1...20 MHz 0...10 dBm	To provide an external reference signal on the R&S FSW.
REF OUTPUT	1...20 MHz 0...10 dBm	To provide the same external reference signal received by the REF INPUT 1...20 MHZ connector to another device, when available.
REF OUTPUT	10 MHz 10 dBm	To provide the internal reference signal from the R&S FSW to another device continuously. Also used to provide OCXO reference signal to another device.
REF INPUT	100 MHz 0...10 dBm	To provide an external reference signal on the R&S FSW.
REF OUTPUT	100 MHz 6 dBm	To provide a 100 MHz reference signal from the R&S FSW to another device.
REF OUTPUT	640 MHz 16 dBm	To provide a 640 MHz reference signal from the R&S FSW to another device.

> **SYNC TRIGGER**
>
> The SYNC TRIGGER connector can also be used to synchronize the reference frequency on several devices (see chapter 3.2.2.10, "SYNC TRIGGER OUTPUT/INPUT", on page 49).

3.3 Trying Out the Instrument

This chapter introduces the most important functions and settings of the R&S FSW step by step. The complete description of the functionality and its usage is given in the R&S FSW User Manual. Basic instrument operation is described in chapter 3.4, "Operating the Instrument", on page 66.

Prerequisites

●   The instrument is set up, connected to the mains system, and started up as described
    in chapter 3.1, "Preparing for Use", on page 18.

For these first measurements, you use the internal calibration signal, so you do not need
any additional signal source or instruments. Try out the following:

3.3.1 Measuring a Basic Signal

We will start out by measuring a simple sinus wave, using the internal calibration signal
as the input.

To display the internal 64 MHz calibration signal

1. Press the PRESET key to start out in a defined instrument configuration.

2. Press the SETUP key on the front panel.

3. Tap the "Service" softkey.

4. Tap the "Calibration Signal" tab.

5. Tap the "Calibration Frequency RF" option. Leave the frequency at the default
    64 MHz, with a narrowband spectrum.

    The calibration signal is now sent to the RF input of the R&S FSW. By default, a
    continuous frequency sweep is performed, so that the spectrum of the calibration
    signal is now displayed in the standard level versus frequency diagram.
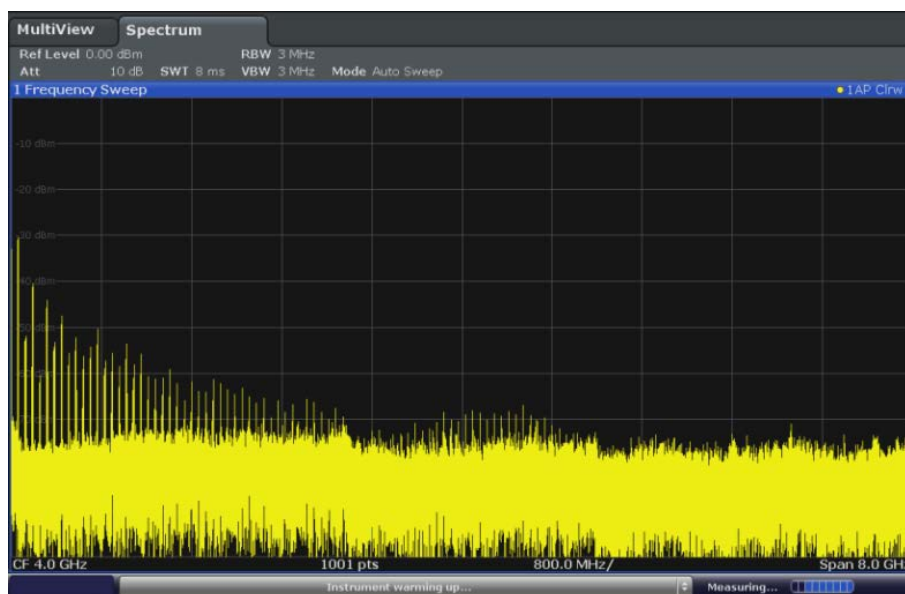
Fig. 3-4: Calibration signal as RF input

Instrument warmup time

Note that the instrument requires an initial warmup time after switching it on. A message in the status bar ("Instrument warming up...") indicates that the operating temperature has not yet been reached. Wait till this message is no longer displayed before you start a measurement.

To optimize the display

In order to optimize the display for the calibration signal, we will adjust the main measurement settings.

1. Set the center frequency to the calibration frequency:

   a) Tap the "Overview" softkey to display the configuration "Overview".
   b) Tap the "Frequency" button.
   c) In the "Center" field, enter *64* on the number pad on the front panel.
   d) Press the "MHz" key next to the number pad.

2. Reduce the span to 20 MHz:

   a) In the "Span" field of the "Frequency" dialog box, enter *20 MHz*.
   b) Close the "Frequency" dialog box.

3. Set the reference level to -25 dBm:

   a) In the configuration "Overview", tap the "Amplitude" button.
   b) In the "Value" field of the "Amplitude" dialog box, enter *-25 dBm*.

The display of the calibration signal is now improved. The maximum at the center frequency (=calibration frequency) of 64 MHz becomes visible.
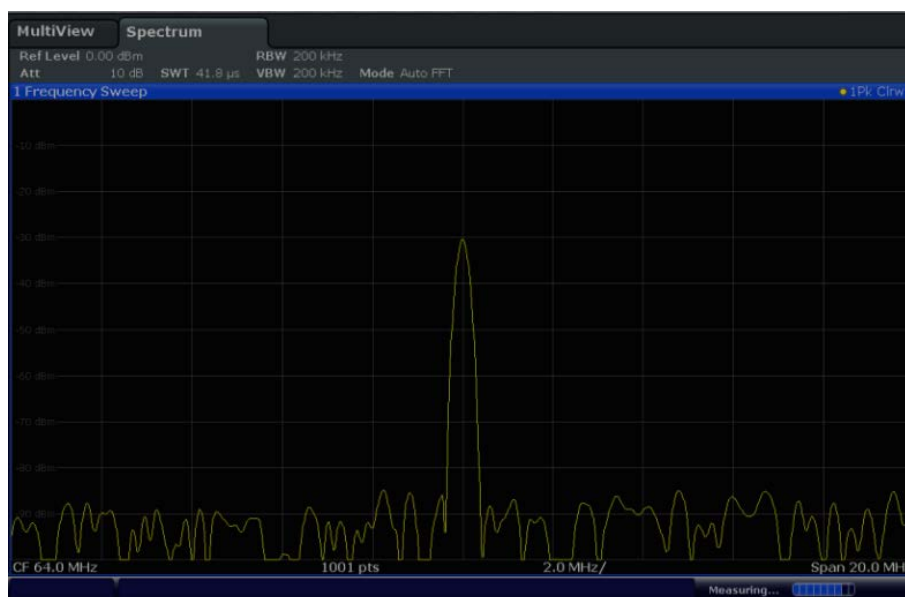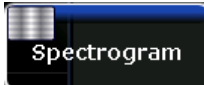
Fig. 3-5: Calibration signal with optimized display settings

3.3.2 Displaying a Spectrogram

In addition to the standard "level versus frequency" spectrum display, the R&S FSW also provides a spectrogram display of the measured data. A spectrogram shows how the spectral density of a signal varies over time. The x-axis shows the frequency, the y-axis shows the time. A third dimension, the power level, is indicated by different colors. Thus you can see how the strength of the signal varies over time for different frequencies.

1. Tap the "Overview" softkey to display the general configuration dialog box.

2. Tap the "Display" button.

   The SmartGrid mode is activated, and the evaluation bar with the available evaluation methods is displayed.

3.

   Drag the "Spectrogram" icon from the evaluation bar to the diagram area. The blue area indicates that the new diagram would replace the previous spectrum display. Since we do not want to replace the spectrum, drag the icon to the lower half of the display to add an additional window instead.
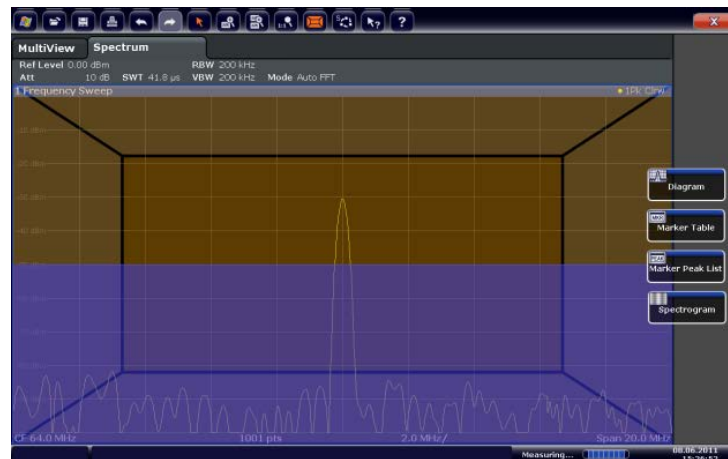
Fig. 3-6: Adding a Spectrogram to the display

Drop the icon.

4.

Close the SmartGrid mode by tapping the "Close" icon at the top right corner of the toolbar.

You see the spectrogram compared to the standard spectrum display. Since the calibration signal does not change over time, the color of the frequency levels does not change over time, i.e. vertically. The legend at the top of the spectrogram window describes the power levels the colors represent.
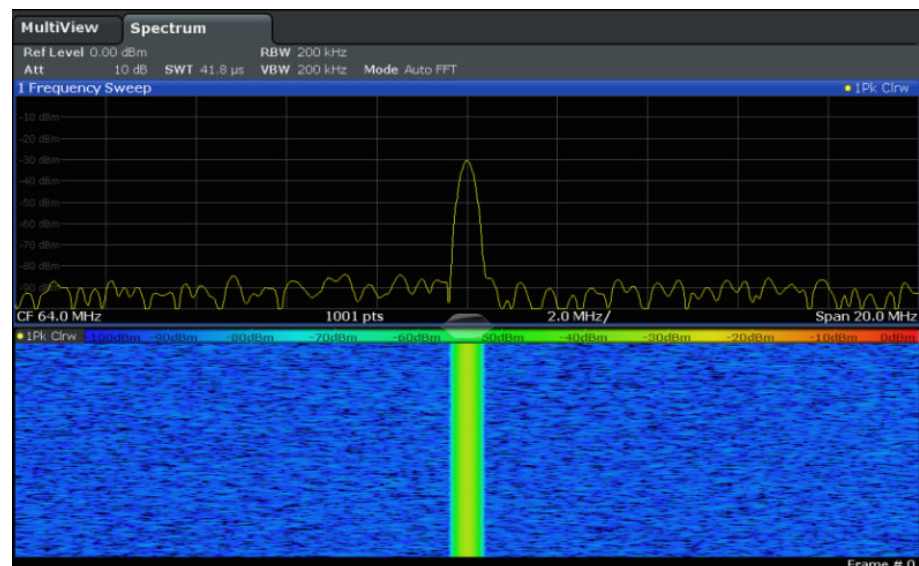
Fig. 3-7: Spectrogram of the calibration signal

3.3.3 Activating Additional Measurement Channels

The R&S FSW features multiple measurement channels, i.e. you can define several measurement configurations in parallel and then switch between the channels automatically to perform the measurements sequentially. We will demonstrate this feature by activating additional measurement channels for a different frequency range, a zero span measurement, and an I/Q analysis.

To activate additional measurement channels

1. Press the MODE key on the front panel.

2. On the "New Channel" tab of the "Signal + Spectrum Mode" dialog box, tap the "Spectrum" button.
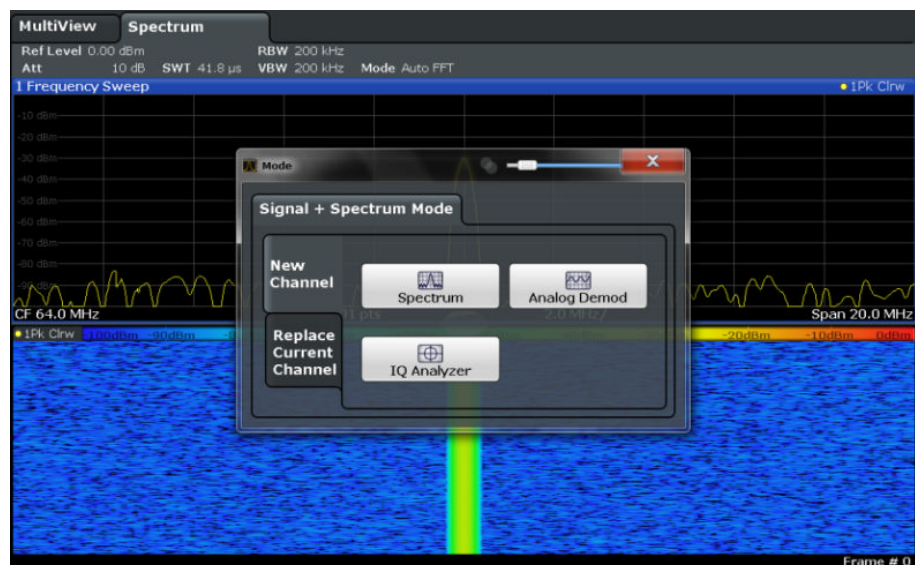
Fig. 3-8: Adding a new measurement channel

3. Change the frequency range for this spectrum display:
   In the "Frequency" dialog box, set the **center frequency** to *500 MHz* and the **span** to *1 GHz*.
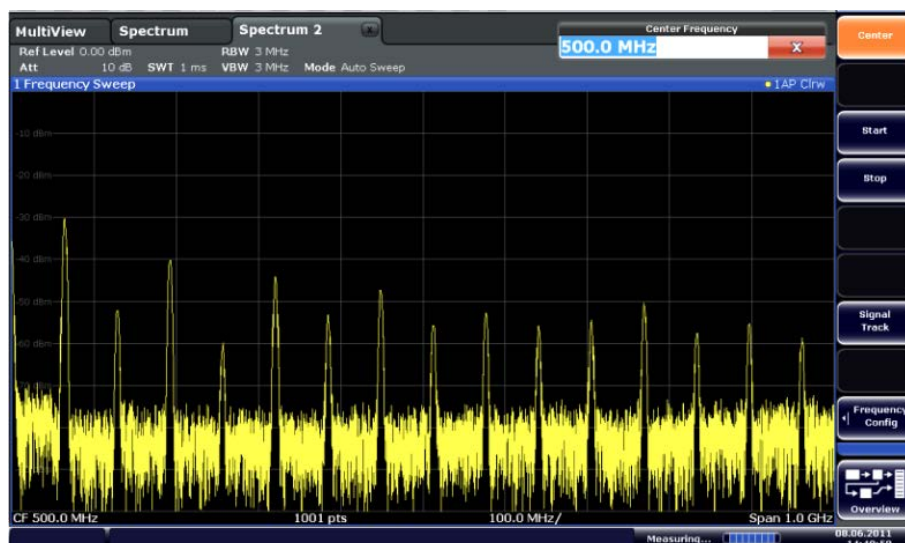
Fig. 3-9: Frequency spectrum of the calibration signal with a larger span

4. Repeat the previous steps to activate a third Spectrum window.

Change the frequency range for this spectrum display:

In the "Frequency" dialog box, set the **center frequency** to *64 MHz* and tap "Zero Span".

As the calibration signal does not vary over time, the level versus time diagram displays a straight line.

Fig. 3-10: Time domain display of the calibration signal

5. Create a new channel for I/Q analysis:

   a) Press the MODE key.
   b) Tap the "IQ Analyzer" button to activate a channel for the I/Q Analyzer application.
   c) Tap the "Display Config" softkey to activate the SmartGrid mode.

d) Drag the "Real/Imag (I/Q)" icon from the evaluation bar to the SmartGrid.

Fig. 3-11: Inserting a Real/Imag diagram for I/Q analysis

e) Close the SmartGrid mode.

The "IQ Analyzer" channel displays the real and imaginary signal parts in separate windows.

To display the MultiView tab

An overview of all active channels is provided in the "MultiView" tab. This tab is always displayed and cannot be closed.

► Tap the "MultiView" tab.
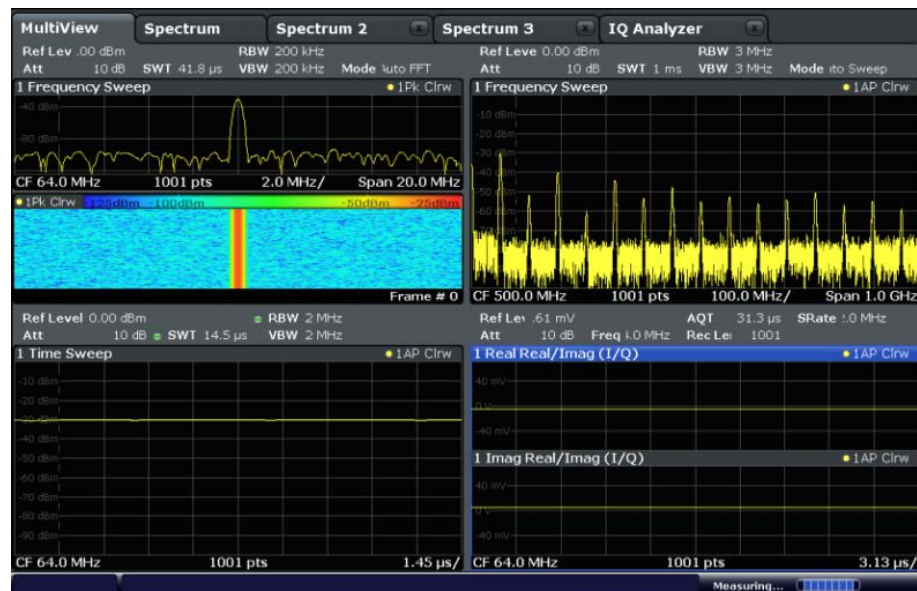
Fig. 3-12: The "MultiView" tab

3.3.4 Performing Sequential Measurements

Although only one measurement can be performed at any one time, the measurements configured in the active channels can be performed sequentially, i.e. one after the other, automatically, either once or continuously.

1.

    Tap the "Sequencer" icon in the toolbar.

2. Toggle the "Sequencer" softkey in the "Sequencer" menu to "On".

    A continuos sequence is started, i.e. each channel measurement is performed one after the other until the Sequencer is stopped.
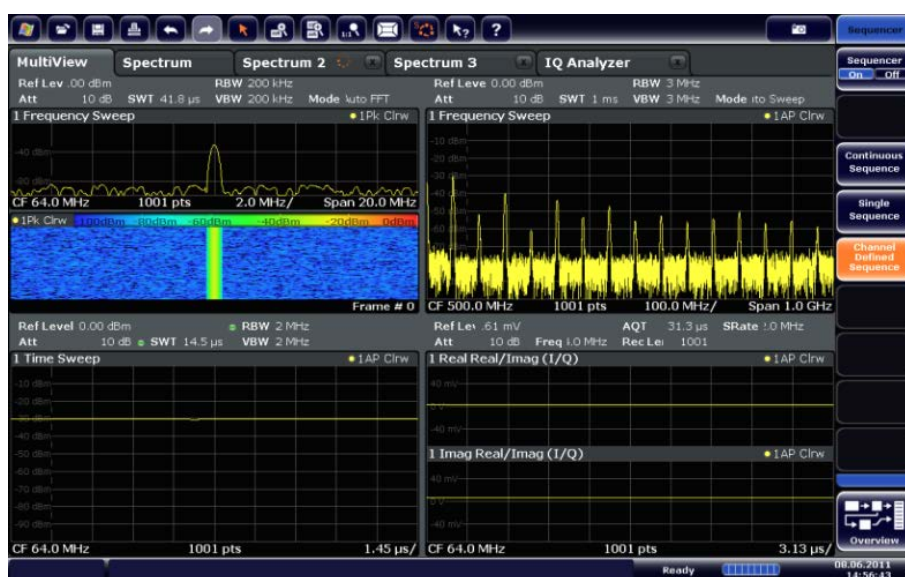
Fig. 3-13: "MultiView" tab with active Sequencer

In figure 3-13, the "Spectrum 2" measurement is currently active (indicated by the "channel active" icon in the tab label).

3. Stop the Sequencer by tapping the "Sequencer" softkey again.

3.3.5 Setting and Moving a Marker

Markers are useful to determine the position of particular effects in the trace. The most common use is to determine a peak, which is the default setting when you activate a marker. We will set a marker on the peak in our first Spectrum measurement.

1. In the "MultiView" tab, double-tap the "Spectrum" window (frequency sweep with spectrogram display) to return to the "Spectrum" channel.

2. Tap the spectrum display to set the focus on that window.

3.

   Press the "Split/Maximize" key on the front panel to maximize the spectrum window, as we currently do not need the spectrogram display.

4. Press the "RUN SINGLE" key on the front panel to perform a single sweep so we have a fixed trace to set a marker on.

5. Press the MKR key on the front panel to display the "Marker" menu.

   Marker 1 is activated and automatically set to the maximum of trace 1. The marker position and value is indicated in the diagram area as M1[1].
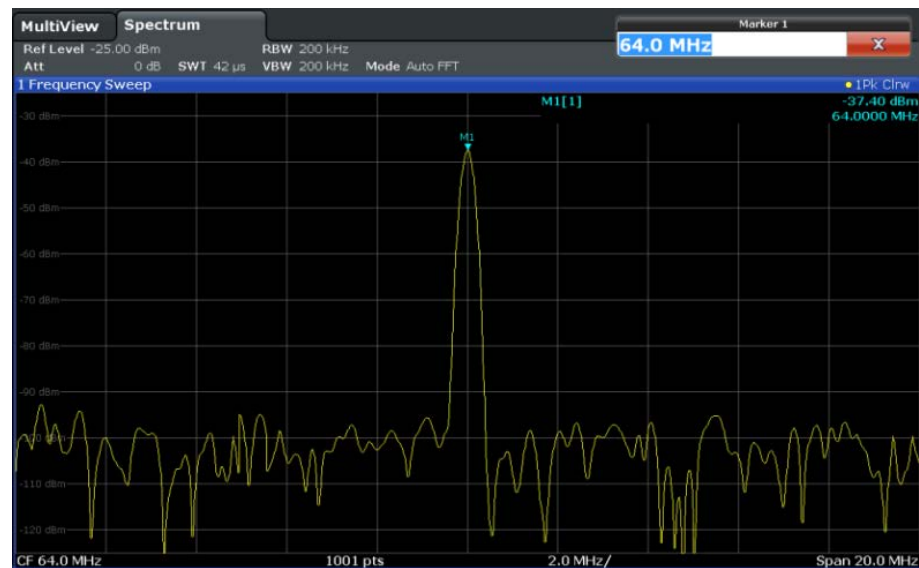
6. Now you can move the marker by tapping and dragging it to a different position. The current position is indicated by a dotted blue line. Notice how the position and value change in the marker area of the diagram.
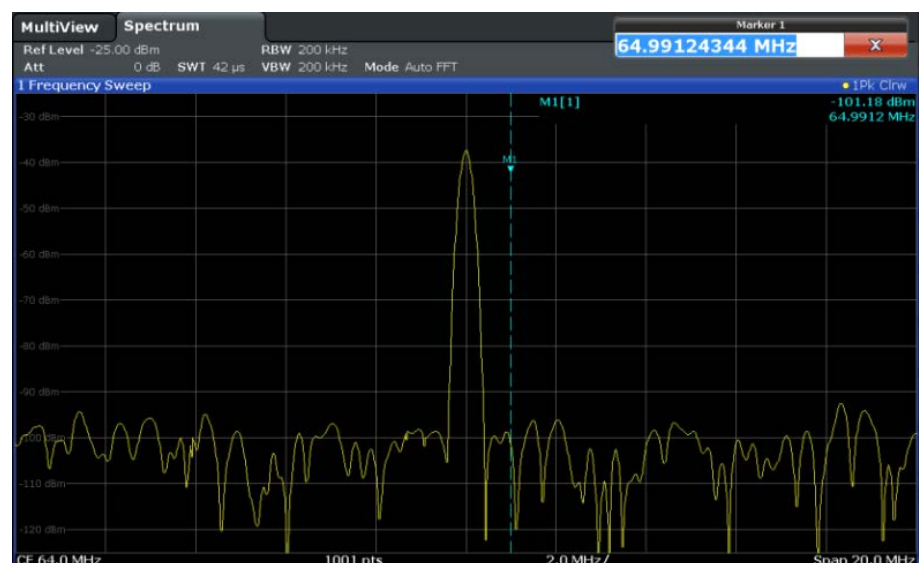
3.3.6 Displaying a Marker Peak List

The marker peak list determines the frequencies and levels of peaks in the spectrum automatically. We will display a marker peak list for the Spectrum 2 channel.

1. Tap the "Spectrum 2" tab.

2. Press the "RUN SINGLE" key on the front panel to perform a single sweep for which we will determine the peaks.

3.

    Tap the "SmartGrid" icon in the toolbar to activate SmartGrid mode.

4. Drag the "Marker Peak List" icon from the evaluation bar to the lower half of the display to add a new window for the peak list.

5. Close the SmartGrid mode.

6. To obtain a more conclusive peak list that does not contain noise peaks, for example, define a threshold that is higher than the noise floor:

    a) Press the MKR key on the front panel.
    b) Tap the "Marker Config" softkey in the "Marker" menu.
    c) Tap the "Search" tab in the "Marker" dialog box.
    d) In the "Threshold" field, enter *-68 dBm*.
    e) Tap the "State" box for "Threshold" to activate its use.
        Only peaks that are larger than -68 dBm will be included in the peak list.

The marker peak list displays the determined peaks that are above the defined threshold.

Fig. 3-14: Marker Peak List

3.3.7 Zooming into the Display

In order to analyze the areas around the peak levels in more detail, we will zoom into the top 3 peaks.

1.

Tap the "Multiple Zoom" icon in the toolbar.

The icon is highlighted orange to indicate that multiple zoom mode is active.

2. Tap the diagram near the first peak and drag your finger to the opposite corner of the zoom area. A white rectangle is displayed from the point where you tapped to the current position.
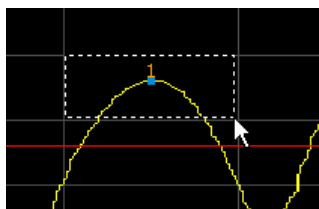
Fig. 3-15: Defining the zoom area

When you remove your finger, the zoom area is enlarged in a second (sub-)window.

Fig. 3-16: Zoomed display around a peak

Zoom mode is automatically disabled, and the default selection mode is restored, indicated by the highlighted "Selection mode" icon.

3. In figure 3-16 the enlarged peak is represented by a very thick trace. This is due to the insufficient number of sweep points. The missing sweep points for the zoomed display are interpolated, which provides poor results. To optimize the results, we will increase the number of sweep points from the default 1001 to 32001.

    a) Press the SWEEP key on the front panel.

    b) Tap the "Sweep Config" softkey in the "Sweep" menu.

    c) In the "Sweep Points" field, enter *32001*.

    d) Press the RUN SINGLE key on the front panel to perform a new sweep with the increased number of sweep points.
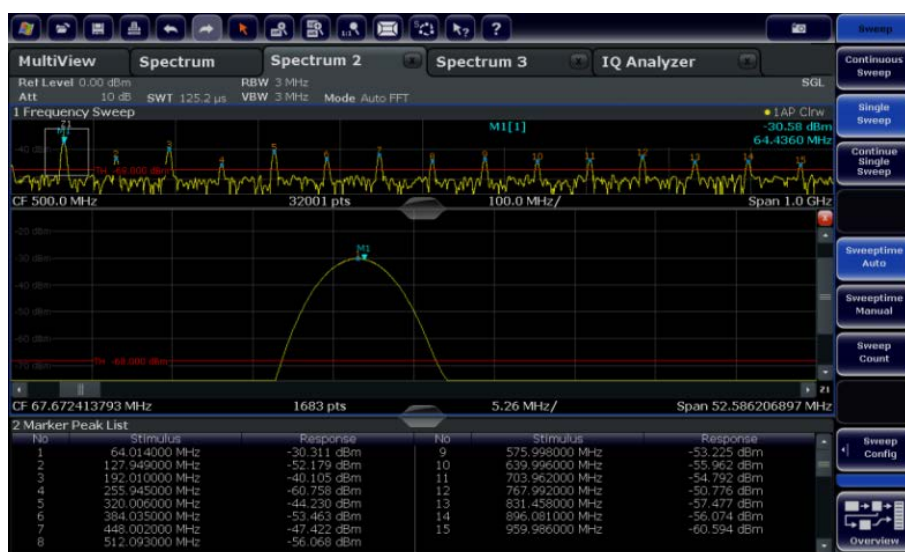
Fig. 3-17: Zoomed peak with increased number of sweep points

Note that the trace becomes much more precise.

4.

Tap the "Multiple Zoom" icon in the toolbar again and define a zoom area around markers M4, M5 and M6.
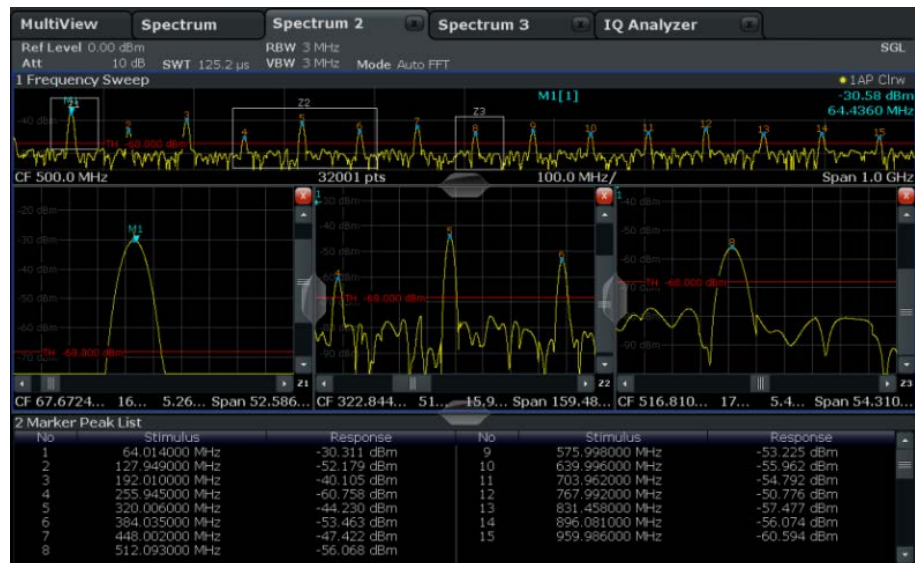
Fig. 3-18: Multiple zoom windows

5. Tap the 🔲 "Multiple Zoom" icon in the toolbar again and define a zoom area around marker M8.

6. To increase the size of the third zoom window, drag the "splitter" between the windows to the left or right or up or down.
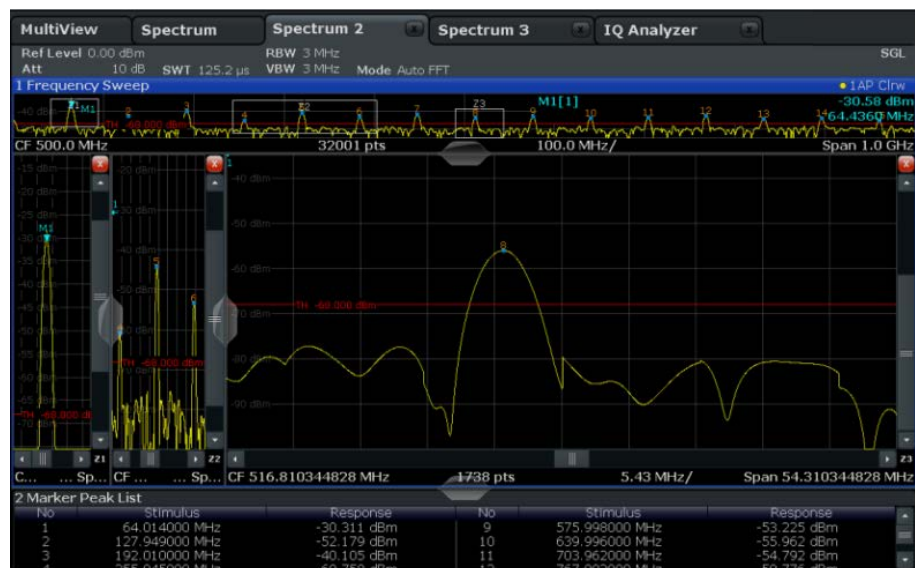
Fig. 3-19: Enlarged zoom window

3.3.8 Saving Settings

In order to restore the results of our measurements at a later time, we will store the instrument settings to a file.

To save the instrument settings to a file

1.

    Tap the "Save" icon in the toolbar.

2.

    Press the keyboard key on the front panel to display the online keyboard, as you will have to enter text in the next step.

3. In the "Save" dialog box, tap the "File Name" field and enter *MyMultiViewSetup* using the keyboard.
    Keep the default "File Type" setting "Instrument with all Channels" to store the configuration of all channels.
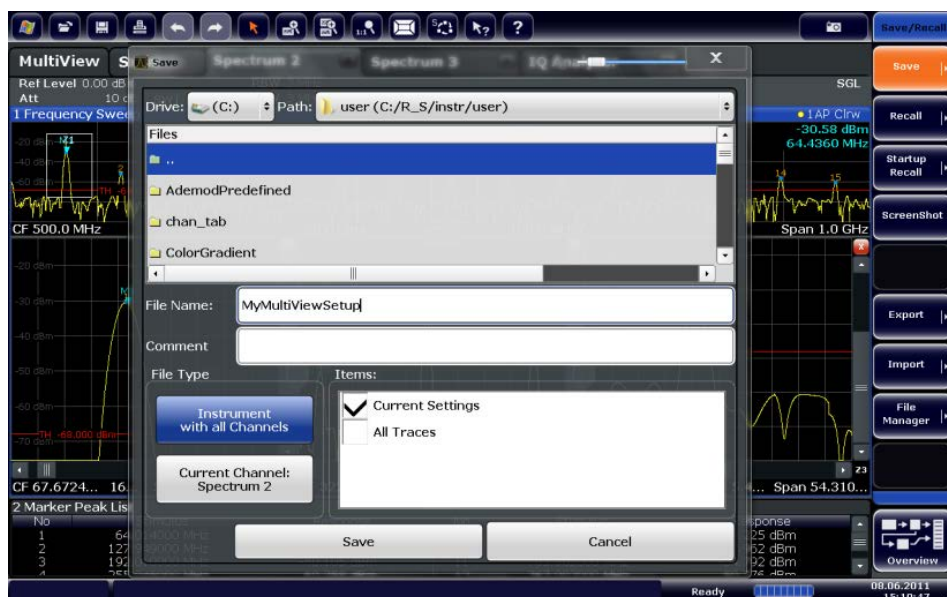
Fig. 3-20: Saving the instrument settings to a file

4. Tap the "Save" button.

    The file `MyMultiViewSetup.dfl` is stored in the default directory `C:/R_S/instr/user`.

To load stored instrument settings

You can restore the settings to the instrument at any time using the settings file.

1. Press the PRESET button to restore the default instrument settings so you can check that the stored user settings are actually restored afterwards.

2.

    Tap the "Load" icon in the toolbar.

3. In the "Load" dialog box, select the `MyMultiViewSetup.dfl` file in the default directory `C:/R_S/instr/user`.

4. Tap the "Load" button.

All instrument settings are restored and the display should ressemble figure 3-19, which shows the instrument display right before the settings were stored.

3.3.9 Printing and Saving Results

Finally, after a successful measurement, we will document our results. First we will export the numeric trace data, then we will create a screenshot of the graphical display.

To export the trace data

1. Press the TRACE key on the front panel.

2. Tap the "Trace Config" softkey.

3. Tap the "Trace Export" tab.

4. Tap the "Export Trace to ASCII File" button.

5. Enter the file name *MyMultiViewResults*.

The trace data is stored to `MyMultiViewResults.DAT`

To create a screenshot of the display

1.

Tap the "Print immediately" icon in the toolbar.

A screenshot of the current display is created. Note that the colors on the screen are inverted in the screenshot to improve printout results.

2. In the "Save Hardcopy as Portable Network Graphics (PNG)" dialog box, enter a file name, e.g. *MyMultiViewDisplay*.

The screenshot is stored to `MyMultiViewDisplay.png`.

3.4 Operating the Instrument

This chapter provides an overview on how to work with the R&S FSW. It describes what kind of information is displayed in the diagram area, how to operate the R&S FSW via the front panel keys and other interaction methods, and how to use the Online Help.

3.4.1   Understanding the Display Information

The following figure shows a measurement diagram during analyzer operation. All different information areas are labeled. They are explained in more detail in the following sections.
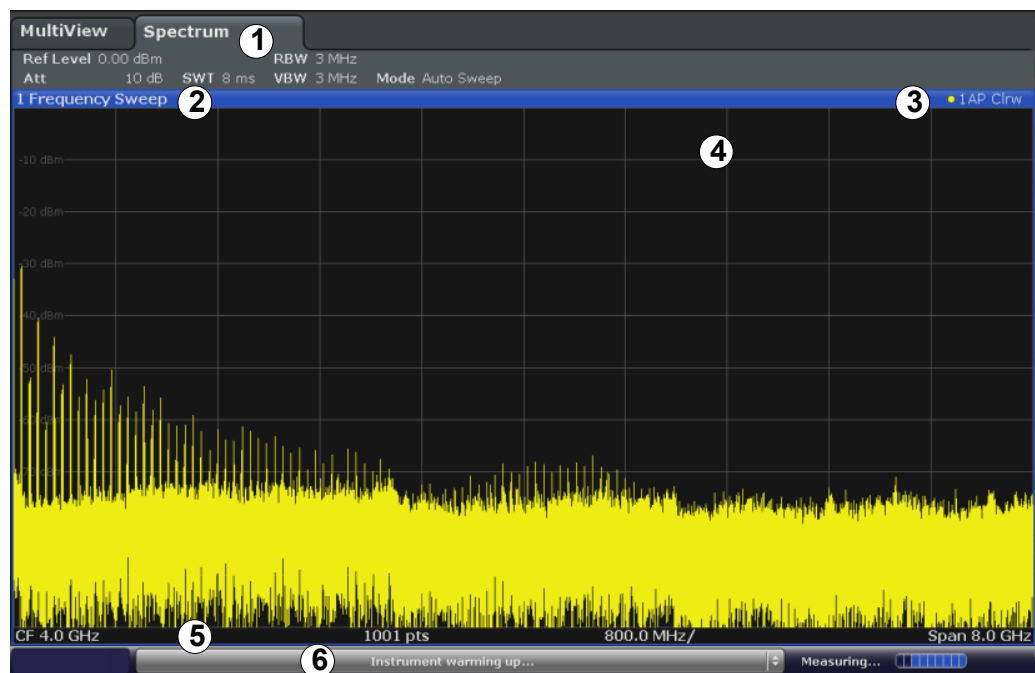
1   = Channel bar for firmware and measurement settings
2+3 = Window title bar with diagram-specific (trace) information
4   = Diagram area with marker information
5   = Diagram footer with diagram-specific information, depending on measurement application
6   = Instrument status bar with error messages, progress bar and date/time display

3.4.1.1   Channel Bar

Using the R&S FSW you can handle several different measurement tasks (channels) at the same time (although they can only be performed asynchronously). For each channel,

a separate tab is displayed on the screen. In order to switch from one channel display to another, simply press the corresponding tab.
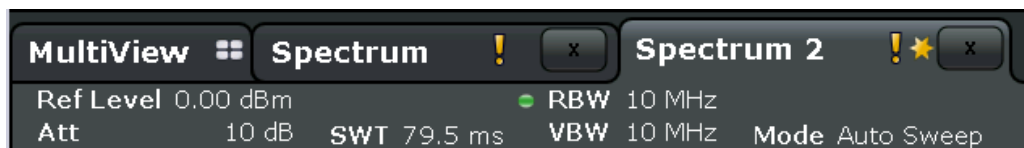
The ★ icon on the tab label indicates that the displayed trace no longer matches the current instrument settings. This may be the case, for example, if a trace is frozen and the instrument settings are changed. As soon as a new measurement is performed, the icon disappears.

The ❗ icon indicates that an error or warning is available for that measurement channel. This is particularly useful if the MultiView tab is displayed.

An orange "IQ" (in MSRA mode only) indicates that the results displayed in the MSRA application(s) no longer match the data captured by the MSRA Master. The "IQ" disappears after the results in the application(s) are refreshed.

Alternatively, if many tabs are displayed, select the tab selection list icon at the right end of the channel bar and select the channel you want to switch to from the list.
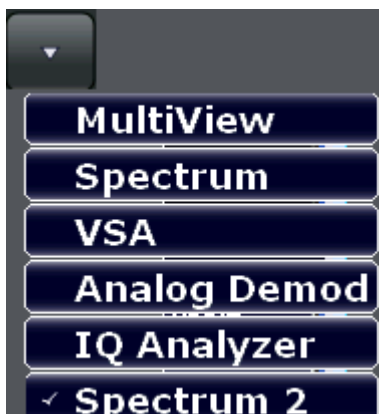
MultiView tab

An additional tab labelled "MultiView" provides an overview of all active channels at a glance. In the "MultiView" tab, each individual window contains its own channel bar with an additional button. Tap this button to switch to the corresponding channel display quickly.
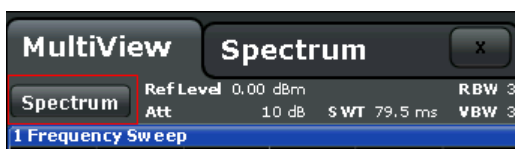
A **Sequencer** function activates one channel after the other automatically; the currently active channel during a measurement sequence is indicated by an ⚙ icon in the channel bar.

Channel-specific settings

Beneath the channel name, information on channel-specific settings for the measurement are displayed in the **channel bar**. A bullet next to the setting indicates that user-defined settings are used, not automatic settings. A green bullet indicates this setting is valid and the measurement is correct. A red bullet indicates an invalid setting that does not provide useful results. Channel information varies depending on the active application.

In the Spectrum application, the R&S FSW shows the following settings:

Table 3-5: Channel settings displayed in the channel bar in the Spectrum application

Ref Level	Reference level
m.+el.Att	Mechanical and electronic RF attenuation that has been set.
Ref Offset	Reference level offset
SWT	Sweep time that has been set.
	If the sweep time does not correspond to the value for automatic coupling, a bullet is displayed in front of the field. The color of the bullet turns red if the sweep time is set below the value for automatic coupling. In addition, the UNCAL flag is shown. In this case, the sweep time must be increased.
Meas Time	Measurement time, calculated from analysis bandwidth and number of samples (for statistics measurements)
RBW	Resolution bandwidth that has been set.
	If the bandwidth does not correspond to the value for automatic coupling, a green bullet appears in front of the field.
VBW	Video bandwidth that has been set.
	If the bandwidth does not correspond to the value for automatic coupling, a green bullet is displayed in front of the field.
AnBW	Analysis bandwidth (for statistics measurements)
Compatible	Compatible device mode (FSP, FSU, default; default not displayed)
Mode	Indicates which sweep mode type is selected: ● "Auto FFT": automatically selected FFT sweep mode ● "Auto sweep": automatically selected swept sweep mode ● "FFT": manually selected FFT sweep mode

Common settings

In addition to the channel-specific settings, the channel bar above the diagram also displays information on instrument settings that affect the measurement results even though this is not immediately apparent from the display of the measured values. This information is displayed in gray font and only when applicable for the current measurement, as opposed to the channel-specific settings that are always displayed.
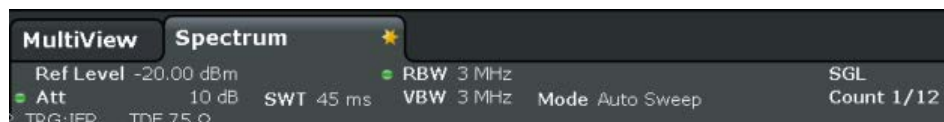
The following types of information may be displayed, if applicable.

Table 3-6: Common settings displayed in the channel bar

SGL	The sweep is set to single sweep mode.
Sweep Count	The current signal count for measurement tasks that involve a specific number of subsequent sweeps (see "Sweep Count" setting in "Sweep settings" in the User Manual)
TRG	Trigger source (for details see "Trigger settings" in the User Manual) • **BBP**: Baseband power (with Digital Baseband Interface R&S FSW-B17 only) • **EXT**: External • **GP_0**: General purpose bit (with Digital Baseband Interface R&S FSW-B17 only) • **IFP**: IF power (+trigger bandwidth) • **PSE**: Power sensor • **RFP**: RF power • **SQL**: Squelch • **TIM**: Time • **VID**: Video
6dB/RRC/CHN	Filter type for sweep bandwidth see "Filter Type" on page 263
PA	The preamplifier is activated.
YIG Bypass	The YIG filter is deactivated.
GAT	The frequency sweep is controlled via the TRIGGER INPUT connector.
TDF	A transducer factor is activated.
75 Ω	The input impedance of the instrument is set to 75 Ω.
FRQ	A frequency offset ≠ 0 Hz is set.
DC/AC	An external DC or AC calibration signal is in use.
ExtMix \<band\>	An external mixer is activated for input (requires option R&S FSW-B21); the used band is also indicated
\<NOR | APR\> **Ext. Gen**	An external generator is being controlled by the R&S FSW (requires option R&S FSW-B10). **NOR**: the measurements are normalized with the results of the external generator calibration **APR** (approximation): the measurements are normalized with the results of the external generator calibration; however, the measurement settings have been changed since calibration If neither label is displayed, no calibration has been performed yet or normalization is not active. For details see chapter 6.2.4, "External Generator Control (Option R&S FSW-B10)", on page 291.
LVL	A level offset is applied to the external generator signal (only if external generator control is active).

3.4.1.2   Window Title Bar

Each channel in the R&S FSW display may contain several windows. Each window can display either a graph or a table as a result of the channel measurement. Which type of result evaluation is displayed in which window is defined in the display configuration (see

The window's title bar indicates which type of evaluation is displayed.

3.4.1.3 Trace Information in Window Title Bar

Information on the displayed traces is indicated in the window title bar.
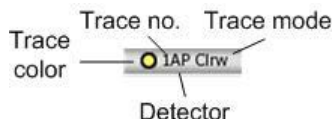
Trace color		Color of trace display in diagram
Trace no.		Trace number (1 to 6)
Detector		Selected detector:
	AP	AUTOPEAK detector
	Pk	MAX PEAK detector
	Mi	MIN PEAK detector
	Sa	SAMPLE detector
	Av	AVERAGE detector
	Rm	RMS detector
	QP	QUASIPEAK detector
Trace Mode		**Sweep mode:**
	Clrw	CLEAR/WRITE
	Max	MAX HOLD
	Min	MIN HOLD
	Avg	AVERAGE (Lin/Log/Pwr)
	View	VIEW
Norm/NCor		Correction data is not used.

3.4.1.4 Marker Information

Marker information is provided either in the diagram grid or in a separate marker table, depending on the configuration.

Marker information in diagram grid

Within the diagram grid, the x and y-axis positions of the last 2 markers or delta markers that were set, if available, as well as their index are displayed. The value in the square brackets after the index indicates the trace to which the marker is assigned. (Example:

M2[1] defines marker 2 on trace 1.) For more than 2 markers, a separate marker table is displayed beneath the diagram by default.

Marker information in marker table

In addition to the marker information displayed within the diagram grid, a separate marker table may be displayed beneath the diagram. This table provides the following information for all active markers:

Type	Marker type: N (normal), D (delta), T (temporary, internal), PWR (power sensor)
Ref	Reference (for delta markers)
Trc	Trace to which the marker is assigned
X-value	x-value of the marker
Y-value	y-value of the marker
Func	Activated marker or measurement function
Func .Result	Result of the active marker or measurement function

The functions are indicated with the following abbreviations:

FXD	Fixed reference marker
PHNoise	Phase noise measurement
CNT	Signal count
TRK	Signal tracking
NOIse	Noise measurement
MDepth	AM modulation depth
TOI	Third order intercept measurement

3.4.1.5 Frequency and Span Information in Diagram Footer

The diagram footer (beneath the diagram) contains the following information, depending on the current application:

Label	Information
CF	Center frequency
Span	Frequency span (frequency domain display)
ms/	Time per division (time domain display)
Pts	Number of sweep points or (rounded) number of currently displayed points in zoom mode

3.4.1.6 Instrument and Status Information

Global instrument settings, the instrument status and any irregularities are indicated in the status bar beneath the diagram.

In the MultiView tab the status bar always displays the information for the currently selected measurement.

Hiding the status bar

You can hide the status bar display, e.g. in order to enlarge the display area for the measurement results ("Setup > Display > Displayed Items"). See the User Manual for details.

The following information is displayed:

Instrument status

	The instrument is configured for operation with an external reference.
IQ IN	The optional Digital Baseband Interface (R&S FSW-B17) is being used for digital input
	For details on the Digital Baseband Interface (R&S FSW-B17) see the R&S FSW I/Q Analyzer User Manual.
IQ OUT	The optional Digital Baseband Interface (R&S FSW-B17) is being used to provide digital output
	For details on the Digital Baseband Interface (R&S FSW-B17) see the R&S FSW I/Q Analyzer User Manual.

Progress

The progress of the current operation is displayed in the status bar.

In the MultiView tab, the progress bar indicates the status of the currently selected measurement, not the measurement currently being performed by a Sequencer, for example.

Date and time

The date and time settings of the instrument are displayed in the status bar.

You can hide the date and time display in the status bar, or the entire status bar ("Setup > Display > Displayed Items").

For details see the R&S FSW User Manual.

Error messages

If errors or irregularities are detected, a keyword and an error message, if available, are displayed in the status bar.

3.4.1.7 Error Information

If errors or irregularities are detected, a keyword and an error message, if available, are displayed in the status bar.

Depending on the type of message, the status message is indicated in varying colors.

Table 3-7: Status bar information - color coding

Color	Type	Description
red	Fatal	A serious error occurred in the application; regular operation is no longer possible.
red	Error	An error occurred during a measurement, e.g. due to missing data or wrong settings, so that the measurement cannot be completed correctly.
orange	Warning	An irregular situation occurred during measurement, e.g. the settings no longer match the displayed results, or the connection to an external device was interrupted temporarily.
gray	Information	Information on the status of individual processing steps.
gray	Message	An event or state has occurred that may lead to an error during further operation.
green	No errors	No messages displayed.

If any error information is available for a measurement channel, the ! icon is displayed next to the channel name. This is particularly useful when the MultiView tab is displayed, as the status bar in the MultiView tab always displays the information for the currently selected measurement only.

Furthermore, a status bit is set in the STATus:QUEStionable:EXTended:INFO register for the application concerned (see "STATus:QUEStionable:EXTended:INFO Register" on page 579). Messages of a specific type can be queried using the SYST:ERR:EXT? command, see SYSTem:ERRor:EXTended? on page 952.

The following keywords are used:

DATA ERR	For Digital Baseband Interface (R&S FSW-B17) only:
	Error in digital I/Q input data
	For details on the Digital Baseband Interface (R&S FSW-B17) see the R&S FSW I/Q Analyzer User Manual.
FIFO OVLD	For Digital Baseband Interface (R&S FSW-B17) only:
	Input sample rate from connected instrument is too high
	For details on the Digital Baseband Interface (R&S FSW-B17) see the R&S FSW I/Q Analyzer User Manual.

IF OVLD	Overload of the IF signal path after the input mixer. • Increase the reference level.
INPUT OVLD	The signal level at the RF input connector exceeds the maximum. The RF input is disconnected from the input mixer to protect the device. In order to re-enable measurement, decrease the level at the RF input connector and reconnect the RF input to the mixer input.
LOUNL	Error in the instrument's frequency processing hardware was detected.
NO REF	Instrument was set to an external reference but no signal was detected on the reference input.
OVEN	OCXO reference frequency (option R&S FSW-B4) has not yet reached its operating temperature. The message usually disappears a few minutes after power has beeen switched on.
OVLD	Overload of the input signal path after the input mixer (only when RF INPUT path is NOT used, e.g. for input from the Digital Baseband Interface (R&S FSW-B17) or the Analog Baseband Interface (R&S FSW-B71)). • Reduce the input level.
PLL UNLOCK	For Digital Baseband Interface (R&S FSW-B17) only: Error in digital I/Q input data For details on the Digital Baseband Interface (R&S FSW-B17) see the R&S FSW I/Q Analyzer User Manual.
RF OVLD	Overload of the input mixer. • Increase the RF attenuation (for RF input). • Reduce the input level (for digital input)
UNCAL	One of the following conditions applies: • Correction data has been switched off. • No correction values are available, for example after a firmware update. • Record the correction data by performing a self alignment (For details refer to chapter 3.1.1.6, "Performing a Self Alignment and a Self Test", on page 23).
WRONG_FW	The firmware version is out-of-date and does not support the currently installed hardware. Until the firmware version is updated, this error message is displayed and self-alignment fails. (For details refer to chapter 9.3.4.4, "Firmware Updates", on page 526).

3.4.2 Accessing the Functionality

All tasks necessary to operate the instrument can be performed using this user interface. Apart from instrument specific keys, all other keys that correspond to an external keyboard (e.g. arrow keys, ENTER key) operate conform to Microsoft.

For most tasks, there are at least 2 alternative methods to perform them:

• Using the touch screen

• Using other elements provided by the front panel, e.g. the keypad, rotary knob, or arrow and position keys.

The measurement and instrument functions and settings can be accessed by selecting one of the following elements:

• System and function keys on the front panel of the instrument

- Softkeys on the touch screen
- Context-sensitive menus for specific elements on the touch screen
- Icons on the tool bar in the touch screen
- Displayed setting on the touch screen

3.4.3 Changing the Focus

Any selected function is always performed on the currently focused element in the display, e.g. a dialog field, diagram, or table row. Which element is focused is indicated by a blue frame (diagram, window, table) or is otherwise highlighted (softkey, marker etc.). Moving the focus is most easily done by tapping on the element on the touch screen. Alternatively, use the "Tab" key on the on-screen keyboard or the rotary knob to move the focus from one element to the next on the display.

To move the focus between any displayed diagrams or tables in a window, press the "Change focus" key on the front panel. The focus moves from the diagram to the first table to the next table etc. and then back to the diagram, within the same window.

3.4.4 Entering Data

Data can be entered in dialog boxes using one of the following methods:

- Using the touch screen, via the online keyboard
- Using other elements provided by the front panel, e.g. the keypad, rotary knob, or navigation keys
  The rotary knob acts like the ENTER key when it is pressed.
- Using a connected external keyboard

Particularities in Windows dialog boxes

In some cases, e.g. if you want to install a printer, original Windows dialog boxes are used. In these dialog boxes, the rotary knob and function keys do not work. Use the touch screen instead.

3.4.4.1 Entering Numeric Parameters

If a field requires numeric input, the keypad provides only numbers.

1. Enter the parameter value using the keypad, or change the currently used parameter value by using the rotary knob (small steps) or the UP or DOWN keys (large steps).

2. After entering the numeric value via keypad, press the corresponding unit key.
   The unit is added to the entry.

3. If the parameter does not require a unit, confirm the entered value by pressing the ENTER key or any of the unit keys.

The editing line is highlighted in order to confirm the entry.

3.4.4.2 Entering Alphanumeric Parameters

If a field requires alphanumeric input, you can use the on-screen keyboard to enter numbers and (special) characters (see "On-screen Keyboard" on page 38).

Alternatively, you can use the keypad. Every alphanumeric key represents several characters and one number. The decimal point key (.) represents special characters, and the sign key (-) toggles between capital and small letters. For the assignment refer to table 3-8. In principle, the input of alphanumeric parameters works like writing an SMS on your cell phone.

Entering numbers and (special) characters via the keypad

1. Press the key once to enter the first possible value.

2. All characters available via this key are displayed in a popup.

3. To choose another value provided by this key, press the key again, until your desired value is displayed.

4. With every key stroke the next possible value of this key is displayed. If all possible values have been displayed, the series starts with the first value again. For information on the series refer to table 3-8.

5. To change from capital to small letters and vice versa, press the sign key (-).

6. When you have chosen the desired value, wait for 2 seconds (to use the same key again), or start the next entry by pressing another key.

Entering a blank

► Press the "Space" bar, or press the "0" key and wait 2 seconds.

Correcting an entry:

1. Using the arrow keys, move the cursor to the right of the entry you want to delete.

2. Press the BACKSPACE key.

   The entry to the left of the cursor is deleted.

3. Enter your correction.

Completing the entry

► Press the ENTER key or the rotary knob.

Aborting the entry

► Press the ESC key.

The dialog box is closed without changing the settings.

Table 3-8: Keys for alphanumeric parameters

Key name (upper inscription)	Series of (special) characters and number provided
7	7 µ Ω ° € ¥ $ ¢
8	A B C 8 Ä Æ À Ç
9	D E F 9 É
4	G H I 4
5	J K L 5
6	M N O 6 Ñ Ö
1	P Q R S 1
2	T U V 2 Ü
3	W X Y Z 3
0	\<blank\> 0 – @ + / \ < > = % &
.	. * : _ , ; " ' ? ( ) #
–	\<toggles between capital and small letters\>

3.4.5 Displaying Results

The R&S FSW provides several instrument applications for different analysis tasks and different types of signals, e.g. 3G FDD, I/Q analysis or basic spectrum analysis. For each application, a new measurement channel is created and displayed in a separate tab on the screen.

The results of a measurement channel can be evaluated in many different ways, both graphically and numerically. For each evaluation method the results are displayed in a separate window in the tab.

The R&S FSW allows you to configure the display to suit your specific requirements and optimize analysis.

3.4.5.1 Activating channels

When you activate an application, a new measurement channel is created which determines the measurement settings for that application. The same application can be activated with different measurement settings by creating several channels for the same application. Whenever you switch channels, the corresponding measurement settings are restored. Each channel is displayed in a separate tab on the screen.

An additional tab ("MultiView") provides an overview of all currently active channels at once.

Only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided.
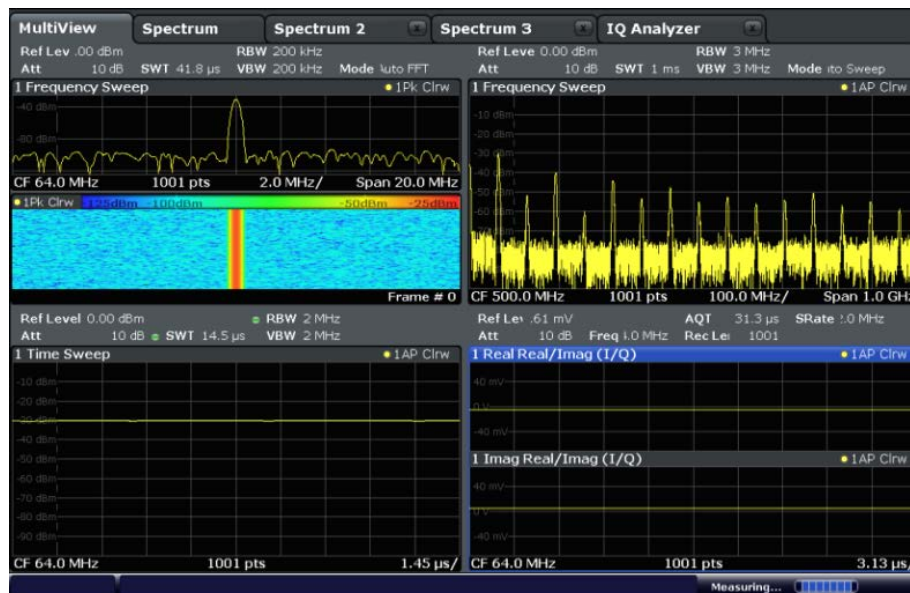
To start a new channel

1. Select the MODE key.

2. In the "Mode" dialog box, select the required application on the "New Channel" tab.
   A new tab is displayed for the new channel.

To change the application in an active channel

1. Select the tab of the channel you want to change.

2. Select the MODE key.

3. In the "Mode" dialog box, select the new application to be displayed on the "Replace Current Channel" tab.
   The selected application is displayed in the current channel.

3.4.5.2   Laying out the Result Display with the SmartGrid

Measurement results can be evaluated in many different ways, for example graphically, as spectrograms, as summary tables, statistical evaluations etc. Each type of evaluation is displayed in a separate window in the channel tab. Up to 16 individual windows can be displayed per measurement channel (i.e. per tab). To arrange the diagrams and tables on the screen, the Rohde & Schwarz SmartGrid function helps you find the target position simply and quickly.

(For details on evaluation methods see the User Manual.)

Principally, the layout of the windows on the screen is based on an underlying grid, the SmartGrid. However, the SmartGrid is dynamic and flexible, allowing for many different layout possibilities. The SmartGrid functionality provides the following basic features:

- Windows can be arranged in columns or in rows, or in a combination of both.
- Windows can be arranged in up to four rows and four columns.
- Windows are moved simply by dragging them to a new position on the screen, possibly changing the layout of the other windows, as well.
- All evaluation methods available for the currently selected measurement are displayed as icons in the evaluation bar. If the evaluation bar contains more icons than can be displayed at once on the screen, it can be scrolled vertically. The same evaluation method can be displayed in multiple windows simultaneously.
- New windows are added by dragging an evaluation icon from the evaluation bar to the screen. The position of each new window depends on where you drop the evaluation icon in relation to the existing windows.
- All display configuration actions are only possible in SmartGrid mode. When SmartGrid mode is activated, the evaluation bar replaces the current softkey menu display. When the SmartGrid mode is deactivated again, the previous softkey menu display is restored.

Background Information: The SmartGrid Principle

SmartGrid display

During any positioning action, the underlying SmartGrid is displayed. Different colors and frames indicate the possible new positions. The position in the SmartGrid where you drop the window determines its position on the screen.
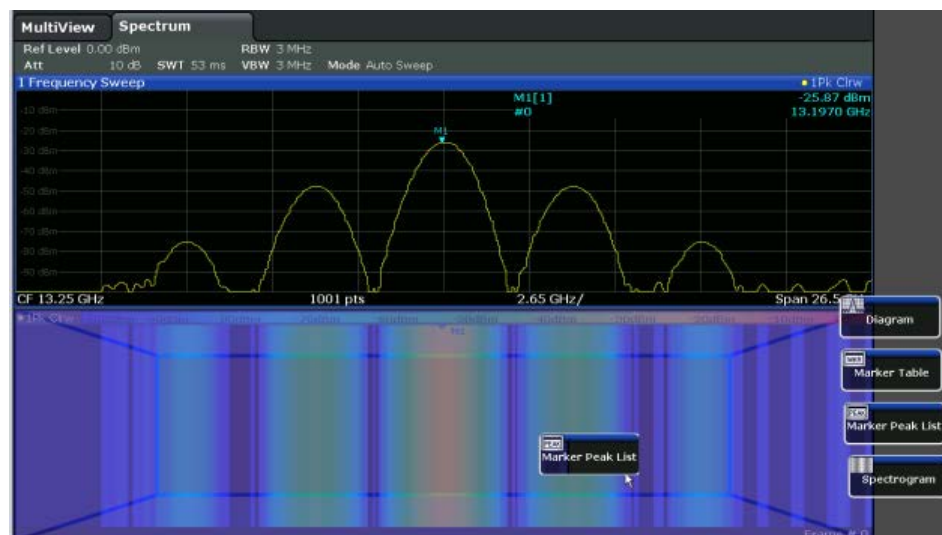
Fig. 3-21: Moving a window in SmartGrid mode

The brown area indicates the possible "drop area" for the window, i.e. the area in which the window can be placed. A blue area indicates the (approximate) layout of the window as it would be if the icon were dropped at the current position. The frames indicate the

possible destinations of the new window with respect to the existing windows: above/ below, right/left or replacement (as illustrated in figure 3-22). If an existing window would be replaced, the drop area is highlighted in a darker color shade.

Positioning the window

The screen can be divided into up to four rows. Each row can be split into up to four columns, where each row can have a different number of columns. However, rows always span the entire width of the screen and may not be interrupted by a column. A single row is available as the drop area for the window in the SmartGrid. The row can be split into columns, or a new row can be inserted above or below the existing row (if the maximum of 4 has not yet been reached).
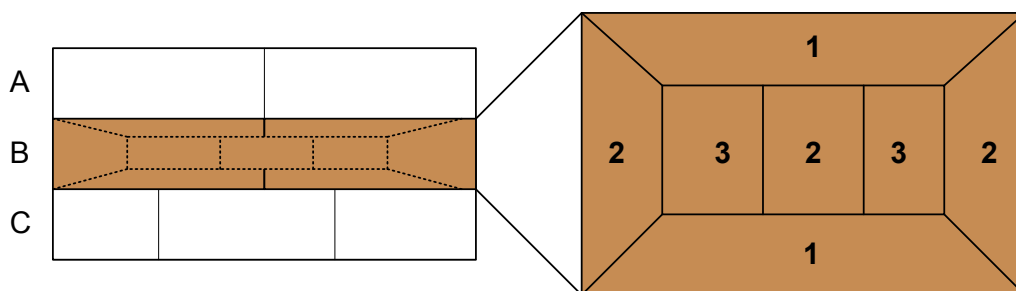
Fig. 3-22: SmartGrid window positions

1 = Insert row above or below the existing row
2 = Create a new column in the existing row
3 = Replace a window in the existing row

SmartGrid functions

Once the evaluation icon has been dropped, icons in each window provide delete and move functions.

The "Move" icon allows you to move the position of the window, possibly changing the size and position of the other displayed windows.

The "Delete" icon allows you to close the window, enlarging the display of the remaining windows.

How to Activate SmartGrid Mode

All display configuration actions are only possible in SmartGrid mode. In SmartGrid mode the evaluation bar replaces the current softkey menu display. When the SmartGrid mode is deactivated again, the previous softkey menu display is restored.

► To activate SmartGrid mode, do one of the following:

-

  Select the "SmartGrid" icon from the toolbar.
- Select the "Display Config" button in the configuration "Overview".

● Select the "Display Config" softkey from the MEAS CONFIG menu.

The Smartgrid functions and the evaluation bar are displayed.

To close the SmartGrid mode and restore the previous softkey menu select the "Close" icon in the righthand corner of the toolbar, or press any key on the front panel.

How to Add a New Result Window

Each type of evaluation is displayed in a separate window. Up to 16 individual windows can be displayed per measurement channel (i.e. per tab).

1. Activate SmartGrid mode.

   All evaluation methods available for the currently selected measurement are displayed as icons in the evaluation bar.

2. Select the icon for the required evaluation method from the evaluation bar.
   If the evaluation bar contains more icons than can be displayed at once on the screen, it can be scrolled vertically. Touch the evaluation bar between the icons and move it up or down until the required icon appears.

3. Drag the required icon from the evaluation bar to the SmartGrid, which is displayed in the diagram area, and drop it at the required position. (See for more information on positioning the window).

How to Arrange the Result Windows

1. Select an icon from the evaluation bar or the 🖑 "Move" icon for an existing evaluation window.

2. Drag the evaluation over the SmartGrid.
   A blue area shows where the window will be placed.

3. Move the window until a suitable area is indicated in blue.

4. Drop the window in the target area.

   The windows are rearranged to the selected layout, and "Delete" and "Move" icons are displayed in each window.

5. To close a window, select the corresponding 🗑 "Delete" icon.

3.4.5.3 Changing the Size of Windows

Each channel tab may contain several windows to evaluate the measurement results using different methods. A "splitter" allows you to change the size of neighboring windows.
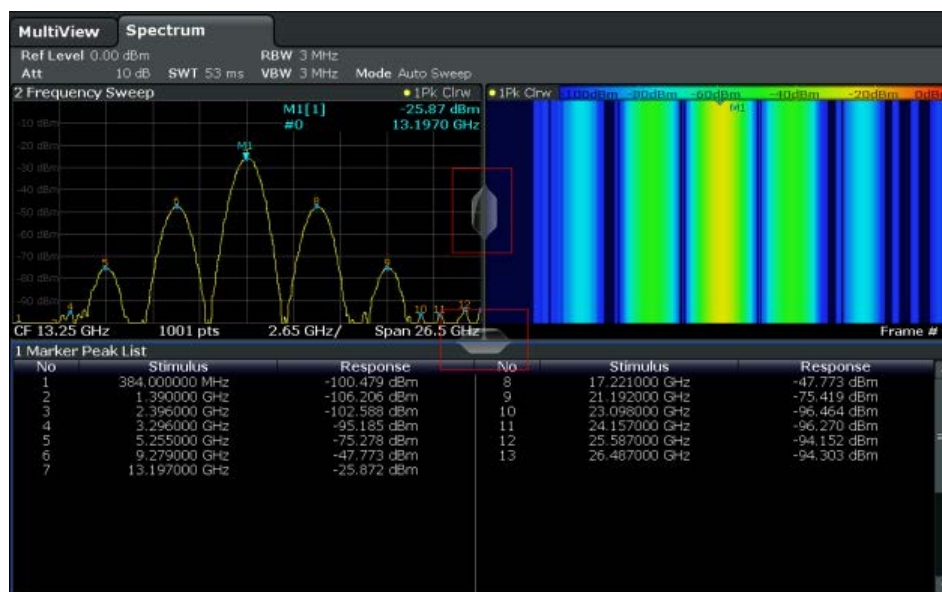
The splitters are not available in SmartGrid mode.

► To change the size of two neighboring windows, drag the splitter between the windows in either direction.

3.4.5.4   Switching Between a Split and Maximized Window Display

To get an overview of the results, displaying several windows at the same time may be helpful. However, the individual windows may become rather small. In this case it is useful to maximize an individual window to the entire screen temporarily in order to analyze the results in more detail.

To switch between a split and a maximized display without having to close and re-open windows, press the SPLIT/MAXIMIZE key on the front panel. In maximized display, the currently focused window is maximized. In split display, all active windows are displayed.

3.4.5.5   Changing the Display

The display can be optimized for your individual needs. The following display functions are available and are described in detail in chapter 9.4, "Display Settings", on page 535 and chapter 7, "Common Analysis and Display Functions", on page 397.

● Displaying a simulation of the entire front panel of the instrument on the screen ("Front Panel")
● Displaying the main function hardkeys in a separate window on the screen ("Mini Front Panel")

● Hiding or showing various screen elements
● Selecting a display theme and colors
● Changing the display update rate
● Activating or deactivating the touch-sensitivity of the screen
● Zooming into the diagram

3.4.6 Getting Help

If any questions or problems concerning the R&S FSW arise, an extensive online help system is provided on the instrument and can be consulted at any time. The help system is context-sensitive and provides information specifically for the current operation or setting to be performed. In addition, general topics provide an overview on complete tasks or function groups as well as background information.

3.4.6.1 Calling Up Help

The online help can be opened at any time by selecting one of the "Help" icons on the toolbar or by pressing the F1 key on an external or the online keyboard.

Calling context-sensitive help

► To display the "Help" dialog box for the currently focused screen element, e.g. a softkey or a setting in an opened dialog box, select the "Help" icon on the toolbar.

The "Help" dialog box "View" tab is displayed. A topic containing information about the focused screen element is displayed.
If no context-specific help topic is available, a more general topic or the "Contents" tab is displayed.

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

► To display a help topic for a screen element not currently focused:

a) Select the "Help pointer" icon on the toolbar.

The pointer changes its shape to a "?" and an arrow.

b) Select the screen element to change the focus.

A topic containing information about the selected (now focused) screen element is displayed.

3.4.6.2 Using the Help Window

The Help window contains several tabs:
● "View" - shows the selected help topic
● "Contents" - contains a table of help contents
● "Index" - contains index entries to search for help topics
● "Search" - provides text search

The Help toolbar provides some buttons:
● To browse the topics in the order of the table of contents: Up arrow = previous topic, Down arrow = next topic
● To browse the topics visited before: Left arrow = back, Right arrow = forward
● To increase or decrease the font

To navigate the Help, use the touchscreen. Alternatively, you can also use the navigation keys on the front panel.

To search for a topic in the Index

The index is sorted alphabetically. You can browse the list, or search for entries in the list.

1. Switch to the "Index" tab.

2. Tap the "Keyboard" icon besides the entry field.

3. Enter the first characters of the keyword you are interested in.

   The entries containing these characters are displayed.

4. Double-tap the suitable index entry.

   The "View" tab with the corresponding help topic is displayed.

To search topics for a text string

1. Switch to the "Search" tab.

2. Tap the "Keyboard" icon besides the entry field.

3. Enter the string you want to find.
   If you enter several strings with blanks between, topics containing all words are found (same as AND operator).

   For advanced search, consider the following:
   ● To find a defined string of several words, enclose it in quotation marks. For example, a search for *"trigger qualification"* finds all topics with exactly *"trigger*

qualification". A search for *trigger qualification* finds all topics containing the words *trigger* and *qualification*.

● Use "Match whole word" and "Match case" to refine the search.
● Use operators AND, OR, and NOT.

To close the Help window

► Tap the "Close" icon in the upper right corner of the help window.
Or:
Press the ESC key on the front panel.

3.4.7 Remote Control

In addition to working with the R&S FSW interactively, located directly at the instrument, it is also possible to operate and control it from a remote PC. Various methods for remote control are supported:

● Connecting the instrument to a (LAN) network (see chapter 3.1.5, "Setting Up a Network (LAN) Connection", on page 29)
● Using the LXI browser interface in a LAN network
● Using the Windows Remote Desktop application in a LAN network
● Connecting a PC via the GPIB interface

How to configure the remote control interfaces is described in the User Manual.

The R&S FSW is delivered with *IECWIN* installed, the auxiliary remote control tool provided free of charge by R&S.

For details on the IECWIN tool, see the "Network and Remote Control" chapter of the R&S FSW User Manual.

3.4.7.1 Using the LXI Browser Interface in a LAN

LAN eXtensions for Instrumentation (LXI) is an instrumentation platform for measuring instruments and test systems that is based on standard Ethernet technology. LXI is intended to be the LAN-based successor to GPIB, combining the advantages of Ethernet with the simplicity and familiarity of GPIB. The LXI browser interface allows for easy configuration of the LAN.

Restrictions

Only user accounts with administrator rights can make use of the LXI functionality. For details see chapter 3.1.2.3, "Login", on page 25.

3.4.7.2 Remote Desktop Connection

Remote Desktop is a Windows application which can be used to access and control the instrument from a remote computer through a LAN connection. While the instrument is

in operation, the instrument screen contents are displayed on the remote computer, and Remote Desktop provides access to all of the applications, files, and network resources of the instrument. Thus, remote operation of the instrument is possible.

With Windows XP, Remote Desktop Client is part of the operating system. For other versions of Windows, Microsoft offers the Remote Desktop Client as an add-on.

3.4.7.3 Connecting a PC via the GPIB Interface

A GPIB interface is integrated on the rear panel of the instrument. You can set the GPIB address and the ID response string. The GPIB language is set as SCPI by default but can be changed to emulate other instruments. By connecting a PC to the R&S FSW via the GPIB connection you can send remote commands to control and operate the instrument.

4 Applications and Operating Modes

The R&S FSW provides several applications for different analysis tasks and different types of signals, e.g. W-CDMA, I/Q analysis or basic spectrum analysis. When you activate an application, a new measurement channel is created which determines the measurement settings for that application. The same application can be activated with different measurement settings by creating several channels for the same application. Each channel is displayed in a separate tab on the screen.

The maximum number may be limited further by the available memory on the instrument.

Independant vs correlating measurements

With the **conventional R&S FSW Signal and Spectrum Analyzer** you can perform several different measurements almost simultaneously. However, the individual measurements are independant of each other - **each application captures and evaluates its own set of data**, regardless of what the other applications do.

In some cases it may be useful to **analyze the exact same input data using different applications**. For example, imagine capturing data from a base station and analyzing the RF spectrum in the Analog Demodulation application. If a spur or an unexpected peak occurs, you may want to analyze the same data in the I/Q Analyzer to see the real and imaginary components of the signal and thus detect the reason for the irregular signal. Normally when you switch to a different application, evaluation is performed on the data that was captured by that application, and not the previous one. In our example that would mean the irregular signal would be lost. Therefore, a new operating mode has been introduced to the R&S FSW: Multi-Standard Radio Analyzer (MSRA) mode.

In **Multi-Standard Radio Analyzer mode**, data acquisition is performed once and the captured data is then evaluated by any number of applications for different radio standards. Data acquisition and global configuration settings are controlled globally, while the evaluation and display settings can be configured individually for each application. Using the Multi-Standard Radio Analyzer, unwanted correlations between different signal components using different transmission standards can be detected. Thus, for example, an irregularity in a GSM burst can be examined closer in the R&S FSW 3G FDD BTS (W-CDMA) application to reveal dependencies like a change in the EVM value.

Distinct operating modes

Although the applications themselves are identical in either operating mode, the handling of the data between applications is not. Thus, the operating mode determines which applications are available and active. Whenever you change the operating mode, the currently active measurement channels are closed. The default operating mode is Signal and Spectrum Analyzer mode; however, the presetting can be changed.

Remote command:

INST:MODE SAN, see INSTrument:MODE on page 626

Switching between applications

When you switch to a new application, a set of parameters is passed on from the current application to the new one:

● center frequency and frequency offset
● reference level and reference level offset
● attenuation

After initial setup, the parameters for the measurement channel are stored upon exiting and restored upon re-entering the channel. Thus, you can switch between applications quickly and easily.

4.1 R&S MultiView

Each application is displayed in a separate tab. An additional tab ("MultiView") provides an overview of all currently active channels at a glance. In the "MultiView" tab, each individual window contains its own channel bar with an additional button. Tap this button to switch to the corresponding channel display quickly.
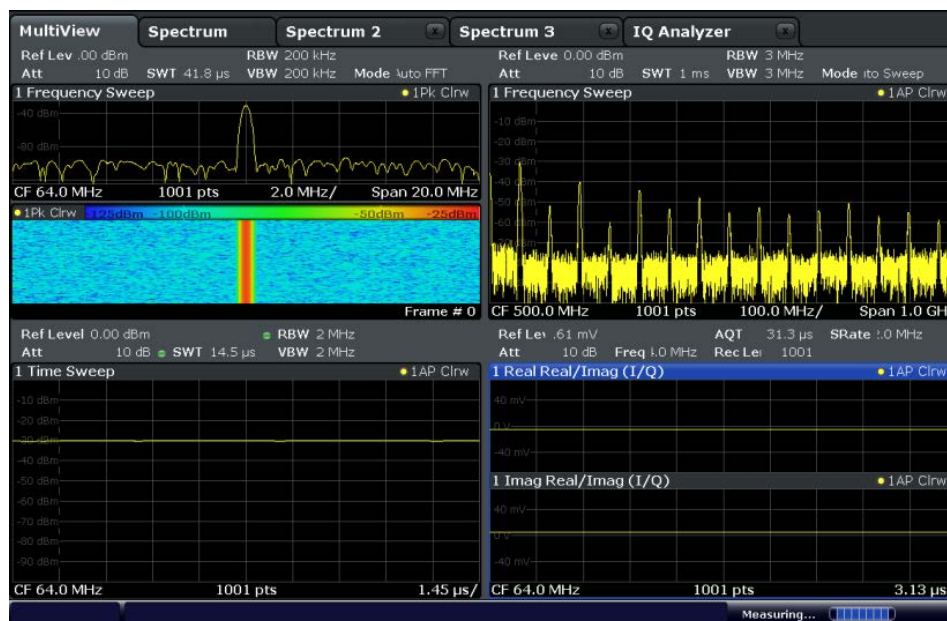
4.2 Available Applications

The R&S FSW provides some applications in the base unit while others are available only if the corresponding firmware options are installed. Not all R&S FSW applications are supported in MSRA mode. For an overview of supported MSRA applications see the R&S FSW MSRA User Manual.

> **Spectrogram application**
>
> Spectrogram measurements are not a separate application, but rather a trace evaluation method, thus they are available as an evaluation method for the Display Configuration, not by creating a new channel. Spectrograms are configured and activated in the "Trace" settings. See chapter 7.3.1.6, "Spectrograms", on page 411 for details.

Spectrum

In the Spectrum application the provided functions correspond to those of a conventional spectrum analyzer. The analyzer measures the frequency spectrum of the RF input signal over the selected frequency range with the selected resolution and sweep time, or, for a fixed frequency, displays the waveform of the video signal. This application is used in the initial configuration.

For details see chapter 5, "Measurements", on page 101.

Remote command:
INST:SEL SAN, see INSTrument[:SELect] on page 627

1xEV-DO BTS

The 1xEV-DO BTS application requires an instrument equipped with the 1xEV-DO BTS Measurements option, R&S FSW-K84. This application provides test measurements for 1xEV-DO BTS downlink signals (base station signals) according to the test specification.

For details see the R&S FSW-K84/-K85 User Manual.

Remote command:
INST:SEL BDO, see INSTrument[:SELect] on page 627

1xEV-DO MS

The 1xEV-DO MS application requires an instrument equipped with the 1xEV-DO MS Measurements option, R&S FSW-K85. This application provides test measurements for 1xEV-DO MS uplink signals (mobile signals) according to the test specification.

For details see the R&S FSW-K84/-K85 User Manual.

Remote command:

INST:SEL MDO, see INSTrument[:SELect] on page 627

3G FDD BTS

The 3G FDD BTS application requires an instrument equipped with the 3GPP Base Station Measurements option, R&S FSW-K72. This application provides test measurements for W-CDMA downlink signals (base station signals) according to the test specification.

For details see the R&S FSW-K72/-K73 User Manual.

Remote command:

INST:SEL BWCD, see INSTrument[:SELect] on page 627

3G FDD UE

The 3G FDD UE application requires an instrument equipped with the 3GPP User Equipment Measurements option, R&S FSW-K73. This application provides test measurements for W-CDMA uplink signals (mobile signals) according to the test specification.

For details see the R&S FSW-K72/-K73 User Manual.

Remote command:

INST:SEL MWCD, see INSTrument[:SELect] on page 627

Analog Demodulation

The Analog Demodulation application requires an instrument equipped with the corresponding optional software. This application provides measurement functions for demodulating AM, FM, or PM signals.

For details see the R&S FSW-K7 User Manual.

Remote command:

INST:SEL ADEM, see INSTrument[:SELect] on page 627

cdma2000 BTS

The cdma2000 BTS application requires an instrument equipped with the cdma2000 BTS Measurements option, R&S FSW-K82. This application provides test measurements for cdma2000 BTS downlink signals (base station signals) according to the test specification.

For details see the R&S FSW-K82/-K83 User Manual.

Remote command:

INST:SEL BC2K, see INSTrument[:SELect] on page 627

cdma2000 MS

The cdma2000 MS application requires an instrument equipped with the cdma2000 MS Measurements option, R&S FSW-K83. This application provides test measurements for cdma2000 MS uplink signals (mobile signals) according to the test specification.

For details see the R&S FSW-K82/-K83 User Manual.

Remote command:
INST:SEL MC2K, see INSTrument[:SELect] on page 627

(Multi-Carrier) Group Delay
The Group Delay application requires an instrument equipped with the Multi-Carrier Group Delay Measurements option R&S FSW-K17. This application provides a Multi-Carrier Group Delay measurement.

For details see the R&S FSW-K17 User Manual.

Remote command:
INST:SEL MCGD, see INSTrument[:SELect] on page 627

GSM
The GSM application requires an instrument equipped with the GSM Measurements option R&S FSW-K10. This application provides GSM measurements.

For details see the R&S FSW-K10 User Manual.

Remote command:
INST:SEL GSM, see INSTrument[:SELect] on page 627

I/Q Analyzer
The I/Q Analyzer application provides measurement and display functions for I/Q data.

For details see the R&S FSW I/Q Analyzer User Manual.

Remote command:
INST:SEL IQ, see INSTrument[:SELect] on page 627

LTE
The LTE application requires an instrument equipped with the LTE Measurements option R&S FSW-K10. This application provides LTE measurements.

For details see the R&S FSW-K10x (LTE Downlink) User Manual.

Remote command:
INST:SEL LTE, see INSTrument[:SELect] on page 627

Noise Figure
The Noise Figure application requires an instrument equipped with the Noise Figure Measurements option R&S FSW-K30. This application provides noise figure measurements.

For details see the R&S FSW-K30 User Manual.

Remote command:
INST:SEL NOISE, see INSTrument[:SELect] on page 627

Phase Noise
The Phase Noise application requires an instrument equipped with the Phase Noise Measurements option, R&S FSW-K40. This application provides measurements for phase noise tests.

For details see the R&S FSW-K40 User Manual.

Remote command:
INST:SEL PNOISE, see INSTrument[:SELect] on page 627

Pulse Measurements
The Pulse application requires an instrument equipped with the Pulse Measurements option, R&S FSW-K6. This application provides measurement functions for pulsed signals.

For details see the R&S FSW-K6 User Manual.

Remote command:
INST:SEL PULSE, see INSTrument[:SELect] on page 627

TD-SCDMA BTS
The TD-SCDMA BTS application requires an instrument equipped with the TD-SCDMA Base Station Measurements option, R&S FSW-K76. This application provides test measurements for TD-SCDMA downlink signals (base station signals) according to the test specification.

For details see the R&S FSW-K76/-K77 User Manual.

Remote command:
INST:SEL BTDS, see INSTrument[:SELect] on page 627

TD-SCDMA UE
The TD-SCDMA UE application requires an instrument equipped with the TD-SCDMA User Equipment Measurements option, R&S FSW-K77. This application provides test measurements for TD-SCDMA uplink signals (mobile signals) according to the test specification.

For details see the R&S FSW-K76/-K77 User Manual.

Remote command:
INST:SEL MTDS, see INSTrument[:SELect] on page 627

Vector Signal Analysis (VSA)
The VSA application requires an instrument equipped with the Vector Signal Analysis option, R&S FSW-K70. This application provides measurements and evaluations for Vector Signal Analysis.

For details see the R&S FSW-K70 User Manual.

Remote command:
INST:SEL DDEM, see INSTrument[:SELect] on page 627

WLAN
The WLAN application requires an instrument equipped with the WLAN option, R&S FSW-K91/91n. This application provides measurements and evaluations according to the WLAN IEEE 802.11 standards.

For details see the R&S FSW-K91 User Manual.

Remote command:
INST:SEL WLAN, see INSTrument[:SELect] on page 627

4.3 Selecting the Operating Mode

The default operating mode is Signal and Spectrum Analyzer mode, however, the presetting can be changed.

(See chapter 9.3.4.5, "Preset", on page 527).

Both the operating mode and the application can be selected in the "Mode" dialog box which is displayed when you press the MODE key.
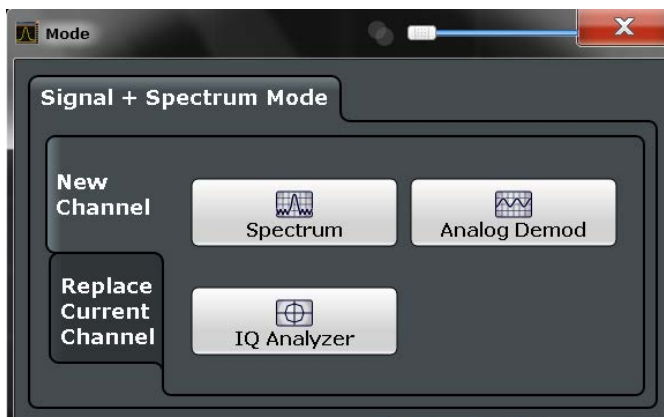
To switch the operating mode, select the corresponding tab.

The remote commands required to perform these tasks are described in chapter 11.4, "Selecting the Operating Mode and Application", on page 623.

To activate the Signal and Spectrum Analyzer operating mode

1. Press the MODE key on the front panel of the R&S FSW.

   A dialog box opens that contains all operating modes and applications currently available on your R&S FSW.

2. Select the "Signal and Spectrum Analyzer" tab.

3. Confirm the message informing you that you are changing operating modes.

   The R&S FSW stores and closes all active measurement channels in the current operating mode, then opens a new measurement channel for the Signal and Spectrum Analyzer operating mode.
   Note: when you return to the previous operating mode, the stored configuration of all measurement channels is restored.

   The default Spectrum measurement channel is displayed and the Sequencer is automatically activated in continuous mode (see chapter 4.5, "Running a Sequence of Measurements", on page 96).

4.4 Starting an Application

The default application in Signal and Spectrum Analyzer mode is a Spectrum measurement.

The application can be selected in the "Mode" dialog box which is displayed when you press the MODE key.
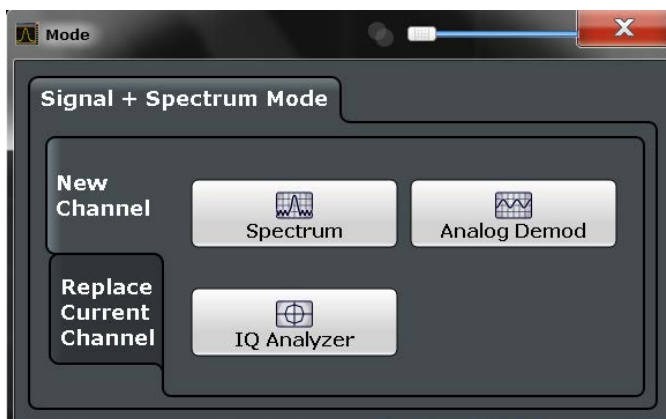
To select an application, select the corresponding button.

The measurement channels are labeled with their default name. If that name already exists, a sequential number is added. In remote control, the name of the measurement channel can be changed. For details and an overview of default names see table 11-1.

Switching between applications

When you switch to a new application, a set of parameters is passed on from the current application to the new one:
- center frequency and frequency offset
- reference level and reference level offset
- attenuation

After initial setup, the parameters for the measurement channel are stored upon exiting and restored upon re-entering the channel. Thus, you can switch between applications quickly and easily.

To deactivate a channel, simply close the corresponding tab.

The remote commands required to perform these tasks are described in chapter 11.4, "Selecting the Operating Mode and Application", on page 623.

New Channel

The applications selected on this tab are started in a new channel, i.e. a new tab in the display.

Remote command:

INSTrument:CREate[:NEW] on page 624

INSTrument[:SELect] on page 627

Replace Current Channel

The applications selected on this tab are started in the currently displayed channel, replacing the current application.

Remote command:

INSTrument:CREate:REPLace on page 624

Duplicate Current Channel

The currently active channel can be duplicated, i.e. a new measurement channel of the same type and with the identical measurement settings is started. The name of the new channel is the same as the copied channel, extended by a consecutive number (e.g. "Spectrum" -> "Spectrum 2").

This command is not available if the MSRA Master channel is selected.

Remote command:

INSTrument:CREate:DUPLicate on page 623

4.5 Running a Sequence of Measurements

Only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided.

4.5.1 The Sequencer Concept

The instrument can only be in one specific channel at any time. Thus, only one measurement can be performed at any time, namely the one in the currently active channel. However, in order to perform the configured measurements consecutively, a Sequencer function is provided, which changes the application of the instrument as required. If activated, the measurements configured in the currently active channels are performed one after the other in the order of the tabs. For each individual measurement, the sweep count is considered. Thus, each measurement may consist of several sweeps. The currently active measurement is indicated by a ⚙ symbol in the tab label. The result displays of the individual channels are updated in the tabs (including the "MultiView") as the measurements are performed. Sequential operation itself is independant of the currently *displayed* tab.

Sequencer modes

Three different Sequencer modes are available:

● **Single Sequence**
  Similar to single sweep mode; each measurement is performed once, until all measurements in all active channels have been performed.

● **Continuous Sequence**
  Similar to continuous sweep mode; the measurements in each active channel are performed one after the other, repeatedly, in the same order, until sequential operation is stopped. This is the default Sequencer mode.

● **Channel-defined Sequence**
  First, a single sequence is performed. Then, only channels in continuous sweep mode are repeated continuously.

Example: Sequencer procedure

Assume the following active channel definition:
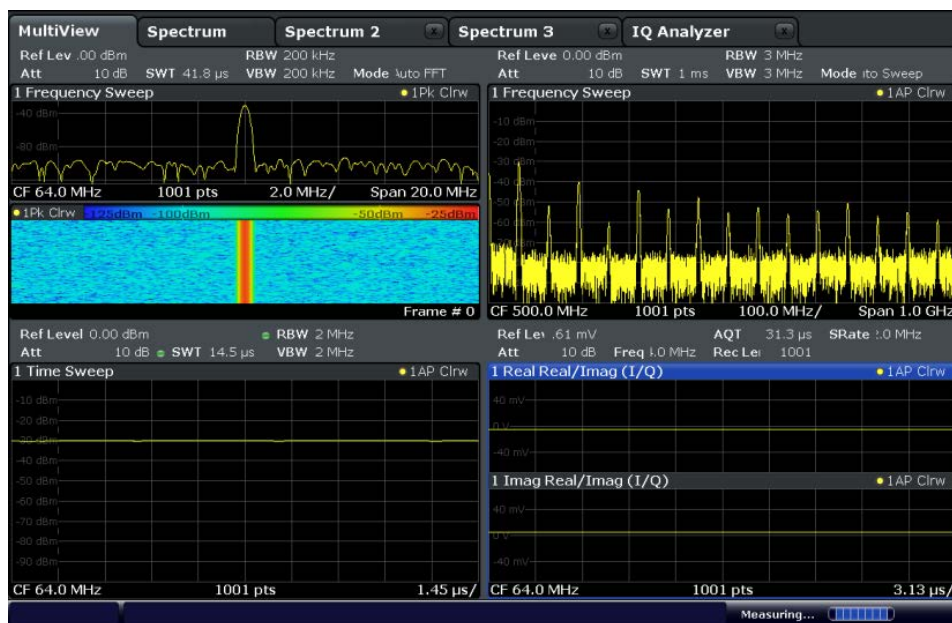
Tab name	application	Sweep mode	Sweep count
Spectrum	Spectrum	Cont. Sweep	5
Spectrum 2	Spectrum	Single Sweep	6

Tab name	application	Sweep mode	Sweep count
Spectrum 3	Spectrum	Cont. Sweep	2
IQ Analyzer	IQ Analyzer	Single Sweep	7

For **single Sequence**, the following sweeps will be performed:

5x Spectrum, 6x Spectrum 2, 2 x Spectrum 3, 7x IQ Analyzer

For **continuous Sequence**, the following sweeps will be performed:

5x Spectrum, 6x Spectrum 2, 2 x Spectrum 3, 7x IQ Analyzer,

5x Spectrum, 6x Spectrum 2, 2 x Spectrum 3, 7x IQ Analyzer,

...

For **channel-defined Sequence**, the following sweeps will be performed:

5x Spectrum, 6x Spectrum 2, 2 x Spectrum 3, 7x IQ Analyzer,

5x Spectrum, 2 x Spectrum 3,

5x Spectrum, 2 x Spectrum 3,

...

RUN SINGLE/RUN CONT and Single Sweep/Sweep Continuous keys

While the Sequencer is active, the RUN SINGLE and RUN CONT keys on the front panel control the Sequencer, not individual sweeps. RUN SINGLE starts the Sequencer in single mode, while RUN CONT starts the Sequencer in continuous mode.

The "Single Sweep" and "Continuous Sweep" softkeys control the sweep mode for the currently selected channel only; the sweep mode only has an effect the next time the Sequencer activates that channel, and only for a channel-defined sequence. In this case, a channel in single sweep mode is swept only once by the Sequencer. A channel in continuous sweep mode is swept repeatedly.

4.5.2 Sequencer Settings

The "Sequencer" menu is available from the toolbar.

Sequencer State
Activates or deactivates the Sequencer. If activated, sequential operation according to the selected Sequencer mode is started immediately.

Remote command:
SYSTem:SEQuencer on page 629
INITiate:SEQuencer:IMMediate on page 628
INITiate:SEQuencer:ABORt on page 628

Sequencer Mode

Defines how often which measurements are performed. The currently selected mode softkey is highlighted blue. During an active Sequencer process, the selected mode softkey is highlighted orange.

"Single Sequence"

Each measurement is performed once, until all measurements in all active channels have been performed.

"Continuous Sequence"

The measurements in each active channel are performed one after the other, repeatedly, in the same order, until sequential operation is stopped.
This is the default Sequencer mode.

"Channel-defined Sequence"

First, a single sequence is performed. Then, only channels in continuous sweep mode are repeated.

Remote command:
INITiate:SEQuencer:MODE on page 628

4.5.3 How to Set Up the Sequencer

In order to perform the configured measurements consecutively, a Sequencer function is provided.

1. Configure a channel for each measurement configuration as required, including the sweep mode.

2. In the toolbar, select the "Sequencer" icon.

   The "Sequencer" menu is displayed.

3. Toggle the "Sequencer" softkey to "On".

   A continuous sequence is started immediately.

4. To change the Sequencer mode and start a new sequence immediately, select the corresponding mode softkey, or press the RUN SINGLE or RUN CONT key.

   The measurements configured in the currently active channels are performed one after the other in the order of the tabs until the Sequencer is stopped.
   The result displays in the individual channels are updated as the measurements are performed.

To stop the Sequencer

► To stop the Sequencer temporarily, press the highlighted RUN SINGLE or RUN CONT key (not for a channel-defined sequence). To continue the Sequencer, press the key again.

To stop the Sequencer permanently, select the "Sequencer" icon in the toolbar and toggle the "Sequencer" softkey to "Off".