



Quick Start Guide

R&S[®] SFU BROADCAST TEST SYSTEM

The Quick Start Guide describes the following models and options of the BROADCAST TEST SYSTEM:

- ◆ R&S®SFU 2110.2500.02

The firmware of the instrument makes use of several valuable open source software packages. The most important of them are listed below, together with their corresponding open source license. The verbatim license texts are provided in the release notes.

Package	Link	License
OpenSSL	http://www.openssl.org	OpenSSL/SSLLeavy
zlib	http://www.zlib.net	zlib, v.1.2.3
Xalan Xerces	http://xalan.apache.org/ http://xerces.apache.org/	Apache Software License, Version 2.0
ONC/RPC	http://www.plt.rwth-aachen.de	SUN
VNC	http://www.realvnc.com/	GPL V3

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

© 2010 Rohde & Schwarz GmbH & Co. KG
Muehldorfstr. 15, 81671 Munich, Germany
Phone: +49 89 41 29 - 0
Fax: +49 89 41 29 12 164
E-mail: info@rohde-schwarz.com
Internet: <http://www.rohde-schwarz.com>

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

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Basic Safety Instructions

Always read through and comply with the following safety instructions!

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








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








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

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

Basic Safety Instructions




Symbols and safety labels

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

						
Be careful when handling electrostatic sensitive devices	ON/OFF supply voltage	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double (reinforced) insulation

Tags and their meaning

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

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

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

Basic Safety Instructions

Operating states and operating positions

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

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

Electrical safety

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

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.

Basic Safety Instructions

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

Basic Safety Instructions

12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
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".

Basic Safety Instructions

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

Repair and service

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

Basic Safety Instructions

Batteries and rechargeable batteries/cells

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

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

Transport

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

Basic Safety Instructions

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

Waste disposal

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

Informaciones elementales de seguridad

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

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








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




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

Informaciones elementales de seguridad

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

Símbolos y definiciones de seguridad

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

	○		≡	~	⎓	
Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)	Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Informaciones elementales de seguridad

Palabras de señal y su significado

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



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



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



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



AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo. En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

Estados operativos y posiciones de funcionamiento

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

Informaciones elementales de seguridad

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

Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.

Informaciones elementales de seguridad

4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión $U_{\text{eff}} > 30 \text{ V}$ se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

Informaciones elementales de seguridad

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

Funcionamiento

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

Informaciones elementales de seguridad

3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

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

Informaciones elementales de seguridad

control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Informaciones elementales de seguridad

Transporte

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

Eliminación

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

Safety Instructions for Instruments with Fold-Out Feet

⚠ WARNING

Danger of injury

The feet may fold in if they are not folded out completely or if the instrument is shifted. The feet may break if they are overloaded.

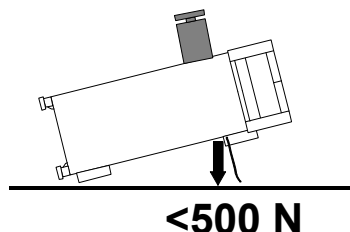
Fold the feet completely in or completely out to ensure stability of the instrument and personal safety.

To avoid injuries, never shift the instrument when its feet are folded out.

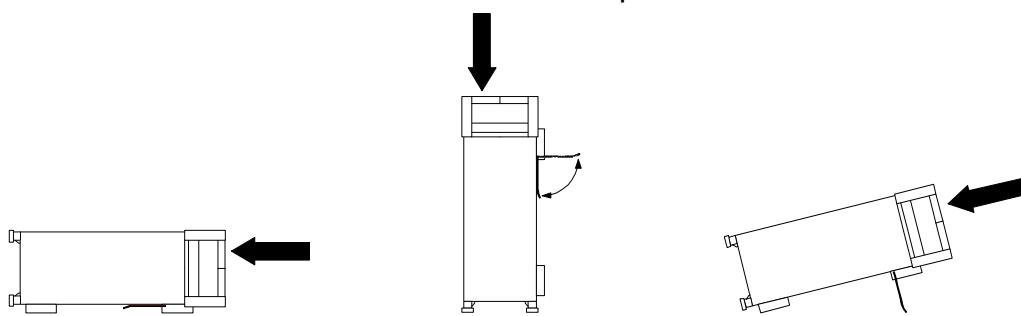
The overall load (the instrument's own weight plus that of the instruments stacked on top of it) on the folded-out feet must not exceed 500 N.

Place the instrument on a stable surface. Secure the instruments stacked on top of it against slipping (e.g. by locking their feet on the top front frame).

When the instrument is standing on its folded-out feet, do not work under the instrument and do not put anything under it, otherwise injuries or material damage could occur.



The instrument can be used in each of the positions shown here.



Informaciones de seguridad para aparatos con telepiés

⚠ ADVERTENCIA

Peligro de heridas

Los telepiés pueden doblarse hacia adentro si no han sido desdoblados por completo o si el aparato es movido. Los telepiés pueden romperse si son sobrecargados.

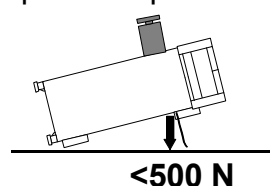
Doblar los telepiés por completo hacia afuera o hacia adentro. De esta manera se puede asegurar la estabilidad del aparato y a la vez la seguridad de las personas.

No mover nunca el aparato con los telepiés desdoblados, para evitar heridas.

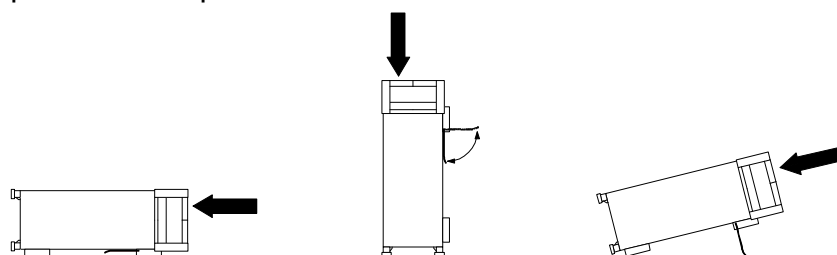
El peso total equilibrado (peso propio más el de los aparatos posicionados sobre este) ejercido sobre los telepiés no deberá exceder a los 500 N.

Posicionar el aparato sobre una superficie estable. Los aparatos puestos encima de éste deben estar asegurados para que no resbalen (por ejemplo fijando los pies del aparato en el listón del marco de delante arriba).

Por favor no manipulen debajo del aparato y no pongan nada debajo de este cuando esté posicionado sobre los telepiés desdoblados, ya que si no pueden originarse heridas o daños en objetos.



El aparato puede ser puesto en funcionamiento en cualquiera de las posiciones aquí descritas.



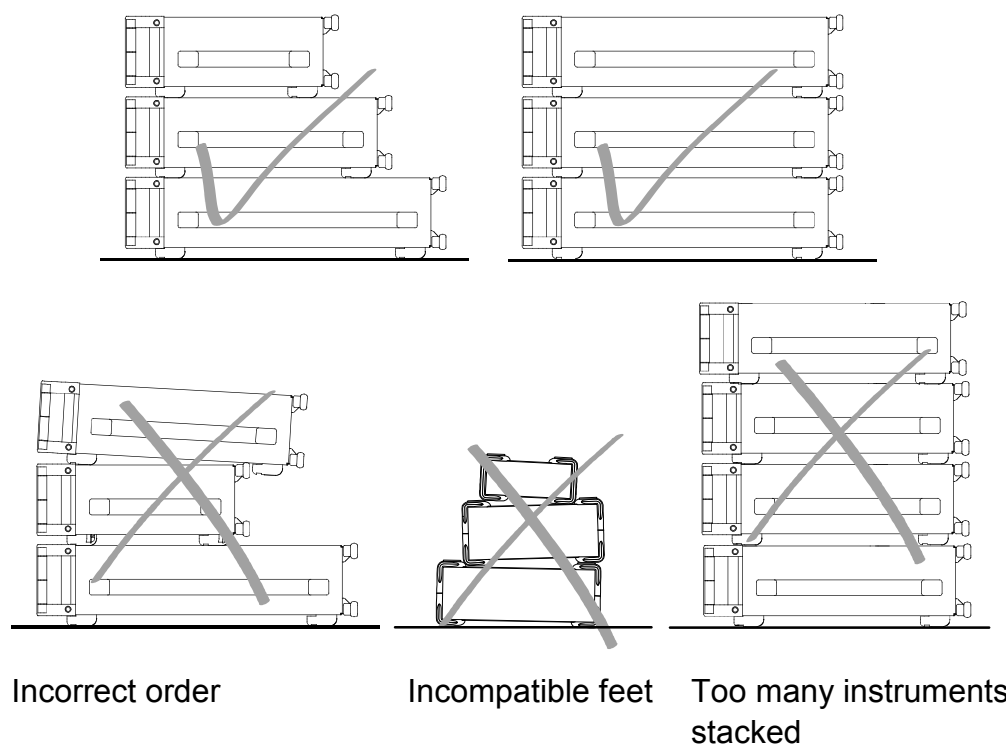
Safety Instructions for Stacking Instruments

⚠ WARNING

Danger of injury

Instruments may slip if they are stacked on top of each other.

Place the instrument on a stable, even surface. Stack the instruments according to their size, with the largest instrument on the bottom. Do not stack more than three instruments directly on top of each other. Instruments may only be stacked if their feet and housing allow horizontal stacking. If these conditions are not met, the instruments must be installed in a rack in order to avoid the risk of personal injury and material damage.



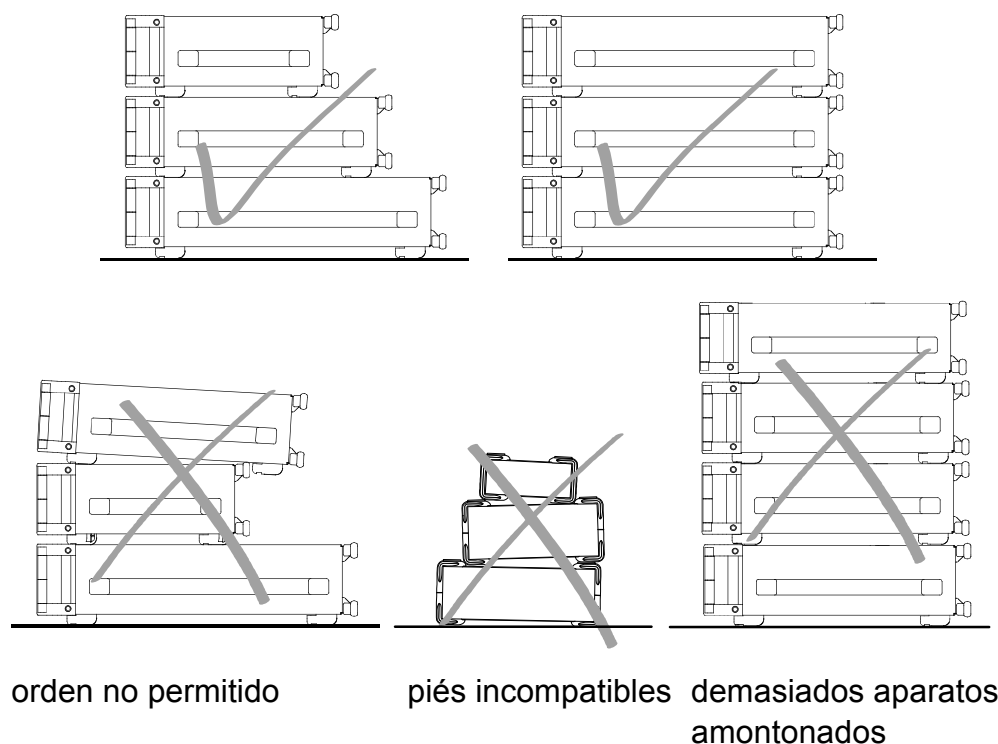
Informaciones de seguridad para el amontonamiento de aparatos

⚠ ADVERTENCIA

Peligro de heridas

Los aparatos pueden desplazarse al ser amontonados.

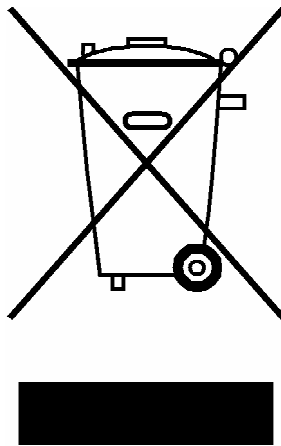
Posicionar los aparatos sobre una superficie estable y lisa. Amontonar los aparatos por orden de su tamaño. No amontonar nunca más de tres aparatos uno sobre el otro. Los aparatos solamente deberán ser amontonados, si los piés y la caja del aparato correspondiente hacen posible amontonarlos de forma horizontal. Si no se cumplen estas condiciones, deberán ser montados los aparatos en una caja apta para este propósito. De esta manera evitarán el riesgo de daños en personas y daños en el aparato.



Customer Information Regarding Product Disposal

The German Electrical and Electronic Equipment (ElektroG) Act is an implementation of the following EC directives:

- 2002/96/EC on waste electrical and electronic equipment (WEEE) and
- 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).



Product labeling in accordance with EN 50419

Once the lifetime of a product has ended, this product must not be disposed of in the standard domestic refuse. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Rohde & Schwarz GmbH & Co. KG has developed a disposal concept for the environmental-friendly disposal or recycling of waste material and fully assumes its obligation as a producer to take back and dispose of electrical and electronic waste in accordance with the ElektroG Act.

Please contact your local service representative to dispose of the product.



Customer Support

Technical support – where and when you need it

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

Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish.

We will take care that you will get the right information.

USA & Canada

Monday to Friday	(except US public holidays)
8:00 AM – 8:00 PM	Eastern Standard Time (EST)
Tel. from USA	888-test-rsa (888-837-8772) (opt 2)
From outside USA	+1 410 910 7800 (opt 2)
Fax	+1 410 910 7801
E-mail	CustomerSupport@rohde-schwarz.com

East Asia

Monday to Friday	(except Singaporean public holidays)
8:30 AM – 6:00 PM	Singapore Time (SGT)
Tel.	+65 6 513 0488
Fax	+65 6 846 1090
E-mail	CustomerSupport@rohde-schwarz.com

Rest of the World

Monday to Friday	(except German public holidays)
08:00 – 17:00	Central European Time (CET)
Tel.	+49 89 4129 13774
Fax	+49 (0) 89 41 29 637 78
E-mail	CustomerSupport@rohde-schwarz.com



ROHDE & SCHWARZ

Qualitätszertifikat

Certificate of quality

Certificat de qualité

Certified Quality System

ISO 9001

Certified Environmental System

ISO 14001

Sehr geehrter Kunde,

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

Der Umwelt verpflichtet

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

Dear Customer,

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

Environmental commitment

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

Cher client,

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

Engagement écologique

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

75 Years of
Driving
Innovation



ROHDE & SCHWARZ



ROHDE & SCHWARZ

EC Certificate of Conformity



Certificate No.: 2004-31

This is to certify that:

Equipment type	Stock No.	Designation
SFU	2110.2500.02	Broadcast Test System
SFU-B1	2110.7424.02	Coder Extension 1
SFU-B2	2110.7430.02	Coder Extension 2
SFU-B3	2110.7447.02	Memory Extension 1
SFU-B4	2110.7453.02	Memory Extension 2
SFU-B5	2110.7460.02	User IN/OUT
SFU-B6	2110.7501.02/.03	Additional Harddisk 1
SFU-B10	2110.7747.02	Extension Board 10
SFU-B11	2110.7553.02/.03	ETI Input
SFU-B30	2110.7530.02	Fading Simulator
SFU-B31	2110.7547.02	Fading Simulator Extension
SFU-B90	2110.8008.02/03	High power

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits (2006/95/EC)
- relating to electromagnetic compatibility (2004/108/EC)

Conformity is proven by compliance with the following standards:

EN61010-1 : 2001

EN55011 : 1998 + A1 : 1999 + A2 : 2002, Klasse B

EN61326 : 1997 + A1 : 1998 + A2 : 2001 + A3 : 2003

For the assessment of electromagnetic compatibility, the limits of radio interference for Class B equipment as well as the immunity to interference for operation in industry have been used as a basis.

Affixing the EC conformity mark as from 2004

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich, 2008-12-17

Central Quality Management MF-QZ / Radde

2110.2500.02

CE

E-8

1 Putting into Operation

1.1 Manual Overview

- Chapter 1** This chapter describes the instrument's controls and the connectors using front- and rear-panel views. How to prepare the instrument for operation is also described. Connection of external devices such as a printer, keyboard, mouse and monitor is also explained. Specifications for the interfaces are contained in the data sheet.
- Chapter 2** "Brief Introduction" provides an overview of the instrument's functions and operating concept.
- Chapter 3** provides a much more detailed description of how to operate the instrument and includes an overview of the menus.

1.2 CD-ROM

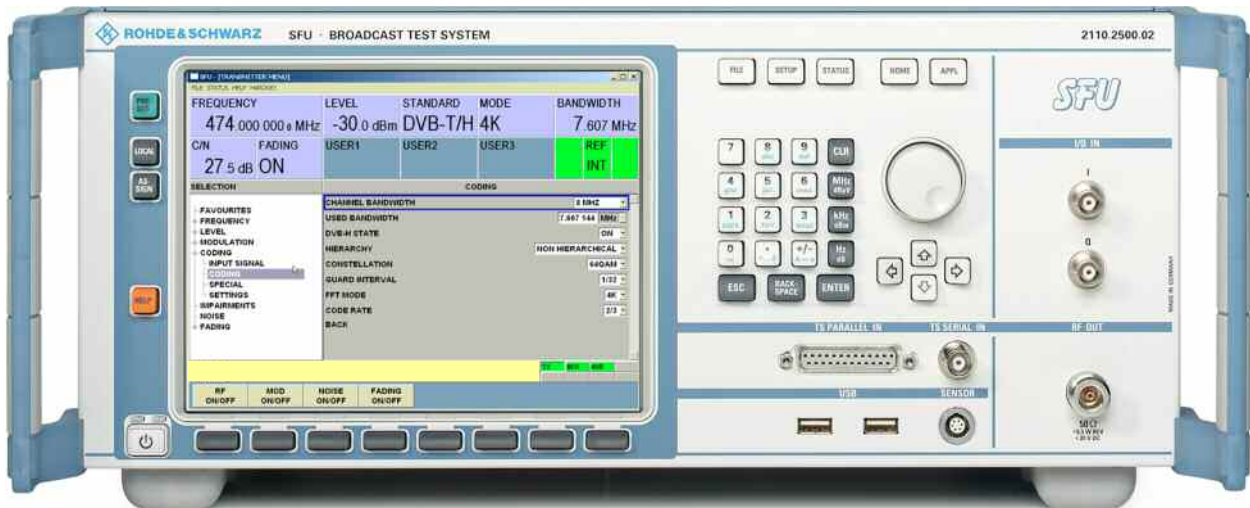
The CD-ROM contains the complete manual with additional chapters in a format you can print (PDF).

- Chapter 4** "Reference Part" explains the instrument's individual menus and functions.
- Chapter 5** describes the basic principles of remote control.
- Chapter 6** describes how to use the remote control commands.
- Chapter 7** describes the instrument's interfaces.
- Chapter 8** describes how to maintain the instrument.
- Chapter 9** contains an overview of the possible error messages the instrument can produce.

1.3 Explanation of the Front Panel

This section provides an overview of the controls and connectors on the instrument's front panel. Each control or connector is briefly described along with a reference to the chapter(s) containing detailed information about its usage.

Figure 1-1 Explanation of the front panel



The ON/OFF button switches the instrument from stand-by mode to ready mode.

The AC power switch on the back of the instrument must be switched on.

The yellow LED to the right is illuminated in stand-by mode.

The green LED to the left is illuminated in ready mode (see Chapter "[Switching On the Instrument](#)").

WARNING

Shock hazard

In stand-by mode, the instrument is still power-supplied.

Hardkeys



Sets a defined instrument state.
(see Operating Manual, Chapter 4).



Switches from REMOTE mode (remote control) to LOCAL mode (manual operation).
(see Operating Manual, Chapter 4)



To manage the favorites and the user fields in the information region of the display.
(see Operating Manual, Chapter 4)



Key for accessing context-sensitive help.
(see Operating Manual, Chapter 4).



To save and reload instrument states and to manage files



Instrument configuration



Overview of the instrument settings



Resets the navigation



To select/switch to another application (TX, BER, TSGEN,...)
(see Operating Manual, Chapter 4)

Softkeys



To execute the commands displayed by the softkey labels (see also "[Graphical User Interface](#)").

Keypad



Keypad for entering data



Used to enter zero
Used to enter a space



Used to enter a decimal point
Used to enter a special character



Used to enter the sign
Switches between upper-case and lower-case letters



Deletes the current input



Input of the unit



Change between inserting and overwriting mode



Deletes the character to the left of the cursor



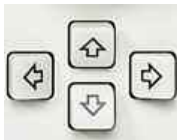
- ◆ Calls up the next menu level
- ◆ Activates editing mode for the marked numeric and alphanumeric parameters
- ◆ Data entry is completed and the new value is accepted. For numeric parameters, the unit is displayed in the menu next to the value.
- ◆ Switches the marked status parameters on/off (State On/Off)
- ◆ Confirms (OK) and closes message windows (see Chapter 3)

Rotary Knob



- ◆ Varies the input value at the cursor position. You can set and activate a fixed step size for the variation for the frequency and the level.
- ◆ Navigation within the tree and the work view
- ◆ Moves the cursor in the tables and drop-down lists
- ◆ Complete your entry by pressing on the rotary knob (Click = Enter). Editing mode is terminated and the value is accepted (see Chapter 3).

Cursor Keys

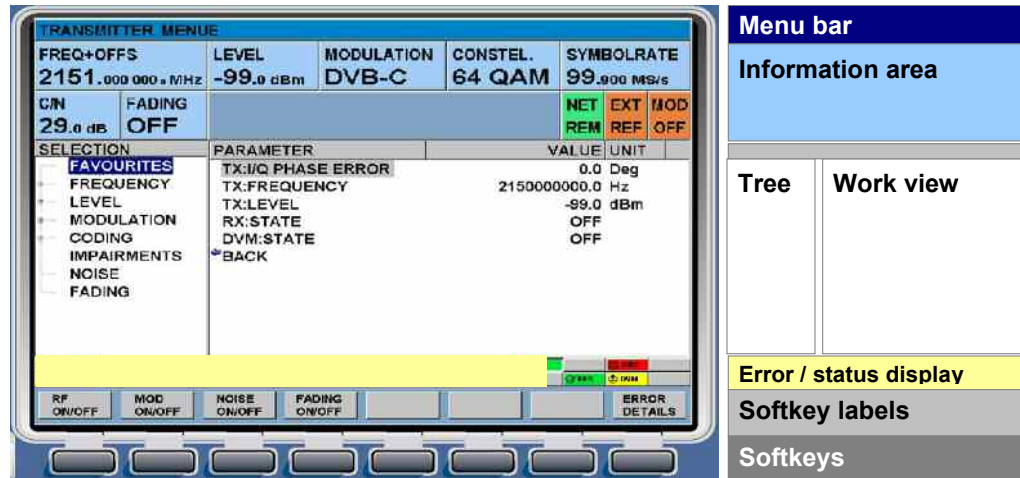


- ◆ Varies the input value or marks the selection in a list in editing mode.
- ◆ Marks the parameters in the menus and in the tables (up/down).



- ◆ Moves the cursor in the input fields in editing mode.
- ◆ Marks the parameters in the menus and in the tables (left/right). (see Chapter 3)

Graphical User Interface



Menu bar

The menu bar allows additional access to the hardkeys on the front panel (used primarily for remote operation).

Information area

Displays the main parameters for the selected application.

Tree

Navigates within the main areas of the active application.

Work view

Displays the parameters for the active application. Parameters can be modified here.

Error / status display

Current error messages and warnings for the application that is running. Overview of other active applications.

Softkey labels

Display for the executable commands

Softkeys

Keys for execution of commands

Interfaces and Connectors on the Front Panel

For information on the pin assignment of interfaces and connectors refer to the Operating Manual, Chapter 7.



I/Q INPUT

I Input for an external analog modulation signal for I/Q modulation (I/Q Wideband or I/Q Analog In).

Q Input for an external analog modulation signal for I/Q modulation (I/Q Wideband or I/Q Analog In).

See Chapter 7 and the data sheet.



RF OUT

50 Ω BNC output for the RF signal.

NOTICE

Do not overload the RF outputs.

See the data sheet for the maximum permissible reverse power.

TS PARALLEL IN



TS PARALLEL IN is used to connect a parallel MPEG2 transport stream. (see Chapter 7)



TS SERIAL IN

TS SERIAL IN is used to feed in a serial MPEG2 transport stream. (see Chapter 7)

USB



USB interfaces (USB = Universal Serial Bus) type A (host USB).

- ◆ Connection of external devices such as a mouse, keyboard, printer
- ◆ Connection of the memory stick for transferring files
- ◆ Firmware update

Another USB interface type A (host USB) and a USB interface type B (device USB for data transmission) are available on the rear panel. (see Chapter 7)



SENSOR

This female connector is used to connect a power sensor (R&S NRP-Z21 or R&S NRP-Z51), (see Chapter 7).

1.4 Explanation of the Rear Panel

This section provides an overview of the connectors on the instrument's rear panel. Each connector is briefly described along with a reference to the chapter(s) containing detailed information about its usage. Specifications for the connectors are contained in the data sheet. Information on the pin assignment of interfaces and connectors is provided in the Operating Manual, Chapter 7.

Figure 1-2 Rear-panel view



AC power connector

The R&S SFU is equipped with AC voltage detection. The instrument will automatically set itself to the AC voltage it detects (range: see the type label). No external switching or modification of the fuses is necessary.

AC power switch

The AC power switch is located below the AC power connector.

AC power fuse

See Chapter "[AC Power Fuses](#)" and the data sheet

BER interfaces



These four BNC female connectors are associated with the bit error rate tester application (BER R&S SFU-K60) provided by the R&S SFU. They are used for serial bit error rate (BER) measurement. For details, see Chapter 4.

TRIGGER I/O



15-pin connector for trigger signals

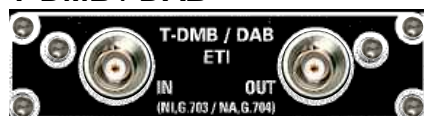


TRIGGER IN

TRIGGER OUT

EXT TS CLK IN

T-DMB / DAB



External ETI input / output (Ensemble Transport Interface) for transmission standard T-DMB/DAB.

The BNC female connectors are associated with the specification ETS 300 799.

ETI NI (Network Independent) and ETI NA 5592 or ETI NA 5376 (NA: network adaptation) signals are accepted.

External ETI output (Ensemble Transport Interface) for transmission standard T-DMB/DAB.

USER IN / OUT

Application-specific inputs/outputs.
Used to synchronize two R&S SFU systems to simulate the co-channel interference (CCI) in DVB-S2.

100 BASE-T

LAN interface

TS PARALLEL IN

TS PARALLEL IN is used to connect a parallel MPEG2 transport stream.

**DIG I/Q IN
DIG I/Q OUT**

Input / output for the digital I/Q signal (option R&S SFU-K80)

**USB IN**

USB interfaces (USB = Universal Serial Bus) type B (device USB).

- ◆ Used to feed in external asynchronous modulation data
- ◆ Remote control of the broadcast test system
- ◆ Software download

See Chapters 1 and 8



USB

USB interfaces (USB = Universal Serial Bus) type A (host USB).

- ◆ Connection of external devices such as a mouse, keyboard, printer
- ◆ Connection of the memory stick for transferring files

Further USB interfaces type A (host USB) are located on the front panel of the instrument.

See Chapters 1 and 8

IEC 625/IEEE 488



IEC bus (IEEE 488) interface for remote control of the R&S SFU, see Chapters 5 and 6



TS SERIAL IN

TS SERIAL IN is used to feed in a serial MPEG2 transport stream.



TS GEN SER OUT

TS SERIAL OUT allows you to make external use of the transport stream generated internally by the TS Generator Option (R&S SFU-K20).



I ANALOG OUT

Output for the analog I signals



Q ANALOG OUT

Output for the analog Q signals



REF FREQ IN

Reference frequency input



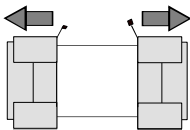
REF FREQ OUT

Reference frequency output

1.5 Preparing for Operation

The following section describes how to prepare the instrument for operation and how to connect external devices. Please heed the general safety instructions for operating the instrument. For information on installing options and updating the software, refer to the description provided with the software or key code.

1.5.1 Unpacking the Instrument



Remove
protective
covers

After unpacking the instrument, check the supplied equipment against the delivery note and the lists of accessories to make sure that it is complete.

Remove the two protective covers at the front and the rear of the Broadcast Test System and carefully check the instrument for possible damage.

Should there be any damage, please inform the carrier immediately. Keep the packaging material to support your claim.

The original packaging is also useful for transporting or shipping the Broadcast Test System later on. Keep at least the two protective covers for the front and rear panel to keep the controls and connectors from being damaged during subsequent shipping.

1.5.2 Positioning or Installing the Instrument in a 19" Rack

The instrument is designed for interior use only. You can set it up individually or install it in a 19" rack.

To install it in a 19" rack, you must use a rack mounting adapter (see data sheet for order number). Instructions are included with the adapter.

1.5.3 Safety Instructions

1.5.3.1 General Safety Instructions

NOTICE

Any noncompliance with these instructions can damage the instrument.

Prior to putting the instrument into operation, check the following:

- ◆ The instrument cover is in place and screwed on.
- ◆ Vent holes are not obstructed, and air flow is not blocked on the rear panel and the lateral vent. The spacing from the wall should be at least 10 cm.
- ◆ The signal levels at the inputs do not exceed permissible limits.
- ◆ The outputs of the instrument are not overloaded or incorrectly connected.
In particular, please heed the maximum permissible reverse power allowed on the RF outputs (see data sheet).
- ◆ The instrument may be operated only in a horizontal position and the surface on which it is placed must be level.
- ◆ The ambient temperature must be in the range specified in the data sheet.

1.5.3.2 Protective Measures against Electrostatic Discharge

NOTICE



Damage to the equipment under test due to electrostatic discharge

In order to avoid damage to the electronic components of the equipment under test (EUT) due to electrostatic discharge when touched, we recommend that you use the appropriate protective equipment.

1.5.3.3 Positioning the Instrument

WARNING

Risk of injuries

Before positioning the instrument, read the safety instructions for instruments with fold-out feet at the beginning of this manual and respectively on the CD-ROM carefully.

1.5.3.4 EMC Safety Precautions

NOTICE

Prevent electromagnetic interference.

To prevent electromagnetic interference, the instrument must be operated only when closed and with all shielding covers fitted. Only suitable and shielded signal and control cables may be used.

- ◆ This applies particularly to cables which are connected to the ASI/BER/TRIGGER inputs and outputs. Regardless of the data rate and the packet timing of the transport stream, high signal levels can occur at individual points in the signal spectrum. To avoid EMC problems, the cables should have at least 80 dB shielding protection up to 1 GHz. This generally requires the use of cables with double shielding.
- ◆ If a cable is attached to TS-GEN-SER-OUT, it must be provided with a conclusion
- ◆ When connecting the USB interfaces, use only peripheral equipment that does not cause limit violations.
- ◆ If DIG I/Q IN/OUT is connected by means of a conventional cable, it is possible that the specifications of limit class B are not longer met.
- ◆ During the wiring of the LAN interface (100 BASE-T) it is to be made certain that a suitable cable (e.g. Category 6) is used.

1.5.4 Connecting the Instrument to AC Power

The R&S SFU is equipped with AC voltage detection. The instrument will automatically set itself to the AC voltage it detects (see rear). No external switching or modification of the fuses is necessary. The AC power connector is at the rear of the instrument.

1.5.5 Switching On the Instrument

Instruments with an AC power switch



- ◆ Use the supplied AC power cable to connect the instrument to the AC power mains.

Since the instrument is in compliance with safety class EN61010-1, it should only be connected to a socket with a ground contact.

- ◆ Put the AC switch on the rear of the instrument into the I position.

Once the instrument is switched on, it will be in the stand-by state or in the ON state depending on the position of the ON/STANDBY switch on the front of the instrument (see below).



Note:

The AC power switch can be left permanently switched on. You need to switch off the instrument only if it is to be completely disconnected from the AC power line.



- ◆ Press the ON/STANDBY switch on the front of the instrument; the green LED should light up.

The instrument is now ready for operation. All of the subassemblies in the instrument are now live.

1.5.6 AC Power Fuses



Prior to exchanging the fuses, switch off the instrument and disconnect it from the power supply.

The instrument is equipped with two fuses of type F1/F2: IEC127-T4.0H/250 V. The fuses are located under the AC power switch on the rear panel of the instrument.

Exchanging the fuses:

- ◆ Open the cover on the fuse box and remove the fuse holder.
- ◆ Replace defective fuses and put fuse holder back into place.
- ◆ Close the fuse box cover.

1.5.7 Start-Up Screen and Booting the R&S SFU

Once the instrument is powered on, the installed BIOS version and some of the computer features are displayed on the screen for a few seconds.

Then, the Windows XP Embedded operating system will be booted, followed by the instrument firmware. During the boot-up procedure, the instrument firmware is subjected to a self-test. Once the boot-up procedure is complete, the main screen of the Broadcast Test System will appear and the instrument can be operated. The settings that were active before the instrument was last switched off are used unless another instrument setting was selected in the **File** menu.



Note:

If the software freezes unexpectedly, you can reboot the instrument by pressing the ON/STANDBY switch for about 5 seconds.

1.5.8 Switching Off the Instrument



- ◆ Press the ON/STANDBY switch on the front of the instrument.

The R&S SFU saves the current settings to the hard disk and then shuts down the Windows operating system. During this process, the following message may be displayed:



The power supply is then switched over to stand-by and the yellow LED is illuminated.

In stand-by mode, only the power supply has the operating voltage supplied to it and the crystal oven is maintained at its operating temperature.

⚠ WARNING

Shock hazard

In stand-by mode, the instrument is still power-supplied.

Only in case of complete disconnection from the AC power line:

- ◆ Put the AC switch on the rear of the instrument into the **O** position. None of the LEDs on the front panel should be illuminated.

**Note:**

We recommend that you switch to stand-by prior to complete disconnection from the AC power line. If you set the power switch to the O position before the instrument is switched over to stand-by mode, the current settings will be lost.

1.5.9 Functional Check

The Broadcast Test System automatically monitors the main instrument functions during power-on and on an ongoing basis during operation. If an error is detected, an “ERROR” indication will appear in the error/warnings line of the display along with a brief description of the error.

To obtain more information about the error, press the **ERROR/WARNING DETAILS** softkey. A description of the error(s) will be shown in the display (see Chapter 9, Error messages).

Besides automatic monitoring of instrument functions, the R&S SFU also offers other ways of ensuring proper operation of the Broadcast Test System:

- ◆ **System error correction (“internal adjustment”)**
Internal adjustment can be carried out in the **Setup Adjustments** menu. This is a way of obtaining the best possible level accuracy, for example.
- ◆ **Self checks**
If necessary can be arranged self checks.
- ◆ **Test points**
You can also query certain internal measurement points and display the results. See Chapter 4.

1.5.10 Presets

Press the **PRESET** button to reach a defined state for the instrument:

RF frequency	1 GHz
RF level	-10 dBm
Reference frequency	Internal, adjustment off
Modulation	First available real-time modulation starting with K1, K2,...
Attenuator mode	AUTO
Internal level control	Level ALC: AUTO
IP address	Unchanged

PRESET sets all parameters and switching states to specific values (even for operating modes that are not currently enabled).

The presettings of the remote command ***RST** are as following:

RF frequency	1 GHz
RF level	-99 dBm
Reference frequency	Internal, adjustment off
Modulation	OFF
Attenuator mode	AUTO
Internal level control	Level ALC: AUTO
IP address	Unchanged

1.5.11 Connecting an External Keyboard



The R&S SFU allows you to connect a standard external keyboard with a USB interface. A keyboard will make it easier to enter comments, file names, etc. It is necessary if you want to have easy access to the power of Windows XP.

The keyboard is connected to one of the USB interfaces (type A) on the instrument's front or rear panel.

The keyboard should be automatically detected once you connect it. The default language setting is for a UK keyboard. You can change the language and modify other settings such as the repetition rate in Windows XP under **Start - Control Panel - Keyboard** or **Regional and Language Options**. Access this menu by pressing the Windows key on an external keyboard.

1.5.12 Connecting a Mouse



The R&S SFU allows you to connect a standard mouse with a USB interface. The mouse will make it easier to use the block diagram with the associated menus. It is necessary if you want to have easy access to the power of Windows XP.

The keyboard is connected to one of the USB interfaces on the instrument's front or rear panel.

The mouse should be automatically detected once you connect it. Certain settings such as the speed of the mouse cursor can be modified in the Windows XP menu **Start - Control Panel - Mouse**. Access this menu by pressing the Windows key on an external keyboard.

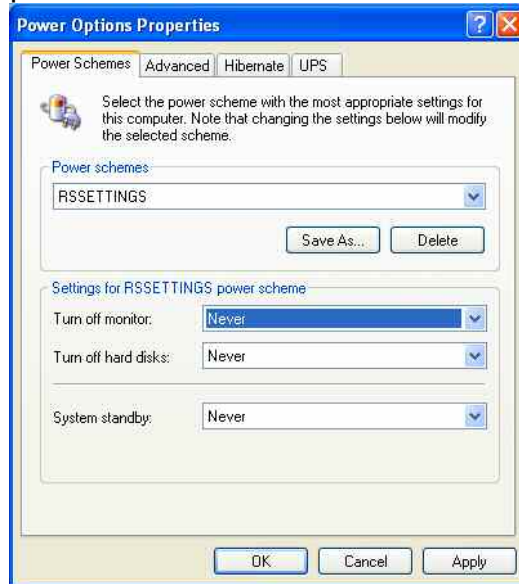
1.5.13 Displaying the Screen on an External Monitor

The R&S SFU does not have a connector for connecting an external monitor with an analog interface. However, it is possible to display the screen on external monitors by launching remote operation on an external computer (using the Windows program Remote Desktop Connection).

1.5.14 Activating the Power Save Mode

Power saver mode is not set by default for the R&S SFU.

If the display isn't needed, the monitor can be switched off in Windows XP under **Start – Control Panel – Power Options** after a particular time.



1.6 Notes on the Operating System and Firmware Update

1.6.1 Installation of the Software

NOTICE

- ◆ Only software authorized by Rohde & Schwarz for use in the R&S SFU may be installed. In case of doubt, please contact your local Rohde & Schwarz representative.
 - ◆ Changes to the system are only permissible in agreement with Rohde & Schwarz.
 - ◆ Updating the operating system, e.g. installing a service pack, is not allowed without permission.
-

Otherwise the stability and performance of the system may be impaired. Rohde & Schwarz shall not assume any liability for faults caused by impermissible manipulations of the system.

1.6.2 Windows XP Embedded

NOTICE

The drivers and programs that are used with Windows XP have been modified to suit the Broadcast Test System. In order to avoid disrupting the operation of the instrument, you should not change any settings unless they are mentioned in the following section. The existing software may be modified only using update software approved by Rohde & Schwarz. Likewise, you should only run programs on the instrument that have been approved by Rohde & Schwarz for such use.

The Broadcast Test System is equipped with the Windows XP Embedded operating system. When the instrument is delivered, the configuration of this operating system has been set for optimum operation of the Broadcast Test System. Changes to the system settings are required only if you install peripherals such as a keyboard

and printer or if you configure the network and the settings do not conform to the default settings (see the following sections). When you power on the Broadcast Test System, the operating system will boot up and then automatically launch the instrument firmware without asking for a password (“auto login”).

**Note:**

Auto login uses the user name and the password “Instrument”. This standard user has administrator rights so that it is possible to install printers and networks.

Access to the operating system requires the connection of an external keyboard. Use the Windows key on the external keyboard (next to the CTRL key) to open the Windows XP start menu so you can run Windows XP programs. You should connect a mouse if you want more convenient access to Windows XP.

The instrument screen is brought to the foreground if you double-click on the Windows button **SFU [xxx]** in the taskbar.

You can modify the system settings under Windows XP in the **Start - Control Panel** menu (see the documentation for Windows XP and for the hardware for the required settings).

The R&S SFU does not have a disk drive. Data can be exchanged using a memory stick which you plug into one of the USB interfaces. The memory stick is automatically assigned a free drive letter and you can use Windows Explorer to transfer data.

1.6.3 Firmware Update

Information on the firmware and instructions how to perform a firmware update are provided in the release notes. The release notes are supplied together with the new firmware or you can download the current version from the Rohde & Schwarz Home Page (<http://www.rohde-schwarz.com/downloads/firmware/sfu.html>).

1.7 Connecting the R&S SFU to a Network (LAN)

The R&S SFU is equipped with a network connection and can be connected to an Ethernet LAN (Local Area Network). Provided the appropriate rights have been granted by the network administrator, files can be transferred via the network, and network resources, e.g. network directories, can be used. The instrument can also be remote-controlled and remote-operated in the network. Remote operation allows someone to operate the R&S SFU from an external computer situated anywhere in the world. For example, a user can operate one or more R&S SFUs that are part of a test setup situated in another part of a building from his or her desk. Remote control of the instrument via the LAN interface is described in Chapter 5 of the operating manual (on the supplied CD-ROM).

1.7.1 Connecting to the Network

NOTICE

We recommend that you co-ordinate the connection of the instrument to the network with the network administrator. Any errors that occur during the connection process can affect the entire network.

The instrument should be switched off (stand-by mode) when you connect and disconnect the network cable. This is the only way to ensure that the network connection is reliably detected and any disruptions during the operation of the instrument are avoided.



The instrument is connected to the LAN using a standard RJ-45 cable via the LAN interface on the rear of the instrument.

Chapter 7 contains a description of the connector.

1.7.1.1 Configuring the R&S SFU for Network Operation

The network interface functions with 100 MHz Ethernet IEEE 802.3u. The TCP/IP network protocol and the associated network services are preconfigured.

To be able to exchange data within a local area network (LAN), every computer or instrument that is connected must have a unique IP address or a unique computer name. Access between different users is managed with access authorizations.

These access authorizations determine which of the available network resources such as file storage systems are available for the R&S SFU, for example.

Networks with DHCP

The R&S SFU is preconfigured for networks using the dynamic host configuration protocol (DHCP). In such networks, the R&S SFU is automatically assigned a free IP address. In this case, identification in the network is based on the use of a unique computer name.

Every R&S SFU is assigned an individual computer name at the factory. You can view and modify this name in the Windows XP **Start - My Computer** menu (see under "[Querying the Computer Name](#)").

Networks that assign fixed IP addresses

In networks that assign fixed IP addresses, it is usually the network administrator who handles this process. The fixed IP address must be entered under Windows XP **Start - Control Panel** (see below "[Entering the IP Address](#)").

Point-to-point connections

To set up a single network (a LAN connection between an R&S SFU and a single computer without integration into a larger network), an IP address needs to be assigned to the R&S SFU and the computer. The IP addresses 192.168.xxx.yyy are available for use here. xxx and yyy can assume values of 1 to 254, and the value for the subnet mask is 255.255.255.0.

In this case, a standard RJ-45 cross-over cable is required for the connection.

User parameters

For the R&S SFU, the standard user name is "**Instrument**". The user name is used for auto login when the instrument is started up and for remote operation. The password is also "**Instrument**". The network administrator must grant authorization to this user to determine what network directories and resources can be accessed by the R&S SFU.

Preparations

The instrument is configured for network operation in the menus of the Windows XP embedded operating system. The operating system can be accessed only when an external keyboard is connected. We recommend using a mouse for more convenient operation. Power down the instrument prior to connecting the keyboard and mouse so that the operating system with properly recognize them.

1. Switch off the instrument.
2. Connect the external keyboard and mouse to the USB interface.
3. Switch on the instrument.

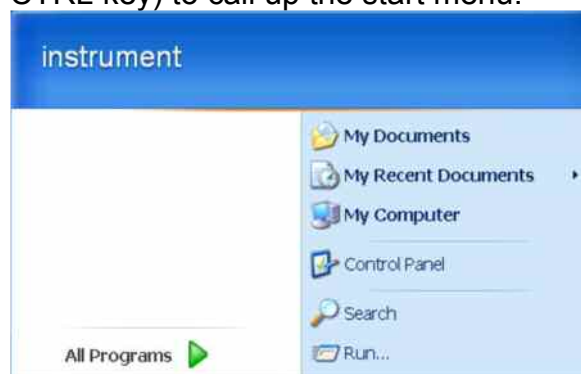
1.7.1.2 Entering the IP Address

Using the Firmware

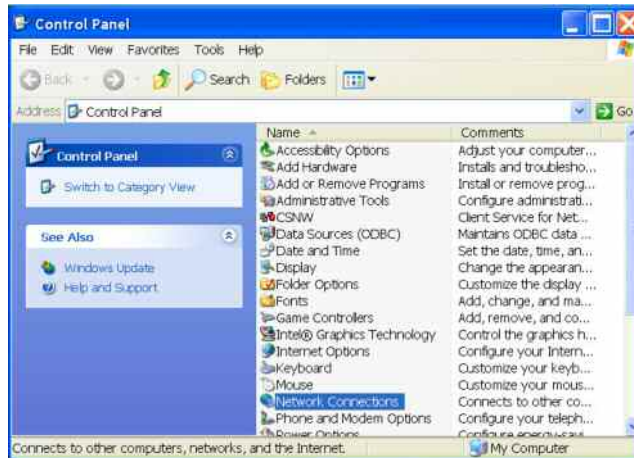
1. Press the SETUP key.
2. Select COMMUNICATION.
3. Under SFU - TCP/IP ADDRESS, enter the IP address.

Using Windows XP

1. Press the Windows key on the external keyboard (next to the CTRL key) to call up the start menu.



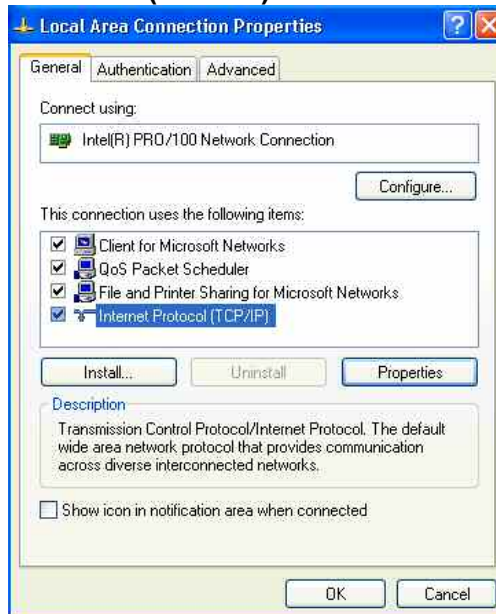
2. Click on **Control Panel** and then **Network**



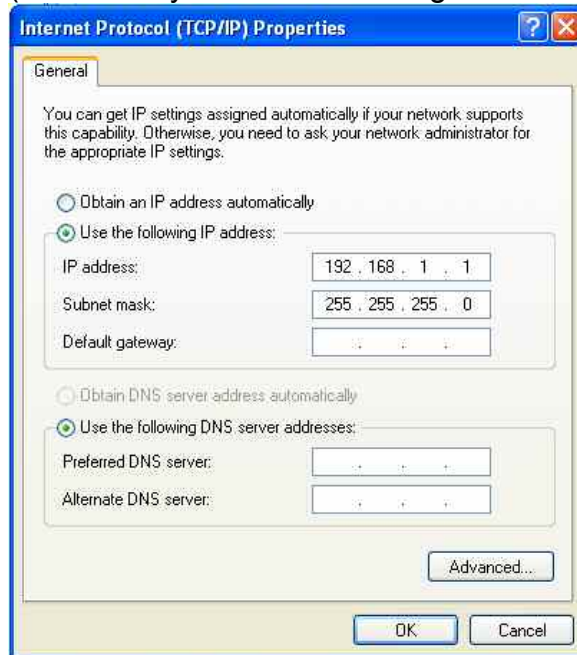
3. In the Network **Connections** menu, click on **LAN Area Connection 2** on the right.



4. In the **General** tab activate Properties. In the field **This connection uses the following items:** mark the **Internet Protocol (TCP/IP)** item and then click on the **Properties** button.



5. In the **Internet Protocol (TCP/IP) Properties** menu, enter the IP address in the field **Use the following IP address** (you should ask your network administrator if you need more information). Finish by clicking on OK in all of the menus. The default setting will be **Obtain an IP address automatically** (DHCP = Dynamic Host Configuration Protocol).



1.7.1.3 Querying the Computer Name

Using the Firmware

1. If the instrument has its DEFAULT COMPUTER NAME the computer name is displayed as part of the window title of the application:



Otherwise follow the next steps:

2. Press the SETUP key.
3. Select COMMUNICATION.
Under SFU - FULL COMPUTER NAME, the computer name is displayed.

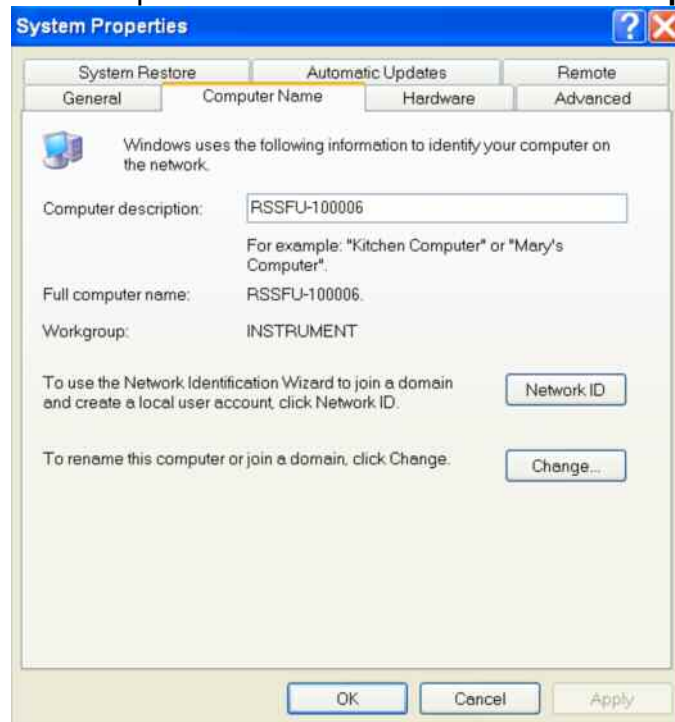
Using Windows XP

1. Press the Windows key on the external keyboard (next to the CTRL key) to call up the start menu. Select **My Computer** or **instrument on RSSFU-xxxxxx** and call up the contextual menu with the right mouse button.



2. Click on **Properties** and select the **Computer Name** tab in the menu.

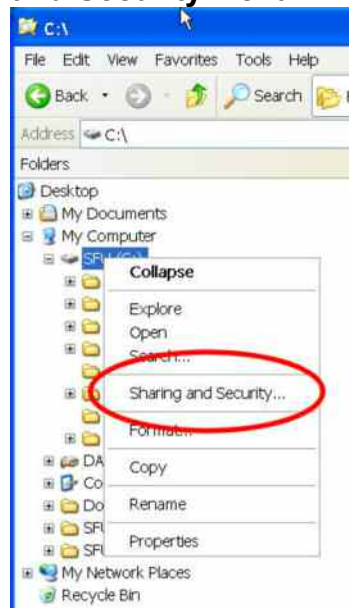
The computer name is shown under **Full Computer Name**.



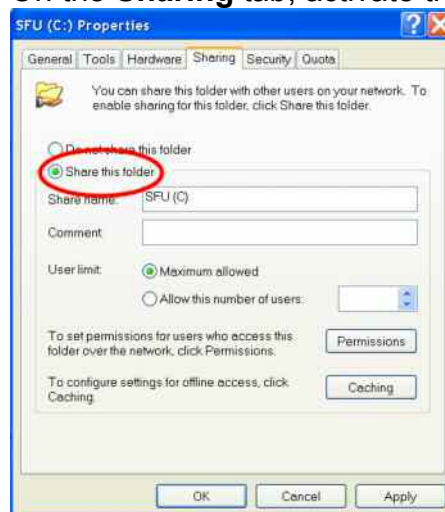
1.7.2 Sharing and Accessing R&S SFU Drives

Access to R&S SFU drives is managed using a system of access authorizations. Complete integration of the R&S SFU into a larger network is complex due to the access authorizations involved and is normally performed by a network administrator. However, access to the R&S SFU hard drives is relatively simple.

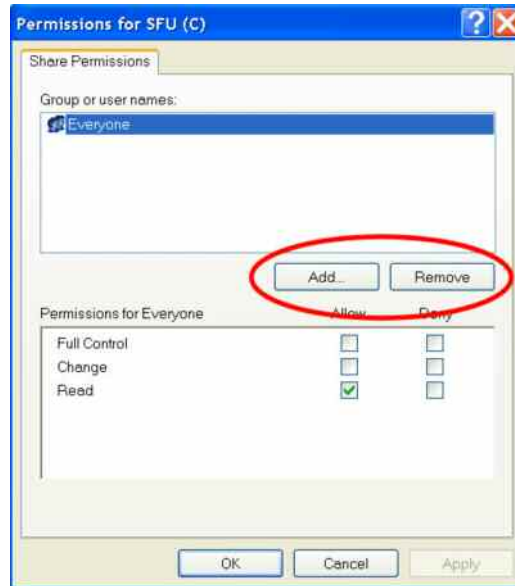
1. Select the directory in question on the R&S SFU using Windows Explorer and use the right mouse button to call up the **Sharing and Security** menu.



2. On the **Sharing** tab, activate the **Share this folder** option.



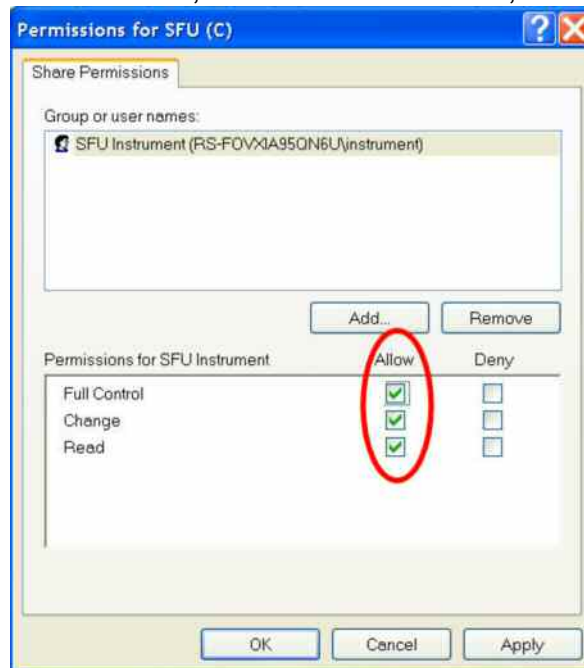
3. Click **Permissions** and remove user "Everyone".



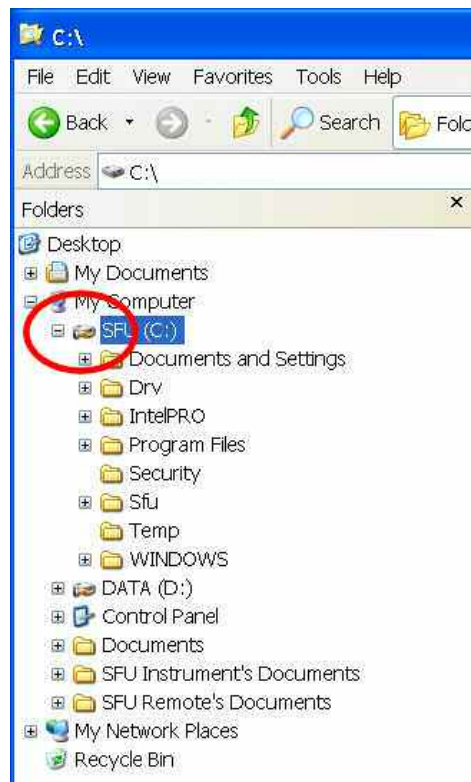
4. Click **Add...**
5. Enter the object name "instrument".



6. Under **Allow**, activate **Full Control**, **Change** and **Read**.

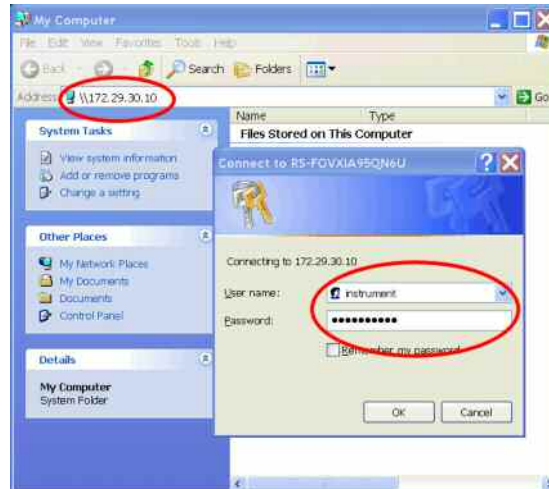


7. Shared drives are marked now. Use the same procedure for drive D if necessary



8. On your PC, open the Windows Explorer and enter the IP-Address of the R&S SFU in the form \\xx.xx.xx.xx.

9. Enter user "instrument" and password "instrument".



The shared directories should appear, and you can access the files.

1.7.3 Accessing Network Directories from R&S SFU

Access to network drives is managed using a system of access authorizations. Complete integration of the R&S SFU into a larger network is complex due to the access authorizations involved and is normally performed by a network administrator.

However, access by the R&S SFU to the hard drive of another computer in the network is relatively simple. The desired directory that the R&S SFU will access just needs to be enabled on the other computer. The R&S SFU can then use the Windows XP search function to access this directory.

This procedure is also relevant to a point-to-point connection, e.g. for launching a firmware update for which the files are stored on the hard drive of another computer.



Note:

The computer and the Broadcast Test System must both have a computer name and an IP address (see section "[Configuring the R&S SFU for Network Operation](#)").

Enable the desired directory on the other computer.

**Note:**

Depending on the operating system and language used on the other computer, the names of the menus can vary from those shown below.

1. Select the directory in question on the computer using Windows Explorer and use the right mouse button to call up the **Properties** menu.
2. In the **Sharing** panel, activate the **Share this folder** checkbox.
3. Note the computer name (see section "[Querying the Computer Name](#)").

On the R&S SFU, now access the shared directory.

1. Use the Windows key to call up the Start menu.
2. In the **Search Computers or People** menu, select **A Computer on the Network**.
3. In the input window for the query **Which Computer you are looking for?**, enter the computer name in question and press Enter to start the search.
The computer should be listed along with its name in the search results.
4. Click on the computer name. The shared directory should appear, and you can access the files stored there from the R&S SFU.

**Note:**

If you are asked for a user name and password when accessing the computer, you will have to enter the login name and password for that computer.

1.7.4 Configuration for Remote Operation (“Remote Desktop”)

It is possible to manually operate the R&S SFU via a network connection from a remote computer. Such operation is based on the Windows program **Remote Desktop Connection**. Remote operation is described in Chapter 3, section “Remote Operation”.

The following requirements must be met for remote operation of the Broadcast Test System:

- ◆ On the external computer, Windows 95 or later must be installed along with the **Remote Desktop Connection** program and a LAN interface must be configured for the network
- ◆ The Broadcast Test System and the computer must be connected via the LAN (see "[Configuring the R&S SFU for Network Operation](#)").
- ◆ On the Broadcast Test System, the **Remote Desktop Connection** program must be activated (see "[Activating the Remote Desktop on the R&S SFU](#)").
- ◆ The R&S SFU data must be entered on the external computer in the program **Remote Desktop Connection** (IP address or computer name of the R&S SFU in the network) [see "[Querying the Computer Name](#)"].
- ◆ Login must have been computed on the external computer for the R&S SFU with the proper user name (“Instrument”) and password (also “Instrument”) (see "[Starting Remote Desktop on the External Computer](#)").

1.7.4.1 Activating the Remote Desktop on the R&S SFU

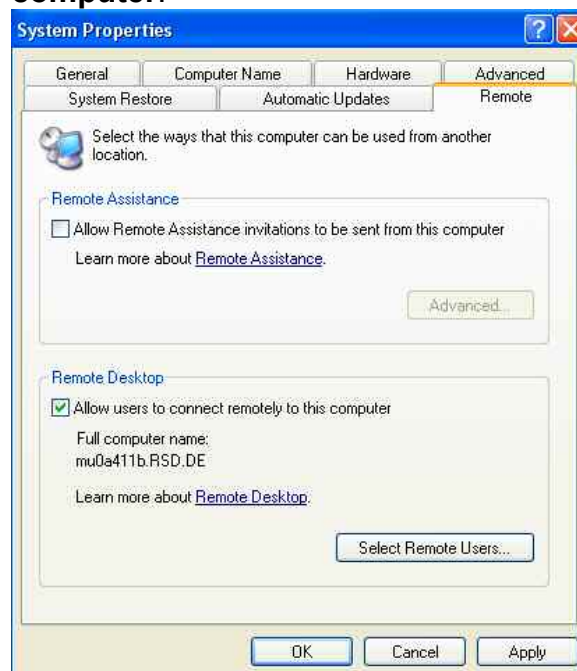
NOTICE

Following activation of Remote Desktop, any user in the network can access this R&S SFU if they know the computer name and login data for the Broadcast Test System.

1. Press the Windows key on the external keyboard (next to the CTRL key) to call up the start menu. Select **My Computer** and call up the contextual menu with the right mouse button.



2. Click on **Properties** and select the **Remote** tab in the menu.
3. Activate the checkbox **Allow users to connect remotely to this computer**.



1.7.4.2 Starting Remote Desktop on the External Computer

The **Remote Desktop Connection** program is already installed in the Windows XP operating system. For all other Windows operating systems starting with Windows95™, the program is available as a free download at (<http://www.microsoft.com>). It can be loaded onto any external computer as described in the instructions (also available on the Internet).

1. If necessary, install the **Remote Desktop Connection** program on the external computer.
2. Launch the program from the Windows menu **Start - All Programs - Accessories - Communications**.




Prior to the initial use, you will need to enter the instrument and user data for the R&S SFU on the external computer. The instrument data (the computer name of the R&S SFU) identify the R&S SFU in the network. Every R&S SFU is delivered with a computer name that is suitable for use with Remote Desktop. For information on querying the computer name, see the section "[Querying the Computer Name](#)".

In this dialog the IP-Address of the R&S SFU can also be used.

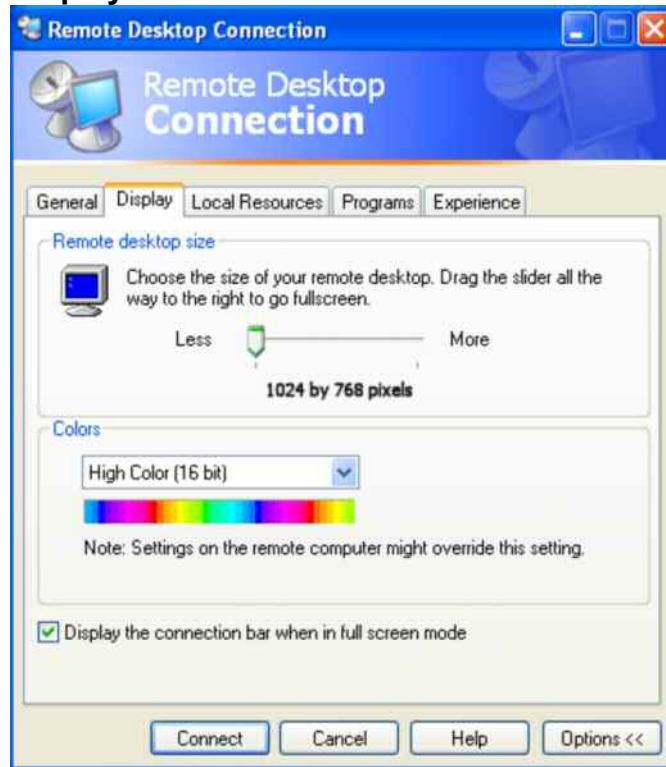
The user data is necessary in order to obtain access authorization for the R&S SFU. This data is preset on the R&S SFU. The user name and the password are both set to “**Instrument**”. Nothing is required in the **Domain** input field.

3. The instrument and user data are entered in the **General** tab of the **Remote Desktop Connection** extended menu. You can access this data with the **Options>>** button.



4. You can save the login data using the **Save as** button. If this is saved in the file **default.rdp**, the connection to the R&S SFU will be the default when the program is launched. If you save the data under another name, the settings for connection to the R&S SFU will be shown in the selection list which is called up by pressing the  button in the **Computer** field.

5. Set the resolution for display of the R&S SFU screen in the **Display** tab to 1024 x 768.



6. Establish the connection by clicking on the **Connect** button. Once the connection is established, the generator screen will appear on the external computer. You can operate the instrument with the mouse and/or keyboard. Keys on the front panel that do not have a direct match on the keyboard can be replaced using key combinations. (see the table in Chapter 3, section “Key overview”).

If you want to manually operate several R&S SFUs from a remote computer, then you will need to open a separate **Remote Desktop Control** window for each R&S SFU. This is possible by restarting the program on the external computer as many times as is necessary.

1.7.5 Configuration for Remote Operation (VNC)

As an alternative, the instrument can be operated by using VNC. The following requirements must be met for remote operation of the Broadcast Test System:

- ◆ On the external computer, Windows 95 or later must be installed along with the **VNC Viewer** program and a LAN interface must be configured for the network
- ◆ The Broadcast Test System and the computer must be connected via the LAN (see "[Configuring the R&S SFU for Network Operation](#)")
- ◆ The program **VNC Server** must be installed and activated on the Broadcast Test System.
- ◆ The R&S SFU data must be entered on the external computer in the program **VNC Viewer** (IP address or computer name of the R&S SFU in the network (see "[Querying the Computer Name](#)")
- ◆ The R&S SFU must be logged into the external computer with the proper session password.

1.7.5.1 Installing the VNC Server Program on the R&S SFU

The set-up program already is on the hard disk of the R&S SFU (C:\Program Files\VNC). It can be started from there .

Install VNC server as described in the enclosed documentation on the test system.

Configure VNC as shown in the following figure:



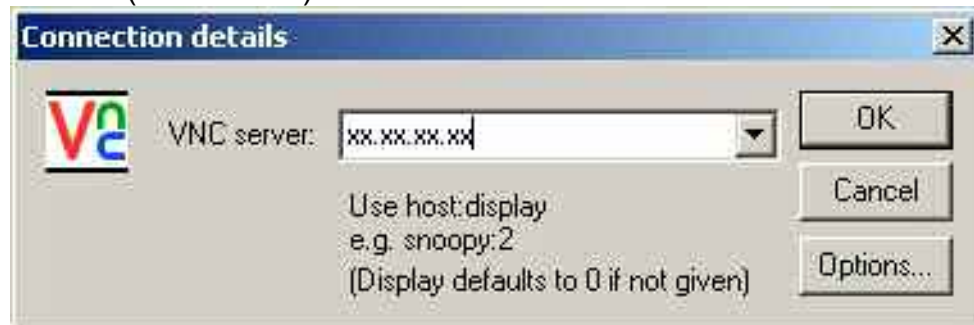
We recommend that you use "SFU" as the password.

1.7.5.2 Starting Remote Desktop on the External Computer

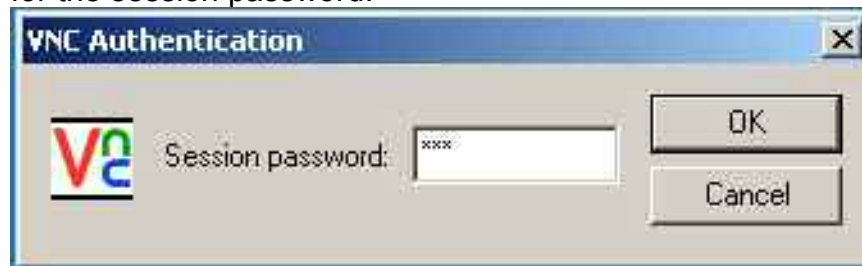
If necessary, install the **VNC Server** program on the external computer.

Launch the program from the Windows menu **Start - All Programs - RealVNC – VNC-Viewer**.

The R&S SFU must be selected as the instrument for remote operation, i.e. its IP address must be entered in the Connection details window (VNC server).



Click on the OK button to establish the connection. You will be asked for the session password.



After entering the password **SFU**, the screen of the test system will appear on the external computer.

If you need to directly operate the R&S SFU, it is not necessary to log off the external user.

The external user can end remote operation on the external window by closing the VNC application.

1.8 Windows XP Recovery and Backup Partition

R&S SFU provides a backup and recovery partition. A backup of the factory system partition (C:\) is stored per default and can be recovered in case of a system crash.

In addition, backups of up to 5 firmware versions can be stored on this partition. It is e.g. possible to backup the current system partition prior to a firmware update or to provide different system configurations for different environments. When recovered, the system partition (C:/) is deleted, formatted and the newly written. The data partition (D:\) is not affected.

**Note:**

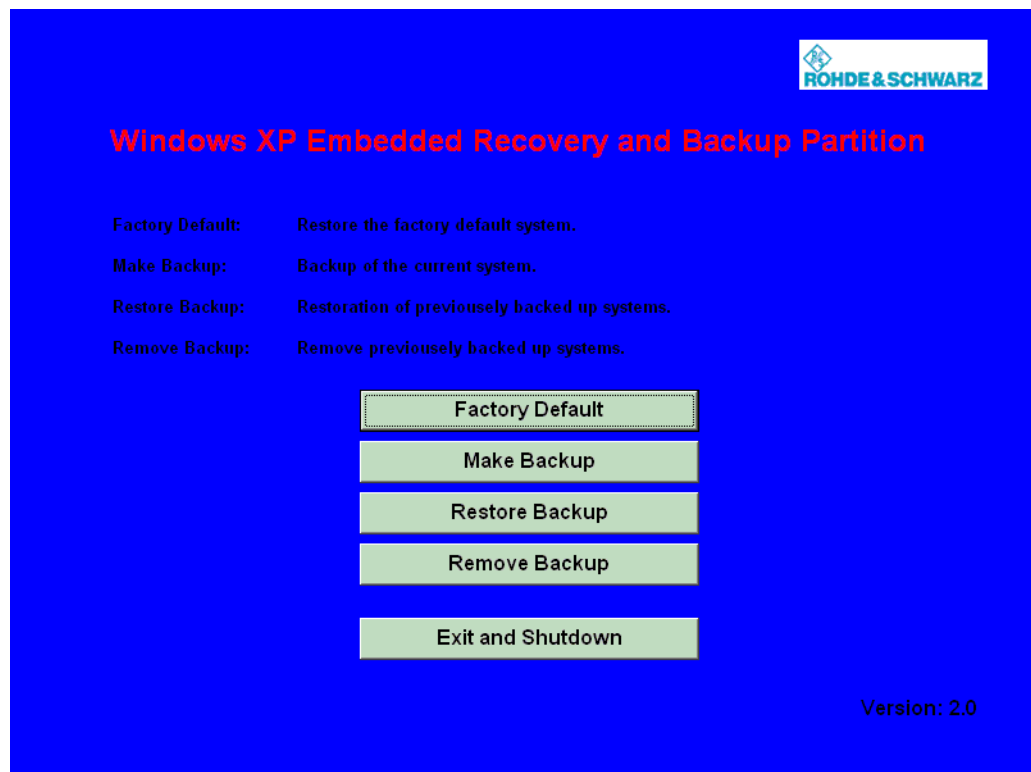
Ignore the following message if it appears during backup or recovery and do not restart your instrument, i.e. select 'No'.



1.8.1 Opening the Windows XP Embedded Recovery and Backup Partition Dialog Box

1. Connect a keyboard and a mouse to the USB interfaces.
2. Switch the instrument off and on again.
3. In the boot dialog box, select **Backup/Recovery** using the up/down cursors of the external keyboard.
4. Press the rotary knob to open the **Windows XP Embedded Recovery and Backup Partition** dialog box.
The dialog box shows the available selections for the recovery and backup partition:

Figure 1-3 Windows XP Embedded Recovery and Backup Partition dialog box



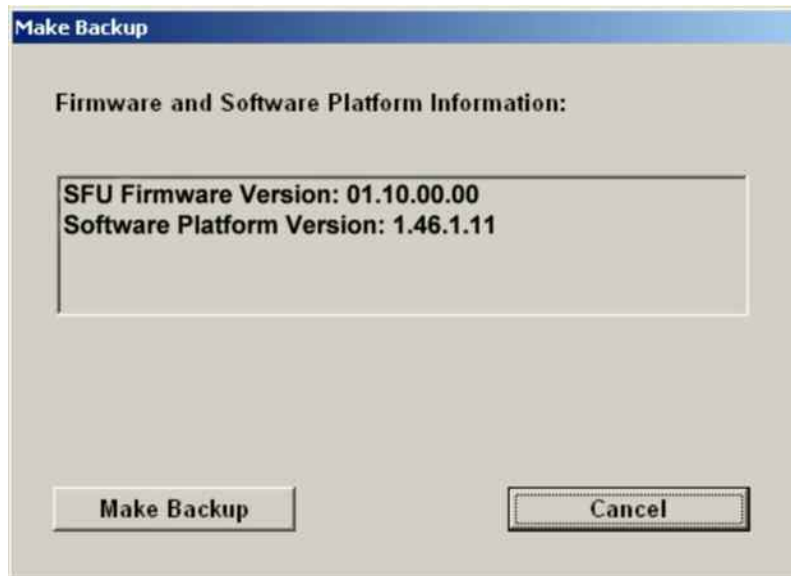
Note:

In the **Windows XP Embedded Recovery and Backup Partition** dialog box and all successive dialog boxes, you need a mouse to work with.

1.8.2 Backup Current System Partition

1. In the **Windows XP Embedded Recovery and Backup Partition** dialog box, click **Make Backup**.

The **Make Backup** dialog box is displayed. It shows the current versions of the firmware and the software platform.

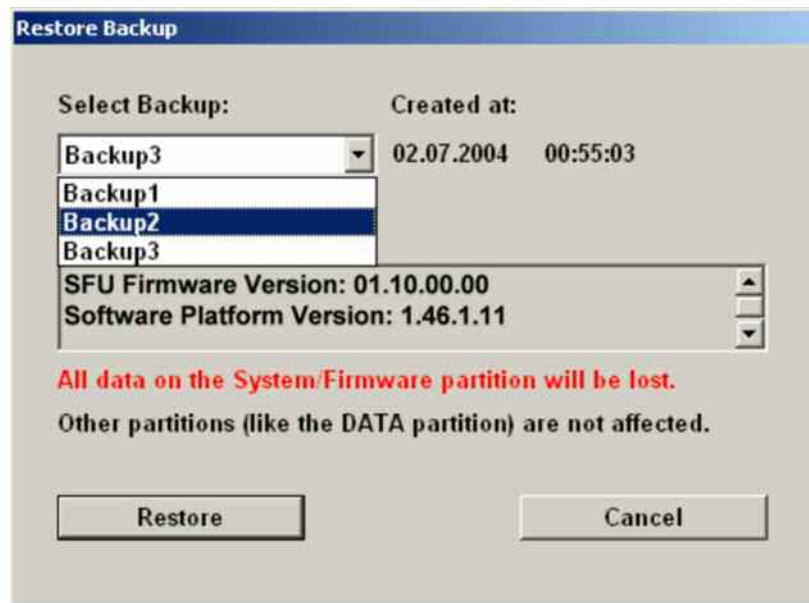


2. Click **Make Backup**.
After the backup, the **Windows XP Embedded Recovery and Backup Partition** dialog box is displayed again.
3. Click **Exit and Shutdown**.

1.8.3 Recover Selected Version of System Partition

1. In the **Windows XP Embedded Recovery and Backup Partition** dialog box, click **Restore Backup** to recover a selected version of the system partition.

The **Restore Backup** dialog box is displayed. It shows the versions of the firmware and the software platform of the backup displayed under **Select Backup**.



2. Under **Select Backup**, select the backup to be restored.
3. Click **Restore**.

The script which is performed during recovery is displayed. After the recovery the instrument is shut down and switched off.

1.8.4 Recover Factory Default

1. In the **Windows XP Embedded Recovery and Backup Partition** dialog box, click **Factory Default** to recover the factory version of the system partition.

The **Factory Default** dialog box is displayed. It shows the versions of the firmware and the software platform on delivery.



2. Click **Restore now**.

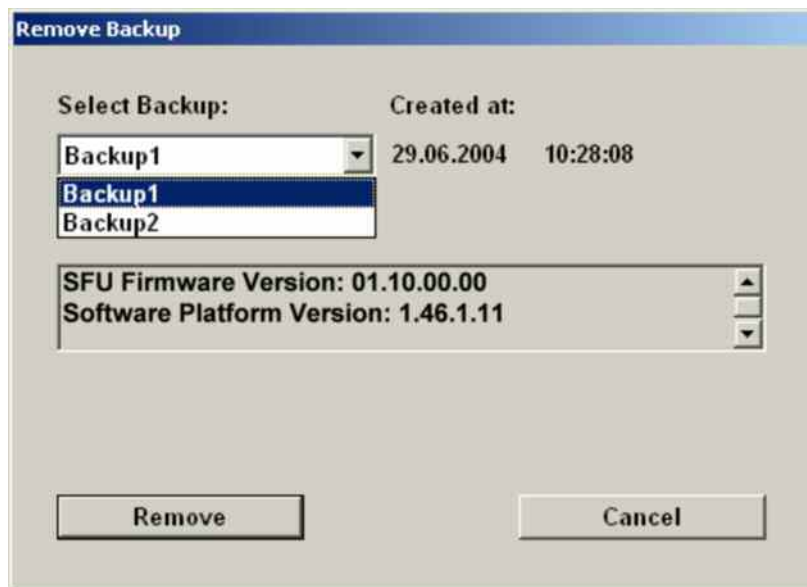
The script which is performed during recovery is displayed. After the recovery the instrument is shut down and switched off.

1.8.5 Delete Backups

Up to five backups in addition to the factory default can be stored on the recovery partition. To provide space for new backups it might be necessary to remove older backups. The factory default cannot be deleted.

1. In the **Windows XP Embedded Recovery and Backup Partition** dialog box, click **Remove Backup** to delete a selected backup.

The **Remove Backup** dialog box is displayed. It shows the versions of the firmware and the software platform of the selected backup.



2. Under **Select Backup**, select the backup to be deleted.
3. Click **Remove**.

After the deletion, the instrument returns to the **Remove Backup** dialog box as long as backups are still available. If the last backup is deleted, the **Windows XP Recovery and Backup Partition** dialog box is displayed again.

4. Click **Cancel** to return the **Windows XP Embedded Recovery and Backup Partition** dialog box.
5. In the **Windows XP Embedded Recovery and Backup Partition** dialog box, click **Exit and Shutdown**.

2 Brief Introduction

2.1 Introduction

The Broadcast Test System R&S SFU has been designed as a platform for different applications and for future options. It provides a number of instruments and applications in a cabinet of only four height units and offers unrivaled RF and baseband characteristics.

Due to its modular design, the R&S SFU can be optimally adapted to the requirements of different applications. It is an ideal research and development tool for making improvements to introduced standards and for generating new standard signals. Applications that previously required many different instruments are now fully covered by the R&S SFU.

The modern, intuitive concept of the R&S SFU ensures fast and easy operation.

You can easily switch operating parameters (e.g. roll-off, puncturing rate, QAM mode) and select operating parameters whose values exceed those defined in the standard for lab applications. For special tasks such as in DVB-T/H, modulation, individual carriers and carrier groups can be deactivated. Sweeps across the entire RF range are possible.

General characteristics

- ◆ DTV multi-standard platform
- ◆ ATV signal generation
- ◆ Output frequency from 100 kHz to 3 GHz
- ◆ Generation of internal interferers
- ◆ Fully digital baseband signal processing
- ◆ Upgradeability to multifunctional broadcast test system
- ◆ Easy installation of most options at customer site

Intuitive, fast and easy operation

- ◆ Color display with 1024 × 768 pixels (XVGA format, 8.4")
- ◆ Intuitive user interface with Windows XP Embedded
- ◆ Context-sensitive help system
- ◆ User-definable favorites for fast access
- ◆ Easy software update by means of USB and Windows

Outstanding signal quality

- ◆ I/Q modulator with 180 MHz RF bandwidth
- ◆ Very low SSB phase noise of type. -135 dBc at 1 GHz (20 kHz carrier offset, 1 Hz measurement bandwidth)
- ◆ High optional output power of up to +19 dBm (PEP), over range +26 dBm
- ◆ High-stability reference oscillator as standard

Unrivalled flexibility for research and development

- ◆ Expandable multi-standard platform
- ◆ Universal coder for real-time signal generation
- ◆ Transmission simulations
- ◆ TS baseband generator
- ◆ TRP and ETI player, recorder
- ◆ Arbitrary waveform generator with 128 Msample, supported by WinIQSIM™ software
- ◆ Variety of signal libraries with waveforms and transport streams
- ◆ Up to two internal hard disks for storing waveforms and streams
- ◆ Integrated power measurement with external power sensors

Ideal for use in production

- ◆ Wear-free electronic attenuator of up to 3 GHz over the full level range
- ◆ Minimum space requirements:
- ◆ TS generator and test transmitter are accommodated in one instrument of only four height units
- ◆ Favorably priced and future-proof non-real-time production solution, since it can be upgraded with software at any time
- ◆ Fast, flexible software option solutions for new requirements

Easy remote access

- ◆ Remote control via GPIB and LAN (VXI 11)
- ◆ User-friendly remote operation by VNC or Remote Desktop
- ◆ USB connectors for keyboard, mouse and USB memory stick

2.2 One-Box Solution

2.2.1 Transport Stream Signal Source

Video and audio applications require baseband signals. A variety of such signals are available as transport stream signal sources.

Rohde & Schwarz libraries with ready-to-use special signals for tests and development can be replayed with the transport stream generator.

Customer files can be easily loaded and replayed with the transport stream player.

The internal transport stream recorder supports recording of customer transport streams from any sources.

2.2.2 Test Transmitter

RF signals for a variety of transmission standards can be transmitted over a wide, user-variable frequency range by the integrated test transmitter. It is easily possible to switch over between the different standards for terrestrial, satellite or cable transmission. The software is reloaded to provide the multi-standard test transmitter functionality, and a highly accurate spectrum is generated.

2.2.3 Bit Error Ratio Meter

The integrated BER meter makes it possible to measure and evaluate errors on the transmission link. A BER value can be determined on the transport stream in parallel or serially as well as via the serial data and clock circuits.

2.2.4 Channel Simulator

Integrated transmission simulators for AWGN, phase noise, impulsive noise and fading are available for simulating real and, above all, reproducible environmental conditions in the lab.

2.2.5 I/Q Signal Generator

Customer I/Q waveforms or Rohde & Schwarz waveform libraries for different transmission standards can be replayed with the arbitrary waveform generator.

2.2.6 High Output Power

High output levels and signal amplifiers are usually required in production. The R&S SFU provides this high output power with its high power option.

2.2.7 Power Measurement

High-precision power measurements with power sensors from Rohde & Schwarz can be performed and displayed on the R&S SFU's large screen.

2.2.8 I/Q Interface

The digital I/Q interface provides the high-quality I/Q signals that are required in development as input and output signals. The instrument also features an analog I/Q interface and an I/Q wideband input that allows I/Q signals to be fed directly to the modulator.

2.3 Coders

All coders are software-based; you can activate them immediately by means of an enabling code (see right). It is thus not necessary to open the instrument.

2.3.1 Cable Standards

DVB-C

The DVB-C coder supports all QAM modulations defined in the EN 300429 standard. The powerful coder hardware is also able to cover high-order QAM modulations that have not yet been standardized.

J.83/B

J.83/B is an American cable transmission standard. The coder also supports the standard enhancement with 1024QAM.

2.3.2 Satellite Standards

DVB-S/DSNG

DVB-S (EN 300421/EN 301210) was introduced in 1994 as a satellite transmission standard. DVB-S uses QPSK modulation. Since its introduction, DVB-S has established itself as the world's most widely used satellite transmission standard. DVB-S/DSNG also uses 8PSK and 16QAM.

DVB-S2

DVB-S2 is an innovative and efficient channel coding method that is used in combination with high-order modulation modes. The method is very robust, offers safe reception and provides up to 30 % higher data transmission rates than DVB-S. The R&S SFU supports the broadcast service mode for non-backwards-compatible broadcast services.

DIRECTV

DIRECTV (and DIRECTV legacy mode) is a proprietary standard with conditional access that is widely used in America and primarily in the United States. For transmission, a proprietary transport stream protocol with 130-byte packets is generated. After conversion to 188 bytes, - DIRECTV transport streams can be replayed with the R&S SFU-K22 TRP player option.

2.3.3 Digital Terrestrial TV Standards

DVB-T

DVB-T permits high-quality transmission of digital broadcast signals. Its success will continue with the conversion from analog to digital TV.

ISDB-T

ISDB-T is a Japanese digital standard for terrestrial transmission of video, audio, and data signals by means of 13 segments. ISDB-T with partial reception is for mobile operation.

ISDTV

ISDTV is the Brazilian digital standard for the terrestrial transmission of video, audio, and data signals. It is based on ARIB STD-B31 and thus corresponds to ISDB-T as regards RF transmission.

DMB-T

DMB-T is a non-standardized multi-carrier transmission method developed for use in China. It can be regarded as the predecessor of DTMB (GB 20600-2006).

DTMB (GB20600-2006)

DTMB was developed in China and has meanwhile become known as the GB20600 standard. It offers high-quality digital TV with excellent characteristics, based either on an OFDM or a single-carrier transmission method.

ATSC/8VSB

8VSB is a terrestrial DTV standard from the USA with vestigial sideband modulation. At a bandwidth of 6 MHz, a sideband is suppressed in the spectrum.

ATSC/A-VSB

A-VSB is another terrestrial DTV standard from the USA. It is based on 8VSB and has been especially developed for mobile reception.

2.3.4 Video Goes Mobile

The following standards are terrestrial transmission methods for broadcast applications with mobile receivers such as mobile phones and PDAs.

DVB-H

The DVB-T/H coder provides the following functions: the newly introduced 4k mode, use of the TPS carriers for time slicing signaling, the additional 5 MHz channel bandwidth and corresponding native and in-depth symbol interleavers as well as MPE forward error correction (FEC). Hierarchical coding is also possible.

T-DMB/DAB

T-DMB was developed in Korea and is based on the digital audio broadcasting (DAB) standard known in Europe, which was also developed for mobile reception with radios. The T-DMB/DAB coder in the R&S SFU supports both the Korean and the European transmission standards.

ISDB-T (partial reception)

With mobile ISDB-T in accordance with ARIB 1.5, only one of altogether 13 available segments is used for transmission. The remaining 12 segments can transmit TV programs for stationary reception.

MediaFLO™

MediaFLO™ was developed and standardized by the American company QUALCOMM. The baseband signal in this proprietary standard is based on a transport stream with 188 bytes. MediaFLO™ is currently used in a nationwide network in the USA. QPSK and 16QAM methods are used as OFDM modulation at a bandwidth of 5.5 MHz. The data rates transmitted to the mobile receiver range between 50 kbit/s and 1 Mbit/s.

DMB-TH

DMB-TH is the Chinese DMB-T, which in a modified version is also used for handheld reception. DMB-TH has evolved from DMB-T.

2.3.5 Analog Terrestrial Television Standards

B/G, D/K, M/N, L und I

Analog standards with the B/G, D/K, M/N, L, and I transmission systems as well as the PAL, NTSC, and SECAM color systems are also available. Since the baseband signal has already been integrated, an additional signal generator is not required.

2.3.6 Terrestrial Sound Broadcasting Standards

DAB

Based on a COFDM transmission method, DAB was developed for digital and high-quality audio transmission to mobile receivers.

ISDB-T_{SB}

ISDB-T_{SB} is a Japanese narrow-band digital sound broadcasting standard for the terrestrial transmission of audio and data signals by means of one segment. ISDB-T_{SB} is mostly used for mobile applications.

2.4 Baseband

2.4.1 TS Generator (R&S SFU-K20)

A transport stream generator in the baseband internally provides test streams for the real-time coder. For external equipment, the test streams are made available at an ASI output. An external MPEG-2 generator is therefore no longer necessary. Furthermore, the number of instruments needed for testing set-top boxes is reduced and the costs are minimized.

The transport stream generator allows you to generate endless and seamless high-bit-rate MPEG-2 transport streams for the broadcast range. The SDTV transport stream library included as standard contains ATSC and DVB test streams. The numerous transport streams from Rohde & Schwarz cover a wide range of applications and test scenarios.

2.4.2 Transport Stream Libraries

A large number of additional libraries can be integrated. They make development faster and easier and allow new products to be tested.

- ◆ SDTV – test streams for DVB and ATSC
- ◆ HDTV – tests of HDTV receivers
- ◆ DVB-H – tests of mobile receivers
- ◆ ISDB-T – test streams
- ◆ H.264 – test streams
- ◆ TCM – STB tests

Further libraries will soon be available.

2.4.3 Stream Generation Tools

Stream generation tools provide full flexibility when generating your own streams, which can be used with the R&S SFU-K20 TS generator. The R&S DV-ASC advanced stream combiner allows you to generate your own transport streams, also for DVB-H.

2.4.4 TS Recorder (R&S SFU-K21)

A transport stream recorder and player as an expansion of the data source is available for the R&S SFU. It allows you to record any externally applied transport streams and ETI data streams at data rates between 100 kbit/s and up to 90 Mbit/s.

The available recording formats are TRP with eight bits (8-bit data) and T10 (10-bit data, 1-bit data valid, 1-bit packet sync) and ETI. With the 8-bit and T10 formats, the parallel SPI (LVDS) interface is used. The R&S SFU-B11 ETI interface (optional) is required for the ETI format.

The amount of data that can be recorded is limited only by the size of the hard disk. The recorded transport streams can be transferred to other storage media via the USB or LAN interface. Using the TS recorder, the streams can be replayed endlessly and seamlessly with packet-exact cutting at the end-of-file/start-of-file transition.

To enable R&S SFU-K21, you require the Additional Hard Disk R&S SFU-B6, Memory Extension 2 R&S SFU-B4 and TRP Player R&S SFU-K22.

2.4.5 TRP Player (R&S SFU-K22)

The TRP player lets you replay your own transport streams in TRP format. The transport streams can be copied via the USB or LAN interface to the R&S SFU file system and be replayed from there.

In addition, this TRP player is used to replay T-DMB and DAB ETI streams. For this purpose, the TRP player can replay predefined ETI test streams for T-DMB and DAB from an optional T-DMB/DAB library (R&S SFU-K221).

To enable the R&S SFU-K22 TRP player option, the Additional Hard Disk R&S SFU-B6 and Memory Extension 2 R&S SFU-B4 are required.

2.4.6 Video/Audio Generator (R&S SFU-K23)

Together with the analog realtime coders, the video/audio generator offers a complete solution for modulated analog and interruption-free video test patterns and audio signals. The video/audio generator is generally available with every analog realtime coder.

In addition to the PAL, NTSC, and SECAM test patterns included in the basic configuration, an ATV-Video library with comprehensive analog video test signals can be integrated.

2.5 Simulation

2.5.1 Arbitrary Waveform Generator

The integrated arbitrary waveform (ARB) generator of the R&S SFU opens up a wide range of additional applications, such as simulating occupied adjacent channels, adding interferers to the useful signal and generating user-defined RF signals (e.g. notched noise).

It is thus possible to generate any externally computed complex modulation signals. A hardware resampler and a low oversampling rate significantly reduce the memory space needed to store I/Q waveforms on the hard disk. This allows you to store a large number of I/Q waveforms directly on the hard disk.

Externally generated I/Q waveform files can also be loaded into the instrument and read out via one of the computer interfaces such as USB or LAN, or via the IEC/IEEE bus.

Together with the R&S SFU-K81 option, which switches off the real-time coder function, the ARB generator can also be used for easy, cost-efficient production solutions. If a wider scope of functions is required, the real-time coders integrated in the R&S SFU can subsequently be enabled by means of key code options (see figure at right).

2.5.1.1 Waveform Libraries

Additional waveform libraries allow quick evaluation of new modulations. I/Q waveform libraries are available for the following signals:

- ◆ T-DMB/DAB (R&S SFU-K351)
- ◆ DVB-T/H (R&S SFU-K352)
- ◆ DRM (R&S SFU-K353)
- ◆ Digital/MBRAI Interferer (R&S SFU-K354)
- ◆ MediaFLO™ (R&S SFU-K355)
- ◆ Cabel Interferer SCTE40 (R&S SFU-K356)
- ◆ HD Radio (R&S SFU-K357)

Further waveform libraries will soon be available.

2.5.1.2 Simulation Tools

The R&S SFU allows full use of R&S WinIQSIM™ simulation software. All waveforms generated with R&S WinIQSIM™ can be loaded into the ARB generator of the R&S SFU. Other software tools that utilize R&S WinIQSIM™ can also be used.

2.5.1.3 Technical Details

As an I/Q modulation source, the ARB generator features the following:

- ◆ 128 Msample memory for I and Q
- ◆ Up to 100 Msample/s

2.5.2 Modulation Impairments

You can easily switch operating parameters (e.g. roll-off, puncturing rate, QAM mode) and select operating parameters whose values exceed those defined in the standard for lab applications. Non-ideal behavior of the I/Q modulator can be simulated by selectively changing amplitude, phase and carrier leakage before the signal enters the I/Q modulator.

2.5.3 Noise

2.5.3.1 AWGN Generator (R&S SFU-K40)

The digital additive white Gaussian noise (AWGN) generator is used as a source for generating a pure noise signal modulated onto the carrier and for influencing the actual useful signal. Realistic noise can be simulated in the transmission path – via satellite, cable or antenna – by generating a 96 MHz broadband AWGN signal with a Gaussian amplitude distribution in the digital baseband.

The AWGN generator can be used if the R&S SFU-K40 software option has been enabled.

2.5.3.2 Phase Noise (R&S SFU-K41)

The phase noise of the R&S SFU synthesizer is typically less than -135 dBc/Hz (1 GHz, 20 kHz offset). The R&S SFU is therefore ideal for simulating phase noise. The option allows you to simulate phase noise in oscillators and phase lock loops. In the setting range from -10 dBc/Hz to -110 dBc/Hz, the wanted phase noise can be loaded as a profile. User-defined profiles can be generated with conventional simulation programs such as MATLAB, ported as a file to the R&S SFU by means of a USB stick and stored on the hard disk. The phase noise functionality can be used if the R&S SFU-K41 software option has been enabled.

2.5.3.3 Impulsive Noise (R&S SFU-K42)

Impulsive noise permits the pulsed addition of an AWGN signal to the useful signal with a settable number of pulses. Implementation is in line with DTG, Dbook and A/74 with a maximum bandwidth of 96 MHz. In addition, the statistical distribution of the pulse intervals can be selected. The pulse generator required for the pulses is integrated in the R&S SFU. An additional external signal generator and the associated cabling are thus no longer necessary. The pulse spacing limits, the number of pulses and the burst duration can be configured very easily. The impulsive noise functionality can be used if the R&S SFU-K42 software option has been enabled.

2.5.3.4 Multi-Noise Use (R&S SFU-K43)

The multi-noise use functionality can be used if the R&S SFU-K43 software option has been enabled. It permits the simultaneous use of multiple noise sources in the form of an additive noise signal which, in turn, can be added to the useful signal.

2.5.4 Fading Simulator (R&S SFU-B30/-B31)

The channel simulator (fading simulator) of the R&S SFU is ideal for real-time simulation of multi-path and mobile reception. The basic version (R&S SFU-B30) provides up to 20 paths; with the full version (R&S SFU-B31), up to 40 paths are available.

2.5.4.1 Profiles

The fading simulator supports profiles in accordance with DVB and ATTC. Several fading profiles per path can be selected and simulated. You may choose from the following profiles:

- ◆ Pure Doppler
- ◆ Rice
- ◆ Rayleigh
- ◆ Constant phase
- ◆ Static phase
- ◆ Lognormal
- ◆ Suzuki
- ◆ Gaussian

Dynamic fading profiles can be used with the R&S SFU-K30 enhanced fading option.

You can vary all fading parameters such as attenuation, phase, delay and Doppler, speed and direction.

2.5.4.2 DAB with Gaussian Fading

The Gaussian fading (R&S SFU-K32) used for DAB and for the Korean T-DMB mobile standard is included in the real-time T-DMB/DAB coder (R&S SFU-K11) and in the T-DMB/DAB waveforms option (R&S SFU-K351), respectively, and permits the corresponding channel simulations.

2.5.4.3 Enhanced Fading (R&S SFU-K30)

The moving propagation and birth-death dynamic fading configurations can be used to increase the resolution of the fading path delay to simulate dynamic propagation conditions as well as fine delay configurations. These configurations are provided by the enhanced fading option.

The enhanced fading functionality can be used if the R&S SFU-K30 software option has been enabled. It requires an installed R&S SFU-B30 option (or R&S SFU-B30 and R&S SFU-B31).

2.5.4.4 Diversity Simulation

When testing diversity receivers, a separate RF receive signal must be provided for each antenna of the receiver. The receive signals must have the same baseband signal and the RF signal must be coupled. The noise and fading signals, however, must show no correlation; this is only possible with one R&S SFU per antenna.

The RF signals of the two R&S SFUs are coupled as master/slave by means of the reference frequency.

The digital I/Q baseband signals are interconnected quickly, reliably and without loss of quality via the extended I/Q interface between the R&S SFUs.

The functions of the digital I/Q interface can be used after the R&S SFU-K80 software option has been activated.

2.5.5 Interferers

Interferers can be added to the useful signals at different points along the transmission path. When adding the interferers, the level can be varied within a wide range. The maximum frequency shift to the useful signal can be ± 40 MHz.

Transmission simulations can be used for the mixed signals. The R&S SFU can simulate the impairment of the useful signal by interferers very compactly and without requiring any external signal sources.

In addition to the signals and signal libraries already available from - Rohde & Schwarz (such as the multi ATV predefined option with analog TV signals), you can define other interferers by means of the R&S WinIQSIM™ software and use them on the R&S SFU.

2.5.5.1 Interferer Libraries

The following options are available as signal libraries for analog and digital interferer scenarios in line with IEC 62002 (MBRAI), NORDIG and A/74:

- ◆ R&S SFU-K199, multi ATV predefined, analog interferers
- ◆ R&S SFU-K354, DTV interferers, digital interferers

These libraries also contain test signals with more than one interference signal.

2.5.5.2 Interferer Management

The R&S SFU-K37 option permits easy and straightforward interferer management. Level, frequency, frequency offset and signal type can be set.

2.5.5.3 Internal Interferers

The R&S SFU-K199/-K354 interferer libraries/signals or any other ARB I/Q signal can be used as internal interferers.

2.5.5.4 External Interferers

External interferers can be applied via the R&S SFU-K80 analog or digital I/Q interface while ARB sequences or analog TV signals can be provided internally.

2.6 Analysis

2.6.1 BER Measurement

The BER measurement, which operates independently of other applications, is used to check channel conditions. The integrated BER tester allows you to evaluate a signal demodulated and decoded by the DUT by means of the BER measurement. Two general methods are available for this purpose.

A measurement with a pure pseudo-random binary sequence (PRBS) can check the demodulation section of the receiver. A known PRBS-modulated data sequence is sent to the DUT, which decodes the signal and feeds the decoded data and the associated clock back to the R&S SFU. If the error ratio of the decoding branch must also be measured, the MPEG-2 TS can be returned. In this case, the test signal comprises an MPEG-2 TS that contains a PRBS as payload. If path measurements on a live MPEG-2 signal are to be performed, the null packets must contain a PRBS payload. The BER tester of the R&S SFU synchronizes to the returned, known PRBS and counts the bit errors. The quotient obtained by dividing the number of error bits by the total number of bits is the BER.

2.6.2 Power Measurement

To allow you to determine the input power directly on the DUT, the R&S SFU provides a power measurement function. Software is available for controlling and evaluating the measurement.

2.7 Miscellaneous

2.7.1 Connectivity

LAN (100BaseT), GPIB and a USB connector are available as interfaces on the instrument's rear panel. Files, firmware updates and modulation data can be loaded fast and easily via these interfaces.

2.7.2 Remote Operation and Remote Control

The R&S SFU can be remote-operated via an Ethernet connection or in a LAN network over IP and is preconfigured for DHCP use. The preinstalled Remote Desktop software or the VNC software that comes with the instrument makes this very easy to do.

Remote control is possible by means of control commands via the IEC/IEEE bus (GPIB) or LAN. The R&S SFU can thus be integrated into existing test programs and remote-controlled.

2.7.3 Looking Forward

The R&S SFU's modular design makes it a future-proof investment. Options can usually be activated quickly and conveniently on-site at any time by means of firmware update and license code.

This feature ensures fast and easy availability without time loss and is a big advantage for use in production and development. The R&S SFU can be adapted to perfectly match current requirements, and its configuration can be tailored to meet customer-specific needs. It thus saves a lot of money yet offers full flexibility and openness for new, evolving fields of application.

2.8 Sample Settings

2.8.1 Transmitter Application



An MPEG2 transport stream is fed into the R&S SFU via the serial interface (TS SERIAL IN ASI) on the front panel.



This MPEG2 transport stream undergoes channel encoding and modulation in the instrument for transmission in compliance with the DVB-C specification and is output as an RF signal on the RF output jack.




The communications parameters are as follows:

Center frequency	330 MHz
Level	-20.0 dBm
Transmission standard	DVB-C
Constellation	64 QAM
Symbol rate	6.9 MS/s
Roll off	0.15
Transport stream input	ASI front

2.8.1.1 Selecting the Transmitter Application (TX)

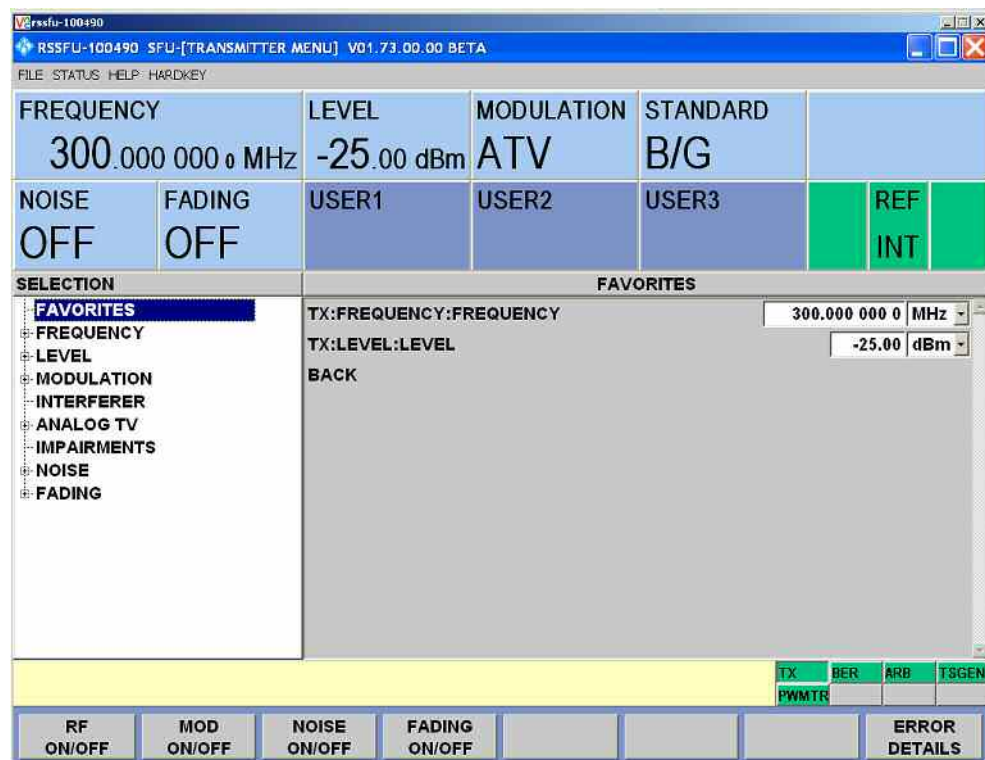


Press the APPL button to choose an application.

Select the TX application using the  and  keys or the rotary knob. Press the rotary knob or the  key to confirm your entry. The softkeys can be used alternatively.

DVB-C transmission is a transmitter application.

Figure 2.8-1 TX application



Select the transmitter application (TX). The TX application appears with the TX information area in the upper third of the display, the TX Tree on the left side of the display and the associated work view.

2.8.1.2 Setting the Output FREQUENCY




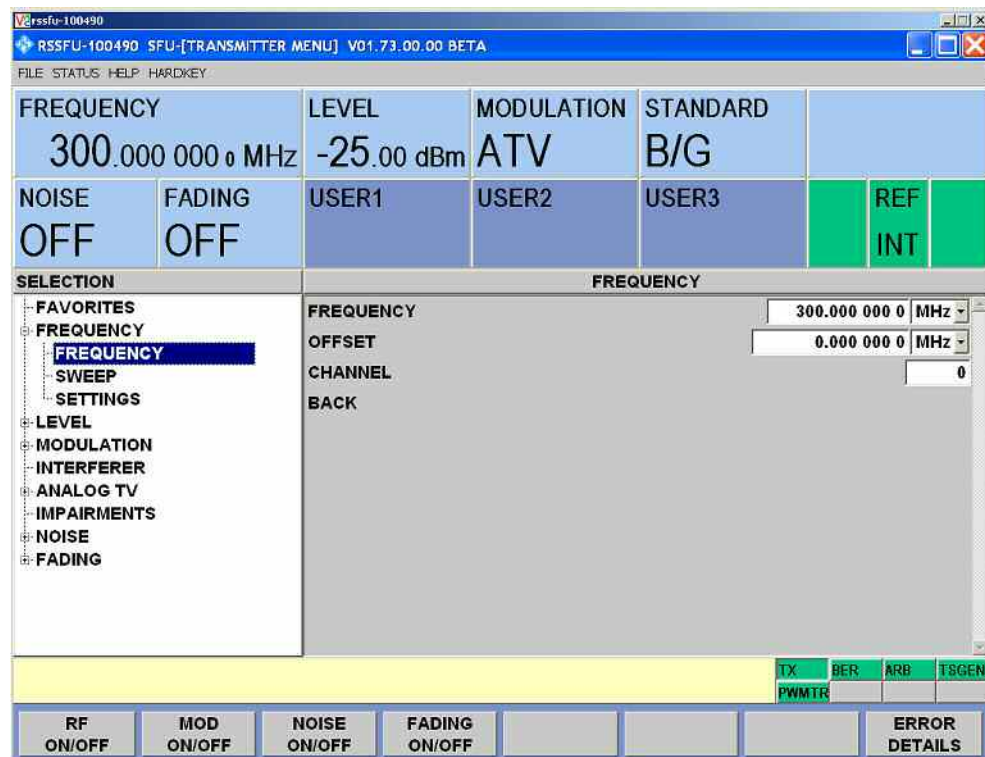
Use the  and  keys or the rotary knob in the tree (left side) to select the FREQUENCY menu. If you press the  key or the rotary knob while the FREQUENCY menu is selected, the tree is expanded and the FREQUENCY submenu is displayed.




Figure 2.8-2 FREQUENCY menu



In the FREQUENCY menu, select the FREQUENCY item again (cursor keys or rotary knob) and confirm your entry with ENTER (or press the rotary knob). This will activate the work view on the right side.

Use the cursor keys or the rotary knob to select the FREQUENCY field in the work view.

The output frequency of 330 MHz can then be set:

- ◆ Input "330" using the digit keys and press the unit key  to the right next to the digit keys.
- ◆ The frequency you entered will now be displayed in the INFO area in the FREQUENCY field.
- ◆ Exit by pressing the  key and the  key (or by selecting and confirming the BACK field in the work view).

2.8.1.3 Setting the Output LEVEL




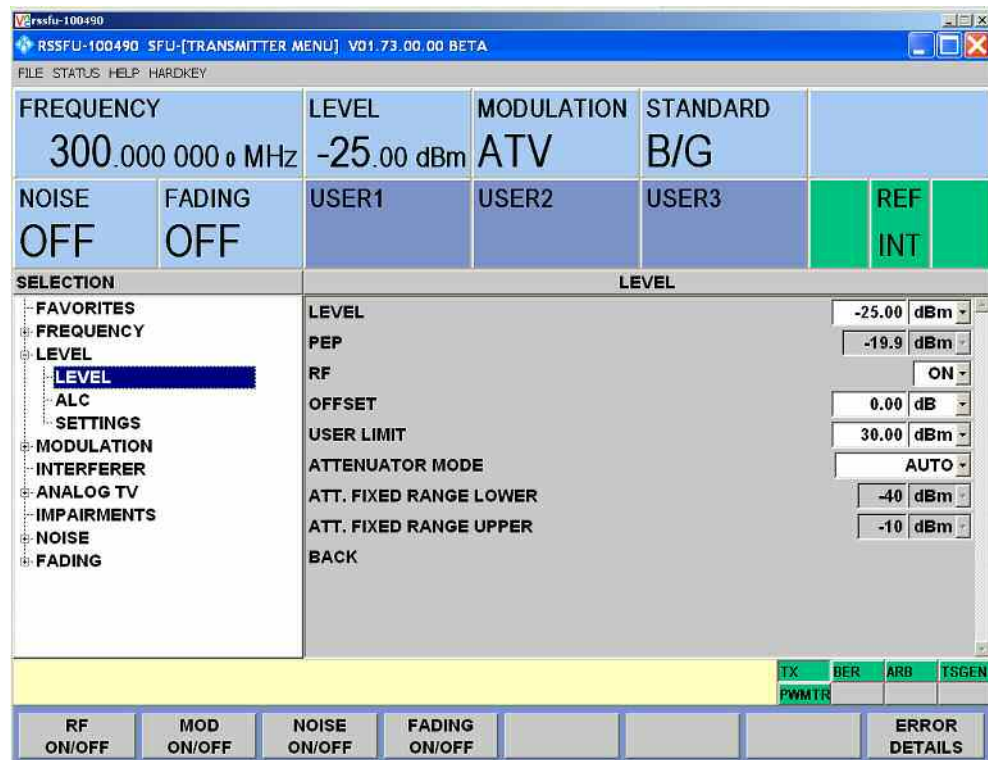




Use the  and  keys or the rotary knob in the tree (left side) to select the LEVEL menu. If you press the  key or the rotary knob while the LEVEL menu is selected, the tree is expanded and the LEVEL submenu is displayed.

Figure 2.8-3 LEVEL menu




In the LEVEL menu, use the  key (or press the rotary knob) to select the LEVEL item again ( and  keys or rotary knob) and confirm your entry. This will activate the work view on the right side. Use the cursor keys or the rotary knob to select the LEVEL field in the work view.



The output level of -20 dBm can then be set:

- ◆ Input "-20" using the sign key and the digit keys and then press the unit key  to the right next to the digit keys.

The level you entered will now be displayed in the LEVEL field.

You can select and confirm a different unit if you so desire in the LEVEL menu and the SETTINGS menu.

The LEVEL UNIT field is selected in the corresponding work view on the right side. After you press the  key (or press the rotary knob), you can select one of several possible units.

- ◆ Exit the menu by pressing the  key and the  key (or by selecting and confirming the BACK field in the work view).

2.8.1.4 Modulation Settings and Selection of the TRANSMISSION STANDARD




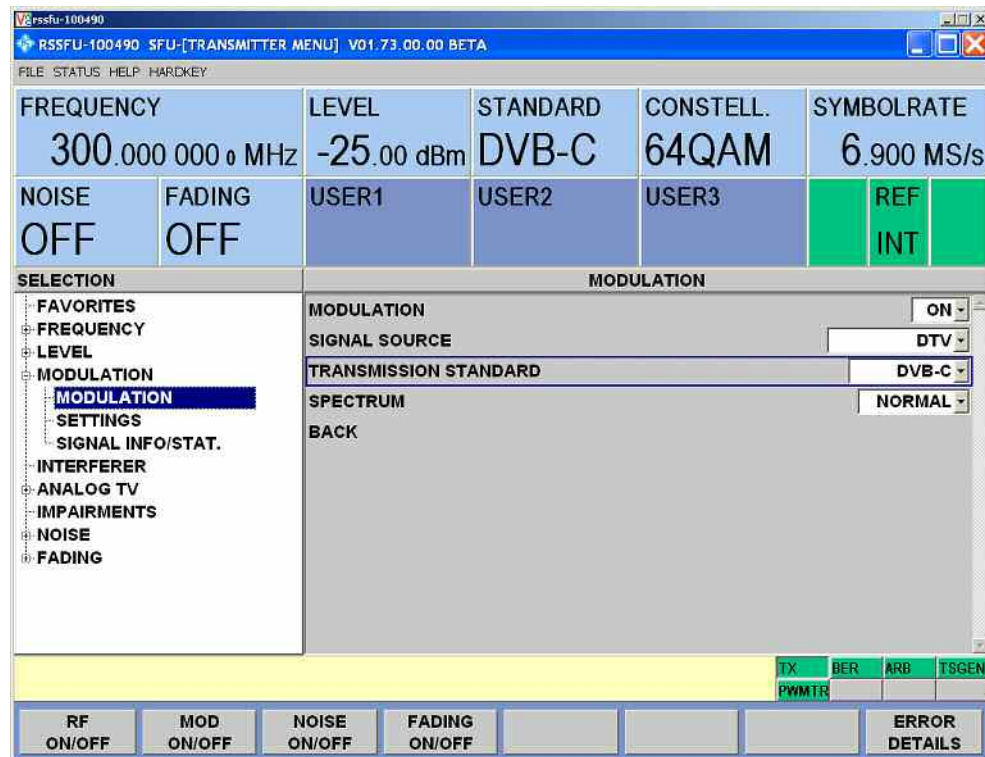

Use the  and  keys or the rotary knob in the tree (left side) to select the MODULATION menu. If you press the  key or the rotary knob while the MODULATION menu is selected, the tree is expanded and the MODULATION submenu will appear.

Figure 2.8-4 TRANSMISSION STANDARD menu



In the MODULATION menu, select the MODULATION item again


(cursor keys or rotary knob) and confirm your entry with  (or press the rotary knob). This will activate the work view on the right side.



Use the cursor keys or the rotary knob to select the MODULATION field in the work view.

Press the  key (or the rotary knob) to select ON and OFF.


Use the  and  keys or the rotary knob to select and confirm ON.



Use the cursor keys or the rotary knob to select the SIGNAL SOURCE field in the work view.

After you press the  key (or the rotary knob), the selection DTV,ATV,ARB, I/Q DIGITAL, I/Q ANALOG etc. will be displayed.

Use the  and  keys or the rotary knob to select and confirm INTERNAL.



Use the cursor keys or the rotary knob to select the TRANSMISSION STANDARD field in the work view.

After you press the  key (or the rotary knob), the available transmission standards will be shown.

Use the  and  keys or the rotary knob to select and confirm DVB-C.

I/Q Modulation is now switched on, the internal coder is selected as the signal source and the DVB-C transmission standard is set.

DVB-C will now be displayed in the STANDARD field in the INFO area.

Use the  key or the  key to display the work view in the MODULATION menu. After you confirm the field BACK in the work view, you can exit the menu.

2.8.1.5 Selection of the Transport Stream Input and Setting the DVB-C Transmission Parameters




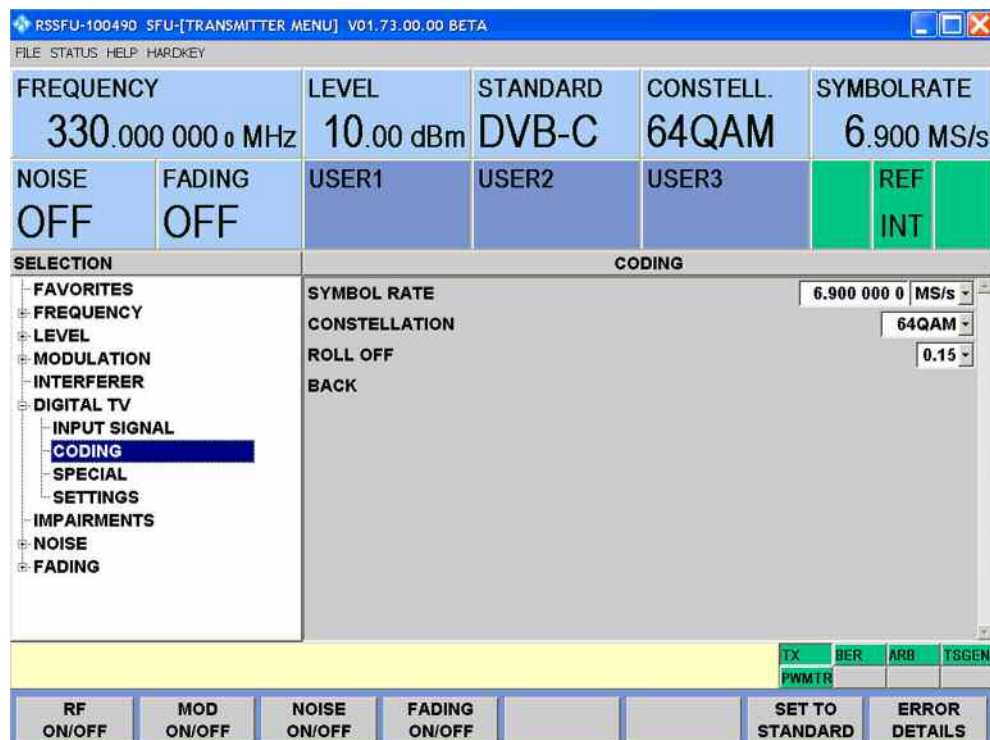
Use the  and  keys or the rotary knob in the tree (left side) to select the DIGITAL TV menu. By pressing the  key or the rotary knob with the DIGITAL TV menu selected, the tree is expanded and the DIGITAL TV submenu is displayed.



Figure 2-1 DIGITAL TV menu



In the DIGITAL TV menu, select the INPUT SIGNAL item (cursor keys or rotary knob) and confirm your entry with ENTER (or press the rotary knob). This will activate the work view on the right side.



Use the cursor keys or the rotary knob to select the SIGNAL SOURCE field in the work view.

When you press the ENTER key (or the rotary knob), the selection EXTERNAL, TS PLAYER, TEST SIGNAL will be displayed.



Use the  and  keys or the rotary knob to select and confirm EXTERNAL.

Use the cursor keys or the rotary knob to select the INPUT field in the work view.

When you press the ENTER key (or the rotary knob), the selection ASI FRONT, ASI REAR, SPI FRONT, etc. will be displayed.

Use the  and  keys or the rotary knob to select and confirm ASI FRONT.


The STUFFING field in the work view must be set to ON. This ensures that the incoming transport stream will be adapted to the proper data rate of the coder. The data rate of the coder will depend on the transmission parameters. The data stream is padded with NULL PACKETS to allow adaptation to the transmission parameters.

Press the  and the  key (or select and confirm the BACK field) to exit the work view.

In the DIGITAL TV menu, select the CODING item (cursor keys or rotary knob) and confirm your entry with ENTER (or press the rotary knob). The work view on the right side of the display will be activated.

Use the cursor keys or the rotary knob to select the SYMBOL RATE field in the work view.


The symbol rate of 6.9 MS/s can then be set in several different ways:

- ◆ Input "6.9" using the digit keys and the decimal point and confirm your entry with the  key (assuming the units field to the right already shows units of "MS/s").



If the units field indicates another unit, you can select this field with the cursor keys. After you confirm, you can select the unit. Once you have selected and confirmed "MS/s", you can enter the appropriate symbol rate.

The symbol rate you entered will now be displayed in the INFO area in the SYMBOL RATE field.



- ◆ Use the cursor keys or the rotary knob to select the CONSTELLATION field in the work view.

Use the  key (or press the rotary knob) to make your selection:

16 QAM, 32 QAM, 64 QAM, 128 QAM or 256 QAM

Use the  and  keys or the rotary knob to select and confirm 64 QAM.

The constellation you entered will now be displayed in the INFO area in the CONSTELLATION field.

Press the  and the  key (or select and confirm the BACK field) to exit the work view.




All of the parameters listed earlier are now set (unless you made special settings in the previous settings).

2.8.2 Bit Error Rate Meter

2.8.2.1 Selecting the Bit Error Rate Meter Application (BER)



Press the APPL button to choose an application.

Use the rotary knob or the  and  keys to select the BER application. Press the  key or the rotary knob to confirm your entry.

The softkeys can be used alternatively.

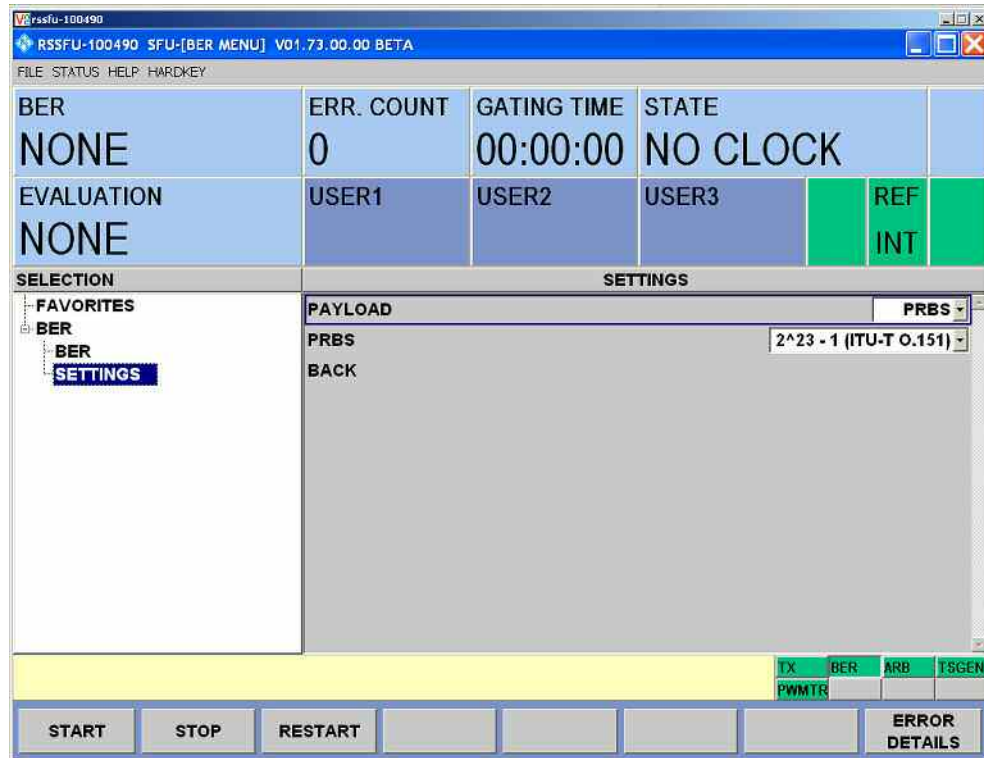
2.8.2.2 Configuration

Some sample settings for using the bit error rate meter are given in this section. This examples makes use of the serial inputs. A suitable data source is required which must provide a serial pseudorandom bit sequence (PRBS) and the related clock. This function can be handled by a digital transmission analyzer.

First, connect the clock and data output of the BER generator to the corresponding inputs of the R&S SFU and configure the BER generator to provide a suitable PRBS in compliance with ITU-T O.151 (e.g. $2^{23} - 1$). The data rate must be, say, 10 Mbit/s.

After you launch the BER application on the R&S SFU (APPL key), the BER menu will appear on the screen. In the tree, you must first select the BER / SETTINGS entry.

Figure 2.8-5 BER settings

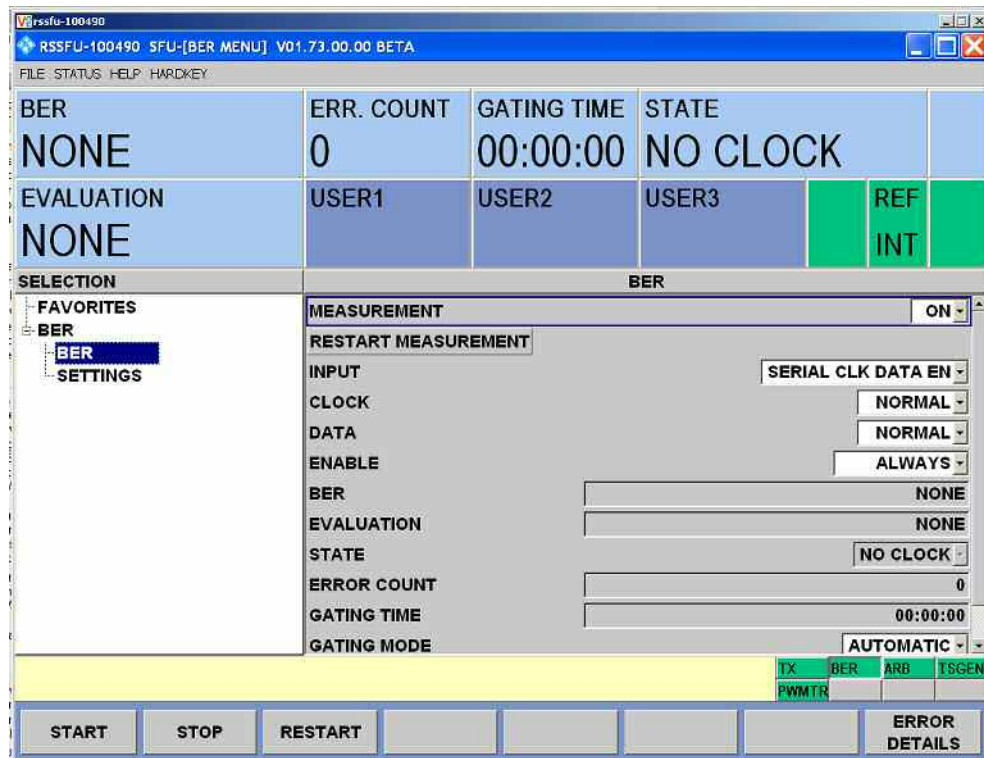


Set the following values:

Menu item	Value	Remarks
PAYLOAD	PRBS	The data content of the BER generator consists of a PRBS.
PRBS	2 ²³ -1 (ITU-T O.151)	Here, the type of PRBS is specified in greater detail. You should select the same sequence that is set on the BER generator.

Now, select the main window of the bit error rate meter in the tree (BER / BER).

Figure 2.8-6 BER main window



Set the following values:

Menu item	Value	Remarks
INPUT	SERIAL CLK DATA EN	The serial data input is used for the bit error rate measurement.
CLOCK	NORMAL	The rising edge of the input clock is used for data timing.
DATA	NORMAL	Normal setting. The polarity of the data is not inverted.
ENABLE	ALWAYS	In this example, the ENABLE input is not used.
MEASUREMENT	ON	The measurement is initiated.

2.8.2.3 Initiating a Measurement

Menu item	Value	Remarks
MEASUREMENT	ON	The measurement is initiated.

The bit error rate measurement has now been activated. Display of the measurement results is illustrated in the following table.

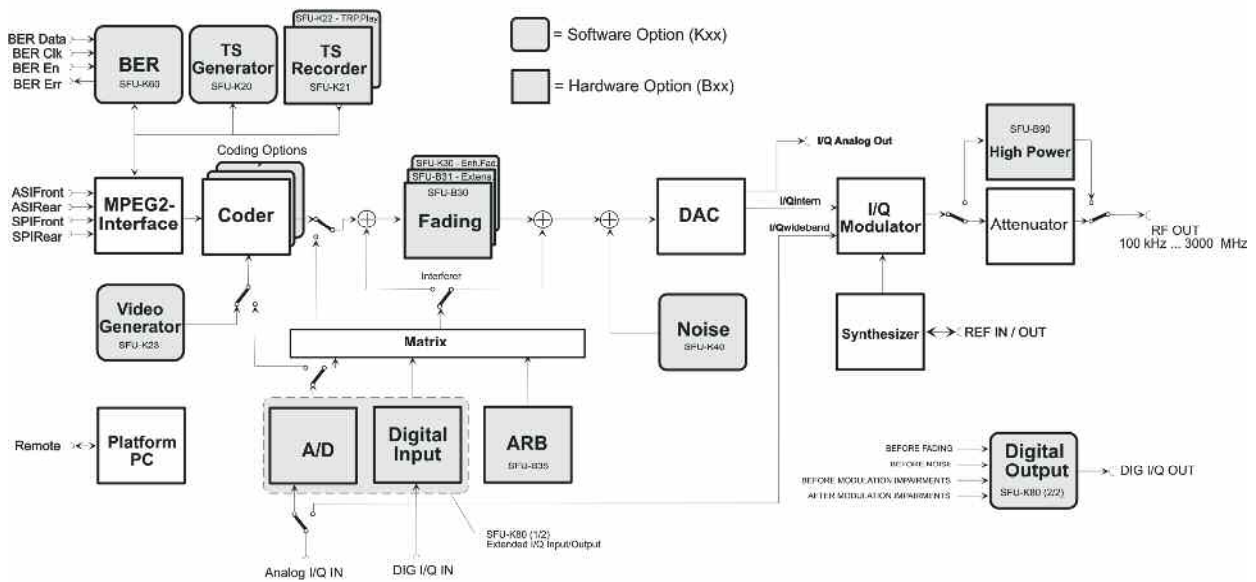
Menu item	Display	Remarks
BER	e.g.: 0.00E-07	Display of the measured bit error rate. The BER generator might be able to generate intentional bit errors in certain cases. The BER display should then change accordingly.
EVALUATION	e.g.: 6.3E9/1E10	For details, please see Chapter 4 (BER / EVALUATION)
STATE	SYNC	The bit error rate measurement is synchronized to the PRBS.
ERROR COUNT	e.g.: 0	Total number of bit errors detected during the measurement.
MEASUREMENT TIME	e.g.: 00:31:15	The measurement has been running for this amount of time (here: 31 minutes and 15 seconds).

You can restart the measurement by pressing the **RESTART MEASUREMENT** button.

You can also use the **START**, **STOP** and **RESTART** softkeys to control the measurement.

2.9 Basic Instrument Concept

Figure 2.9-1 The R&S SFU is a flexible hardware platform



2.9.1 The Instrument's Baseband Section

The instrument's baseband section contains the hardware for generating and processing I/Q signals. It is entirely digital in design.

Input interface

This subassembly provides all of the transport stream (TS) interfaces and handles processing of the transport streams. It also includes all of the interfaces needed for BER measurement and the inputs for analog and digital I/Q signals. The TS generator and TS recorder options are also found here. The ARB hardware option can also be installed on this subassembly.

Coder

The coder receives the processed transport stream signals from the input interface and performs the FEC for the selected digital TV standard. The subassembly generates digital I/Q signals which are forwarded to the digital baseband section.

D/A converter

This module is situated at the end of the digital baseband section. It converts the digital signal into an analog I/Q signal. This analog I/Q signal feeds the I/Q modulator. The D/A converter also provides the analog I/Q outputs. Using the AWGN software option (Option R&S SFU-K40 Noise Generator 2110.7653), additive Gaussian white noise can be generated.

Fading module

This module allows fading on baseband signals in real time. In case of standard fading, up to 20 fading paths (40 paths with option R&S SFU-B31) are possible simultaneously. The software option R&S SFU-B30 includes dynamic fading configurations (moving propagation and birth-death) as well as fine delay configurations with increased resolution of the fading path delay.

2.9.2 The Instrument's RF Section

The instrument's RF section contains the **synthesizer, output section with I/Q modulator** and **calibration line**.

The frequency range is from 100 kHz to 3 GHz.

Using the option R&S SFU-B90 High Power + Overload Protection 2110.8008, the RF path can be configured for higher output levels.

For more information about the different options, please consult the data sheet and the R&S SFU Configuration Guide which is found on the R&S SFU homepage on the Internet.

3 Manual Operation






3.1 Introduction

The instrument can be operated manually in several different ways:

- ◆ **Using the controls on the front panel:**
The instrument is operated using the buttons on the front panel and the rotary knob. Pressing the rotary knob has the same function as pressing the ENTER key.
- ◆ **Via an external keyboard and mouse:**
A USB keyboard and also a USB mouse can be connected to the USB jacks on the front panel or the rear panel.
The hardkeys of the R&S SFU can be selected using the mouse in the HARDKEY SELECTION menu.
- ◆ **Remote operation:**
The R&S SFU can be operated if so desired using remote operation (e.g. with Remote Desktop or VNC).
The instrument has to be connected to an Ethernet network. The Ethernet address is used to connect the PC and R&S SFU. The screen of the R&S SFU is then displayed on the PC monitor. The R&S SFU can now be operated with the PC keyboard and mouse.
The hardkeys of the R&S SFU can be selected using the mouse in the HARDKEY SELECTION menu.

Equal Access Rights for Manual Operation

The access rights are the same whether the instrument is operated using the front-panel controls or the keyboard and mouse.

Use the buttons on the front panel (  and  ) to navigate in the tree. Each entry is terminated with the  key. The rotary knob and its Enter function (press the rotary knob) can be used for navigation purposes.


Navigation in the tree is possible using the USB keyboard and the cursor keys (or the USB mouse and the mouse buttons).

Local operation and remote operation also have equal access rights during VNC operation. In “Remote Desktop” mode, remote operation is the only choice.

All Operating Modes are Possible Simultaneously

Example:

During VNC operation using a connected PC, a user selects the FREQUENCY menu item in the R&S SFU’s tree using the USB mouse. At the same time, another user can change the value using the rotary knob and the numerical keys on the instrument’s front panel.


The entry can be terminated using the  key on the instrument or the ENTER key with the USB mouse that is connected.

3.2 Operating Concept

3.2.1 Different Applications in the R&S SFU

The R&S SFU is an instrument platform that is designed for diverse applications (for example TX, BER, TSGEN, ARB,...). Every application is a separate unit and is operated independently of the other applications (more or less like two separate instruments). If links between the applications are required, you can switch to additional applications.

3.2.2 Selecting the Application

When you press the  key, the applications available in the instrument will be displayed above the soft keys. Select the application to appear in the foreground.

To change the settings or to read off the measured values, navigate in the application's tree. The main parameters of each application are shown in the INFO area. The softkey assignments will change when you change applications. All of the other applications will be in the background. They are activated when you switch to them.

3.2.3 Information about the Different Applications

To obtain details about settings or measured values for a specific application, you must select the application in question (i.e. bring it to the foreground).

This information is called up when you press the STATUS button and then select the application.

In each application, there is a different number of user fields available in the INFO area. A setting or a measured value from another application is shown in these user fields.



Example: In the TX application, there are three free user fields in the INFO area. In one of these user fields, the current bit error ratio status in the BER application can be shown.

3.2.4 Possible Actions within an Application

In a given application, different selections, settings or entries can be made. Different measured values can also be displayed.


3.2.4.1 Navigating in the Tree

The menu tree is used to navigate in the application's menus. The tree consists of main items and sub items (where necessary). The position in the tree of the currently selected application is marked accordingly.



Use the   buttons or the rotary knob to navigate in the vertical direction.

To navigate in the tree, place the mouse pointer on a tree element and mark it by clicking on the mouse. The marker will appear at the location where the cursor is currently located. This marker will move appropriately.

Any sub items present in the branches of the tree can be opened and closed for a given main item.


Open and close the sub items with the  button or by pressing the rotary knob.

Double clicking on the mouse will have the same effect.

When navigating with the  and  buttons or the rotary knob in the opened tree, you will automatically branch to the sub-tree. After passing through the sub-tree, you will reach the next main item in the tree.

There is a work view associated with each tree element which is always displayed in relation to the marking in the tree. The work view changes dynamically based on how you navigate in the tree.

If the marker is on a sub item in the tree or on a main item without any


sub items, the work view can be activated by pressing the  key. Double clicking on the mouse will have the same effect.


The tree will stay marked at the place that you switched to in the work view.

3.2.4.2 Navigating in the Work View

You can use the rotary knob and the cursor keys to navigate in the work view. The marker in the work view will follow the cursor commands. Using the rotary knob, you can mark all of the selectable items in the work view one after another. When using the mouse, you can place the mouse pointer on a selected item.

Use the  key (ESCape) or the  button to exit the work view. The BACK menu item in the work view has the same function.

If you exit a given work view, you can press the  key to reactivate it.

The  key does not have the same effect.

3.2.4.3 Measured Value Displays or Settings in the Work View

If all of the measured values and settings in the work view are visible at once without scrolling, then you do not need to activate the work view. If an item is marked in the tree, then the corresponding work view is continually updated and displayed along with the associated measured values and settings.


3.2.4.4 Actions in the Work View

You can switch a parameter (toggle function), e.g. ON/OFF.



You can make a selection, e.g. 1 out of n selection.

You can enter values, e.g. a frequency value.


However, the relevant parameter must be marked in the work view to

perform such actions. Pressing the  key, pressing the rotary knob or double-clicking on the mouse immediately executes a toggle function. A selection or value input is now activated.

A window will open after you make your selection. Use the cursor or rotary knob to make the desired selection and terminate your entry with

the  key. Use the  key to exit the window without changing the values. The input area is activated in case you need to input values. A value that is already present can be modified using the cursor keys and/or the rotary knob. The change will take effect immediately.

Use the digit keys on the front panel or the external keyboard (if present) to enter a new numerical value. Terminate your entry with the

 key. When entering frequencies or levels, you can also use the unit keys on the front panel. If you want to exit the input area without making a change, press the ESC key.

As soon as the action is terminated in the work view and is executed, the parameter will be updated (assuming it is used in an INFO field).

3.2.4.5 Fast Access to Commonly Used Menu Items with Softkeys

In order to clearly structure the operation of the instrument and its front panel, no application-specific hardkeys have been used in the R&S SFU. This helps to maintain clarity.

Important menu items are accessed using the softkeys.

The softkeys have fixed assignments that are independent of the application.

Example: In the TX application, the following commonly used menu items are implemented as softkeys: RF ON/OFF, MODULATION ON/OFF, C/N ON/OFF, FADING ON/OFF.

3.2.4.6 Fast Access to Commonly Used Menu Items with FAVORITES

To allow fast access to commonly used menu items, you can add any of the menu items to your FAVORITES. (You can also delete them from the FAVORITES if you need to.)

The list of FAVORITES can be accessed from every application. Menu items can be added to the list of FAVORITES from any application.

This allows fast operation that goes beyond individual applications.

Press the HOME hardkey to call up the FAVORITES in the tree of the application in question. Since the FAVORITES can contain menu items from all of the applications, the operating speed will be significantly higher with the HOME hardkey.

Example: In the TX application, the FREQUENCY and LEVEL menu items are very commonly used. The FREQUENCY and LEVEL menu items have been saved in the list of FAVORITES.

If the BER application is in the foreground (e.g. when bit errors are measured at the receiver), it is possible with the HOME hardkey to make a level change in the TX application using the LEVEL, FAVORITES selection.

3.3 Display

3.3.1 Applications

The display content is dependent on the current application and the selected operating mode:

Figure 3.3-1 Display areas



Menu Bar

Here, you can use the FILE, STATUS and HELP commands for file management purposes. During remote operation of the instrument, it is also possible to access the hardkeys on the front panel.

Information Area

The information area shows the most important communications parameters. Some of the INFO fields have fixed assignments for each application.

USER Area

Free INFO fields are known as USER fields. These fields can be filled by users with their preferred display parameters.

Special Fields

Besides the INFO fields and the USER fields, there are three further special fields:

- LEFT:** The special field on the left indicates whether the instrument is being remote-controlled/remote-operated (and if so, how).
- CENTER:** The special field in the center shows what has been selected. The instrument reference is supplied externally (REF EXT) or the internal instrument reference is used (REF INT). The green color means: Reference OK. The red color means that problems have occurred with the reference.
- RIGHT:** The special field on the right indicates the status of the output signal or the modulation in the TX application: MOD OFF, RF OFF (or empty field if both are switched on).

Tree and Work View

The tree is arranged on the left side. You can use the tree to navigate the menus. You can open and close the existing branches of the tree. If the tree is longer than the tree field, only a portion of the tree will appear, but you can scroll through all of it.

Located to the right of the tree is the work view which corresponds to the selected tree element. Use the work view to input data, make selections and turn parameters ON and OFF.

Error / Status Display

Error messages or warnings for the current application are shown in this line.

The right part of the line contains fields which show all of the active applications.

If the field for an application is green, this means that no errors or warnings are present.

Yellow indicates that there is a warning for the application in question.

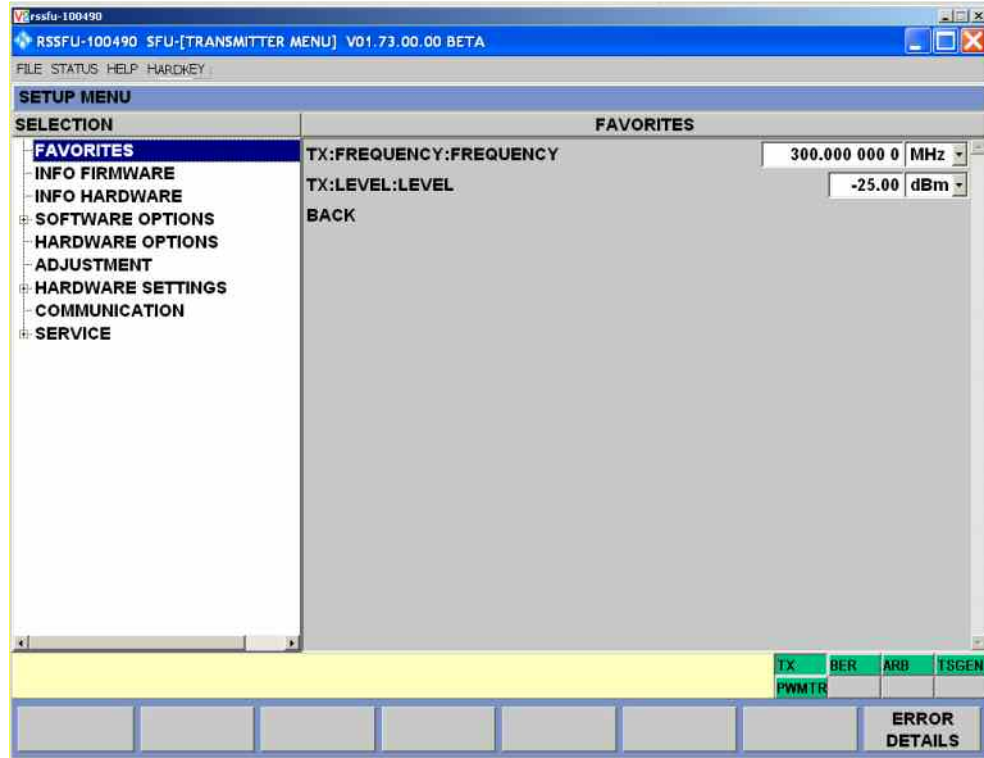
Red indicates that there is an error for the application in question.

Softkey Labels

There are eight softkeys. The labeling for the softkeys will vary from application to application.

3.3.2 Setup

Figure 3.3-2 Screen layout for SETUP



Menu Bar

See Section "[Menu Bar](#)".

Tree and Work View

The tree is arranged on the left side. You can use the tree to navigate the SETUP menus. You can open and close the existing branches of the tree.

Located to the right of the tree is the work view which corresponds to the selected tree element. In the work view for SETUP, you can input data and make settings that apply to the whole instrument (i.e. all applications).

The user can also get information about the software version used in the instrument.

Calibration routines and software updates are also activated here.

Error / Status Display

Error messages or warnings for the current application are shown in this line.

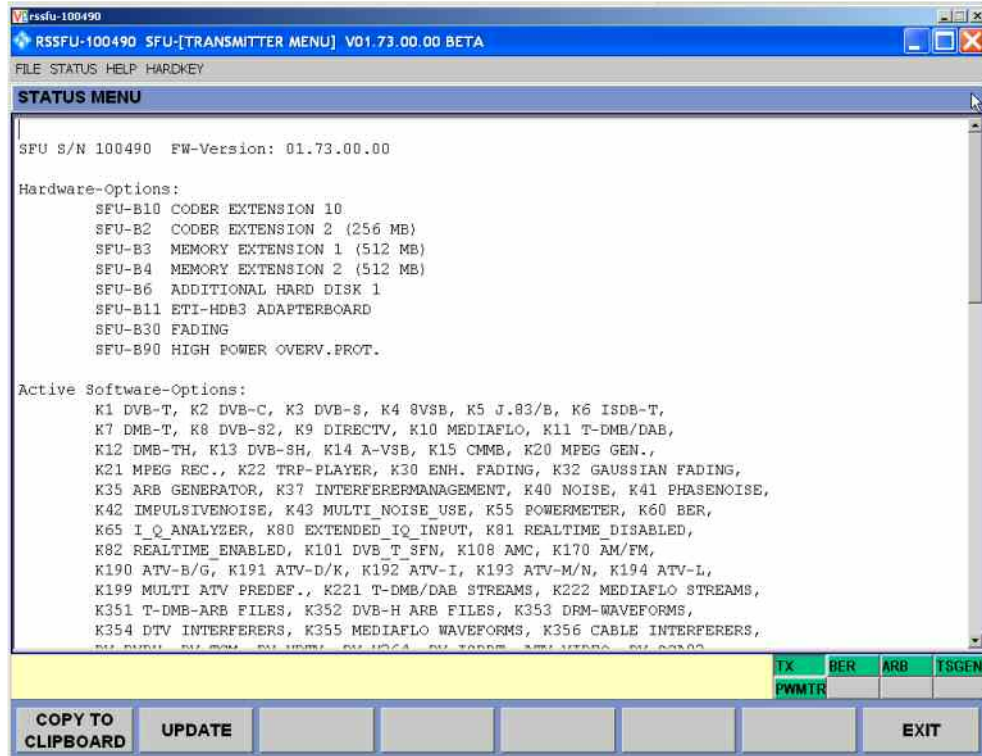
The right part of the line contains fields which show all of the active applications.

Softkey Labels

There are 8 softkeys. The labeling for the softkeys can vary from tree element to tree element.

3.3.3 Status

Figure 3.3-3 Screen layout for STATUS



Menu Bar

See Section "[Menu Bar](#)".

Text Output of the STATUS

The instrument status is output in text format.

You can scroll through the display if the text is too long.

Message Line

Error messages or warnings for the current application are shown in this line.

The right part of the line contains fields which show all of the active applications.

SOFTKEYS

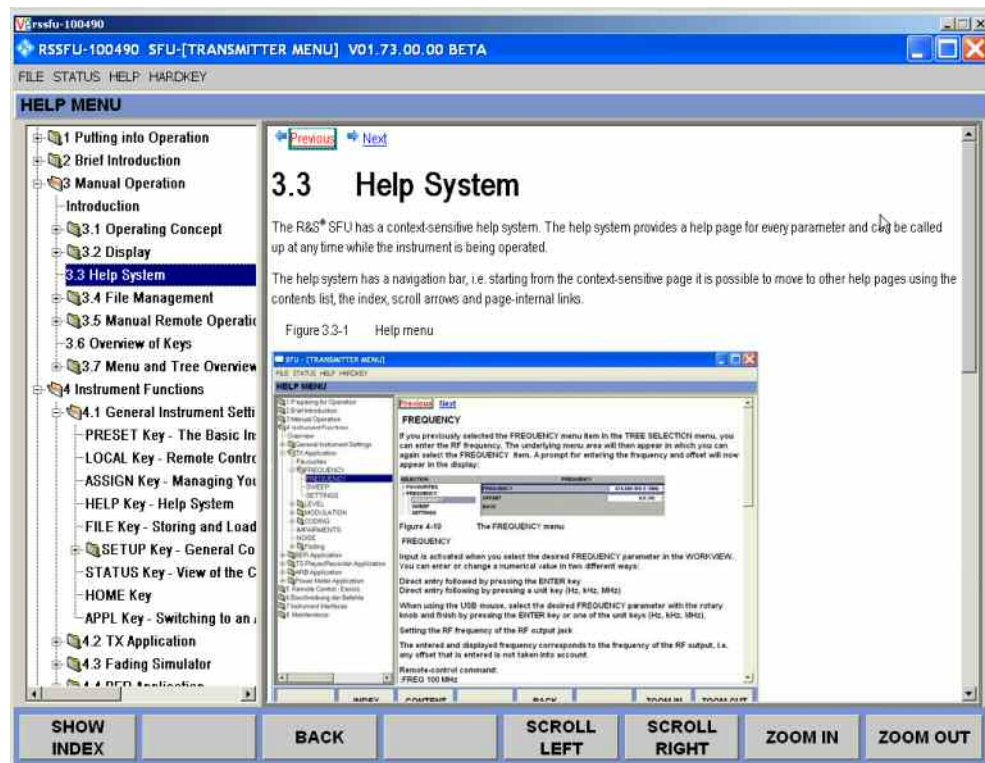
There are 8 softkeys. Use the softkeys to copy the status information to the clipboard or to update the status display.

3.4 Help System

The R&S SFU has a context-sensitive help system. The help system provides a help page for every parameter and can be called up at any time while the instrument is being operated.

The help system has a navigation bar, i.e. starting from the context-sensitive page it is possible to move to other help pages using the contents list, the index, scroll arrows and page-internal links.

Figure 3.4-1 Help menu



In addition to the context-sensitive help, online help for all functions of the R&S SFU is compiled on the supplied CD-ROM. This help can be called up on any computer using the Internet Explorer (version 4.0 and higher).

Operating the Context-Sensitive Help

Function	Front panel	Mouse
<p>Open help</p> <p>Help page for selected parameter is displayed.</p>	Press HELP key.	Click on HELP/CONTENTS
Close help	Press HELP key again.	Click on HELP/CONTENTS
<p>Activate link</p> <p>Help opens linked page.</p>	Highlight link using rotary knob or arrow keys and activate with rotary-knob click or ENTER key.	Click link.
Scroll through help	Highlight Previous or Next in help window using cursor keys and activate with rotary-knob click or ENTER key.	Click Previous or Next .
<p>Select item from contents list</p> <p>Help page for selected item is displayed.</p>	Press Show Contents button below index list. Highlight desired item using rotary knob or cursor keys and then press rotary knob or ENTER key.	<p>Click Show Contents</p> <p>Click item.</p>
<p>Select index item</p> <p>Help page for selected item is displayed.</p>	<p>Press Show Index button below contents.</p> <p>Type desired term in entry field and then press rotary knob or ENTER key</p> <p>or</p> <p>highlight item using rotary knob or cursor keys and then press rotary knob or ENTER key.</p>	<p>Click Show Index</p> <p>Click item.</p>

3.5 Remote Operation

The R&S SFU can be remote-operated from an external PC. This allows convenient operation of the Broadcast Test System from the desktop although the instrument is integrated in a rack in the next room.

Remote operation (in contrast to remote control) does not use remote control commands but separate Windows software which is installed on the external PC.

There are two possibilities: Usage of VNC or Remote Desktop.

3.5.1 Remote Desktop

When launched, the Windows XP software **Remote Desktop Connection** simulates the R&S SFU user interface. This allows the instrument to be manually operated at the external computer in the same way as at the instrument itself.

A precondition for remote operation is a connection between test system and PC via a LAN network and the installation of the software on the PC.

How to set up a connection and install the remote operation software on the external computer is described in Chapter 1.

Remote operation is started on the external computer by calling up the **Remote Desktop Connection** program and clicking the **Connect** button. The R&S SFU must be selected for remote operation, i.e. its computer name must be displayed in the **Computer:** window.



If the PC is configured for remote operation of several instruments, the instruments are in the list selected with the button. The user ID and password (**instrument** in both cases) can be stored when the software is first installed. The entries are made in the extended menu "Options>>".



After login, the instrument firmware of the R&S SFU boots on the external PC. After booting is completed, the test system's screen appears and the R&S SFU is ready for remote operation from the external computer. The start settings that were active before the connection was established are used unless another start setting is explicitly selected in the **File** menu. The individual functions are operated using the mouse and keyboard. Front-panel keys which are not directly available on the keyboard can be substituted by key combinations (see table in the section below).

The device firmware of the R&S SFU is disabled when the connection is set up. Operation at the R&S SFU itself is not possible during remote operation. Access by an external computer and the identity of the remote user is indicated on the login display of Windows XP Embedded.

For return to direct operation on the R&S SFU, the external user must be logged off and the local user logged on.

The external user can log off in the **Start** menu on the external controller by clicking **Disconnect** in the lower right-hand corner of menu.

Figure 3.5-1 Log-off in the remote operation message window

This log-off is also possible in the remote operation message window on the R&S SFU.

Log-in of the local user is possible only in the remote operation display on the R&S SFU. In the R&S SFU, the local user can log in with the name "**Instrument**" as standard; the password is also "**Instrument**". After local log-in, the instrument software starts with the settings made during remote operation unless another start setup was explicitly selected in the **File** menu.

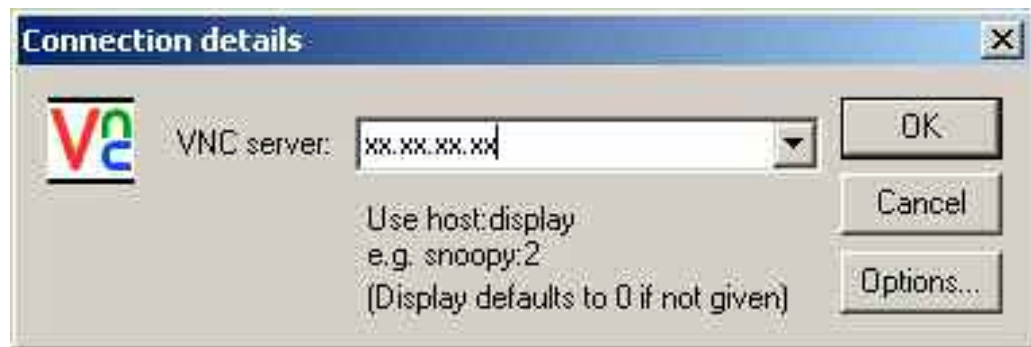
3.5.2 VNC

Once it is launched, VNC simulates the user interface of the R&S SFU. This allows the instrument to be manually operated at the external computer in the same way as at the instrument itself.

For remote operation to work, there must be a connection between the test system and computer via a LAN, VNC viewer must be installed on the computer and VNC server must be installed on the R&S SFU test system.

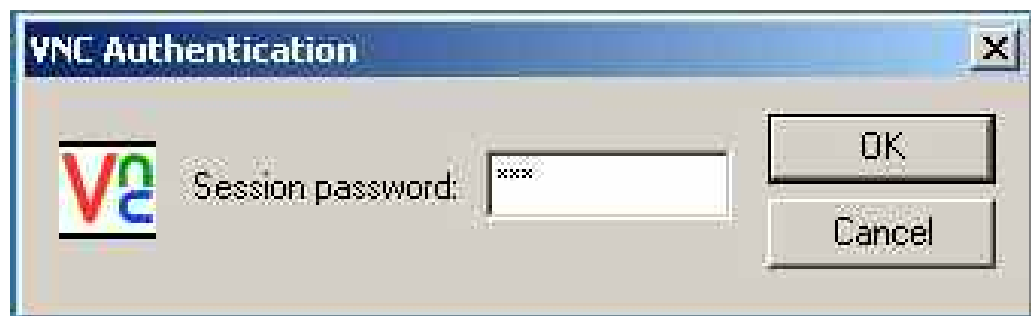
Remote operation is launched on the external computer by launching the VNC viewer. The R&S SFU must be selected as the instrument for remote operation, i.e. its IP address must be entered in the Connection details window (VNC server).

Figure 3.5-2 Connection details



Click on the OK button to establish the connection. You will be asked for the session password.

Figure 3.5-3 VNC Authentication





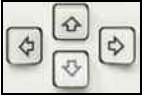










After entering the password **SFU**, the screen of the test system will appear on the external computer.











If you need to directly operate the R&S SFU, it is not necessary to log off the external user.

The external user can end remote operation on the external window by closing the VNC application.

3.6 Overview of Keys

The table lists all key functions available on the front panel. The table also gives the PC keyboard key combinations which can be used to trigger the functions of the keys on the front of the instrument.

Key on front panel	With PC keyboard	Function
	Tab key (move left) Shift + Tab (move right)	The rotary knob moves the input point.
	Enter	The rotary knob is used to terminate an entry (like the ENTER key).
	Cursor keys	Moves the input point.
	. / *...#	Enters a period/decimal point. Enters a special character.
	CTRL - / (shift+) a—z	Enters the sign. Switches between upper-case and lower-case letters.
	0-9 / a...z	Enters numbers/letters.
	Backspace	Deletes the last entry (digit, sign or decimal point)
	Enter	Terminates an entry.
	ESC	Changes to the next higher menu/selection level. When you leave edit mode with ESC, the previous value is restored.
	Delete	Deletes the last entry.
	ALT + F10	Selects units of MHz, or dBµV for the RF level.
	ALT + F11	Selects units of kHz, or dBm for the RF level.
	ALT + F12	Terminates entries in the basic unit and dimensionless entries. Selects Hz as the unit. Selects dB for the level offset and level step size.

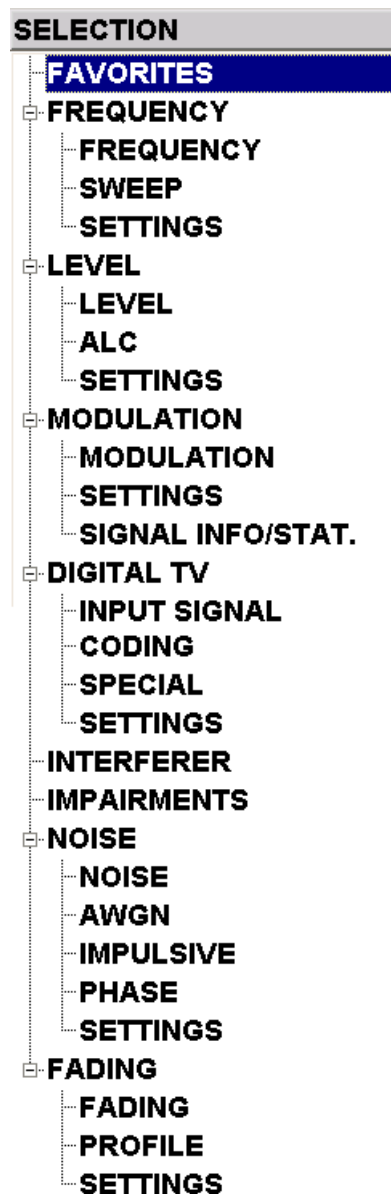
Key on front panel	With PC keyboard	Function
	CTRL + 1 – 8	Triggers the function assigned to the softkey.
	F4	Sets a defined state for the instrument.
	F3	Switches from remote control to manual operation.
	F2	Starts management of FAVORITES.
	F1	Opens and closes the context-sensitive help function.
	F5	Activates the menu for saving instrument settings.
	F6	Opens the SETUP menu for general instrument settings.
	F7	Displays the instrument status.
	F8	Resets tree navigation.
	F9	Selects another application.

3.7 Menu and Tree Overview

The menu, setup and trees for various applications are shown in the following sections.

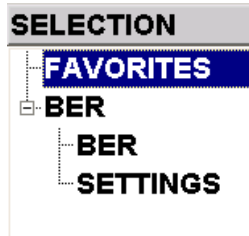
3.7.1 TX Tree Overview

Figure 3.7-1 The TX menu



3.7.2 BER Tree Overview

Figure 3.7-2 The BER menu



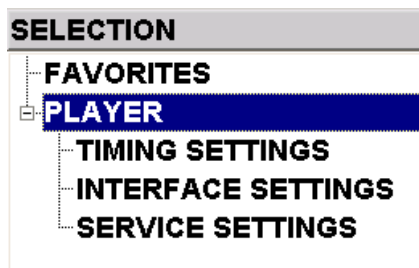
3.7.3 ARB Tree Overview

Figure 3.7-3 The ARB menu



3.7.4 TSGEN / TSREC Tree Overview

Figure 3.7-4 The TSGEN / TSREC menu



3.7.5 POWERMETER Tree Overview

Figure 3.7-5 The POWERMETER menu



3.7.6 Setup Tree Overview

Figure 3.7-6 The Setup menu

