Service Manual

Signal Generator

R&S® SMB100A

1406.6000.02

ROHDE&SCHWARZ
Test and Measurement

Dear Customer,

throughout this manual, the Signal Generator R&S® SMB100A is abbreviated as R&S SMB.

The firmware of the instrument makes use of the operating system LINUX® and other 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 on the user documentation CD-ROM (included in delivery).

Package	Link	License
LINUX® Kernel	http://www.linux.org/	GPL 2
gLibc	http://www.gnu.org/software/libc/	LGPL
busybox	http://www.busybox.net/	GPL 2
OpenSSL	http://www.openssl.org/	OpenSSL / SSLeay
XFree86	http://www.xfree86.org/	XFree86
Xitami	http://www.xitami.com	NetSnmp-5.0.8
PHP	http://www.php.net	2.5b6
OpenSSL	http://www.openssl.org	BSD
BOOST Library	http://www.boost.org	Artistic
zlib	http://www.zlib.net	Boost Software, v.1
PC/SC-Lite	http://www.linuxnet.com/	ACE_TAO

The OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/). includes cryptographic software written by Eric Young (eay@cryptsoft.com) and software written by Tim Hudson (tjh@cryptsoft.com).

LINUX® is a trademark of Linus Torvalds.

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

Chapter Overview

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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.

Symbols and safety labels

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

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

Tags and their meaning

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

indicates a hazardous situation which, if not avoided, will result in death or serious injury.

indicates a hazardous situation which, if not avoided, could result in death or serious injury.

indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

indicates the possibility of incorrect operation which can result in damage to the product.
In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

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

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

Electrical safety

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

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

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

Operation

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

Repair and service

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

Batteries and rechargeable batteries/cells

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

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

Transport

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

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

Waste disposal

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

Informaciones elementales de seguridad

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

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

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

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

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

Símbolos y definiciones de seguridad

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

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

Palabras de señal y su significado

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

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

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

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

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

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

Estados operativos y posiciones de funcionamiento

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

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

Seguridad eléctrica

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

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

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

Funcionamiento

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

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

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

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

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

Transporte

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

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (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.

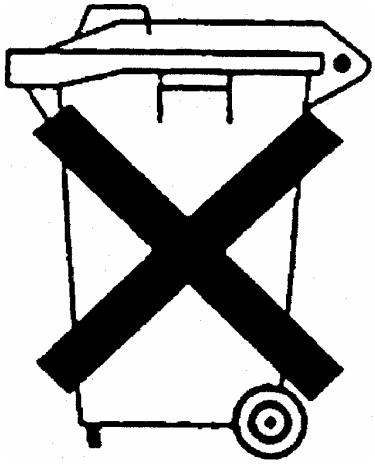
Kundeninformation zur Batterieverordnung (BattV)

Dieses Gerät enthält eine schadstoffhaltige Batterie. Diese darf nicht mit dem Hausmüll entsorgt werden.

Nach Ende der Lebensdauer darf die Entsorgung nur über eine Rohde&Schwarz-Kundendienststelle oder eine geeignete Sammelstelle erfolgen.

Safety Regulations for Batteries (according to BattV)

This equipment houses a battery containing harmful substances that must not be disposed of as normal household waste.



After its useful life, the battery may only be disposed of at a Rohde & Schwarz service center or at a suitable depot.

Normas de Seguridad para Baterías (Según BattV)

Este equipo lleva una batería que contiene sustancias perjudiciales, que no se debe desechar en los contenedores de basura domésticos.

Después de la vida útil, la batería sólo se podrá eliminar en un centro de servicio de Rohde & Schwarz o en un depósito apropiado.

Consignes de sécurité pour batteries (selon BattV)

Cet appareil est équipé d'une pile comprenant des substances nocives. Ne jamais la jeter dans une poubelle pour ordures ménagéres.

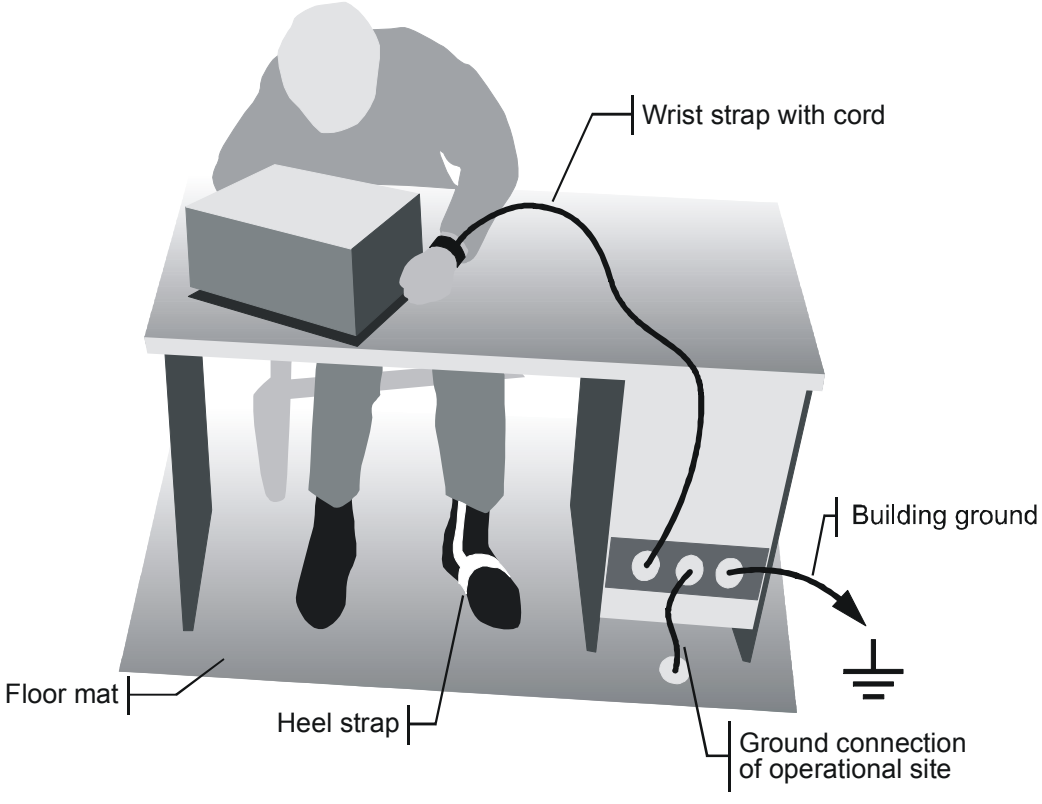
Une pile usagée doit uniquement être éliminée par un centre de service client de Rohde & Schwarz ou peut être collectée pour être traitée spécialement comme déchets dangereux.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).



The following two methods of ESD protection may be used together or separately:

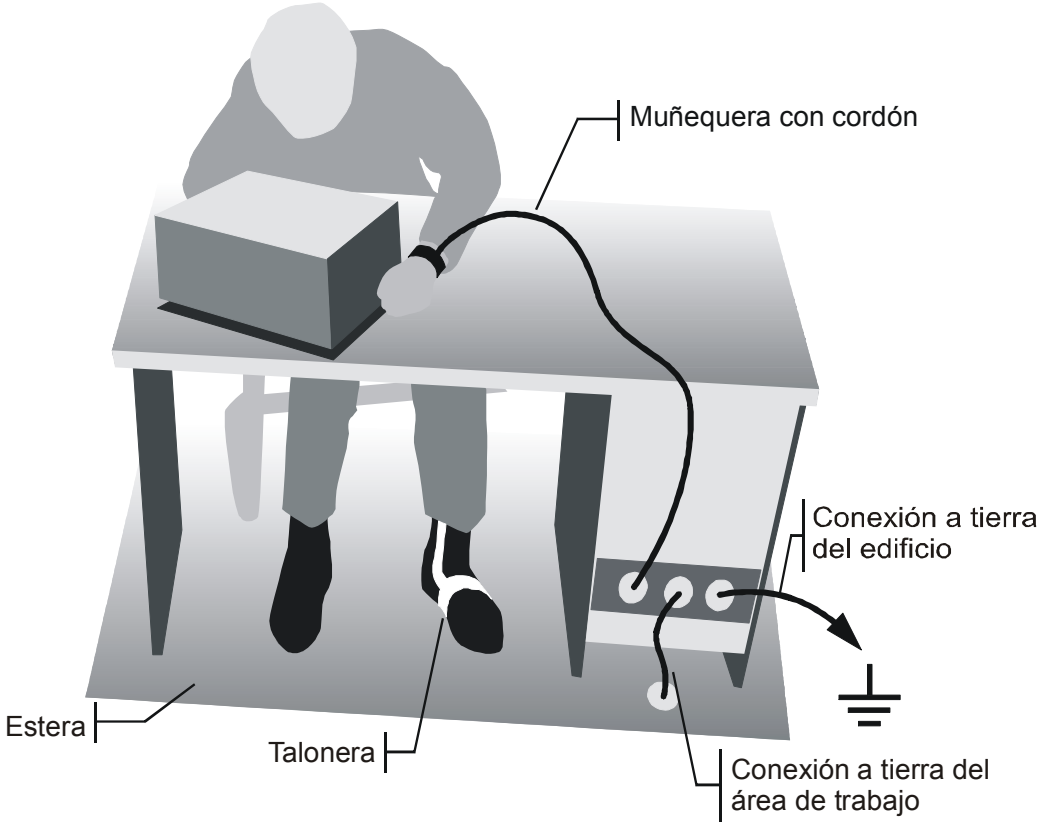
- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

Para evitar averías en los componentes electrónicos, el área de trabajo tiene que estar protegido contra descargas electroestáticas ESD (electrostatic discharge).



Los siguientes dos métodos de protección ESD pueden ser usados juntos o separados:

- Muñequera con cordón para conexión a tierra
- Combinación de estera antiestática y talonera

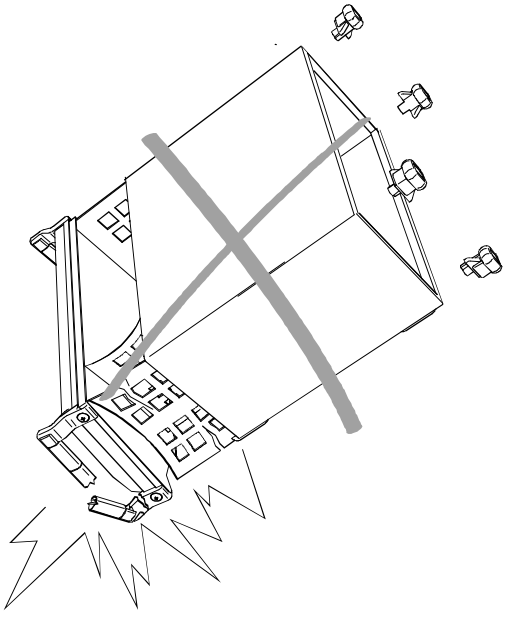
Safety Instructions for Units with Removable Cabinet

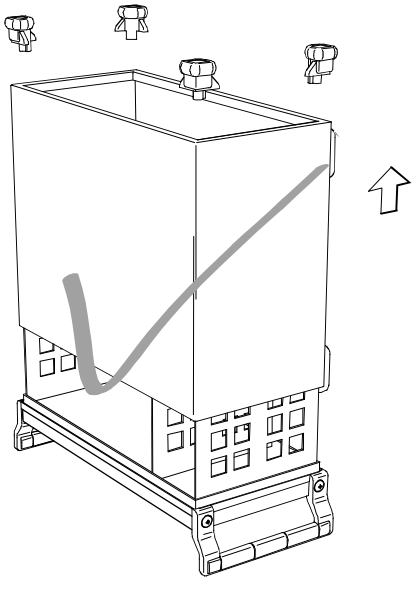
⚠ WARNING

Danger of injuries

When removing the rear feet, the unit can slip out of the cabinet.

Put the unit onto the front handles, before removing the rear feet and taking off the cabinet. Thus the risk of personal injuries and damages to the unit is avoided.





When mounting the cabinet take care not to pen in the fingers. Also pay attention not to damage or pull off cables. Screw the rear feet back on immediately after mounting the cabinet. Do not move the unit with the rear feet missing.

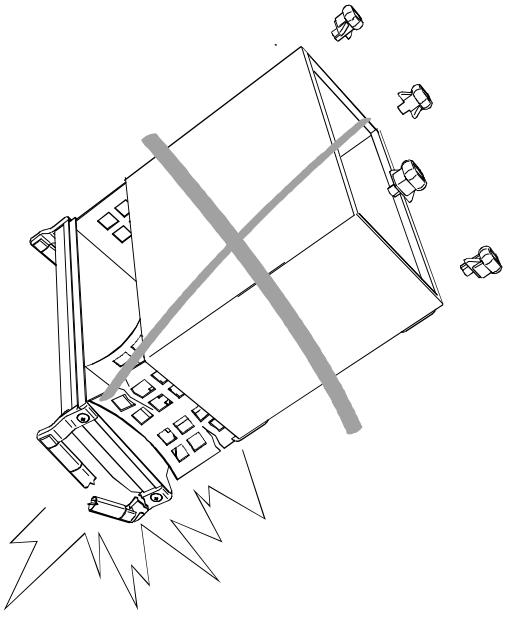
Informaciones de seguridad para aparatos con tubo de quita y pon

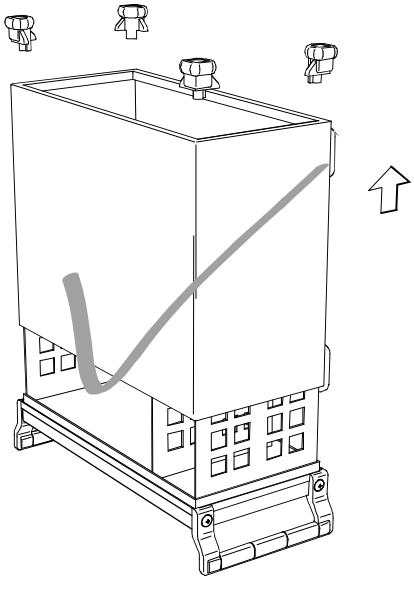
⚠ ADVERTENCIA

Peligro de heridas

Al sacar los piés de la pared posterior puede deslizarse el aparato fuera de la caja.

Posicionar el aparato de manera segura sobre las asas delanteras, antes de sacar los piés de la pared posterior y entonces sacar la caja. De esta manera evitarán el riesgo de daños en personas y daños en el aparato.





Existe el riesgo de heridas en el momento de poner otra vez la caja, como por ejemplo posiblemente engancharse los dedos. Por favor tengan además en cuenta de que no se enganchen o desconecten cables. Por favor atornillen los piés de la pared posterior directamente despues de poner la caja. No muevan el aparato nunca sin que los piés de la pared posterior estén atornillados.

Procedure in Case of Service and Ordering of Spare Parts

This section contains information on shipping an instrument to your service center and ordering spare parts.

Please contact your local Rohde & Schwarz service center if you need service or repair work of your equipment or to order spare parts. The list of the Rohde & Schwarz representatives is provided at the beginning of this service manual. You can find the current address of your representative on our homepage www.rohde-schwarz.com. Navigate to Service & Support / Service Locations.

Shipping the Instrument

We require the following information in order to answer your inquiry fast and correctly and to determine whether the warranty is still valid for your instrument:

- Instrument model
- Serial number
- Firmware version
- Must the instrument be returned with this firmware?
- Detailed error description in case of repair
- Indication of desired calibration
- Contact person for possible questions

In some countries, an RMA process is available for the return shipment of the instrument. For details, contact your local representative.

When shipping the instrument, be careful to provide for sufficient mechanical and antistatic protection.

- Use the original packaging for transporting or shipping the instrument. The protective caps for the front and rear prevent damage to the operating elements and the connectors.
- If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the box. Wrap antistatic packing foil around the instrument to protect it from electro-static charging.

Rohde & Schwarz offers repair and calibrations of the test systems it produces. The calibration documentation fulfills ISO 17025 requirements.

Shipping Defective Modules

Also when shipping a module, be careful to provide for sufficient mechanical and antistatic protection.

- Ship the module in a sturdy, padded box.
- Wrap the module in antistatic foil.

If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the tightly fitting packaging is conductive.

Exception:
If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

Ordering Spare Parts

To deliver spare parts promptly and correctly, we need the following information:

- Stock number (see list of spare parts in chapter "Documents")
- Designation
- Component number according to list of spare parts
- Number of pieces
- Instrument type for which the spare part is needed
- Instrument stock number
- Instrument serial number
- Contact person for possible questions

Refurbished Modules

Refurbished modules are an economical alternative to original modules. Bear in mind that refurbished modules are not new, but repaired and fully tested parts. They may have traces from use, but they are electrically and mechanically equivalent to new modules.

Your Rohde & Schwarz representative will be happy to inform you about which modules are available as refurbished modules.

Taking Back Defective Replaced Modules

Defective modules of the replacement program which cannot be repaired are taken back within three months following delivery. A repurchasing value is credited.

Excluded are parts which cannot be repaired, e.g. printed boards that are burnt, broken or damaged by attempts to repair them, incomplete modules, and parts with severe mechanical damage.

Please return the defective replacement modules, together with the accompanying document for returned merchandise, which you received with the spare module. We need the following information:

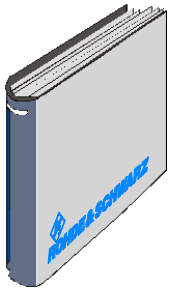
- Stock number, serial number and designation of the removed part
- Detailed error description
- Stock number, serial number and type of instrument from which the module was removed
- Date of removal
- Name of the engineer/technician who replaced the module
- R&S ordering number
- Service reference number (if available)

Contents of User Documentation for Signal Generator R&S SMB

The user documentation describes the Signal Generator R&S SMB and all options. It includes a printed Quick Start Guide and a CD-ROM with the complete operating and service manual in printable pdf-format.

The R&S SMB is equipped with a context-sensitive online help that offers a help page for each instrument function.

Quick Start Guide

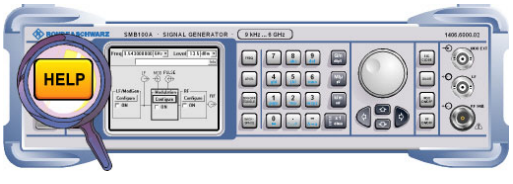


The present quick start guide describes everything that is needed to put the instrument into operation and to get familiar with the generator. The quick start guide gives an introduction to remote control and manual control via external monitor, mouse and keyboard.

The quick start guide is subdivided into the data sheet plus 3 chapters plus index:

The data sheet	informs about specifications and characteristics of the instrument.
Chapter 1	describes the control elements and connectors on the front and rear panel as well as all procedures required for putting the instrument into operation.
Chapter 2	gives an introduction the operating concept and typical applications of the R&S SMB.
Chapter 3	describes key operating modes, the structure of the graphical interface and the principles of manual control.
Annex	lists the remote-contol commands in alphabetical order, and contains an index for the quick start guide.

Help System

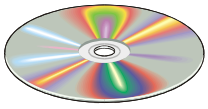


The help system is embedded in the instrument, offering quick, context-sensitive reference to the information needed for operation and programming. The help contains the complete user documentation for the Signal Generator including the contents of the present quick start guide.

The help files (*.chm) are also available on the CD-ROM and can

be used as a standalone help.

Documentation CD-ROM

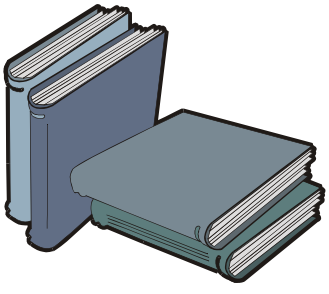


The CD-ROM provides the complete user documentation for the Signal Generator:

- The online help system (*.chm).
- The complete operating manual and service manual in printable form (*.pdf).
- The data sheet (brochure and specifications) in printable form.
- Links to different useful sites in the R&S internet.

Note: *Please use the ADOBE® Acrobat® Reader for PDF files and the browser Internet Explorer® ≥ 4.0 for the HTML help.*

Optional Documentation



The printed version of the operating and service manual provides the contents of the quick start manual plus the complete reference and the service information for the Signal Generator. This manual can be ordered as an option (stock no. 1407.0806.32 (English - A4 format) or 1407.0806.39 (English - letter format)); see ordering information in the data sheet.

Note: *The CD-ROM contains the *.pdf version of the manuals.*

Manual Control

The operating manual contains comprehensive information about the instrument functions and remote control, in addition to the chapters of the quick start guide. It includes information about maintenance of the instrument and about error detection listing the error messages which may be output by the instrument. It is subdivided into 10 chapters:

The data sheet	informs about specifications and characteristics of the instrument.
Chapter 1	describes the control elements and connectors on the front and rear panel as well as all procedures required for putting the instrument into operation.
Chapter 2	gives an introduction to the operating concept and typical applications of the R&S SMB.
Chapter 3	describes key operating modes, the structure of the graphical interface and the principles of manual control.

Chapter 4 forms a reference for manual control of the R&S SMB and contains a detailed description of all instrument functions and their application. The chapter also lists the remote control command corresponding to each instrument function.

Remote Control

Chapter 5 describes the basics for programming the R&S SMB, command processing and the status reporting system.

Chapter 6 lists all the remote-control commands defined for the instrument.

Chapter 7 -

Chapter 8 describes preventive maintenance and the characteristics of the instrument's interfaces.

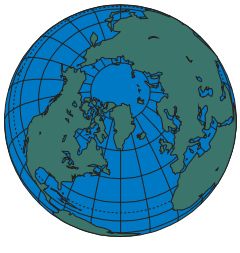
Chapter 9 gives the status messages and a list of error messages that the R&S SMB may generate.

Chapter 10 contains an index for the operating manual.

Service Manual Instrument

The service manual - instrument informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for the maintenance of R&S SMB by exchanging modules. In addition it describes how to perform a firmware update and how to install options.

Internet Site



The Internet site at: Signal Generator R&S SMB100A provides the most up to date information on the R&S SMB. The current operating manual at a time is available as printable PDF file in the download area.

Also provided for download are firmware updates including the associated release notes, instrument drivers, current data sheets and application notes.

Contents - Chapter 1 "Performance Test"

1 Checking the Rated Characteristics

This performance test describes the steps for testing the R&S SMB Signal Generator family and the installed options with respect to function and compliance with specifications.

In the following, the term DUT (Device under Test) is used for any signal generator of this family. The tests to be performed depend on the installed options. The values are given in the data sheet of the respective instrument.

Measuring Equipment and Accessories

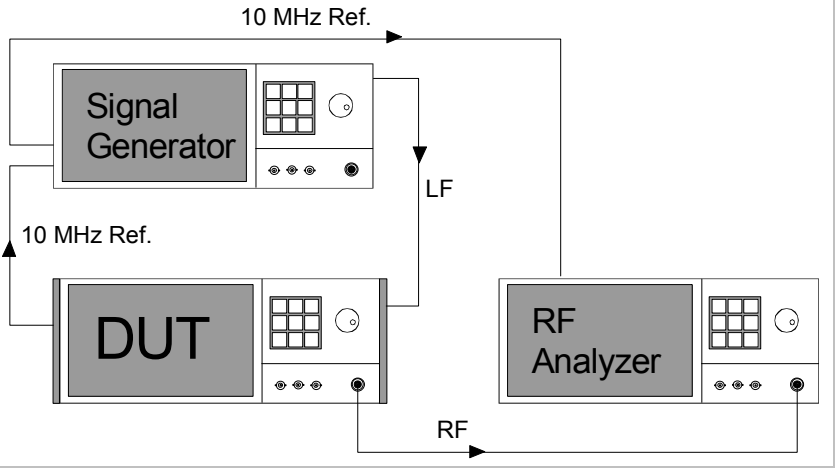
Table 1-1 Measuring equipment and accessories

Item	Type of Instrument	Required Characteristics	Suitable Instrument	R&S Order No.
1	Frequency counter	1 Hz to RF_{max}, resolution 0.1 Hz (included in spectrum analyzer item 18)		
2	Reference source for SSB noise measurements	Identical generator as DUT or generator with at least 10 dB lower SSB noise as DUT Frequency range up to RF_{max}	R&S SMB100A with suited frequency option Reference Synthesizer or R&S SMA100A with option R&S SMA-B106 or R&S SMU200A with option R&S SMU-B106	1406.6000.02 1158.2878 1400.0000.02 1405.0809.02 1142.2005.02 1141.8803.02
5	Signal generator	0.1 MHz to RF_{max}	R&S SMB with option R&S SMB-B106 R&S SMU with options R&S SMU-B106, -B10, -B31 or R&S SMA100A with option R&S SMA-B106	1406.6000.02 1407.2909.02 1141.2005.02 1400.0000.02 1405.0809.02
6	Phase noise test assembly	Phase Noise Test Set or Mixer: 10 MHz to RF_{max}, branching filter 20 MHz, DC decoupling after the mixer	R&S FSUP 8 or FSU or FSQ with phase noise measurement option Mixer: f < 1 GHz: Minicircuits ZFM2H 1 GHz < f < 6 GHz: Miteq DB0118LA2 Preamplifier: based on ADI AD829	1166.3506.08
7	Oscilloscope	Bandwidth ≥ 100 MHz, two channels with DC coupling	Hameg HM1500-2 or similar	
8	RF power meter	9 kHz to RF_{max}	R&S NRP with R&S NRP-Z91 R&S NRP-Z51 or R&S NRVS with R&S NRV-Z5 R&S NRV-Z51	1143.8500.02 1168.8004.02 1138.0005.02 1020.1809.02 0828.3818.02 0857.9004.02
9	Low-noise preamplifier	9 kHz to 1 MHz gain > 20 dB, input noise < 4 nV (1 Hz)	based an ADI AD829	
10	VSWR bridge	100 MHz to RF_{max} directivity > 30 dB	f < 4 GHz: R&S ZRC or f < 6 GHz: Agilent 773D	1039.9492.55
12	RF power amplifier	10 MHz to RF_{max}, power > 33 dBm	Mini Circuits ZHL-03-5WF	

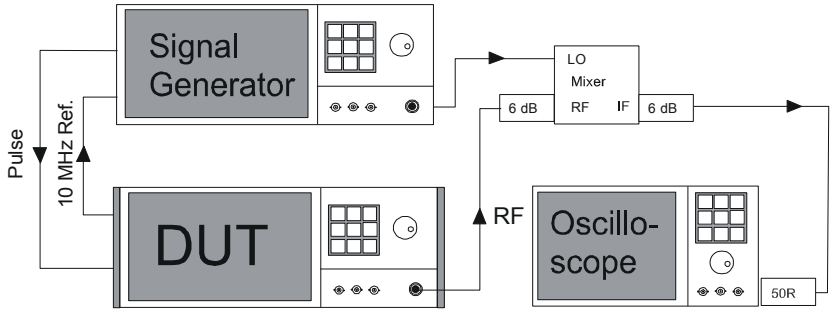
Item	Type of Instrument	Required Characteristics	Suitable Instrument	R&S Order No.
13	Pulse generator	Pulse repetition frequency at least 10 kHz	R&S SMB100A equipped with option K23 or R&S SMA100A	
14	AC/DC voltmeter	10 Hz to 10 MHz	R&S URE3	350.5315.03
15	Broadband FM demodulator	included in spectrum analyzer item 18		
16	RF attenuator	DC to RF_{max}, 10 dB, system N	R&S DNF	0272.4210.50
17	RF attenuator	DC to RF_{max}, 3 dB, system N	R&S DNF	0272.4010.50
18	RF analyzer & Demodulator for analog modulations & FM-demodulator	9 kHz to RF_{max} * 3	R&S FSMR26 with options R&S FSU-B25 R&S FS-B223 or R&S FSQ26 with options R&S FSU-B25 R&S FSQ K7	1166.3311.26 1044.9298.02 1157.1955.26 1155.5001.26 1044.9298.02 1141.1796.02
19	Feed-through termination	50 Ω, BNC system	R&S RAD	0289.8966.00
20	Zero Bias Schottky Detecor	50 Ω	Krytar 202S	
21	Modulation Analyzer	66 MHz to 110 MHz, FM Stereo demodulator, distortion meter, weighting filter ITU-R, ITU-T	R&S FMB with option R&S FMA-B1, R&S FMA-B2, R&S FMA-B3, R&S FMA-B4	856.5005.52 855.2002.52 855.0000.52 856.0003.52 855.6008.52
22	Audio Analyzer	10Hz to 100kHz, S/P DIF source	R&S UPL06/R&S UPL-B29 with BNC/SLR adapters	1078.2008.05
23	RDS Decoder		R&S DMDC	0820.6618.03

Test Assemblies

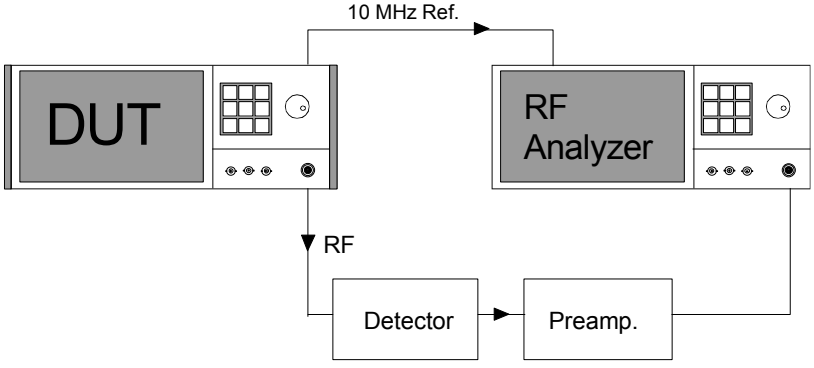
Standard Test Assembly for Analog Modulations

Test equipment	- RF analyzer (*Table 1-1*, item 18) - Signal generator (*Table 1-1*, item 5)
Test setup	The RF analyzer is used as a modulation analyzer. The signal generator is used as modulation source in case of external modulation.
	

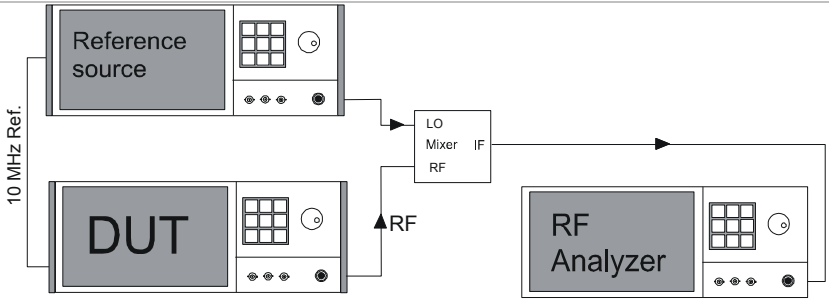
Test Assembly for Pulse Modulation

Test equipment	- Oscilloscope (*Table 1-1*, item 3) - Signal generator (*Table 1-1*, item 5) - Mixer
Test setup	The pulsed RF is mixed down to DC in phase and analyzed with an oscilloscope.
	

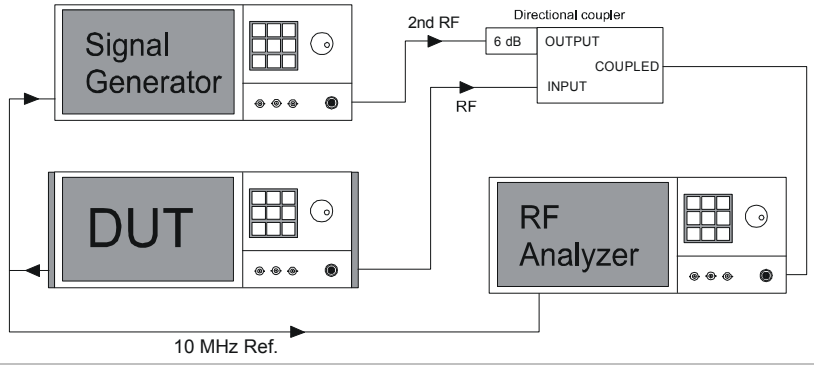
Test Assembly for Residual AM

Test equipment	- RF analyzer (*Table 1-1*, item 18) - Zero Bias Schottky Detector (*Table 1-1*, item 20) - Low Noise Preamplifier 10 Hz – 30kHz, >30dB Gain (*Table 1-1*, item 9)
Test setup	

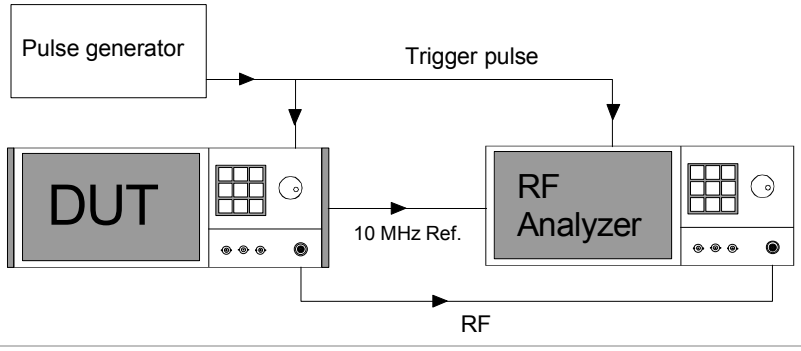
Test Assembly for SSB Phase Noise and Jitter

Test equipment	- SSB reference source (*Table 1-1* item 2), - Phase noise test assembly consisting of - Spectrum analyzer (*Table 1-1* item 18)
Test setup	

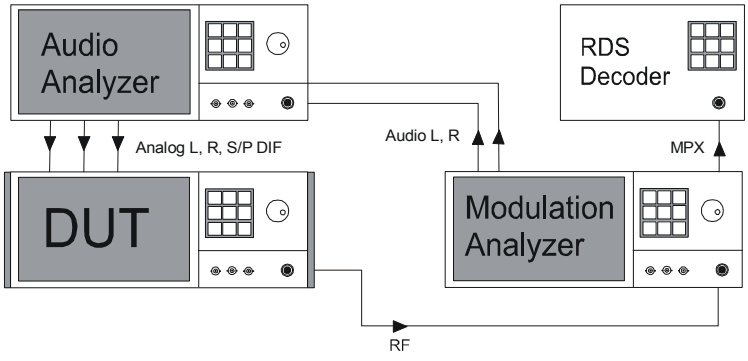
Test Assembly for Output Impedance (VSWR)

Test equipment	- VSWR bridge (*Table 1-1*, item 10), - Second signal generator (*Table 1-1*, item 5) - Spectrum analyzer (*Table 1-1*, item 18)
Test setup	
	Note: *The INPUT of the directional coupler is directly screwed to the DUT. The second signal generator is connected to the line connector (OUTPUT), the analyzer to the coupling output (COUPLED) of the directional coupler.*

Test Assembly for Setting Time

Test equipment	- Spectrum analyzer (*Table 1-1*, item 18) - Pulse generator (*Table 1-1*, item 13)
Test setup	

Test Assembly for Stereo/RDS Coder (Option R&S SMB-B5)

Test equipment	- Modulation analyzer (*Table 1-1*, item 21), - Audio Analyzer (*Table 1-1*, item 22), - RDS Decoder (*Table 1-1*, item 23)
Test setup	

Preparation, Recommended Test Frequencies and Levels

To ensure proper conditions for the performance test and prevent setting errors, the instrument must be prepared as follows:

- Allow for a minimum **warm-up time of 30 minutes** at ambient temperature.
- Carry out all **internal adjustments** (see operating manual, chapter 4, section "Internal Adjustment - Setup-System").
- Press PRESET to establish a defined **initial** state before configuring a new measurement.

The following sections describe the **procedures** for checking the rated values. The **values** are specified in the **data sheet.** Additional uncertainties introduced by the measurement equipment must be taken into account when checking the rated values.

The following table lists the important internal switch point frequencies and the recommended measurement frequencies derived from these frequencies. We recommend measurements at these frequencies unless particular test frequencies are specified. In the following, RF_{max} is the maximal settable RF (depending on installed options).

Table 1-2 Range limits, main test frequencies for CW Mode

Range	Frequency	Hardware switching points	Recommended test frequencies
Direct DDS Synthesis	9 kHz ≤ f ≤ 23.4375 MHz	-	9 kHz; 200 kHz; 1 MHz; 5 MHz; 10 MHz; 23.4375 MHz
Divider/128	23.4375 MHz < f ≤ 46.875 MHz	-	23.438 MHz; 46.875 MHz
Divider /64	46.875 MHz < f ≤ 93.75 MHz	47MHz; 66MHz	46.885 MHz; 65.9 MHz; 93.75 MHz
Divider /32	93.75 MHz < f ≤ 187.5 MHz	94 MHz; 144 MHz; 187 MHz	93.76 MHz; 143.9 MHz; 186.9 MHz
Divider /16	187.5 MHz < f ≤ 375 MHz	265 MHz; 375MHz	187.6 MHz; 264.9 MHz; 374.9 MHz
Divider /8	375 MHz < f ≤ 750 MHz	530MHz; 750MHz	375.1 MHz; 529.9 MHz; 749.9 MHz
Divider /4	750 MHz < f ≤ 1500 MHz	1060MHz; 1500 MHz	750.1 MHz; 1059.9 MHz; 1100 MHz; 1499.9 MHz
Divider /2	1500 MHz < f ≤ 3 GHz	2121 MHz; 3000 MHz	1500.1 MHz; 2120.9 MHz; 2200 MHz; 2999.9 MHz
Base octave	3 GHz < f ≤ 6 GHz	4242 MHz	3000.1 MHz; 3200 MHz; 4241.9 MHz; 5 GHz; 6 GHz

RF_{max} ist the maximum output frequency of the instrument according to its frequency option (1.1 GHz, 2.2 GHz, 3.2 GHz or 6 GHz).

For **high-resolution measurements** in the entire frequency range, a logarithmic frequency grid in 1-2-5 sequence is recommended up to 50 MHz; above this value, linear 50 MHz steps should be used up to the upper limit frequency.

The recommended **test levels** are at the upper and lower switching threshold of the attenuator. The electronic attenuator of the DUT is switched depending on frequency, modulation parameters and level according to an internal stored table in approximately 5 dB steps. The switching thresholds can be detected under **Attenuator fixed range** in the **Level** menu. After setting all other parameters, the threshold level can be detected by level variation. The level at which the attenuator fixed range changes is the threshold. By measuring at the last level setting of one range and the first level setting of the next range, the internal setting range borders are used. In the following, $\mathbf{P_{min}}$ is the lowest level before switching the attenuator, and $\mathbf{P_{max}}$ the highest

Test Procedures

Reference Frequency

Output of Internal Reference

Important: *Allow the DUT to warm up for at least 2 hours before the measurement.*

Test equipment	- Frequency counter (*Table 1-1*, item 1)
Test setup	➢ Connect a calibrated frequency counter to the REF OUT output (on rear panel).
Measurement	➢ Measure the frequency. ⇨ The frequency deviation must not exceed the sum of deviations resulting from the frequency error in the rated temperature range and from aging.

Input for External Reference

Test equipment	- Frequency counter (*Table 1-1*, item 1) - Signal generator (*Table 1-1*, item 5)
Test method	The external reference input frequency of the DUT is varied according to the data sheet and the RF output signal frequency is controlled with a frequency counter to follow this variation.
Preparation of measurement	➢ Connect the signal generator RF output to the REF IN input for the external reference (on rear panel) of the DUT. Connect a calibrated frequency counter to the RF output. Synchronize the signal generator and the frequency counter. ➢ Setting on DUT: - RF on - Level: 0 dBm (suitable level for the frequency counter) - Frequency: 1 GHz - Setup ⇨Reference Oscillator ⇨ Source: External ➢ Setting on signal generator: - RF on - Level: 0 dBm
Measurement	➢ Set the signal generator frequency to 9.99997 MHz and 10.0003 MHz. Measure the output frequency of the DUT. Signal generator frequency: 9.99997 MHz | 10.0003 MHz DUT frequency: 999.997 MHz | 1000.03 MHz There must be no relative frequency error and no error message in the display of the DUT.

Frequency

Frequency Setting

Test equipment	
Test method	The frequency setting is checked by running the internal synthesizer adjustments to check the frequency overlap of the VCOs
Measurement	➢ Run: Setup ⇨ Internal Adjustments ⇨ Adjust Synthesis There must be no error message.

Setting Time

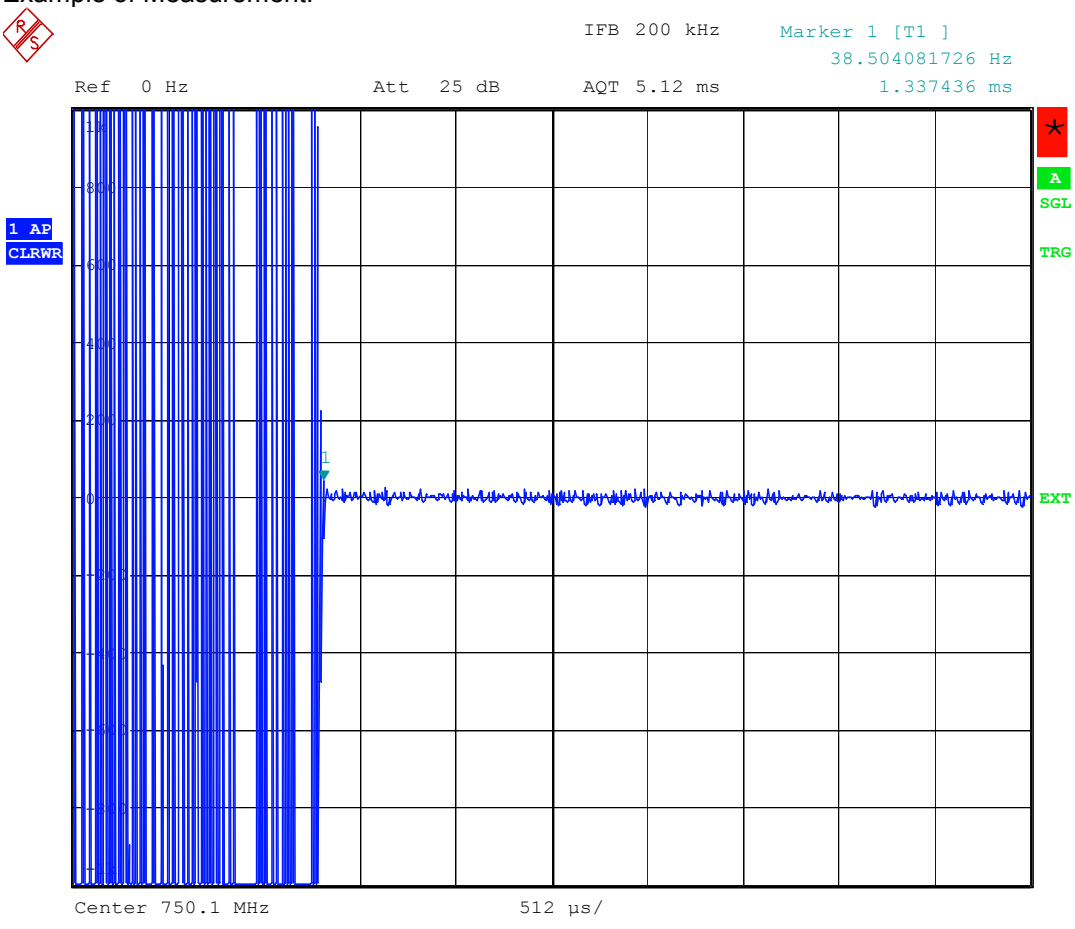
Test assembly	See section "*Test Assembly for Setting Time*", page *1.5*. For measuring after IEC/IEEE bus delimiter the EOI-line of the IEC/IEEE bus is used as trigger signal instead of the pulse generator.
Test method	The spectrum analyzer operates as an FM demodulator. A controller transmits the start and the stop frequency via the IEC/IEEE bus. The analyzer is triggered by the positive edge on the EOI line of the IEC/IEEE bus or the trigger pulse in list mode. At switch over from start to stop frequency, the settling procedure is displayed on the screen of the analyzer.
Preparation of measurement	➢ Synchronize the reference frequencies of the DUT and the analyzer. ➢ Make IEC/IEEE bus and RF connections. ➢ Connect spectrum analyzers trigger connector to EOI line (pin 5) of IEC/IEEE bus. ➢ Settings on DUT: - **Frequency**: start frequency unmodulated, - **Level:** 0 dBm ➢ Settings on spectrum analyzer: - AMPT/REF LEVEL 0 dBm - FREQ/CENTER/STOP FREQUENCY - FM DEMOD ON - DEMOD BW 50 kHz - RANGE /DEVIATION PER DIV 200 Hz - MEAS TIME 10 ms - TRIGGER EXTERN - External triggering by positive edge at 1.4 V.

Measurement	➢ Settings on analyzer: - Set the analyzer to the stop frequency ➢ Set the DUT to the start frequency f_{start} ➢ Send the stop frequency f_{stop} from the controller to the DUT. ⇨ The externally triggered analyzer displays the settling curve. The setting time is defined as the time from which on the frequency deviation from the stop frequency is less than the specified deviation in the data sheet. ➢ Repeat the measurement with ALC state Off: ⇨RF⇨Automatic Level Control⇨State⇨OFF (Sample & Hold)
Measurements in List mode	➢ Connect a trigger source (digital voltage levels: U1 < 0.8 V and U2 > 2 V) to the INSTR TRIG connector of DUT and analyzer. The pulse generator can be used as trigger source for example. ➢ Settings on DUT: - In the List mode menu, generate a list containing the two test frequencies f_{start} and f_{stop} with a level of 0 dBm each. - Set operating mode to **External Step**. ➢ Settings on spectrum analyzer: – Set DEMOD BW to 200 kHz – Set MEAS TIME to 2 ms ➢ Toggle the output voltage of the trigger source. (Settings on pulse generator: single shot) ➢ With each rising edge from the trigger source the frequency toggles between f_{start} and f_{stop}. ⇨ The externally triggered analyzer displays the settling curve. The setting time is defined as the time when the frequency deviation from the stop frequency is less than the specified deviation in the data sheet.

Recommended test frequencies

f_{start}	f_{stop}	Deviation
23.4 MHz	1100 MHz	±110 Hz
46.8 MHz	46.9 MHz	±20 Hz
46.9 MHz	46.8 MHz	±20 Hz
93.7 MHz	93.8 MHz	±20 Hz
93.8 MHz	93.7 MHz	±20 Hz
187.4 MHz	187.6 MHz	±20 Hz
187.6 MHz	187.4 MHz	±20 Hz
374.9 MHz	375.1 MHz	±37.5 Hz
375.1 MHz	374.9 MHz	±37.5 Hz
749.9 MHz	750.1 MHz	±75 Hz
750.1 MHz	749.9 MHz	±75 Hz
1499.9 MHz	1500.1 MHz	±150 Hz
1500.1 MHz	1499.9 MHz	±150 Hz
2999.9 MHz	3000.1 MHz	±300 Hz
3000.1 MHz	2999.9 MHz	±300 Hz
3000.1 MHz	6000 MHz	±600 Hz
6000 MHz	3000.1 MHz	±300 Hz

Example of Measurement:



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The marker is set to the time when the trace enters the specified interval of 750.1 MHz ± 75 Hz. The setting time is 1.34 ms.

Spectral Purity

Harmonics

Test equipment	Spectrum analyzer (*Table 1-1*, item 18)
Test setup	➢ Connect the spectrum analyzer to the RF output of the DUT. ➢ Synchronize the reference frequencies of analyzer and DUT.
Measurement	➢ Settings on analyzer: Reference level = 20 dBm, 10 dB/div. Span 0 Hz, Resolution bandwidth 10 kHz ➢ Settings on DUT: - **Frequency:** test frequencies, unmodulated - **Level:** test levels ➢ First measure the level of the fundamental P_f at the test frequency f as a reference. Then measure the signal levels P_{2*f} and P_{3*f} at twice and three times the carrier frequency f. ⇨ The harmonic spacing is the measured harmonic level referred to the fundamental: HD2 = P_f - P_{2*f} HD3 = P_f – P_{3*f} (in dBc = referred to the carrier)
Recommended test frequencies and levels	Test frequencies: 1 MHz, 5 MHz, 10 MHz, 23.4375 MHz, 23.438 MHz, 46.875 MHz, 46.885 MHz, 65.9 MHz, 66.1 MHz, 93.75 MHz, 93.76 MHz, 143.9 MHz, 186.9 MHz, 187.6 MHz, 264.9 MHz, 374.9 MHz, 375.1 MHz, 529.9 MHz, 530.1 MHz, 749.9 MHz, 750.1 MHz, 1059.9 MHz, 1060.1 MHz, 1100 MHz, 1499.9 MHz, 1500.1 MHz, 2120.9 MHz, 2121.1 MHz, 2200 MHz, 2999.9 MHz, 3000.1 MHz, 3200 MHz, 4241.9 MHz, 4242.1 MHz, 5 GHz, 6 GHz Test level: +8dBm

Nonharmonics

Test equipment	Same as for harmonics
Test setup	Same as for harmonics
Measurement	➢ Setting on analyzer: Reference level = 0 dBm, 10 dB/div. Span 50 Hz, Resolution bandwidth 10 Hz ➢ Setting on DUT Level = 0 dBm ➢ First the carrier level P_f is measured at the test frequency f as reference and then the signal level P_{search} is measured at the analyzer search frequency. ⇨ The nonharmonic spacing D is the measured level referred to the reference level: $D = P_f - P_{search}$ (in dBc = referred to the carrier)
	Note: *Some of the nonharmonics suppression values measured might be outside the analyzer specifications. In case of doubt, repeat the measurement with a 3 dB attenuator at the analyzer input. If the nonharmonic spacing changes the nonharmonic is due to the analyzer.* ***Alternative:*** *Check with a second source with differing synthesizer architecture (not a R&S SMB)*

Recommended settings and search frequencies:

DUT Frequency	Analyzer search frequency
13 MHz	9 MHz
13 MHz	22 MHz
17 MHz	15 MHz
23.4375 MHz	6.25 MHz
23.4375 MHz	29.6875 MHz
511.2 MHz	511.392 MHz
1050.1 MHz	1050.15714 MHz
1100.01 MHz	1100.02 MHz
2045 MHz	2045.133329 MHz
4086 MHz	4086.72 MHz
4289.8 MHz	4293.42975 MHz
4521.6 MHz	4522.351807 MHz
4745 MHz	4745.05747 MHz
5180 MHz	5184.473684 MHz

Non-systematic nonharmonics

Measurement	➢ Settings on DUT: - Test frequencies: 34 MHz, 65.9 MHz, 100 MHz, 143.9 MHz, 264.8 MHz, 529.9 MHz, 1059.9 MHz, 2120.9 MHz, 3000 MHz, 4241.9 MHz - Test level 0dBm unmodulated ➢ Recommended settings on analyzer: - Max peak detector - Filter Type: FFT - Ref-Level 0 dBm ➢ - Set analyzer center frequency to the test frequency, span to 40 MHz and resolution bandwidth to 2 kHz - Measure carrier level P - all signals other than the carrier must be below P – 70 dB - Set analyzer span to 100 kHz and resolution bandwidth to 200 Hz - all signals other than the carrier must be below P – 70 dB
	Note: *Some of the nonharmonics suppression values to be measured might be outside analyzer specifications. In case of doubt, repeat the measurement with a 3 dB attenuator pad at the analyzer input. If the nonharmonics suppression changes the nonharmonics are due to the analyzer. Because of the bell-shaped noise of the analyzer near the carrier, smaller resolution bandwidths may have to be used. To exclude amplitude independent nonharmonics of the analyzer, use a second generator with different synthesis architecture.*

Wideband Noise

Test assembly	Connect spectrum analyzer to RF socket of the DUT.
Test method	The carrier power is measured first. Then the center frequency of the analyzer is increased by 10 MHz and the noise power in a small bandwidth is measured. The difference of the carrier power and the noise power in 1 Hz bandwidth, which is calculated from the measurement, is defined as wideband noise. Because wideband noise degrades with lower electronic levels in front of the output step attenuator the output level of the generator has to be set to the lowest level before switching the step attenuator.
Measurement	➢ Settings on DUT: - frequency: test frequency - Level: 0 dBm - determine Att-fixed range upper Level P_{upper}: - ⇨ RF ⇨ Level⇨ Att fixed range ⇨ upper - set level to P_{upper} + 0.1 dB ➢ Settings on analyzer: - center: test frequency - reference level P_{upper} + 1 dB - Attenuator $D_{min} = P_{upper} - P_{1dBM}$ + 5dB ⇨ round to next larger available Attenuation of the analyzer (P_{1dBM} = analyzer P1dB level at test frequency) - span 110 kHz - Detector RMS - Sweep Time Manual 1s - switch on channel power measurement with 100 kHz bandwidth ➢ Determine the channel power with the center frequency of the analyzer set to the test frequency and note it down as P_{ref}. ➢ Increase the analyzer center frequency by 9.9 MHz. ➢ Inhibit the switching of the attenuator with AMPT RF ATTEN MANUAL without entering a value so that the input mixer is not overdriven. ➢ Lower the reference level of the analyzer by 20 dB, read the new channel power P_{noise}. ➢ Minimize the output level on the DUT by means of RF OFF, read the channel power P_{res}.

Evaluation	➢ If the power $P_{res} < P_{noise}$ - 0.41 dB the inherent noise power of the analyzer can be subtracted: $Wideband\_Noise = -P_{ref} + \log 10(10^{Pnoise} - 10^{Pres}) - 50dB$ ➢ If the power $P_{res} > P_{noise}$ 0.41 dB the analyzer resolution is not sufficient for a precise measurement. The true result is in such case certainly more than 10 dB below the measured value. The result than is at least: $Wideband\_Noise = -P_{ref} + P_{noise} - 50dB - 10dB$ ⇨The difference between the (possibly corrected) power P_{noise} in dBm and the power P_{ref} in dBm is the broadband noise floor in dBc.
➢ Recommended test frequencies	➢ 1.02 MHz, 10.1 MHz, 23.4375 MHz, 23.438 MHz, 46.875 MHz, 46.885 MHz, 65.9 MHz, 66.1 MHz, 93.75 MHz, 93.76 MHz, 143.9 MHz, 186.9 MHz, 187.6 MHz, 264.9 MHz, 374.9 MHz, 375.1 MHz, 529.9 MHz, 530.1 MHz, 749.9 MHz, 750.1 MHz, 1059.9 MHz, 1060.1 MHz, 1100 MHz, 1499.9 MHz, 1500.1 MHz, 2120.9 MHz, 2121.1 MHz, 2200 MHz, 2999.9 MHz, 3000.1 MHz, 3200 MHz, 4241.9 MHz, 4242.1 MHz, 5 GHz, 6 GHz

SSB Phase Noise

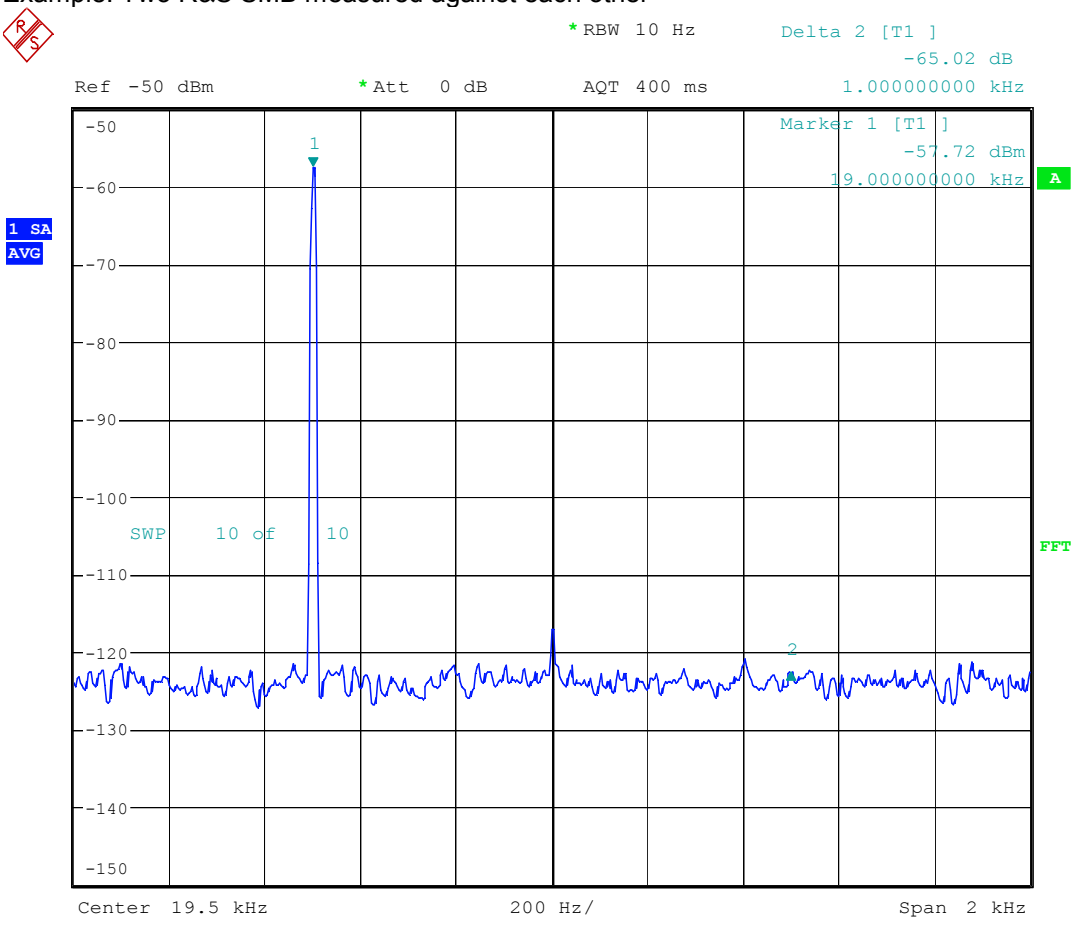
The SSB phase noise of the DUT can be measured direct if a Phase Noise Test Set is available. An R&S FSUP or any other analyzer with phase noise option is suitable if its own phase noise is at least 6 dB less than the guaranteed DUT Phase noise in the data sheet.
Measurement: Set the Level of the DUT to 0 dBm and measure the phase noise at 20 kHz offset with the analyzer in phase noise mode.

If no suited analyzer is available, the Phase noise can be measured with the aid of a second generator and a mixer:

Test assembly	See section "*Test Assembly for SSB Phase Noise and Jitter*", page *1.4*.
Test method	The two generators are set to the test frequency and synchronized with a phase offset of 90° (phase quadrature). Mixing to 0 Hz suppresses the RF carrier. Due to the phase quadrature, the mixer supplies a voltage representing the phase difference between the input signals. This voltage is measured with the spectrum analyzer.

Measurement	➢ Set the levels of the two generators in accordance with the specifications of the mixer used. (For the MITEQ-DB0118 mixer set the LO-level to +10 dBm and the RF-level to 0 dBm.) ➢ Settings of the DUT: - PM int - PM deviation 0.01 rad - Modulation frequency 19 kHz ➢ Settings on the analyzer: - Center frequency 19.5 kHz - Span 2 kHz - Input coupling DC - Attenuator manual 0 dB - average on, count = 10 - average mode: linear/ power - Filter Type: FFT - Resolution Bandwidth 10 Hz - set marker to 19 kHz. - set delta marker to 20 kHz ➢ Adjust the phase of the DUT for phase quadrature: Set the **Delta Phase** in the **Frequency/Phase** menu for maximum marker readout at 19 kHz in the Delta Phase range of 0° to 180°. Note down the relative Delta marker level **D**. ➢ Calculate the SSB phase noise in dbc/Hz: - The Delta Marker measures the noise in 10 Hz bandwidth. The power in 1 Hz bandwidth is one tenth of this power: $\log_{10}(10)$ - The PM with a modulation rate of 0.01 rad is equivalent to a phase noise of -46 dBc. - In baseband the two sidebands fall on each other: -6dB - The phase noises of the two generators add together: - 3dB if they are of the same type. If the reference generator is of the same type as the DUT: PN = D -10 * $\log_{10}(10)$ – 46 dB – 3 dB **PN = D – 59 dB** If the phase noise of the reference generator is at least 10 dB better than the phase noise of the DUT: PN = D- $\log_{10}(10)$ – 46 dB **PN = D – 56 dB**
➢ Recommended test frequencies	➢ 1 GHz, 2.2 GHz, 3.2 GHz, 4 GHz, 6 GHz

Example: Two R&S SMB measured against each other



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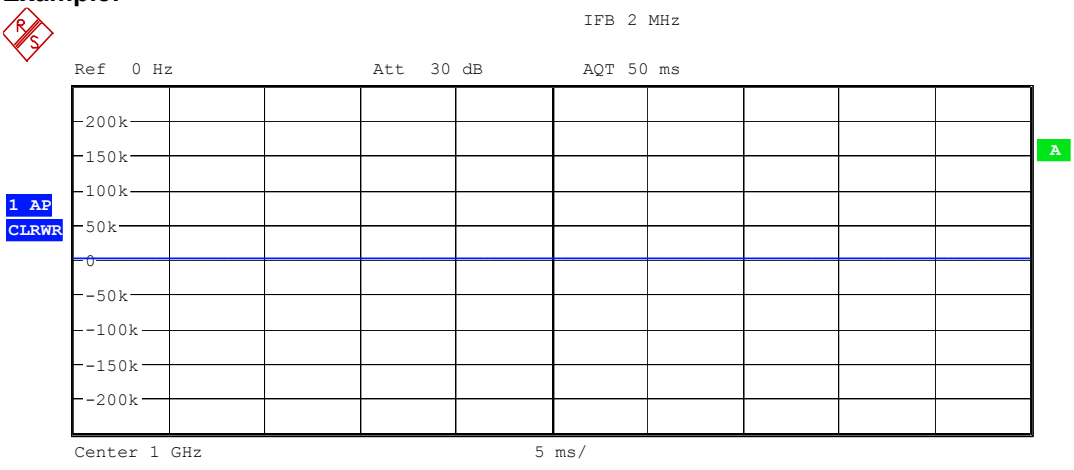
PN = -65.02 dBc -59 dB = 124.02 dBc/ Hz

Residual FM

Test assembly	Connect spectrum analyzer to RF socket of the DUT.
Test method	The FM demodulator of the analyzer is used to FM-demodulate the CW signal of the DUT. By setting the AF-low-pass and high-pass-filters the RMS value in the desired bandwidth can be measured. The value displayed is the sum of the analyzer residual FM and the DUT residual FM. Because they are uncorrelated, the displayed result is worse than residual RMS of the DUT alone. Therefore, if the sum is in tolerance according to the data sheet the DUT is also in tolerance.
Measurement	➢ Settings on DUT: - frequency: 1 GHz - Level: 0 dBm ➢ Settings on analyzer: - CENTER: 1 GHz - REFERENCE LEVEL: 1 dBm - FM DEMOD - FM DEMOD ⇨ MEAS TIME: 100ms - FM DEMOD ⇨ DEMOD BW: 200 kHz - FM DEMOD ⇨ AF-FILTER ⇨ HIGH PASS AF FILTER: 300 Hz - FM DEMOD ⇨ AF-FILTER ⇨ LOW PASS AF FILTER: 3 kHz ➢ The Residual FM in the frequency range 300 Hz – 3 kHz is the RMS value displayed. ➢ Repeat the measurement with setting the HIGH PASS AF FILTER: to 20 Hz and the LOW PASS AF FILTER to 23 kHz.

Example:



Frequency Modulation Summary

Coupling	DC		Carrier Offset	45.639	Hz
Deviation	+peak	12.93 Hz	Carrier Power	-0.91	dBm
	-peak	-12.41 Hz	Modulation Frequency	---	Hz
	±peak/2	12.67 Hz	Sampling Rate	250	kHz
	RMS	3.465 Hz	Record Length	12501	
			Demod Bandwidth	200	kHz
			AF Filter HP	20	Hz
			LP	23	kHz

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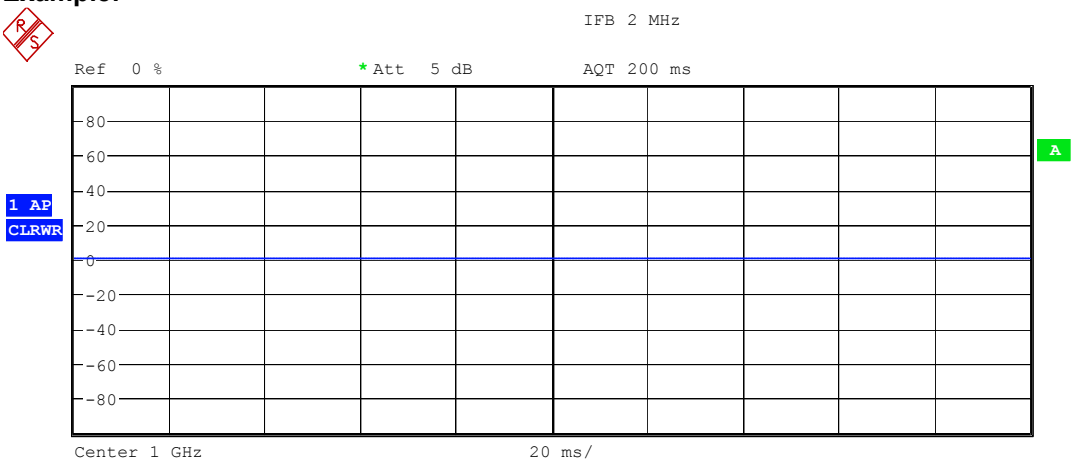
Residual FM = 3.465 Hz

Residual AM

Test assembly	Connect spectrum analyzer to RF socket of the DUT.
Test method	The FM demodulator of the analyzer is used to AM-demodulate the CW signal of the DUT. By setting the AF-low-pass and high-pass-filters the RMS value in the desired bandwidth can be measured. The value displayed is the sum of the analyzer residual AM and the DUT residual AM. Because they are uncorrelated, the displayed result is worse than residual RMS of the DUT alone. Therefore, if the sum is in tolerance according to the data sheet the DUT is also in tolerance.
Measurement	➢ Settings on DUT: - frequency: 1 GHz - Level: 0 dBm ➢ Settings on analyzer: - CENTER: 1 GHz - REFERENCE LEVEL: 1 dBm - AMPT ⇨ RF ATTEN MANUAL: 10 dB - FM DEMOD - FM DEMOD ⇨ RESULT DISPLAY ⇨ AM - FM DEMOD ⇨ MEAS TIME: 100ms - FM DEMOD ⇨ DEMOD BW: 200 kHz - FM DEMOD ⇨ AF-FILTER ⇨ HIGH PASS AF FILTER: 20 Hz - FM DEMOD ⇨ AF-FILTER ⇨ LOW PASS AF FILTER: 20 kHz ➢ The Residual AM in the frequency range 20 Hz – 23 kHz is the RMS value displayed.
Test frequencies	5 MHz, 450 MHz, 1 GHz, 2.2 GHz, 3.2 GHz, 4.5 GHz, 6 GHz

Example:



Amplitude Modulation Summary

Modulation Depth		0.022 %	Carrier Power		-0.87 dBm
Modulation +peak		0.022 %	Modulation Frequency		--- Hz
-peak		-0.023 %	Sampling Rate		250 kHz
±peak/2		0.022 %	Record Length		50001
RMS		0.005 %	Demod Bandwidth		200 kHz
			AF Filter	HP	20 Hz
				LP	23 kHz

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Residual AM = 0.005 %

Level Data

Level Uncertainty

Test method	The level uncertainty is measured in two steps. First, the **frequency response** is measured at a fixed level with high frequency resolution. Then the **level dependant uncertainty** is measured at fixed frequencies over the specified range.
Test equipment	- Power meter (*Table 1-1*, item 8) - Spectrum analyzer (*Table 1-1*, item 18) - Low-noise preamplifier (*Table 1-1*, item 9)

Test method for levels in measurement range of power meter

Test setup	Connect power meter to RF output socket.
Measurement	➢ Setting on DUT: - **Levels :** +18 dBm in level Mode AUTO ➢ Measure the level $P_{absolute}$ at the recommended test frequencies up to RF_{max}. ⇨ The level error is the deviation of the measured level from the set value. ➢ Repeat this measurement at + 13 dBm in level Mode OFF (Sample & Hold) at 200 kHz, 25 MHz, 100 MHz, 1.1 GHz, 2.2 GHz, 3.2 GHz and 6 GHz
Recommended test frequencies for the level frequency response measurement	200 kHz, 500 kHz, 1 MHz; 5 MHz; 7.00000001 MHz; 10 MHz; 23.4375 MHz 25 MHz to 95 MHz in 10 MHz Steps 112.5 MHz to 6 GHz in 25 MHz Steps

Test method for low levels

Test principle	Low levels can only be measured using a frequency selective measurement instrument. Spectrum analyzers with digital IF are best suited for this measurement due to their low linearity error. The absolute accuracy of these analyzers is not sufficient for this measurement. So a relative measurement referred to the measurements performed with the power meter is used to increase the accuracy of the measurement. Only by switching the input attenuator and preamplifier (when available) of the analyzer the needed dynamic range of more than 120 dB can be reached. After switching the analyzer attenuator or preamplifier, a continuity calibration is to be carried out. It is therefore recommended to switch the attenuator not until reaching 50 dB under full scale, since the linearity errors are very small in this range.
Test setup	➢ Connect the spectrum analyzer to the RF output of the DUT with **hermetically sealed RF measurement cables**.
Measurement	➢ Settings on DUT **Frequency** recommended test frequencies **Level** +18 dBm, unmodulated ➢ Setting on the analyzer Test frequency SPAN 10 Hz FILTER TYPE FFT RES BW 5 Hz set Marker to test frequency Reference level P_{ref} = +20 dBm ➢ Read the marker level P_{Marker} and calculate the correction factor $C = P_{absolute} - P_{Marker}$ with $P_{absolute}$ from the measurements performed with the power meter. ➢ Now decrease the DUT level in 5 dB steps and calculate the output power P by adding the Correction factor C to the marker readout. ➢ As soon as the marker level P_{Att1} is lower than P_{ref} -45 dB increase the sensitivity of the analyzer by reducing the input attenuation, switching on the internal preamplifier if available and reducing the resolution bandwidth to 1 Hz for levels below -90 dBm. Set the analyzer reference level to P_{Att1} + 1 dB. After switching the analyzer sensitivity read out the marker level P_{Att2} and recalculate the Correction factor: $C_{new} = C_{old} + P_{Att1} - P_{Att2}$ ➢ Continue the measurement down to -120 dBm in 5 dB steps.
Recommended test frequencies.	201 kHz, 512.5 MHz, 1087.5 MHz, 2187.5 MHz, 3187.5 MHz, 4012.5 MHz, 5012.5 MHz, 5987.5 MHz

Output Impedance

Test assembly	"*Test Assembly for Output Impedance (VSWR)*" (page *1.5*)
Test method	For the VSWR measurement of a source the effect of the level control must be taken into account. For this purpose, an auxiliary generator is used which transmits a wave with a slightly offset carrier frequency into the DUT. The difference frequency hast to be within the control bandwidth of the level control. In the case of ideal source impedance, the wave from the auxiliary generator is not reflected by the DUT. In the case of not ideal DUT source impedance, the output wave of the DUT and the reflected wave of the auxiliary generator are superimposed on one another. A directional coupler couples a part of these outgoing superimposed waves to an analyzer. The frequency offset, results in a beat of the superimposed outgoing waves. The VSWR is the ratio between the maximum and minimum amplitude of the beat.
Measurement	➢ Settings on DUT: - **Level:** test level - **Frequency**: test frequency, unmodulated ➢ Settings on spectrum analyzer: - Test frequency, span 0 Hz, test level - Resolution and video bandwidth 10 kHz - Linear level scale - Sweep time 20 ms ➢ Settings on second signal generator: - set the frequency to the test frequency – 100 Hz, - set minimum level, unmodulated. ➢ Vary the reference level to bring the line displayed on the screen of the spectrum analyzer approximately into the middle of the screen. Measure the voltage of the signal V_{ref}. ➢ Unscrew the VSWR bridge from the DUT and let the test port open. Increase the level of the second signal generator until the voltage on the analyzer is V_{ref} ± 0.5 %. ➢ Screw the VSWR bridge onto the DUT again. ➢ Measure the maximum voltage Vmax and minimum voltage Vmin of the sinusoidal trace. Calculate the VSWR: VSWR = Vmax/Vmin
Recommended test frequencies and levels	➢ Test frequencies: from 200 kHz every 50 MHz up to RF_{max}. ➢ Test levels: +2 dBm and +10 dBm.

Setting Time

Test assembly	Connect the spectrum analyzer (*Table 1-1*, item 18) to the RF connector of the DUT.
Test method	The spectrum analyzer is operated as a fast level meter in zero span. A controller transfers the start and the stop level via the IEC/IEEE bus. The analyzer is triggered by the positive edge on the EOI line of the IEC/IEEE bus. At switch over from start to stop level, the settling procedure is displayed on the screen of the analyzer.
Preparation of measurement	➢ Synchronize the reference frequencies of the DUT and the analyzer. ➢ Make IEC/IEEE bus and RF connections. ➢ Connect spectrum analyzers trigger connector to EOI line (pin 5) of IEC/IEEE bus. ➢ Setting on DUT: - **Frequency**: test frequency unmodulated, - **Level:** start level ➢ Settings on spectrum analyzer: - REFERENCE LEVEL: target level + 3 dB - AMPLITUDE LOG RANGE 10 dB - RESOLUTION BANDWIDTH 200 kHz - VIDEO BANDWIDTH 2 MHz - SPAN 0 Hz - SWEEP TIME: 10 ms - TRIGGER EXTERN - External triggering by positive edge at 1.4 V.
Measurement	➢ Send the stop level from the controller to the DUT. ⇨ The externally triggered analyzer displays the settling curve. The setting time is defined as the time from which on the level deviation from the final level is less than the specified deviation in the data sheet. ➢ Measure the following steps with ALC state AUTO, with ALC state OFF (Sample & Hold) and in List mode.
Recommended test frequencies and levels	**Frequencies**: 1 MHz, 30 MHz, 375 MHz, 1.1 GHz, 2.2 GHz, 3.2 GHz and 6 GHz

Start level	Stop level
-130 dBm	+18 dBm
-35 dBm	-5 dBm

Internal Modulation Generator

Frequency accuracy
The LF-Generator is integrated into an FPGA clocked with the same reference frequency as the synthesizer. Therefore, the LF frequency has the same accuracy as the RF and has not to be measured.

Distortions

Test equipment	Spectrum analyzer (*Table 1-1*, item 18)
Test method	The fundamental and harmonics of the LF-generator are measured with the analyzer. The analyzer calculates the Total Harmonic Distortion with the 'Harmonic Distortion' function.
Test setup	➢ Connect the spectrum analyzer to the LF socket of the DUT through a 150 Ω series resistor. This is necessary, because the LF output can only drive 200 Ω loads with very good harmonic distortion. If the instrument is equipped with a RFBOARD 1406.7207.xx switch the LF Gen output impedance to 600 Ω and omit the 150 Ω series resistor.
Measurement of frequency settings and distortion	➢ Settings on DUT: **LF Output** menu: **LF Gen Voltage** 1 V **LF Gen Frequency** 1 kHz ➢ Settings of the spectrum analyzer: **RF INPUT** DC **AMPT REF LEVEL** 10 dBm **FREQ CENTER** = LF Gen Frequency **MEAS ⇨ HARMONIC DISTOR** **RF ATTEN MANUAL** increase by 10 dB ➢ Read the THD ➢ repeat the measurement at the recommended test frequencies by changing the DUT LF Gen Frequency and the analyzer center frequency.
Recommended test frequencies	100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz

Level Accuracy and Frequency response

Test equipment	AC voltmeter (*Table 1-1*, item 14)
Test method	The output level of the LF Generator is measured direct with an AC voltmeter.
Test setup	➢ Connect the AC voltmeter to the LF socket of the DUT.
Measurement of Level Accuracy	➢ Settings on DUT: **LF Output** menu: **LF Gen Frequency** 1 kHz set **LF Output Voltage** to recommended levels and measure the output level

Recommended test levels for Level Accuracy	3 mV, 10 mV, 30 mV, 100 mV, 300 mV, 1 V and 3 V
Measurement of Frequency response	➢ Settings on DUT: **LF Output** menu: **LF Output Voltage** 1 V set **LF Gen Frequency** to recommended test frequencies and measure the output level ⇨ Determine the highest and the lowest level V_{max} and V_{min}. The frequency response in dB is defined as: $D = 20*\log_{10}(V_{max}) - 20*\log_{10}(V_{min})$
Recommended test frequencies	10 Hz, 1 kHz, 10 kHz, 100 kHz and 1 MHz

Note: *The settling time is a pure computer time and needs therefore not to be measured.*

Amplitude Modulation

AM Setting Uncertainty

Test assembly	See section "*Standard Test Assembly for Analog Modulations*", page *1.3*.
Measurement of accuracy versus modulation depth	➢ Settings on DUT: **RF On** **Frequency** 150 MHz **Level**: 0 dBm **Amplitude Modulation** On **AM Source Internal** **LF Gen Frequency** 1 kHz ➢ Settings on analyzer: **AMPTD** ⇨ **REF LEVEL** test level + 6 dB , **FREQ** ⇨ **CENTER** 150 MHz **FM DEMOD**, **FMDEMOD ON**, **RESULT DISPLAY** ⇨ **AM** **DEMOD BW** 50 kHz **RANGE** ⇨ **DEVIATION PER DIV** 20 % **MEAS TIME** 100 ms ➢ set the **AM Depth** to the recommended modulation depths and read the modulation depth **±peak/2** from the analyzer. ➢ set DUT to **AM Source External**, **AM Ext Coupling AC**, **AM Depth** 80%, **LF Gen Output On**, Connect **LF** output to **MOD EXT** input and read the modulation depth **±peak/2** from the analyzer.
Recommended modulation depths	m = 5%, 10 %, 20 %, 40 %, 60 %, 80 %

Measurement of accuracy versus RF	➢ Settings on DUT: **RF On** **Frequency** recommended test frequencies **Level**: 0 dBm **Amplitude Modulation** On **AM Source Internal** **LF Gen Frequency** 1 kHz **AM Depth** 80 % ➢ Settings on analyzer: **AMPTD** ⇨ **REF LEVEL** 6 dBm, **FREQ** ⇨ **CENTER** same as DUT **FM DEMOD**, **FMDEMOD ON**, **RESULT DISPLAY** ⇨ **AM** **DEMOD BW** 50 kHz **RANGE** ⇨ **DEVIATION PER DIV** 20 % **MEAS TIME** 100 ms ➢ measure the modulation depth for all recommended test frequencies
Recommended test frequencies	➢ 100 kHz; 23.4375 MHz; 23.438 MHz; 374.9 MHz; 375 MHz; 529.9 MHz; 530 MHz; 1449.9 MHz; 1450 MHz; 2120.9 MHz; 2121 MHz; 2999.9 MHz; 3000 MHz; 3999.9 MHz; 4 GHz; 6 GHz

AM Distortion

Test assembly	See section "*Standard Test Assembly for Analog Modulations*", page *1.3*.
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm **Amplitude Modulation** menu: **LF Gen Frequency** 1 kHz **Source Internal** **AM depth** 30%. ➢ Settings on R&S FSQ: **AMPTD / REF LEVEL** 6 dBm, **FREQ / CENTER** test frequency **FM DEMOD**, **FMDEMOD ON,** **RESULT DISPLAY ⇨ AM** **RESULT DISPLAY ⇨ AF SPECTRUM** **DEMOD BW** > 7* f_{mod}, **RANGE ⇨ DEVIATION PER DIV** 20 % **MEAS TIME** 0.16 s ➢ Measure the THD for all recommended test frequencies. To convert the displayed THD value in dB to percent calculate: THD_{pct} = 100 * 10 ^ (THD_{dB}/20). ➢ Repeat the measurement with AM depth set to 80 %.
Recommended test frequencies	➢ 100 kHz, 23.4375 MHz; 23.438 MHz, 374.9 MHz; 375 MHz; 529.9 MHz; 530 MHz; 1449.9 MHz; 1450 MHz; 2120.9 MHz; 2121 MHz; 2999.9 MHz; 3000 MHz; 3999.9 MHz; 4 GHz; 6 GHz

AM Frequency Response

<table>
<tr><td>Test assembly</td><td>See section "Standard Test Assembly for Analog Modulations", page 1.3.</td></tr>
<tr><td>Measurement</td><td>➢ Settings on DUT:
RF On
Level 0 dBm
Amplitude Modulation menu:
Source External
External Coupling DC
AM depth 60%.
➢ Settings on R&S FSQ:
AMPTD / REF LEVEL 6 dBm
FREQ / CENTER test frequency
FM DEMOD,
FMDEMOD ON,
RESULT DISPLAY ⇨ AM
RESULT DISPLAY ⇨ AF SPECTRUM
DEMOD BW 200 kHz,
RANGE ⇨ DEVIATION PER DIV 20 %
MEAS TIME ≥ 16/fmod s
➢ Vary the carrier frequency from 1 MHz to RF_{max}. Recommended test frequencies 1 MHz, 46.87 MHz, 186.9 MHz, 1.1 GHz, 2.2GHz, 3.2 GHz, 6 GHz.
➢ Settings on the signal generator:
- LF Output ON
- LFGen Voltage 1 V (V_{peak}).
➢ Set the generator frequency to the frequencies given below and measure the modulation depth in RMS.
<table>
<tr><td>Gen. frequency</td><td>10 Hz</td><td>100 Hz</td><td>1 kHz</td><td>10 kHz</td><td>50 kHz</td></tr>
<tr><td>MEAS TIME</td><td>1.6 s</td><td>0.2 s</td><td>0.2 s</td><td>0.2 s</td><td>0.2 s</td></tr>
</table>
⇨ The modulation frequency response in dB is the difference between the greatest and the smallest modulation depth m_{max} and m_{min}:
$m_{max-min} = 20 * \log_{10}(m_{max}) - 20 * \log_{10}(m_{min})$</td></tr>
<tr><td></td><td>➢ Repeat the measurement at RF = 1 GHz with the setting
Amplitude Modulation ⇨ External Coupling AC
➢ Repeat the measurement at RF = 1 GHz with the internal modulation generator with the setting
Amplitude Modulation ⇨ Source Internal.</td></tr>
</table>

Synchronous PhiM with AM

Test assembly	See section "*Standard Test Assembly for Analog Modulations*", page *1.3*.
➢ Measurement	➢ Settings on DUT: **RF On** **Level** PEP = P_{max}0 dBm **Amplitude Modulation** menu: **LF Gen Frequency** 1 kHz **Source Internal** **AM depth** 30%. ➢ Settings on spectrum analyzer **AMPTD / REF LEVEL** 3 dBm, **FM DEMOD** **DEMOD BW** 12.5 kHz **MEAS TIME** 100 ms **RESULT DISPLAY** ⇨ **PM** ➢ Recommended test frequencies. 23.4375 MHz, 46.87 MHz, 186.9 MHz, 1.1 GHz, 2.2GHz, 3.2 GHz, 4 GHz, 5 GHz, 6 GHz ➢ Measure the resulting phase modulation with peak detection (±peak/2-value).

Frequency Modulation

Test Methods

Test assembly	See section "*Standard Test Assembly for Analog Modulations*", page *1.3*.
Test Method "FFT Demodulation (Option FS-K7)"	• The FM deviation and distortion are determined by digital signal processing in the spectrum analyzer. ➢ Settings on R&S FSQ: AMPTD / REF LEVEL test level, FREQ / CENTER test frequency FMDEMOD, FMDEMOD ON, RESULT DISPLAY / FM resp. PM DEMOD BW > 2 * (deviation + fmod) for FM, DEMOD BW > 2 * fmod * (1 + deviation) for PM, RANGE / DEVIATION PER DIV 0.5 * deviation MEAS TIME 3/fmod for distortion (up to 3rd harmonic) RESULT DISPLAY / FM resp. PM / AF SPECTRUM DEMOD BW > 2 * (deviation + 3.5 * fmod) for FM, DEMOD BW > 7 * fmod * (1 + deviation) for PM, MEAS TIME 16/fmod

FM Setting Uncertainty

Test Method	➢ FFT Demodulation (see chapter "*Test* ")
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm: **Frequency Modulation** menu: **State on** **FM Source Internal** **FM Mode Normal**
Recommended settings	➢ Recommended test frequencies: 10 MHz, 1000 MHz with LFGen Freq = 1 kHz, FM Deviation = 100 kHz ➢ Repeat measurement at 1000 MHz with changing settings to **FM Source External** **FM Ext Coupling AC** feed in a 1 kHz, 1Vp external modulation signal at the MOD EXT connector

FM Distortion

Test Method	FFT Demodulation (see chapter "*Test* ")
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm: **Frequency Modulation** menu: **State on** **FM Source Internal** **FM Mode Normal** **LFGen Frequency** 2 kHz. ➢ Settings on R&S FSQ: DEMOD BW 5 * FM deviation, RANGE / DEVIATION PER DIV 250 kHz, RESULT DISPLAY / FM, AF SPECTRUM, SWEEP / MEAS TIME 2.5 ms, FREQ / AF STOP 50 kHz. ➢ Read the THD from the display. To convert to percent calculate THDpct = 100 * 10 ^ (THDdB/20).
Recommended settings	➢ CF sweep Recommended test frequencies with FM deviation 250 kHz: 10 MHz, with FM deviation 500 kHz: 375.1 MHz, 500 MHz, 625 MHz, 750 MHz, with FM deviation 1 MHz: 1100 MHz, with FM deviation 2 MHz: 2200 MHz, with FM deviation 4 MHz: 3200 MHz, 6 GHz ➢ Repeat measurement with changing settings to **FM Mode Low Noise** **FM deviation** 500 kHz for test frequencies: 375.1 MHz, 750 MHz ➢ Repeat measurement with changing settings to **FM Mode High Deviation** **FM deviation** 500 kHz for test frequencies: 375.1 MHz, 750 MHz

FM Frequency Response

Test Method	FFT Demodulation (see chapter "*Test* ")
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm **Frequency Modulation** menu: **FM Source External** **FM Ext Coupling DC** **FM Mode Normal** **FM deviation:** 1 MHz ➢ Setting on the signal generator: The internal LF generator of the signal generator delivers the modulation signal to the external modulation input of the DUT. The level of the modulation signal is controlled by use of an AC voltmeter. - LFGen Voltage 1 V peak - State ON ➢ Settings on R&S FSQ: FFT Demodulation ➢ Vary the signal generator frequency and measure the modulation depth. ⇨ The modulation frequency response is the factor between the greatest and the smallest modulation depth.
Recommended settings	➢ LF in logarithmic steps, 3 steps per decade (1, 2, 5) from 10 Hz to 500 kHz ➢ Perform the measurement for test frequency 23 MHz. ➢ Repeat the measurement with changing the settings to **FM Ext Coupling AC** for test frequency 23 MHz. ➢ Repeat the measurement with changing the settings to **FM Ext Coupling AC** for test frequencies: 375.1 MHz, 500 MHz, 625 MHz, 750 MHz. LF sweep from 1 kHz to 500 kHz ➢ Repeat the measurement with changing the settings to **FM Ext Coupling AC** **FM Mode Low Noise** **FM deviation** 500 kHz at test frequency 500 MHz. LF sweep from 1 kHz to 100 kHz ➢ Repeat the measurement with changing the settings to **FM Ext Coupling AC** **FM Mode High Deviation** **FM deviation** 2 MHz at test frequency 500 MHz. LF sweep from 1 kHz to 100 kHz ➢ Repeat the measurement with changing the settings to **FM Source Internal** **FM Mode Normal** **FM deviation** 1 MHz at test frequency 500 MHz. LF sweep from 1 kHz to 500 kHz

Synchronous AM with FM

Test assembly	See section "*Standard Test Assembly for Analog Modulations*", page *1.3*.
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm **Frequency Modulation** menu: **State on** **FM Source Internal** **FM Mode Normal** **FM deviation** 40 kHz **LFGen Frequency** 1 kHz. ➢ Settings on spectrum analyzer AMPTD / REF LEVEL 6 dBm FREQ / CENTER test frequency FMDEMOD, FMDEMOD ON, RESULT DISPLAY / AM / AF Spectrum AF Start = 0 Hz AF Stop = 5 kHz RES BW = 30 Hz DEMOD BW = 100 kHz IF BW MANUAL 10 MHz, RANGE / REFERENCE VALUE 0.2 % MEAS TIME 3 ms ➢ Read the AM depth at 1 kHz modulation frequency from the demodulated AF spectrum.
Recommended settings	➢ CF sweep Recommended test frequencies: 23.4 MHz, 375 MHz, 500 MHz, 750 MHz, 1100 MHz, 2200 MHz, 3200 MHz, 6 GHz

Carrier Frequency Offset with FM

Test assembly	See section "*Standard Test Assembly for Analog Modulations*", page *1.3*.
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm Frequency 1 GHz **Frequency Modulation** menu: **State on** **FM Source Internal** **FM Mode Normal** **FM deviation** 1 MHz **LFGen Frequency** 10 kHz ➢ Settings on spectrum analyzer AMPT / REF LEVEL 0 dBm FREQ / CENTER 1 GHz SPAN 10 kHz MKR / SIGNAL COUNT / NEXT / CNT RESOL 10 Hz ➢ Terminate the DUT External Modulation input with 50 Ω.and execute the internal FM offset adjustment. ➢ Execute a single sweep. Using MKR→ / PEAK, read counted marker frequency. ⇨ The offset is the difference between marker frequency and set carrier frequency. ➢ Repeat measurement with FM source external, coupling ac and dc (2 measurements).

Phase Modulation

PhiM Setting Uncertainty

Test Method	FFT Demodulation (see chapter "*Test* ").
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm **Phase Modulation** menu: **State on** **PhiM Source Internal** **PhiM Mode Normal** **PhiM Deviation 1 rad** **LFGen Freq = 1 kHz** ➢ Settings on spectrum analyzer: see chapter "*Test* "
Recommended settings	➢ Recommended test frequencies: 10 MHz and 500 MHz ➢ Repeat measurement at 500 MHz with changing settings to **PhiM Source External** **PhiM Ext Coupling AC** feed in a 1 kHz external modulation signal at MOD EXT connector

PhiM Distortion

Test Method	FFT Demodulation (see chapter "*Test* ")
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm **Phase Modulation** menu: **State on** **PhiM Source Internal** **PhiM Mode Normal** **LFGen Frequency** 10 kHz ➢ Settings on R&S FSQ: see chapter "*Test* " SWEEP / MEAS TIME 2.5 ms, FREQ / AF STOP 50 kHz, AMPTD / REF LEVEL 0 dBm, FREQ / CENTER test frequency. ➢ Read THD from the Display. To convert to percent calculate THDpct = 100 * 10 ^ (THDdB/20).
Recommended settings	➢ CF sweep Recommended test frequencies with PhiM deviation 1 rad: 10 MHz, 375.1 MHz, 500 MHz, 625 MHz, 750 MHz, with PhiM deviation 2 rad: 1100 MHz, with PhiM deviation 4 rad: 2200 MHz, with PhiM deviation 8 rad: 3200 MHz, 6 GHz ➢ Repeat measurement with changing settings to **PhiM Mode Low Noise** **PhiM deviation** 2.5 rad for test frequencies: 375.1 MHz, 750 MHz ➢ Repeat measurement with changing settings to **PhiM Mode High Deviation** **PhiM deviation** 10 rad for test frequencies: 375.1 MHz, 750 MHz

PhiM Frequency Response

Test method	FFT Demodulation (see chapter "*Test* ").
Measurement	➢ Settings on DUT: **RF On** **Level** 0 dBm **Phase Modulation** menu: **PhiM Source External** **PhiM Ext Coupling DC** **PhiM Mode Normal** **PhiM deviation:** 2 rad ➢ Setting on the signal generator: The internal LF generator of the signal generator delivers the modulation signal to the external modulation input of the DUT. The level of the modulation signal is controlled by use of an AC voltmeter (Item 14 of (*Table 1-1*). - LFGen Voltage 1 V peak - State ON ➢ Settings on R&S FSQ: FFT Demodulation ➢ Vary the signal generator frequency and measure the modulation depth. ⇨ The modulation frequency response is the factor between the greatest and the smallest modulation depth.
Recommended settings	➢ LF in logarithmic steps, 3 steps per decade (1, 2, 5) from 10 Hz to 500 kHz ➢ Perform the measurement for test frequency 23 MHz ➢ Repeat the measurement with changing the settings to **PhiM Ext Coupling AC** for test frequency 23 MHz. ➢ Repeat the measurement with changing the settings to **PhiM Ext Coupling AC** for test frequencies: 375.1 MHz, 500 MHz, 625 MHz, 750 MHz. LF sweep from 1 kHz to 500 kHz ➢ Repeat the measurement with changing the settings to **PhiM Ext Coupling AC** **PhiM Mode Low Noise** **PhiM deviation** 5 rad at test frequency 500 MHz. LF sweep from 1 kHz to 100 kHz ➢ Repeat the measurement with changing the settings to **PhiM Ext Coupling AC** **PhiM Mode High Deviation** **PhiM deviation** 20 rad at test frequency 500 MHz. LF sweep from 1 kHz to 100 kHz ➢ Repeat the measurement with changing the settings to **PhiM Source Internal** **PhiM Mode Normal** **PhiM deviation** 2 rad at test frequency 500 MHz. LF sweep from 1 kHz to 500 kHz

Pulse Modulation

ON/OFF Ratio

Test equipment	- Spectrum analyzer (*Table 1-1*, item 18) - Pulse generator (*Table 1-1*, item 13)
Test setup	➢ To determine the ON/OFF ratio, connect the spectrum analyzer to the RF output socket of the DUT and let the PULSE EXT input open.
Measurement	➢ Setting on DUT: **RF On** **Level** 0 dBm **Frequency** recommended test frequencies **Pulse Modulation** menu: **Source External** **State** On **Polarity** Inverse ➢ Setting on Analyzer **FREQ/CENTER** test frequency **SPAN** 0 Hz **AMPT/REF LEVEL** 0 dBm **BW ⇨ RES BW MANUAL** 3 kHz **SWEEP ⇨ SWEEP TIME MANUAL** 100 ms **MEAS ⇨ TIME DOM POWER** on ➢ Determine the output level of the DUT at the recommended test frequencies with **Pulse Modulation ⇨ Polarity** Inverse and **Pulse Modulation ⇨ Polarity** Normal. ⇨ The level difference between the output level with Polarity Inverse and Polarity Normal is the ON/OFF ratio.
Recommended test frequencies	5 MHz, 150 MHz, 400 MHz, 1.1 GHz, 2.2 GHz, 3.2 GHz., 4 GHz, 5 GHz, 6 GHz

Rise/ Fall Time

Test assembly	Test Assembly for Pulse Modulation (see page 1.3)
Test method	The RF signal is down converted to 0 Hz in phase. Thus, the IF output reproduces the RF amplitude vs. time.
Measurement	➢ Setting on pulse generator: For adjustment statically high level, for measurement square wave pulse sequence with a frequency of 1 MHz, TTL level ➢ Setting on DUT: **RF** On **Level** 0 dBm **Frequency** recommended test frequencies **Pulse Modulation** menu: **State** On ➢ Setting on Signal Generator: **RF** On **Level** Recommended Lo-Level of Mixer **Frequency** same as DUT ➢ Setting on oscilloscope: Adjust V/div according to the mixer in use Time base 20 ns/div Trigger: - for adjustment free running, - for measurement 50 % of signal amplitude, rising and falling edge. ➢ Adjustment: At each test frequency adjust phase using menu **RF Mod / Frequency/Phase / Phase Settings**. Vary the **Delta Phase** to obtain maximal signal output at the mixers IF port. The voltage at maximum corresponds to 100 % of RF amplitude. ➢ Measurement: Evaluate the down converted pulse-modulated signal on the oscilloscope. ⇨ Rise time = time between 10% and 90% of signal amplitude Fall time = time between 90% and 10% of signal amplitude
Recommended test frequencies	400 MHz, 1.1 GHz, 2.2 GHz, 3.2 GHz, 4 GHz, 5 GHz, 6 GHz

Video Crosstalk

Test assembly	As above for ON/OFF Ratio
Measurement	➢ Setting on pulse generator: Square wave pulse sequence with a frequency of 100 kHz, TTL level ➢ Setting on DUT: **RF On** **Frequency** 1 GHz, 6 GHz **Level** 0 dBm **Pulse Modulation State** On ➢ Settings on the Analyzer **REF LEVEL** 0 dBm **FREQ CENTER** 100 kHz **SPAN** 10 kHz ➢ Measure the signal level at 100 kHz with the analyzer. ⇨ The Video Crosstalk is the amplitude of the spectral line found at 100 kHz related to the RF carrier level

Pulse Generator

PULSE VIDEO

Test equipment	- Storage oscilloscope (*Table 1-1*, item 3) with 50Ω Feed-through termination on input.
Test setup	➢ Connect the PULSE VIDEO socket on the rear of the DUT to the storage oscilloscope.
Measurement	Setting on DUT: **Pulse Modulation** menu: **State** On **Source:** Pulse Generator **Pulse Generator** menu: **State** On **Pulse Period** 10 µs **Pulse Width** 5 µs ➢ Setting on oscilloscope: 1 V/div Time base 2.5 µs/div Trigger: 50 % of amplitude, rising edge. ➢ Check the signal for a symmetric square wave with 10 µs pulse period and 3 V amplitude. Rise and fall time < 10 ns

Stereo/RDS Coder (Option R&S SMB-B5)

Frequency Response

Test setup	DUT RF output connected to Modulation Analyzer RF input, Audio analyzer LF output connected to DUT Stereo L, R input.
Test method	Measurement of demodulated AF signal by Modulation Analyzer
Measurement	Setting on DUT: **RF On** **Frequency** 100 MHz **Level** 0 dBm **Stereo Modulation** menu: **State** On **FM Deviation** 40 kHz **Audio Source** LF Gen (EXT L, R) **Mode** Mono L (Mono R) **LF Gen Frequency** 20 Hz **LF Gen Shape** Sine **Stereo Pilot tone settings**: **Pilot State** On **Pilot Deviation** 6.75 kHz **ARI settings**: **State** Off **RDS settings**: **State** Off ➢ Setting on Audio Analyzer UPL: GEN: INSTRUMENT ANALOG: Channel(s) 1 (2) FUNCTION Sine FUNCTION Frequency = 20 Hz FUNCTION Voltage = 0.707 V ➢ Setting on Modulation Analyzer FMB: DEMODULATION FM-STEREO CHANNEL L (R) RELATIVE ➢ Vary the LF Generator frequency and measure the reference level (MEAS-REF).
Recommended settings	➢ LF in logarithmic steps, 7 steps per decade (1, 1.5, 2, 3, 4, 6, 8) from 20 Hz to 15 kHz. ➢ Repeat the measurement for all four combinations (internal L, internal R, external L, external R).

Total Harmonic Distortion and Channel Separation

Test setup	DUT RF output connected to Modulation Analyzer RF input, Audio Analyzer analog and digital LF output connected to DUT Stereo L, R, S/P DIF input, Modulation Analyzer L, R output connected to Audio Analyzer input.
Test method	Demodulation of Stereo signal by Modulation Analyzer, measurement of demodulated AF signal by Audio Analyzer
Measurement	Setting on DUT: **RF On** **Frequency** 66 MHz **Level** 0 dBm **Stereo Modulation** menu: **State** On **FM Deviation** 40 kHz **Audio Source** EXT L, R **Mode** Stereo R!=L **Stereo Pilot tone settings**: **Pilot State** On **Pilot Deviation** 6.75 kHz **ARI settings**: **State** Off **RDS settings**: **State** Off ➢ Setting on Audio Analyzer UPL: FILE: LOAD INSTRUMENT STATE: Mode = Default GEN: INSTRUMENT ANALOG: Channel(s) 1 (2) FUNCTION: Voltage = 0.707 V ANLR: INSTRUMENT: Channel(s) 1 & 2 INSTRUMENT: Ch1, Ch2 Imped = 600 Ohm FREQ / PHASE: Meas Time = Precision FUNCTION: RMS & S/N FUNCTION: Unit Ch1, Ch2 = dBr FUNCTION: Reference Value = STORE Ch1 (Ch2)

Measurement	➢ Setting on Modulation Analyzer FMB: DEMODULATION FM-STEREO CHANNEL L (R) NOISE FILTER OFF ABSOLUTE MAN RANGE dBm RANGE 12 dBm AUTO DIST-SINAD ➢ Channel separation: First note the level of the AF signal on the UPL in channel 1 as reference, then switch the source to channel 2 and measure level of crosstalk 2 -> 1. Carry out the same in reverse and measure level of crosstalk 1 -> 2. ➢ Harmonic distortion: Read the harmonic distortion value from Modulation Analyzer FMB.
Recommended settings	➢ CF sweep Recommended test frequencies: 66 MHz, 76 MHz, 87 MHz, 98 MHz, 110 MHz

Signal to Noise Ratio

Test setup	DUT RF output connected to Modulation Analyzer RF input, Audio Analyzer analog and digital LF output connected to DUT Stereo L, R, S/P DIF input, Modulation Analyzer L, R output connected to Audio Analyzer input.
Test method	Demodulation of Stereo signal by Modulation Analyzer, measurement of demodulated AF signal by Audio Analyzer
Measurement	Setting on DUT: **RF On** **Frequency** 66 MHz **Level** 0 dBm **Stereo Modulation** menu: **State** On **FM Deviation** 67.5 kHz **Audio Source** EXT L, R **Mode** Stereo R!=L **Stereo Pilot tone settings**: **Pilot State** On **Pilot Deviation** 6.75 kHz **ARI settings**: **State** Off **RDS settings**: **State** Off ➢ Setting on Modulation Analyzer FMB: DEMODULATION FM-STEREO INTERN NOISE FILTER ON MAN RANGE RANGE 12 dBm DEEMPHASIS 50 us

Measurement	➢ Setting on Audio Analyzer UPL: FILE: LOAD INSTRUMENT STATE: Mode = Default GEN: FUNCTION: Voltage = 0.707 V ANLR: INSTRUMENT: Channel(s) 1 & 2 INSTRUMENT: Ch1, Ch2 Imped = 600 Ohm FREQ / PHASE: Meas Time = Precision FILTER: CCIR wtd (CCIR unwtd, A Weighting) FUNCTION:Q Pk & S/N, (RMS & S/N) FUNCTION: S/N Sequ = ON ➢ Read the Signal to noise ratio from the Audio Analyzer
Recommended settings	➢ CF sweep Recommended test frequencies: 66 MHz, 76 MHz, 87 MHz, 98 MHz, 110 MHz ➢ Repeat the measurement for following filter / detector combinations: CCIR-Unweighted / RMS A-Weighted / RMS

MPX, Pilot Tone and RDS Subcarrier Deviation

Test setup	DUT RF output connected to Modulation Analyzer RF input
Test method	Measurement of demodulated AF signal by Modulation Analyzer
Measurement	Setting on DUT: **RF On** **Frequency** 66 MHz **Level** 0 dBm **Stereo Modulation** menu: **State** On **FM Deviation** 40 kHz **Audio Source** LF Gen **Mode** Stereo R=L **LF Gen Frequency** 1 kHz **LF Gen Shape** Sine **Stereo Pilot tone settings**: **Pilot State** On **Pilot Deviation** 6.75 kHz **ARI settings**: **State** On **Identification** Off **RDS settings**: **State** Off ➢ Setting on Modulation Analyzer FMB: DEMODULATION FM-STEREO ABSOLUTE DETECTOR +-PEAK/2 CHANNEL L, PILOT, MORE CARR 57 kHz ➢ Read the respective deviation from the Modulation Analyzer.
Recommended settings	➢ CF sweep Recommended test frequencies: 66 MHz, 76 MHz, 87 MHz, 98 MHz, 110 MHz

Preemphasis

Test setup	DUT RF output connected to Modulation Analyzer RF input
Test method	Measurement of demodulated AF signal by Modulation Analyzer
Measurement	Setting on DUT: **RF On** **Frequency** 98 MHz **Level** 0 dBm **Stereo Modulation** menu: **State** On **FM Deviation** 10 kHz **Audio Source** LF Gen **Mode** Stereo R=L **LF Gen Frequency** 100 Hz **LF Gen Shape** Sine **Preemphasis** Off **Stereo Pilot tone settings**: **Pilot State** On **Pilot Deviation** 6.75 kHz **ARI settings**: **State** Off **RDS settings**: **State** Off ➢ Setting on Modulation Analyzer FMB: DEMODULATION FM-STEREO RELATIVE UNIT dBm DETECTOR +-PEAK/2 CHANNEL L ➢ Read the reference level from the Modulation Analyzer. ➢ Change the setting on the DUT: **Stereo Modulation** menu: **LF Gen Frequency** 15 kHz **Preemphasis** 50 us Compare the level displayed on the Modulation Analyzer to the reference level. The ratio of the two levels must be 13.66 dB ±0.5 dB. ➢ Change the setting on the DUT: **Stereo Modulation** menu: **LF Gen Frequency** 15 kHz **Preemphasis** 75 us Compare the level displayed on the Modulation Analyzer to the reference level. The ratio of the two levels must be 17.07 dB ±0.5 dB.

Digital S/P DIF Interface

Test setup	DUT RF output connected to Modulation Analyzer RF input, Audio Analyzer digital LF output connected to DUT Stereo S/P DIF input, Modulation Analyzer L, R output connected to Audio Analyzer input.
Test method	Generation of S/P DIF signal by Audio Analyzer, measurement of demodulated AF signal by Modulation Analyzer
Measurement	Setting on DUT: **RF On** **Frequency** 98 MHz **Level** 0 dBm **Stereo Modulation** menu: **State** On **FM Deviation** 40 kHz **Audio Source** S/P DIF **Mode** Stereo R!=L **Stereo Pilot tone settings**: **Pilot State** On **Pilot Deviation** 6.75 kHz **ARI settings**: **State** On **Identification** Off **RDS settings**: **State** Off ➢ Setting on Modulation Analyzer FMB: DEMODULATION FM-STEREO ABSOLUTE DETECTOR +-PEAK/2 CHANNEL L, R ➢ Setting on Audio Analyzer UPL: GEN INSTRUMENT DIGITAL Channel 1=2 Unbal Out AUDIO OUT Sample Frequency 32 kHz, 44.1 kHz, 48 kHz FUNCTION STEREO SINE Freq. Mode FREQ CH1&2 Volt Mode VOLT CH1&2 Freq Ch.1 1 kHz Freq Ch.2 0.5 kHz Volt Ch.1 0.707 FS Volt Ch.2 0.707 FS

Measurement	➢ Read the respective audio frequency on left and right channel from the Modulation Analyzer. Check the result ➢ Read the respective MPX deviation of the left and right audio signal from the Modulation Analyzer.

RDS Function

Test setup	DUT RF output connected to Modulation Analyzer RF input. Modulation Analyzer AF output connected to RDS decoder MPX input.
Test method	Demodulation of FM signal signal by Modulation Analyzer, decoding of multiplex signal by RDS decoder.
Measurement	Setting on DUT: **RF On** **Frequency** 98 MHz **Level** 0 dBm **Stereo Modulation** menu: **State** On **FM Deviation** 40 kHz **Audio Source** LF Gen **Mode** Stereo R=L **LF Gen Frequency** 1 kHz **LF Gen Shape** Sine **Stereo Pilot tone settings**: **Pilot State** On **Pilot Deviation** 6.75 kHz **ARI settings**: **State** On **RDS settings**: **State** On ➢ Setting on Modulation Analyzer FMB: DEMODULATION FM-STEREO CHANNEL MPX ➢ Setting on RDS demodulator DMDC: RDS Inf1 PI, PS RDS Inf1 CT, PIN ➢ Write data for PI, PS, TP, TA, PTY, DI, MS, CT to data sets DS1 to DS5. ➢ One at a time set ARI identification OFF, DK, BK, DK+BK, ranges A to F and check them on the RDS decoder. ➢ One at a time select RDS dataset 1 to 5 and check the output on the RDS decoder. ➢ Check the time output (CT) on the RDS decoder

Hardware Signals

SIGNAL VALID

Test equipment	- Spectrum analyzer (*Table 1-1*, item 18)
Test setup	➢ Apply connection from the SIGNAL VALID socket on the rear of the DUT to external trigger input of the spectrum analyzer.
Test method	The function of the Signal is tested by triggering the spectrum analyzer.
Measurement	➢ Setting on DUT: - **Frequency:** 100 MHz ➢ Settings on spectrum analyzer: - TRIGGER EXTERN - External triggering by negative edge at 1.4 V. ➢ Change DUT Frequency to 1 GHz ➢ Check trigger on analyzer.

Contents - Chapter 2 "Procedures after Module Replacement"

2 Procedures after Module Replacement

This chapter describes all necessary measures to restore the performance of the R&S SMB after module replacement.

There are no manual adjustments to be performed. Internal and external adjustment routines are implemented for this purpose.

Spare part RF boards are tested at Rohde & Schwarz with calibrated working standards according to the performance test. All measurement values are within the specified values including the measurement uncertainty as a minimum guard band. Power levels are corrected to nearly ideal values. When installing a spare part RF board the only difference at the RF side is the connecting cable between the RF board and the front panel. When testing the RF boards Rohde & Schwarz uses the same type of cable as it is installed in the R&S SMB.

OCXOs are tested at Rohde & Schwarz for the frequency adjustment range and the control voltage for an exact 10 MHz output frequency. This control voltage is coded in a digital value and stored on the OCXO module. In the R&S SMB the digital value is read from the OCXO module.

The probability that the R&S SMB meets it specifications after the replacement of a RF board and / or an OCXO is very high. To increase this probability even further and to detect a defective connecting cable between the RF board and the front panel Rohde & Schwarz recommends to adjust and to verify the power level and the reference frequency according to the instructions in the table below

If a calibration of the instrument is strictly necessary the performance test should be performed completely.

After replacing an assembly, check the following table to see which service procedure you perform.

Changed module	**Required adjustment/correction**	**Recommended Test Procedure (refer to chapter 1 Performance Test "Checking the rated characteristics")**
Basis Board	Setup/Internal Adjustments/Adjust All set correct time and date, see below.	None
RF Board	Setup/Internal Adjustments/Adjust All External Level Correction (power sensor NRP-Z91 or NRP-Z92 required)	Level Data at 0 dBm
OCXO	Setup/Internal Adjustments/Adjust All	Reference Frequency “Output of Internal Reference”
Stereo Coder	Setup/internal Adjustment/Adjust All Setup/internal Adjustment/Adjust S/P DIF (requires release of protection level 2)	MPX deviation and pilot tone deviation
Power Supply	Setup/Internal Adjustments/Adjust All	None

Procedures after Replacing the Lithium Battery

1. Connect an USB keyboard to the R&S SMB.
2. Switch on the R&S SMB. The operating system (LINUX) and the R&S SMB firmware will start.
3. Set correct date and time at R&S SMB setup menu.

Procedures after Replacing the Basis Board

Required equipment
USB Memory Stick (at least 128 MB)

Required software:
Actual SMB_Firmware see R&S homepage www.rohde-schwarz.com
Copy the firmware to the root folder of the memory stick.

Install the new Firmware
See Chapter 4 “Software Update“.

Adjustments

Preliminary Remark

Setting a defined **initial** state by pressing the PRESET key prior to adjustments is recommended. In addition, a valid reference frequency is required, either by setting the instrument to internal reference or by applying an appropriate external reference signal. To ensure that the internal adjustments are valid at operating temperature, at least **20 minutes warm-up time** at this temperature must be observed.

Internal Adjustments

All internal adjustments are available in the **Setup/Internal Adjustments** menu (see operating manual).

Adjustments of the Complete Unit

Performing **Setup/Internal Adjustments/Adjust All** activates all internal adjustments in a reasonable order.

The external adjustments have to be performed, if the recommended calibration interval is exhausted or the RF Board has been replaced.

External Adjustments Requiring Measurement Equipment

The external adjustments require calibrated equipment and special software. Data sheet specifications of the unit are concerned. If required, contact your local Rohde & Schwarz representative.

External Level Correction

External level correction measures output power over frequency and level and stores the correction values inside the instrument to maintain level accuracy. The R&S SMB provides a build in measuring procedure for external level correction.

NOTICE **Risk of damage to the power sensor**

Power sensor NRP-Z91 can be damaged when being exposed to R&S SMBs maximum output power. So it is recommendet to PRESET the instrument before connecting the power sensor. The build-in level correction procedure does not overload the sensor.

Adjustment

Test equipment

- R&S NRP-Z91 or R&S NRP-Z92 power sensor with NRP-Z3 or NRP-Z4 USB adaptor

Test setup

- Power on instrument
- Setting on instrument:

  PRESET
  Setup Menu
  Reference Oscillator
  Source INTERNAL
  Protection
  Protection Level 2 = 147946 ENTER
- Connect the power sensor to the RF plug and to the USB connector of the instrument.
- Allow the R&S SMB and the power sensor to warm up for at least 20 minutes

Adjustment

- Setting on instrument:

  Setup Menu
  Internal Adjustments
  Adjust Ext Level…
  ECEXUTE
  Adjustment Data CUSTOM

Note that the R&S factory level correction data is not replaced by this procedure, instead an additional data set is created.

The active correction data set is selected by the setting “Adjustment data”

Adjustment of internal Reference Frequency

The frequency accuracy of the synthesizer is determined (set to internal reference) by a 200 MHz VTCXO or when the Option R&S SMB-B1 is fitted with a highly stable OCXO that is set to a calibrated frequency standard at the R&S factory. This oscillator is subject to ageing and hence its output frequency can be adjusted.

Adjustment

Important: *Allow the DUT to warm up for at least 20 minutes before adjustment is executed*

Test equipment
- External frequency counter (1 Hz to RF_{max}, resolution 0.1 Hz)

Test setup
- Connect a calibrated external frequency counter to the reference output at the rear panel.

Adjustment
- Setting on DUT:

PRESET

Setup Menu

Protection

Protection Level 2 = 147946 ENTER

- Setting on spectrum analyzer (external frequency counter):

MKR SIGNAL COUNT

MKR / NEXT CNT RESOL 0.1 Hz

- Adjust the TCXO/ OCXO Calibration Value (Setup - Reference Oscillator - Calibration Value) for an external frequency counter reading of 10 MHz, with minimal error.
- Press Write **value to Eeprom** to store the DAC value.

Adjustment of Stereo Coder Module

The analog audio signal path gain and offset can be adjusted by performing the internal adjustment (Setup/Internal Adjustment/Adjust All).

For adjustment of the digital audio signal path, an additional S/P DIF source is required:

Important: *Allow the DUT to warm up for at least 20 minutes before adjustment is executed*

Test equipment	External S/P DIF source
Test setup	➢ Connect the S/P DIF source to the DUT Stereo S/P DIF audio input at the rear panel.
Adjustment	Setting on S/P DIF source: Audio signal: 500 Hz, Sinewave Mode: R=L Amplitude: Full Scale Setting on DUT: **PRESET** Setup Menu Protection Protection Level 2 = 147946 ENTER ➢ Press Setup/Internal Adjustment/Adjust S/P DIF

Internal Self Test

After each module replacement, it is recommended to perform the internal self test (refer to chapter 3, “Troubleshooting with Internal Self Test”). The self test checks the instrument by measuring internal diagnostic points and verifies whether generator is operating properly.

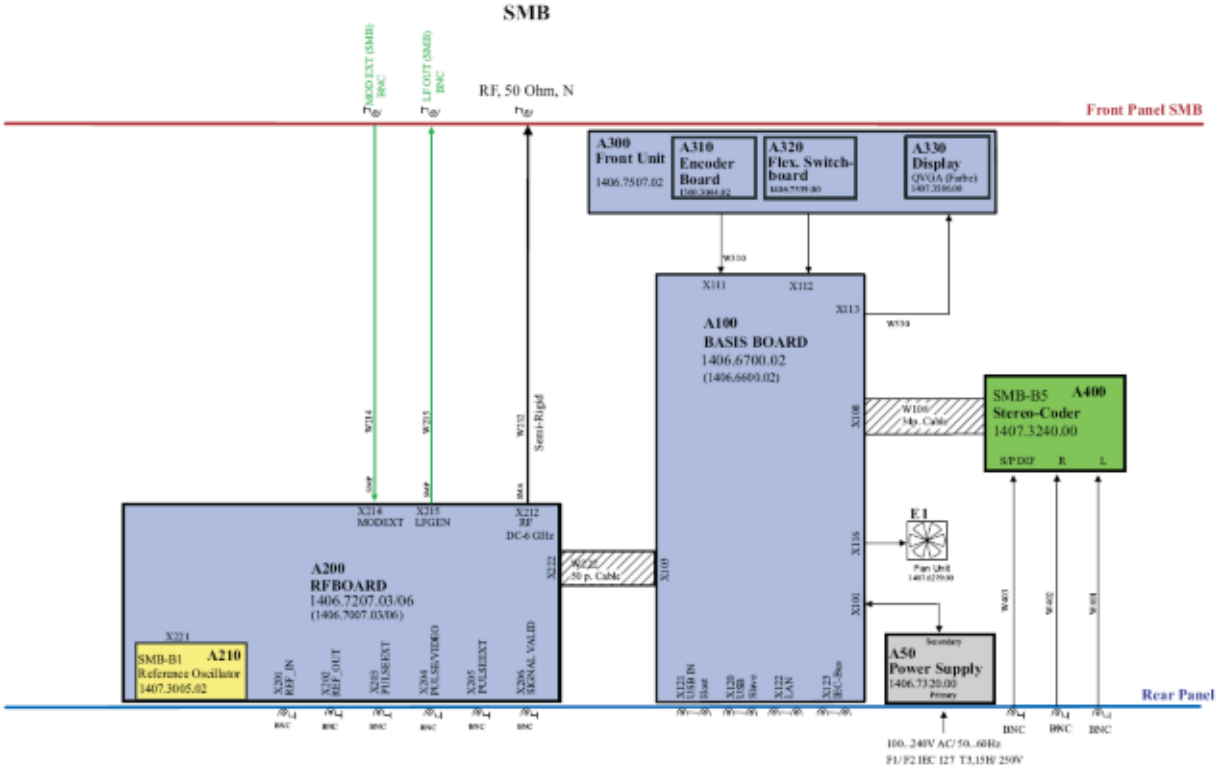
If a self test failure occurs, check again whether all cables are properly connected. If the self test fails continuously, contact your local service center.

Contents – Chapter 3 "Repair"

3 Repair

Instrument Design and Function Description

A schematic of the signal generator's design is presented below as block diagram at module level



The R&S SMB consists of very few main modules and very few connections between these modules. The main units are:

- Power Supply
- Basis Board which includes all digital external Interfaces, the main CPU, the Fan control logic, the hardware drivers for the front panel and the Interface for the RF Board.
- Front Unit consisting of the rotary knob with encoder, the flexible switch board and the QVGA Color Display
- RF Board including the whole measurement hardware.
- R&S SMB-B1 Reference Oscillator which is plugged direct into the RF Board.
- R&S SMB-B5 Stereo/RDS Coder with ribbon cable for connection to the Basis Board and shielded cables for connection to the rear panel.

A detailed description of these modules is given in the next chapter.

RF Board

The RF BOARD contains the complete measuring hardware of the instrument. The RF and LF signals are generated and modulated on the module. The output level is controlled by a level control loop controlling the level before the step attenuator. The fully electronic step attenuator is temperature compensated to achieve very precise output levelling of the instrument. The RF Board is equipped with a reverse power protection to ensure the instrument not being damaged due to supplying reverse power to the RF output of the instrument. The module is controlled by the Basis Board via a serial bus and few additional control signals.

Implemented functions

- Reference crystal oscillator and reference frequency switch
- Synthesizer
- LF generator
- Pulse generator and Pulse modulator control
- Modulation matrix
- DDS module including AM/FM/ φM modulator
- AM modulator
- Harmonics filter
- Pulse modulator
- RF amplifiers
- Level control
- Step Attenuator
- Reverse power protection
- Diagnostics

Internal and external 10 MHz reference

The instrument's reference frequency is determined either by the signal supplied by the built-in OCXO (A210 reference oscillator) or by an external 10 MHz reference signal that is fed to the input X201 REFIN. The output X202 REFOUT provides a buffered 10 MHz signal, which has been derived from the active reference source. In internal reference mode, the frequency of the OCXO can be adjusted by a DAC.

TCXO 200 MHz crystal oscillator

A built-in 200 MHz TCXO delivers the internal reference signal for the DDS based Synthesizer and LF generator..This TCXO is synchronized to the selected10 MHz reference signal (internal OCXO or external applied signal) with a PLL.

RF Synthesizer/ DDS module

The 200 MHz signal of the TCXO provides the system clock for the DDS module. The RF output frequencies from 9 kHz to 23.4375 MHz are generated directly by the DDS. In this mode all the modulation is done fully digital. The modulated signal is converted to the analog domain by a DAC. The analog RF signal is then low pass filtered, amplified and fed to the input of the step attenuator.

For set frequencies above 23.4375 MHz the DDS generates a signal with high resolution, that is upconverted with the 200 MHz Signal from the TCXO and then applied as reference signal to the main PLL of the RF frequency synthesizer. In the synthesizer a VCO is locked to the reference frequency using a fractional-n-PLL. The VCO output signal is then fed to fixed frequency dividers which are set to appropriate divider ratios to generate the RF signal from 23.4375 MHz to 2.2 GHz.

Harmonics filters

The output signal of the frequency dividers is a square wave signal. To reach the guaranteed harmonic performance (see datasheet) the harmonics of the RF signal have to be suppressed. Due to the wide RF frequency range multiple filters are needed. The different filters are selected according to the RF output frequency and their cut off frequency. They are put into the RF signal path by the means of RF switches.

LF generator

The above mentioned DDS module also generates the LF sine wave or square wave signal. This signal can be used as a source for internal modulation or as output signal at LFOUT BNC connector for frequencies up to 1 MHz in sine wave mode or up to 20 kHz in square wave mode. The output amplitude of the LF signal is set with a multiplying DAC in the range from 1 mV to 3 V.

Pulse Generator and Pulse Modulator

The pulse generator is also digitally implemented in the DDS module (FPGA). The pulse generator has three different modes. The pulse generator can run free, can be triggered or gated externally using the PULSE EXT input. The input impedance at the PULSE EXT BNC connector can be chosen high-impedance or 50 Ω. The pulse signal serves as a source for internal pulse modulation and can additionally be applied at the output PULSE/VIDEO in a buffered way.

Below 23.4375 MHz the pulse modulator is implemented digitally switching on and of the output signal of the DAC. Above 23.4375 MHz three RF switches in series are used as pulse modulator.

Modulation matrix and AM/FM/φM modulator

The external modulation signal from MODEXT can be AC- or DC-coupled. This signal is converted into the digital domain by the means of a 12 Bit ADC. The Frequency and Phase Modulations are implemented fully digital in the DDS module..For output frequencies below 23.4375 MHz the AM is implemented fully digital as well. For RF frequencies above 23.4375 MHz, the modulation signal is applied as reference signal to the level control loop. The AM modulation depth is set by a multiplying DAC. A switch matrix to select internal, external or internal + external modulation signals is implemented in analog circuitry and additionally in the digital domain. For RF frequencies from 23.4375 MHz to 375 MHz a variable gain differential amplifier and above 375 MHz a PIN modulator is used as AM modulator in the RF path.

Automatic Level control

With the means of a directional coupler a small part of the output of the power amplifier is fed to an RF detector. The output signal of this RF detector is fed to the Automatic Level Control (ALC) unit. The ALC sets the Level Control Voltage controlling the AM modulators to reach the desired output level.

Step Attenuator and reverse power protection

Due to the limited dynamic range of the ALC RF detector the regulated RF signal is attenuated with passive attenuators. The step attenuator is a settable attenuator with known attenuation.

At the RF output of the RF Board a reverse power protection circuitry detects RF power fed into the RF Board from outside the instrument. To protect the SMB100A against damage a relay disconnects the RF output, when a reverse power of more than approximately 34 dBm is detected. In standby or power off mode this relay is also in off state to protect the RF output of the instrument from damage.

Supply voltage control and filtering

The module supply voltages are filtered by means of passive filtering and additional active voltage regulators. Linear regulators with very good noise and distortion suppression characteristics have been implemented based on operational amplifier circuitry.

Power Supply Module

The power supply module provides all necessary voltages for the operation of the signal generator. It can be switched on and off by means of the power switch on the rear panel. After switch-on, the instrument is either in standby or in operating mode, depending on a value stored in an internal EEPROM.

The power supply works over a wide input voltage range from 100 V to 240 V (±10 %) and AC supply frequencies form 50 Hz to 60 Hz (±5 %).

On the secondary side, the power supply generates three DC voltages (+5.0 V, +13.25 V, -13.25 V) and one standby voltage (+5 V), all ±5 %.

The secondary voltages are open-circuit-proof and short-circuit-proof with respect to ground and each other.

The power inlet module contains two fuses. Replace these fuses only with type and rating specified on the rear panel. If the replaced fuse blows again, change the module.

Further fuses are fitted on the BASIS BOARD as a means of fire protection.

Basis Board

The Basis Board of the signal generator involves the following components and modules:

Fuses

Each supply voltage is fused with one or several fuses on the Basis Board.

Switching regulators

The built-in switching regulators generate the additional 1.2 V, 1.8 V, 3.3 V, 7 V and 28 V supply voltages.

Controller

Central Controller of the SMB100A including all memory devices and external interfaces.

FPGA (SMB_COM)

The SMB_COM FPGA contains the serial bus for internal communication of the instrument, timer functions, the display controller and the logic of the frequency counter.

Keyboard Controller

The keyboard controller notifies the processor about keyboard and spin wheel events. The keyboard controller switches on or off the power supply module and memorizes the power on state of the instrument when the main power is cut. This state is reconstituted on powering the instrument again.

Diagnostic ADC

The diagnostic ADC is used for measuring the voltages in the unit. These voltages are used for internal adjustments and the ALC S&H mode of the SMB100A. Additionally the failure diagnostic of the instrument is carried out by the use of ADC.

EEPROM

The following data is stored here: Serial number of the instrument, header line data of the board.

Temperature sensor

A temperature sensor mounted on the Basis Board monitors the temperature. If a defined temperature above the guaranteed maximum operating temperature is exceeded, the power supply is switched off. So the SMB100A secures itself against damage due to overheating.

Fan Controller

A fan for cooling the RF modules is connected to the BASIS BOARD and directly controlled according to the temperature of the Basis Board. This is done independent of the controller.

Stereo/RDS Coder module

For support of FM Stereo modulation an optional Stereo/RDS Coder module can be installed. The Coder accepts analog signals from the external audio input rear connectors or generated by the RF-Board LF Generator. Alternatively, digital S/P DIF audio signals can be supplied to the S/P DIF connector on the rear panel.

The coder digitally performs the signal processing and generation of ARI/RDS signals. The coder output provides the analog multiplex signal that is fed into the RF-Board modulation matrix.

For power supply and digital control the Coder module is connected to the Basis Board by a ribbon cable.

Troubleshooting

The purpose of these troubleshooting instructions is to help to trace down malfunctions to board level. The instrument can thus be made ready for use again by means of board replacement.

If error tracing doesn't show clear results, we recommend that you ship your instrument to our experts in the service centers (*see* address list) for module replacement and further error elimination. Some module replacements involve calibration procedures requiring calibrated equipment and appropriate software.

DANGER **Danger of shock hazard**

For module replacement, ensure that the instrument is switched off and disconnected from the power supply by removing the plug from the AC and DC power connector.

Read all safety instructions at the beginning of this manual carefully before module replacement!

NOTICE **Risk of damage to the boards**

Be careful not to cause short circuits when measuring voltages at pins placed close together!

The following utilities are provided in the signal generator for easy diagnosis:

- Internal selftest
- Internal diagnosis test points
- Internal adjustments
- Info line with error messages and history of messages
- Internal keyboard test

Note: *When problems occur, first check whether any connections (cables, plug-in connections of boards, etc) are damaged or wrongly connected.*

Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S order No.
1	DC voltmeter		R&S URE	0350.5315.02
2	Spectrum analyzer	Frequency range 0 to 7 GHz	R&S FSP	1164.4391.07
3	Adapting cable	1 m long SMP-to-SMA connection	-	1129.8259.00
4	Oscilloscope	100 MHz	TDS 220	

Switch-On Problems

The yellow LED on the front panel, next to the ON/OFF Button is directly connected to the Standby Voltage of the power supply (via a resistor on the Basis Board) and is therefore a good indicator of the basic working of the power supply.

When the instrument is switched on, the following modules are involved:

- Power supply
- Basis Board
- Switching pad

To analyze switch-on and switch-off problems that occur with the R&S SMB, the interplay of the individual modules is summarized in the following.

Switch-on

When the ON/OFF button on the front panel is pressed, the signal on pin 21 of X112 (switching pad connector) goes low. In this case the Basis Board pulls the signal on pin 13 of X101 (power supply connector see *Fig. 3-3*) low, which in turn switches on the power supply. In case of a prior emergency shutdown (pressing the ON/OFF Botton for more than 5 seconds) it may take a few seconds until this mechanism works again.

Within four seconds after switch-on, the CPU takes over the control of pin 13 of the power supply connector. If the green LED on the front panel lights up for only a short time (approx. five seconds) and then the orange standby LED lights up again, this means that the CPU is not booting properly. The cause may be a defective or overheated power supply or Basis Board.

- **Error: Instrument cannot be switched on.**

Action	Possible error causes and further steps
Check power-on switch on the rear. Check fuses on the rear. ⇓	Power switch OFF: Switch on power supply.
Check yellow LED (standby). ⇓	LED remains unlit: Measure standby voltage at pin1 X101 (see *Fig. 3-1*). Rated value: 4.75 V… 5.25 V No voltage: Check power cable from power supply. no/faulty voltage: change power supply Otherwise: Loose Cable W112 or bad contact of switching pad.

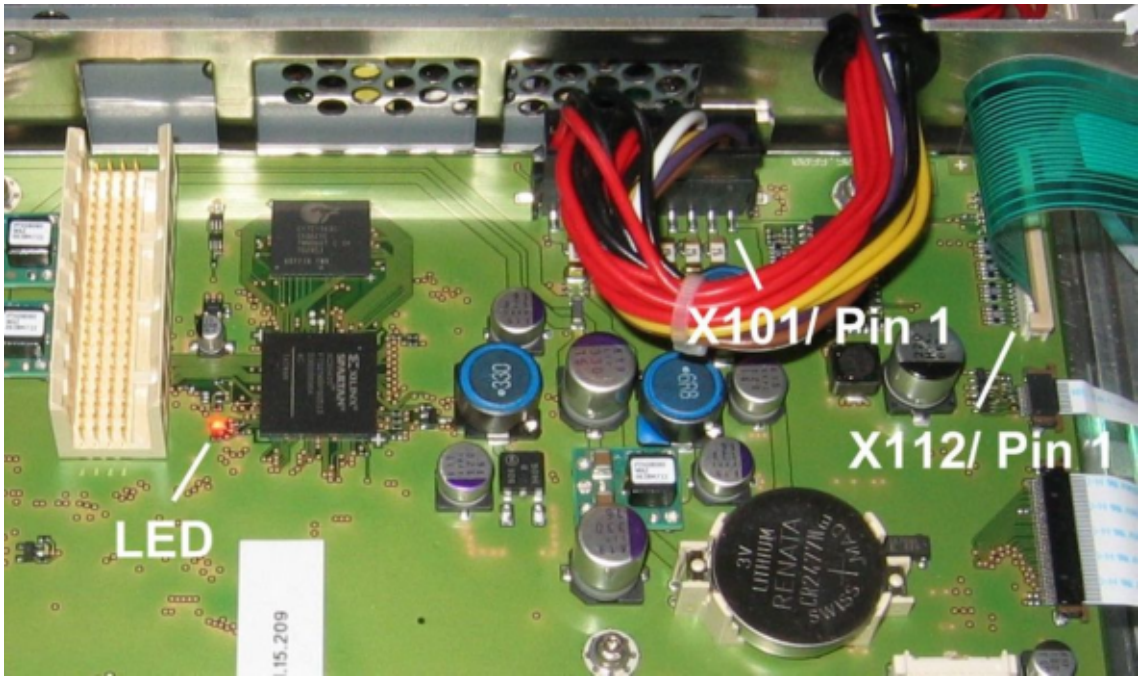


Fig. 3-1 LED, X101 and X112 location on the Basis Board

Switch-off

Besides pressing the power switch, the instrument can be switched off in three ways.

After briefly pressing the ON/OFF button on the front panel, the CPU performs a normal system shutdown and then powers off the power supply via pin 13 of the power supply connector.

Pressing and holding the button on the front panel for longer than five seconds leads to an emergency shutdown, which is controlled by special hardware on the Basis Board. In this case, no user data can be saved.

The instrument can also be switched off by means of the temperature monitoring circuit on the Basis Board. If the temperature sensor on the Basis Board detects an over temperature (e.g. in the event that a fan fails), the power supply is switched off via pin 13 of the power supply connector. It can only be switched on again, after cooling down.

- **Error: Signal generator starts up but display remains black**

Description of error	Possible error causes and further steps
CPU does not boot correctly	➢ Check red LED on Basis Board (see *Fig. 3-1*). If LED does not turn red approx. 1 sec after power on, either the Basis Board FPGA does not configure correctly or the CPU does not boot: try to update the firmware, which includes the FPGA configuration data. If this does not help: Change Basis Board
Cables are loose	➢ Check cabling between Basis Board and Display
TFT display defective	➢ Replace Front panel with TFT display

- **Error: Fan does not work**

Description of error	Possible error causes and further steps
Fan does not work	Disconnect fan and check voltage on BASIS BOARD X116 (fan connector) between pin 1 and 2 (see *Fig. 3-2*): Rated voltage:8 V … 13 V, depending on temperature. Correct voltage: Replace fan Faulty voltage: Check the power supply of the Basis Board (see page *3.20*).

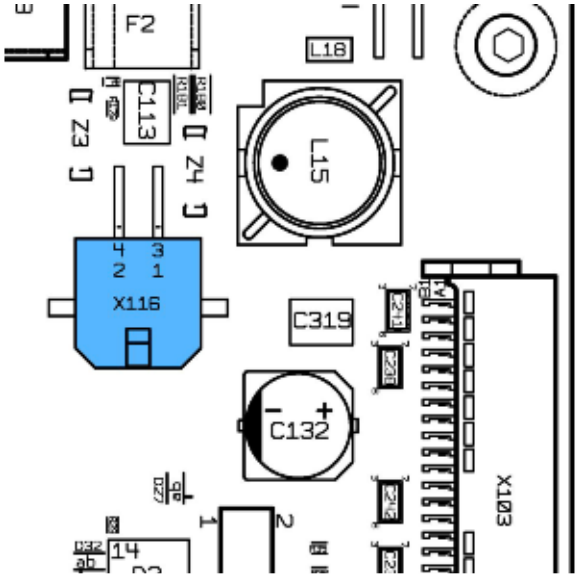


Fig. 3-2 X116 Fan Connector Pin Location

Problems with Booting

- **Error: Unit does not start the application**

After switch-on, the signal generator first runs the Boot Loader. The Boot Loader displays the R&S Logo. The Boot Loader loads the FPGAs on the Basis Board and on the RF Board. After successful initialization of the computer (approx. 10 seconds), the LINUX operating system starts up and displays the background picture. Subsequently, the application is loaded. During loading, several progress bars are shown on the display.

All software of the R&S SMB is stored in an on board flash memory. There are no serviceable hardware parts related to mass memory. The only possible service action is the reinstallation of firmware, which requires at least some basically working computer and firmware.

Normal action	Error, possible causes and corrective action
➢ Start signal generator	 R&S logo does not disappear Error: The operating system (LINUX) does not start. Reinstall the firmware of the device. If this does not solve the problem, replace the Basis Board.

Keyboard and Rotary Knob Test

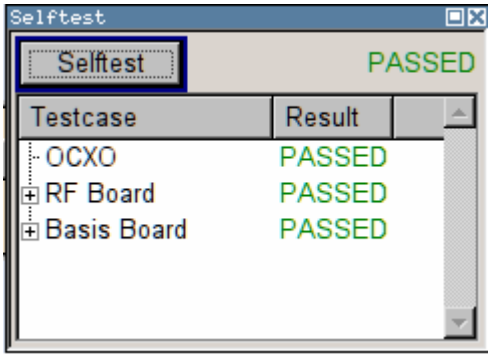
- This **utility** allows you to check for proper operation of all front panel control elements

Normal action	Error, possible causes and corrective action
Test called with SETUP - **Check Front Panel…**	
An image of the front panel appears with gray keys. When a key is pressed once or the knob is moved, the field changes to green. If the key is pressed more than once, the field changes to red.	***Note:*** *Be careful with the rotary knob! Turn only slightly in the specified direction; otherwise the field will change to red.*
When all operating elements including the rotary knob have been actuated once, all fields are green. If operating elements have been actuated twice, the fields are red.	If the color changes to red at the first actuation, a malfunction has occurred (bouncing). If the color of the corresponding field remains the same after actuation, the function is defective. In either case: Change the switching pad and/or rotary knob.
A message is output when all keys have been pressed: "All Front Panel Keys were accessed correctly"	***Note:*** *No error message is output even if a number of keys are red. The user must decide whether a malfunction has occurred.*

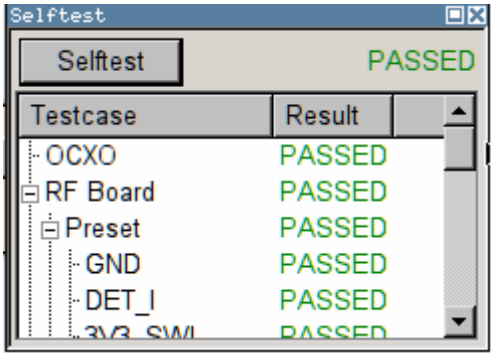
Troubleshooting with Internal Selftest

The internal selftest checks the instrument by setting different internal states and measuring internal diagnostic points.

Execute **SETUP** **- Selftest- Selftest** . The selftest reports the modules failing the test:



To see the details of the selftest open the corresponding branch of the result tree:



Troubleshooting with Internal Adjustments

Various internal adjustments are necessary for correct operation of the instrument. The failure of a certain adjustment can shorten troubleshooting considerably. The affected module is the RF Board module or the installed R&S SMB-B5 Stereo/RDS Coder module.

Note: *Failed internal adjustments can also be queried on the info page -> History.*

Normal action	Error, possible causes and corrective action
Internal adjustments call: SETUP - **Internal Adjustments - Adjust All** Internal adjustment of the RF Board and the optional R&S SMB-B5 Stereo/RDS Coder is executed.	Abort during adjustment: The synthesis and level adjustments are all carried out exclusively on the RF Board, only the Diagnostic A/D converter on the Basis Board is needed. If the synthesis or level adjustment fails and the Test Points on the Basis Board are in tolerance most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*). If not in tolerance check the Basis Board (see *Troubleshooting – Basis Board Module*) If the Stereo/RDS Coder adjustment fails and the synthesis and level adjustments succeed, most probably the Stereo/RDS Coder module is defective. Check the Stereo/RDS Coder being supplied correct (see page 3.30). If not in tolerance check the Basis Board (see *Troubleshooting – Basis Board Module*)

Instrument Faults

The following table lists R&S SMB Faults. For every fault additional test are described to determine the defective module.

Fault	Test	Action if test fails
RF Output Level is wrong	R&S SMB settings: • Instrument Preset • Reference internal • RF on • Level = 15 dBm Measure the Output Level with a power meter across the frequency range. The difference between set and measured level has to be lower than guaranteed in the datasheet.	Check the mating torque of the SMA-connector at cable W 212 being 60 N cm. Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
RF Output Frequency is wrong	R&S SMB settings: • Instrument Preset • Setup ➡ Adjustment ➡ 'Adjust all' • Setup ➡ Reference external • RF on • Level: 0 dBm Supply an external 10 MHz reference signal meeting the level and frequency specification given in the datasheet. Measure output frequency with a spectrum analyzer or a frequency counter synchronized to the same reference. The frequency error has to be < 0.1 Hz.	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
	R&S SMB setting: • Setup ➡ Reference internal Measure the 10 MHz reference output signal with spectrum analyzer or frequency counter and power meter. Output frequency and level have to meet the specifications given in the data sheet.	Without Reference Oscillator B1 being equipped most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*). If the R&S SMB is equipped with Reference Oscillator R&S SMB-B1 remove the unit (see page *3.55*) and perform this test again. If it works most probably the Reference Oscillator B1 is defective. Check the Reference Oscillator being supplied correct (see page *3.28*).

Fault	Test	Action if test fails
Poor Harmonic Distortion	R&S SMB settings: • Instrument Preset • Reference internal • RF on • ATT-Mode Auto • Level = Maximum guaranteed level for harmonic distortion (see datasheet) Measure the level of the fundamental frequency with a spectrum analyzer. The level of every harmonic has to be at least 30 dB lower than the level at the fundamental frequency. Repeat this test over the frequency range of the instrument. Comment: In ATT-Mode fixed harmonic distortion is not guaranteed above Levels displayed under 'Level' menu ➡ 'Attenuator Settings' ➡ 'Fixed Range in'.	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
Overvoltage protection does not trigger	Switch on RF -> apply a RF power of >2 W to RF N connector -> The overvoltage protection must trigger.	If RF output is not switched of the RF Board is defective.
Slow Settling times	Settling times are defined for GPIB remote control only. The settling time is the time-delay after asserting EOI until level and frequency are within the given tolerance from their final values. Be careful not to measure with an instrument drifting on its own due to applying the RF from the R&S SMB.	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
10 MHz Reference Input faulty	Check the 10 MHz reference signal fed into the R&S SMB with a spectrum analyzer or frequency counter and power meter. If level and frequency of this signal is matching the specification in the datasheet set the R&S SMB to: • Instrument Preset • Reference external • RF on • Frequency = 1 GHz • Level = 0 dBm Check for error Messages. No "External Reference Errors" are allowed to occur. Measure output frequency with a spectrum analyzer or a frequency counter synchronized to the same reference. The frequency error has to be < 0.1 Hz.	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).

Fault	Test	Action if test fails
10 MHz Reference Output faulty	R&S SMB setting: • Setup ➡ Reference internal Measure 10 MHz reference output signal with spectrum analyzer or frequency counter and power meter. Output frequency and level have to meet the specifications given in the data sheet.	*R&S SMB without Reference Oscillator R&S SMB-B1:* Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*). *R&S SMB with Reference Oscillator R&S SMB-B1:* Remove the Reference Oscillator B1 (see page *3.55*) and perform this test again. If still failing most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*). If the 10 MHz reference signal is in tolerance most probably the Reference Oscillator B1 is defective. Check this module being supplied correct (see page *3.28*).
LFGen Output Faulty	R&S SMB settings: • LFGen Stat off Measure the input resistance of the LF signal output with a multimeter. The input resistance should be 15 Ω ± 10 Ω.	Check the connection of cable W215 to the RF Board *(see Removing the RF-Board).* If it is connected correct most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
	R&S SMB settings: • Setup ➡ Reference internal • LFGen Stat on • LFGen Level 1 V • LFGen Frequency 100 kHz Attention: LF specification applies to loads greater or equal 200 Ω only! Check the level at the 'LF'-BNC Connector with an oscilloscope or voltage meter. Check the frequency and harmonic distortion with an oscilloscope with FFT functionality or with a spectrum analyzer with high input impedance (i.e. with a 150 Ω series resistor).	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
MOD ext Input Faulty	Measure the input resistance of the Mod Ext BNC connector signal with a multimeter. The input resistance should be 221 kΩ ± 20 %	Check the connection of cable W214 to the RF Board *(see Removing the RF-Board).* If connected correct most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).

Fault	Test	Action if test fails
Amplitude Modulation Faulty	The AM is specified only up to the Peak Envelope Power (PEP) noted in the datasheet. The PEP value of an AM signal with depth m at setting level P is P_{PEP} = Level + 20 $\log_{10}$(1+ m/100) So at m = 100 % the PEP is 6.02 dB higher than the setting level shown in the display. The AM performance has to match the values given in the datasheet. Measure with a true demodulating receiver, i.e. a R&S FSMR or R&S FSL/ FSP/ FSU/ FSQ spectrum analyzer equipped with option R&S K7	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
Frequency/ Phase Modulation Faulty	FM and PhiM Modulation are generated in the DDS synthesizer reference signal on the RF Board. Run Internal Adjustments to ensure the VCOs generating the RF signal working in their optimum. The FM performance has to match the values given in the datasheet. Measure with a true demodulating receiver, i.e. a R&S FSMR or R&S FSL/ FSP/ FSU/ FSQ spectrum analyzer equipped with option R&S-K7	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
Pulse Generator/ Pulse Modulator Faulty	The pulse generator is implemented fully digital in the RF Board FPGA. The pulse signals are fed exclusive on the RF Board to the pulse modulator switch. All external pulse-BNC connectors are fitted on the RF Board as well.	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
Signal Valid	This signal is driven from the RF Board FPGA and the Signal Valid BNC connector is directly fitted onto the RF Board as well.	Most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).
Faulty Remote interface IEEE488, USB or LAN	All remote interfaces including the interface connectors are fitted directly on the Basis Board.	Most probably the Basis Board is defective. Check the Basis Board being supplied correct (see page *3.20*).
External Stereo input Faulty (only applies if option R&S SMB-B5 Stereo/RDS Coder is installed)	Measure the input resistance of the STEREO L, R inputs on the rear panel with a multimeter. The input resistance should be 600 Ω ± 20 % or 200 kΩ ± 20 % dependent on the setting in the Stereo menu Measure the input resistance of the STEREO S/P DIF input on the rear panel with a multimeter. The input resistance should be 75 Ω ± 20 %.	Check the connection of STEREO L, R, S/P DIF cables to the Stereo Coder module *(0).* If connected correct most probably the Stereo Coder module is defective. Check the Stereo Coder being supplied correct (see page).

Fault	Test	Action if test fails
Stereo Modulation Faulty (only applies if option R&S SMB-B5 Stereo/RDS Coder is installed)	The FM Stereo multiplex signal is generated in the Stereo coder module and transferred to the RF Board modulation input. Run Internal Adjustments to ensure the VCOs generating the RF signal working in their optimum and adjust the Stereo coder module. The FM Stereo performance has to match the values given in the datasheet. Measure with a suitable demodulating receiver.	If the Internal Stereo Coder Adjustment fails and the Synthesis Adjustment succeeds, check the Stereo coder output (see). If the Synthesis Adjustment fails, most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).

Troubleshooting – Basis Board Module

Supply Voltages

Before Troubleshooting on the Basis Board switch the R&S SMB on and measure the supply voltages on its power supply connector (X101, see *Fig. 3-3*) and compare them to the values specified in the table below. Pin 13 is the Power On-Signal for the power supply. As long as the voltage at this pin is +5 V the power supply is switched off. The power supply is turned on by assigning 0 V to this pin. If one or more voltages are not of the required level, the power supply is defective.

Pin at X101	Test Point	Fuse	R&S SMB in **stand by mode**	R&S SMB switched **On**
5…10	+5V	F7	0 V	+4.7 V … +5.3 V
5…10	+5V_IQ	F4	0 V	+4.7 V … +5.3 V
3, 4	+12V	F3	0 V	+12.4 V … +14.2 V
3, 4	+12V_IQ	F5	0 V	+12.4 V … +14.2 V
2	-12V_IQ	F6	0 V	-14.2 V … -12.4 V
	+3V3		0 V	+3.1 V … +3.5 V
	+28V		0 V	+26.6 V … + 29.4 V
	+2V5		0 V	+2.38 V … +2.63V
	+1V2		0 V	1.14 V … 1.26 V
1			+4.5 V … + 5.5 V Standby	+4.5 V … + 5.5 V Standby
13			> +3 V	< 0.8 V
14…20			GND	GND

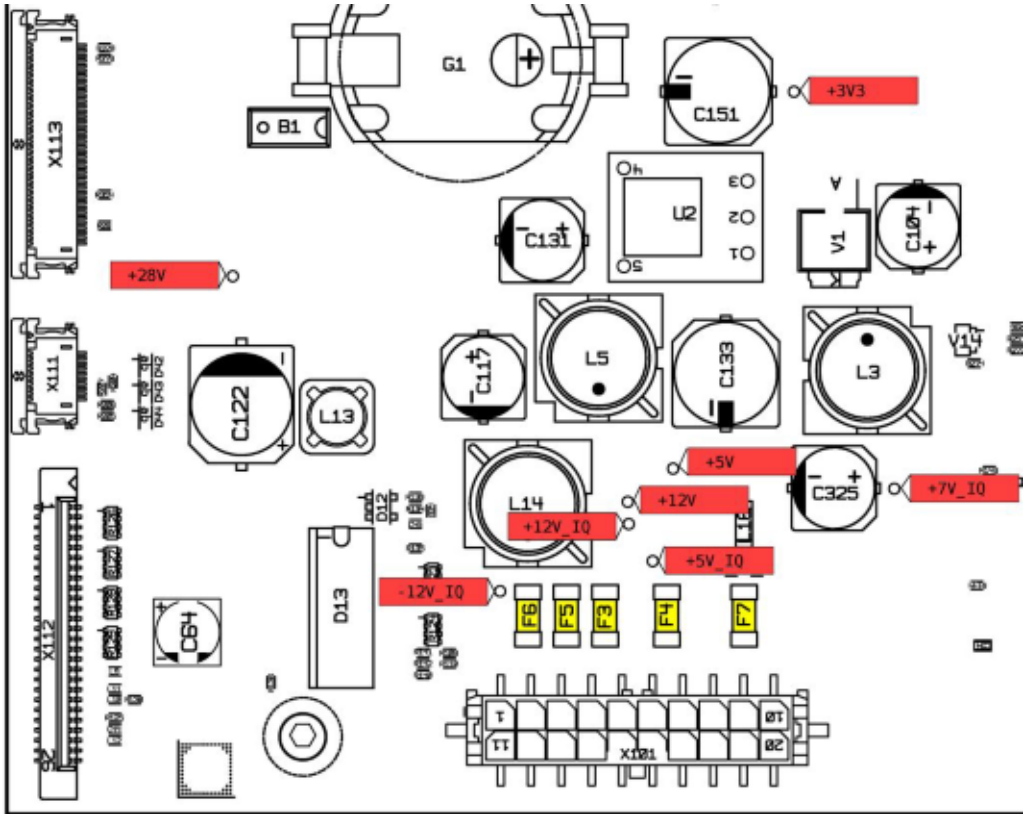


Fig. 3-3 Power Supply Connector of the Basis Board

Fuses

Switch on the R&S SMB and measure the voltage drop across the fuses F3 – F7 (yellow marked see *Fig. 3-3*) with a multimeter. The voltage across every fuse should be in the range -100 mV … +100 mV. The fuses might be blown due to a defective module other than the Basis Board. If one of the fuses is blown replace the fuse with the correct type given below. Remove connection W222 to the RF Board and W113 to the display. Switch on the R&S SMB and check the voltage drop across the fuses after two minutes again. If one of the fuses is blown again the Basis Board is defective. If the fuses are OK switch of R&S SMB again and then connect the display and switch on the R&S SMB again. If one of the fuses is blown after two minutes and the display is not working the display is defective. If the RF Board is equipped with the Reference Oscillator B1 remove this unit first (see page *3.55*). Now repeat the fuse test by first adding the connection to the RF Board and then adding the Reference Oscillator B1. The module causing the blown fuse is defective.

Fuse	Type	R&S Part Number	Manufacturer Part Number
F3	T5A	1090.4442.00	Littlefuse R452.005 NRL (MRL)
F4	FF10A	6104.9199.00	Littlefuse R452.010 NRL (MRL)
F5	T5A	1090.4442.00	Littlefuse R452.005 NRL (MRL)
F6	T5A	1090.4442.00	Littlefuse R452.005 NRL (MRL)
F7	FF10A	6104.9199.00	Littlefuse R452.010 NRL (MRL)

Troubleshooting − RF Board Module

The tests listed below ensure that an assumed error on the RF Board module is not caused by a defective or incorrectly connected cable, incorrect adjustment or another module.

Internal Adjustment "Adjust All"

A comprehensive test of the module is to run the internal adjustment.

Normal action	**Error, possible causes and corrective action**
Internal adjustments call: SETUP - **Internal Adjustments - Adjust All** Internal adjustment of the RF Board is executed.	Abort during adjustment: The adjustments are all carried out exclusively on the RF Board, only the Diagnostic A/D converter on the Basis Board is needed. If the voltage levels at all Test Points on the Basis Board are in tolerance most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*). If not in tolerance check the Basis Board (see page *3.20*)

Supply Voltages

Remove the RF Board from the chassis and connect cable W222 from the Basis Board. Switch on the R&S SMB and measure the supply voltages of the RF Board at the series coils near its power supply connector (X222, see *Fig. 3-4*). The measured voltages have to meet the values given in the table below. If one or more voltages are not of the required level, check the Basis Board (see page *3.20*).

Measuring Point	R&S SMB switched On
Shielding enclosure	GND
L6004	+3.1 V … + 3.5 V
L6001	+6.5 V … +7.5 V
L6000	+12 V … +14 V
L6002	-14 V … -12 V
L6003	+26 V … + 30 V

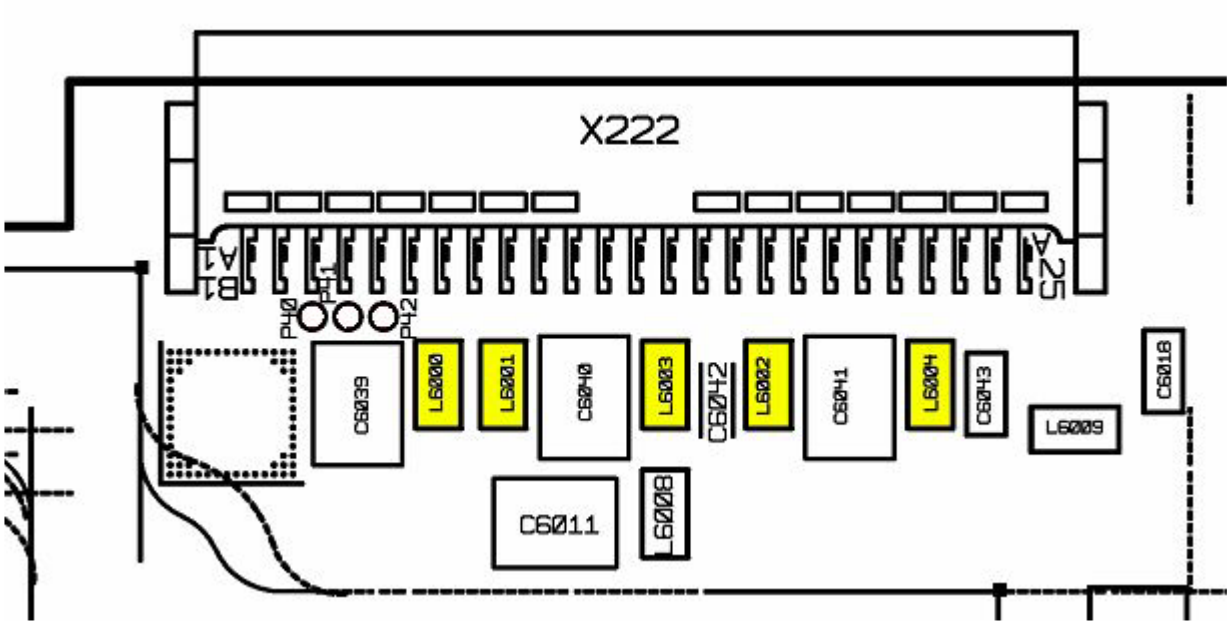


Fig. 3-4 Power Supply and digital interface connector of the RF Board.

Control Signals

The control signals of the RF Board can be measured at test points near connector X222 (see *Fig. 3-5*). Signals going to the RF Board are colored red and signals coming from the RF Board are colored blue.

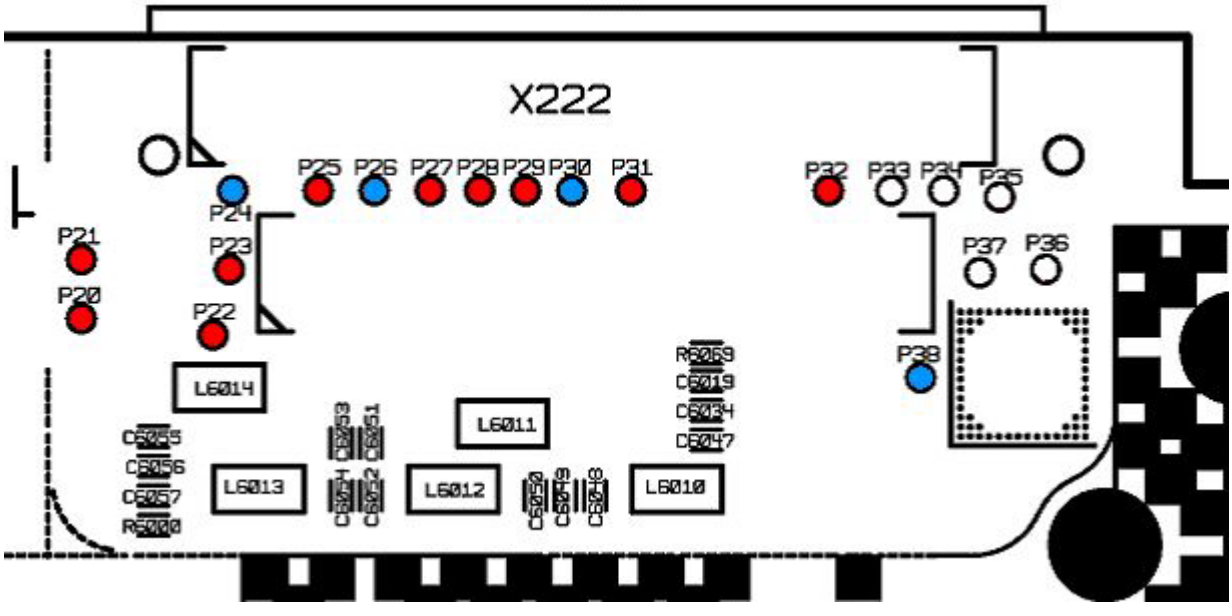


Fig. 3-5 Signal Test Points of the RF Board.

Perform the following settings at the R&S SMB:

- Preset
- RF on
- Unlock Protection Level **2**: 147946
- SETUP - Test Point ⇨ Select Test Point ⇨ DIAG_SMB_RF_LCON
- SETUP - Test Point ⇨ State ⇨ on

Preset the R&S SMB and control the following signals with an Oscilloscope.
Oscilloscope settings:

- Voltage: 1V / Div
- Timespan: 1 µs/ Div
- Trigger: Normal

Measure these signals

Test point	Function	Signal at normal operation	Defective
P23, P25, P27, P28	Logic Control Signals	Check the serial number of the RF Board displayed in the GUI: SETUP **- Hardware-Config – RF Board - More…** If the number is correct these signals are OK. If not measure these Test-Points with an Oscilloscope: They should toggle between 0 V and 3.3 V	Basis Board
P26	Logic Control Signal		RF Board
P29, P31	Reset	3.3 V	Basis Board
P30	Interrupt Signal	normal Operation: 3.3 V Switch R&S to Reference extern without applying 10 MHz Reference signal: 0 V	RF Board
P32	Blank Signal	normal Operation: 0 V during Frequency switching: + 3,3 V	Basis Board
P38	Diagnosis Voltage	Voltage toggles on every update of the diagnosis between 0 V and about 1/5 of the Diagnosis voltage reading in the Display	RF Board
P20, P21, P22	Logic Control Signals	Check the serial number of the MOD-FPGA displayed in the GUI: SETUP **- Hardware-Config – MOD-FPGA - More** If the number is not 0.0 these signals are OK. If not measure these Test-Points with an Oscilloscope: They toggle between 0 V and 3.3 V during the first seconds after switching on the instrument	Basis Board
P24	Logic Control Signal		RF Board

If one of these Signals is not as described change the connector cable and test again. If the signals still not match their description change the defective board according to the table.

Input and Output Signals

Connector, system	Signal name	Setting on signal generator	Frequency	Level	Signal flow
X212, SMA	RF out	RF on	9 kHz to 6 GHz	-145 dBm to + 30 dBm	to N RF connector at front
X215, SMP	LFGEN	LF out on	0.01 Hz to 1 MHz	0 V to 3 V	to LF out at front
X214, SMP	MOD EXT	AM/FM/PM Source Ext	0.0 to 1 MHz	-1 V to +1 V	From Mod ext at front
X213, SMP	REF200		200 MHz	4+-2 dBm	Output for testing purposes

Error Messages Concerning the RF Board Module

Error message	Error correction
“ALC unlocked”	➢ Automatic Level Control ALC exceeds upper bound. ➢ Set attenuator mode “Auto”.
"Synthesis main-loop PLL unlocked"	➢ Execute Internal Adjustment "Adjust Synthesis". ➢ If the error message does not disappear change the module.
"Synthesis adjustment failed"	➢ Execute Internal Adjustment "Adjust Synthesis". ➢ If error messages does not disappear, check the diagnosis (see *Troubleshooting with Internal Selftest*). If the diagnosis measurements work change the RF Board.
"Synthesis adjustment data invalid"	➢ Execute Internal Adjustment "Adjust Synthesis". ➢ If the error messages does not disappear, check the diagnosis (see *Troubleshooting with Internal Selftest*). If the diagnosis measurements work change the RF Board.

Warnings Concerning the RF Board Module

Warnings	Warning correction
“External reference oscillator out of range or disconnected”	➢ Check the external reference input signal. ➢ If the input signal is correct and the error message is still displayed, change the module.
“Output protection tripped”	➢ Excessive reverse power at the RF port tripped the output protection. ➢ Remove the overload condition and press the “RF ON/OFF” button to enter normal operation.
"Pep value greater than defined limit"	➢ The peak envelope power (PEP) is higher than the set upper limit. ➢ Reduce the output level.
"Pep value less than defined lower bound (fix range)"	➢ The peak envelope power (PEP) is lower than the permissible lower limit in the "fix range" mode of the attenuator. ➢ Increase the output level, set the attenuator mode to "Auto", or reset the "fix range" by briefly switching the attenuator mode to "'Auto" and then switching back to "Fixed".
"Pep value greater than defined upper bound (fix range)"	➢ The peak envelope power (PEP) is higher than the permissible upper limit in the "fix range" mode of the attenuator. ➢ Reduce the output level, set the attenuator mode to "Auto", or reset the "fix range" by briefly switching the attenuator mode to "'Auto" and then switching back to "Fixed".
"Settings conflict, pep value vs. AM depth"	➢ The peak envelope power (PEP) is higher than the permissible upper limit because of the set AM modulation depth. ➢ Reduce the output level or increase the level limit (e.g. by switching the attenuator mode to "Auto" if "Normal" or "Fixed" mode was set). Reducing the AM modulation depth will also eliminate the warning.
"Settings conflict, pep value greater than allowed level vs. frequency"	➢ The full output level range cannot be utilized at low frequencies below 1 MHz. because internal components may be overloaded. So you can only set max. +16 dBm CW level below 1 MHz and max. +8 dBm CW level below 50 kHz.
"Settings-conflict: PulseGen"	➢ Settings for the internal pulse generator are incorrect. Check timing settings of the pulse generator

Frequency Error

Error	Error correction
Internal reference frequency: Frequency error greater than limit given in datasheet	➢ The frequency accuracy of the synthesizer is determined (set to internal reference) by a highly stable 200 MHz quartz oscillator that is set to a calibrated frequency standard at the R&S factory. This oscillator is subject to ageing and hence its output frequency can be adjusted (see chapter 2 “Internal Counter Reference Oscillator Adjustment”). ***Note**: The internal reference can be impaired under the menu **Setup** - **Reference Oscillator** - **Adjustment**. This setting does not affect the factory adjustment and can be reset at any time by means of deactivation. If the tuning rang is insufficient to reach the frequency error given in the datasheet the TCXO is defective. Replace the RF Board.*

Troubleshooting − Reference Oscillator option R&S SMB-B1

If the frequency Error of the R&S SMB is > $3*10^{-6}$ the Reference Oscillator is defective, change the module.

Input and Output Signals

The Reference Oscillator has only one Futurbus connector (X1). The Reference Oscillator is plugged into the RF Board (X221 see *Fig. 3-6*). All signals and the supply voltage are fed to the module through this connector. Check the voltages for the OCXO being according to the following table. To test the serial bus signals watch the signal lines while toggling between internal and external reference with an Oscilloscope. Voltage Levels are 0 V and 3.3 V.

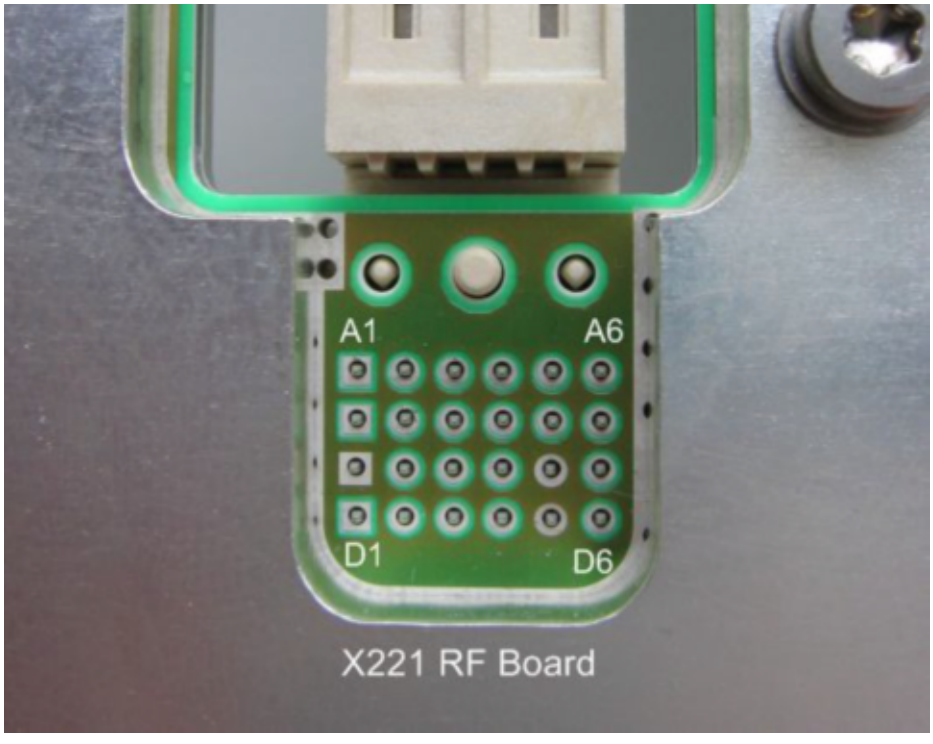


Fig. 3-6 Pin location X221 on RF Board

Pin of X221 RF Board	Voltage/ Signal	Pin of X221 RF Board	Voltage/ Signal	Pin of X221 RF Board	Voltage/ Signal	Pin of X221 RF Board	Voltage/ Signal
A1	Clock-signal serial bus	B1	NC	C1	GND	D1	+4.8 V - +5.6 V
A2	Data-signal to option serial bus	B2	0 V when Oven Cold	C2	NC	D2	0 V when option fitted
A3	Chip Select signal serial bus	B3	Data-signal from option serial bus	C3	+5.0 V when option on	D3	10 MHz LVDS signal
A4	NC	B4	NC	C4	NC	D4	
A5	NC	B5	NC	C5	GND	D5	GND
A6	+4.8 V - +5.6 V	B6	+4.8 V - +5.6 V	C6	+11 V – +14 V	D6	-8 V – -12 V

Error Messages Concerning the Reference Oscillator Module

Error message	Error correction
" OCXO 10 MHz oven cold	➢ If this message does not disappear after 10 minutes, OCXO is defective, change the module.
"Synchronization error on internal reference"	➢ Switch the R&S SMB to external Reference and supply a 10 MHz 10 dBm signal to the Reference Input of the RF BOARD. If the error disappears and the R&S SMB is working correct the OCXO is defective, change the modul.
"OCXO: cannot read EEPROM data" "OCXO: cannot store adjustment data"	➢ This indicates problems concerning the data transfer from and to the EEPROM of the module. If changing the module does not help, change the RF Board module.

Frequency Error, Reference Oscillator Adjustment

Error	Error correction
Internal reference frequency: Frequency error greater than limit given in datasheet	➢ The frequency accuracy of the synthesizer is determined (set to internal reference) by a highly stable oven controlled 10 MHz quartz oscillator that is set to a calibrated frequency standard at the R&S factory. This oscillator is subject to ageing and hence its output frequency can be adjusted (see chapter 2 “Internal Counter Reference Oscillator Adjustment”). ***Note**: The internal reference can be tuned by up to approx. $\pm 10^{-6}$ under the menu **Setup - Reference Oscillator - Adjustment**. This setting does not affect the factory adjustment and can be reset at any time by means of deactivation.*

Troubleshooting − Stereo/RDS Coder option R&S SMB-B5

Input and Output Signals

The Stereo/RDS Coder module is connected to the Basis Board via connector X108 and the ribbon cable W108. The cable supports the Stereo Coder power supply, the digital control lines, and the connections for internal audio input and multiplex output signal. The internal analog modulation signal generated by the RF Board and an associated GND signal passes through the ribbon cable W222 to the Basis Board. On the Basis Board a summing amplifier extracts the differential portion of the signals and delivers the result to the Stereo Coder.

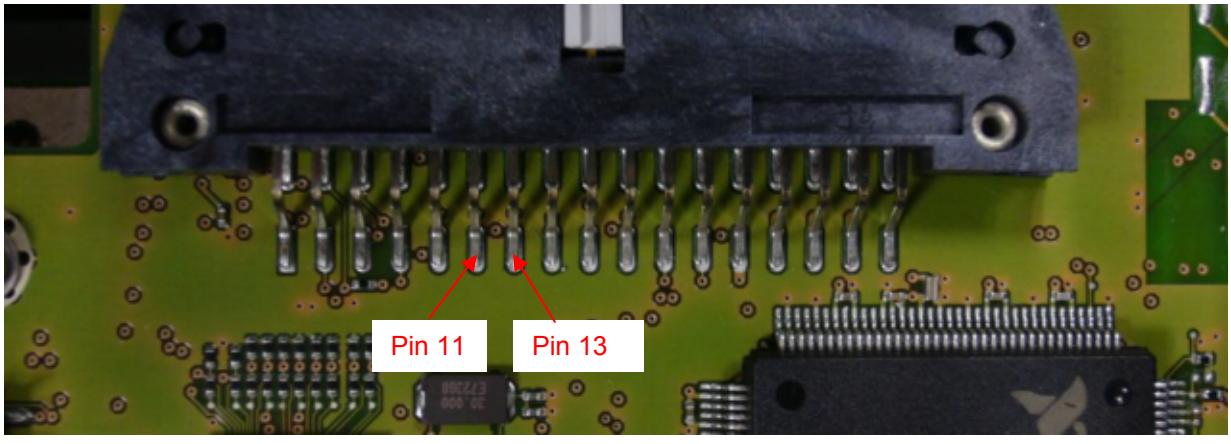
In addition, the Coder is connected to three external audio input BNC connectors on the rear panel via shielded SMP cables.

Stereo Coder module input / output	**Voltage/ Signal**	**Cable**
Connection to Basis Board connector X108	Power supply, digital control, internal analog input / output	W108
Stereo L	Left analog audio input	W401, BNC to SMP, shielded
Stereo R	Right analog audio input	W402, BNC to SMP, shielded
Stereo S/P DIF	S/P DIF digital audio input	W403, BNC to SMP, shielded
MPX	Stereo multiplex signal, not connected	-

Check the voltages for the Stereo Coder being according to the following table.

Pin at X108	**Pin at other end of W108**	**Test Point (Basis Board)**	**Fuse (Basis Board)**	**Voltage**
31	4	+12V_ANA	F3	+12.4 V … +14.2 V
29	6	-12V_ANA	F6	-14.2 V … -12.4 V
27	8	+5V	F7	+4.7 V … +5.3 V
25	10	+3V3	F7	+3.1 V … +3.5 V

Pin at X108	Test Point (Basis Board)	Remark
13	STEREO_MPX	Analog Stereo multiplex signal to rf-board
11	LF_STEREO	Analog modulation signal from rf-board



***Note**: Wire 1 (marked red) of the ribbon cable is connected to pin 34 of X108!*

Fig. 3-7 Pin location X108 on Basis Board

Error Messages concerning the Stereo/RDS Coder module

Error message	Error correction
"Stereo Coder not ready. Please reboot R&S SMB."	➢ Restart R&S SMB. If error persists, most probably the Stereo Coder module or the ribbon cable W108 is defective.
"General stereocoder hardware error" "General stereocoder DSP error"	➢ Restart R&S SMB. If error persists, most probably the Stereo Coder module is defective.
"Stereocoder I2C Bus error"	➢ Retry Stereo Coder access. If access fails, restart R&S SMB. If error persists, most probably the Stereo Coder module or the ribbon cable W108 is defective.
"Stereocoder realtime clock error" "General stereocoder software error" "Stereocoder RDS mailbox not ready"	➢ Restart R&S SMB. If error persists, most probably the Stereo Coder module is defective.
"Stereocoder DSP overflow"	➢ Reconfigure Stereo Coder commands. If error persists, restart R&S SMB.
"Stereocoder RDS configuration error"	➢ Reconfigure RDS consistently.
"Stereocoder command syntax error"	➢ Repeat command using correct syntax
"Invalid stereocoder command parameter"	➢ Repeat command with correct parameters.
"Stereocoder receiver overflow"	➢ Restart R&S SMB.
"Stereocoder offset adjustment failed"	➢ Reboot and repeat internal Stereo Coder adjustment. If adjustment still fails, check the Stereo coder signal path (see page *3.34*).
"Stereocoder gain adjustment failed"	➢ Reboot and repeat internal Stereo Coder adjustment. If adjustment still fails, check the Stereo coder signal path (see page *3.34*).
"Stereocoder S/P DIF adjustment failed"	➢ Make sure correct setting and connection of external S/P DIF source. Reboot and repeat internal Stereo Coder adjustment. If adjustment still fails, check the Stereo coder signal path (see page *3.34*).

Stereo/RDS Coder adjustment

Error	Error correction
RF carrier frequency is shifted by more than 2 kHz when activating Stereo modulation mode.	➢ The RF carrier frequency offset in Stereo mode can be internally adjusted. Perform SETUP **- Internal Adjustments - Adjust All**.
Deviation of pilot tone differs from setting value by more than 4 % or 270 Hz, whichever is greater.	➢ The pilot tone deviation can be internally adjusted. Perform SETUP **- Internal Adjustments - Adjust All**.
Deviation of analog audio signal using internal LF Generator or analog external input differs from setting value by more than 4 % or 1.6 kHz, whichever is greater.	➢ The audio signal FM deviation can be internally adjusted. Perform SETUP **- Internal Adjustments - Adjust All**. If error persists, check correct input signal on the external Stereo audio analog input.
Deviation of audio signal using external S/P DIF source differs from setting value by more than 4 % or 1.6 kHz, whichever is greater.	➢ The audio signal FM deviation using the S/P DIF input can be internally adjusted. Unlock Protection Level 2: 147946. Perform SETUP **- Internal Adjustments - Adjust S/P DIF**. If error persists, check correct input signal on the external Stereo audio S/P DIF input.

Stereo/RDS Coder Faults

Fault	Test	Action if test fails
External analog Stereo input faulty	Check the Stereo modulation with internal LF Generator.	Check the Stereo mode signal path (see page *3.34*). Otherwise, check the connection of STEREO L, R cables to the Stereo Coder module. If connected correct, most probably the Stereo Coder module is defective. Check the Stereo Coder being supplied correct (see page *3.30*).
External digital Stereo input faulty	Measure the input resistance of the STEREO S/P DIF input on the rear panel with a multimeter. The input resistance should be 75 Ω ± 20 %.	Check the connection of the STEREO S/P DIF cable to the Stereo Coder module. If connected correct, most probably the Stereo Coder module is defective.
Stereo Modulation faulty	The FM Stereo multiplex signal is generated in the Stereo coder module and transferred to the RF Board modulation input. Run Internal Adjustments to ensure the VCOs generating the RF signal working in their optimum and for adjustment of the Stereo coder module. The FM Stereo performance has to match the values given in the datasheet. Measure with a suitable demodulating receiver.	If the Internal Stereo Coder Adjustment fails and the Synthesis Adjustment succeeds, check the Stereo coder signal path (see page *3.34*). If the Synthesis Adjustment fails, most probably the RF Board is defective. Check the RF Board being supplied correct (see page *3.22*).

Stereo/RDS Coder signal path check

Perform the tests from top to bottom of the table.

Fault	Test	Action if test fails
Stereo mode signal path faulty	Set the Stereo Coder to **State** On **Audio Source** Off **Pilot State** On **Pilot Deviation** 10 kHz **ARI State** Off **RDS State** Off Check the signal at the multiplex input pin 13 of X108 of the Basis Board with an oscilloscope. The signal must be a 19 kHz sine wave with an amplitude of 80mVp to 200 mVp.	Most probably the Stereo Coder module or the ribbon cable W108 is defective. Check the Stereo Coder being supplied correct (see page *3.30*).
	Set the Stereo Coder to **State** On **FM Deviation** 40 kHz **Audio Source** Ext L, R **Mode Stereo** R=L **Preemphasis** Off **Pilot State** Off **ARI State** Off **RDS State** Off Provide a 1 Vp, 10 kHz sinewave signal to the external STEREO L and STEREO R connectors using a tee junction. Check the signal at the multiplex input pin 13 of X108 of the Basis Board with an oscilloscope. The signal must be a 10 kHz sine wave with an amplitude of 300mVp to 800 mVp. Change the setting to **Mode Stereo** R!=L Check the signal at the multiplex input pin 13 of X108 of the Basis Board with an oscilloscope. The signal must be a 10 kHz sine wave with an amplitude of 300mVp to 800 mVp.	If the cables to the rear panel are connected correctly, most probably the Stereo Coder module or the ribbon cable W108 is defective. Check the Stereo Coder being supplied correct (see page *3.30*).
	Set the Stereo Coder to **State** On **Mode Stereo** R=L **Audio Source** LF Gen **LF Gen Frequency** 10 kHz **LF Gen Shape** Sine Check the signal at pin B3 of X103 on the Basis Board with an oscilloscope. The signal must be a 10 kHz sine wave with an amplitude of 950mVp to 1050 mVp.	Most probably the RF Board or the ribbon cable W222 is defective. Check the RF Board being supplied correct (see page *3.22*).
	Set the Stereo Coder to **State** On **Mode Stereo** R=L **Audio Source** LF Gen **LF Gen Frequency** 10 kHz **LF Gen Shape** Sine Check the signal at pin 11 of X108 with an oscilloscope. The signal must be a 10 kHz	Most probably the Basis Board is defective. Check the Basis Board being supplied correct (see page *3.20*).

	sine wave with an amplitude of 900mVp to 1000 mVp.	
	Set the Stereo Coder to **State** On **FM Deviation** 40 kHz **Audio Source** LF Gen **Mode Stereo** R=L **LF Gen Frequency** 10 kHz **LF Gen Shape** Sine **Preemphasis** Off **Pilot State** Off **ARI State** Off **RDS State** Off Check the signal at the multiplex input pin 13 of X108 of the Basis Board with an oscilloscope. The signal must be a 10 kHz sine wave with an amplitude of 300mVp to 800 mVp.	Most probably the Stereo Coder module or the ribbon cable W108 is defective. Check the Stereo Coder being supplied correct (see page *3.30*).
	Set the Stereo Coder to **State** On **Audio Source** Off **Pilot State** On **Pilot Deviation** 10 kHz **ARI State** Off **RDS State** Off Check the signal at pin A1 of X103 on the Basis Board with an oscilloscope (it is ok to test at the via indicated in Fig 3-7). The signal must be a 19 kHz sine wave with an amplitude of 50mVp to 150 mVp.	Most probably the Basis Board is defective. Check the Basis Board being supplied correct (see page *3.20*).

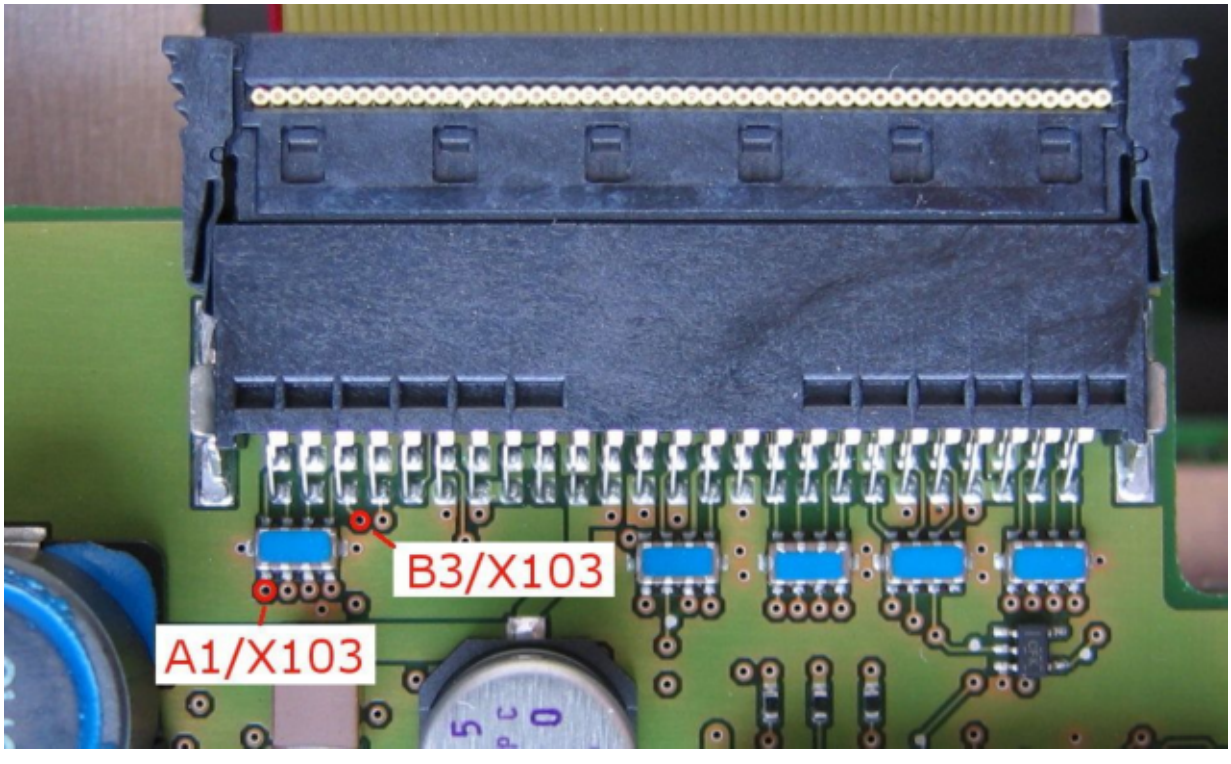


Fig. 3-8 Pin location X103 on Basis Board.

Module Replacement

This section describes in detail the replacement of modules. Chapter 5 provides information on how to order spare parts; it contains the list of mechanical parts with order numbers and the illustrations for module replacement.

Overview of the Modules

Table 3-1 Overview - module replacement

Module	Designation	Order No.	See page
Power Supply (AC 90 V to 264 V)	A50	1406.7320.00	3.52
Basis Board	A100	1406.6600.02 1406.6700.02	3.45
RF Board	A200	1406.7007.13/.16 1406.7207.13/.16	3.50
Reference Oscillator OCXO R&S SMB-B1	A210	1300.3180.03	3.55
Stereo Coder R&S SMB-B5	A400	1407.3240.00	3.56
Front Unit R&S SMB100A	A300	1406.7507.02	3.38
Encoder Board	A310	1300.3044.02	3.43
3.5" TFT (QVGA DRGB LCD)	A330	1407.3586.00	3.42
Push Button Board Set or Flex. Switch Board		1406.7542.00 1406.7559.00	3.43
Front Cover		1406.7520.00	3.38
Fan Unit	E1	1406.6330.00	3.54
Lithium battery CR 2477N (3.0 V / 0.95 AH)		4052.5673.00	3.47

Note: *The words "left" and "right" in the manual always refer to the front view of the instrument.*

After replacing an assembly

After you have replaced one of the assemblies, certain adjustments, functional checks or performance tests have to be carried out. Please refer to chapter 2 “Procedures after module replacement”.

Dismounting the Case

- Put the instrument on the front shock mounts.
- Unscrew the four screws of the rear shock mounts (rear right and rear left) on both sides and take them off.
- Pull off the case.

When mounting the case, take care not to damage or pull off cables!

Replacing Fuses

NOTICE **Risk of damage to the instrument**

Ensure that the power supply cord is disconnected.
If you are not using the supplied spares, be sure to use fuses of the same type and rating.

- Switch off the instrument.
- Disconnect the power supply cord.
- To replace a fuse, unscrew the fuse holder at the rear panel of the instrument.

Replacing the Front Cover and the Front Unit (A300)

(See chapter 5, drawing 1406.6000.01).

Removing the Front Cover

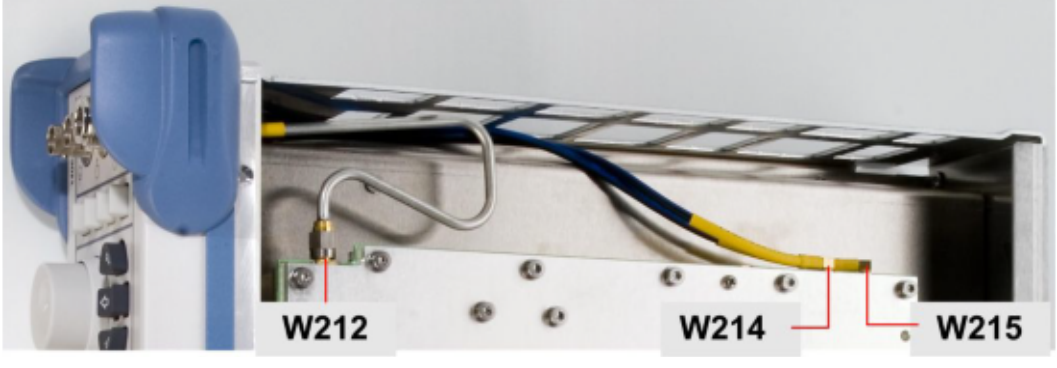
(See chapter 5, drawing 1406.7507.01).

- Switch off the instrument and pull the mains plug.
- Dismounting the case (see page *3.36*).
- Remove the front shock mounts.
- Pull off the front cover (1406.7520.00) towards the front.

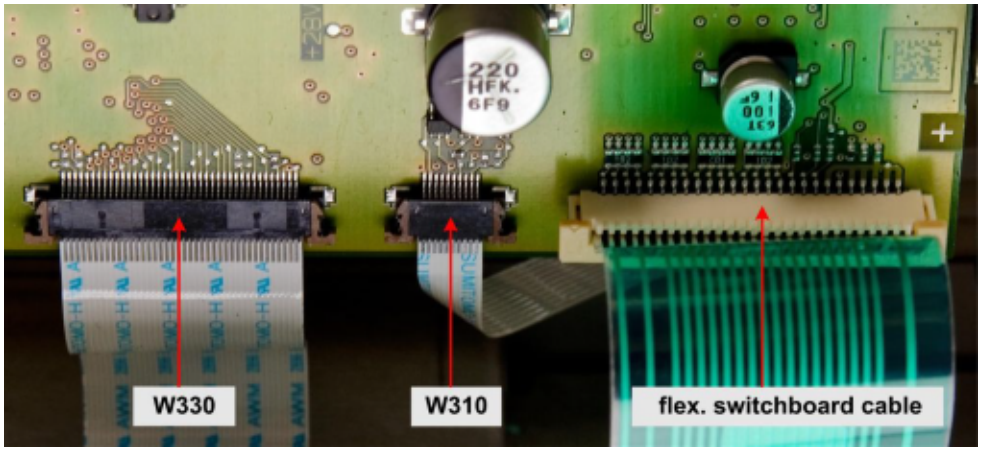
Removing the Front Unit

(See chapter 5, drawings 1406.6000.01 and 1406.7507.01).

- Pull off the RF cables W212, W214 and W215.



- Disconnect the flex. cables W310, W330 and the flex. switchboard cable.



- Pull off the front cover towards the front.
- Remove the knob of the encoder board.

- Unscrew four countersunk screws (1148.2752.00) in the front frame each at the top and at the bottom.

➢ Completely remove the front unit with keyboard and TFT display towards the front (front unit 1406.7507.02).

➢ Unscrew the four screws.
Pull out the RF cable W212 backwards.

Remove the two nuts.
Pull out the RF cables W214 and W215 forwards.

NOTICE

Store the RF cables at a save place.
These cables are not components of the front unit.

When you mount the cables, ensure their correct position in the front unit.

Mounting the Front Unit

- Place the front unit and fix it with four countersunk screws (1148.2752.00).
- Reconnect the cables to the RF-board (W212, W214 and W215) and to the basis board (W310, W330 and the flex. switchboard cable).

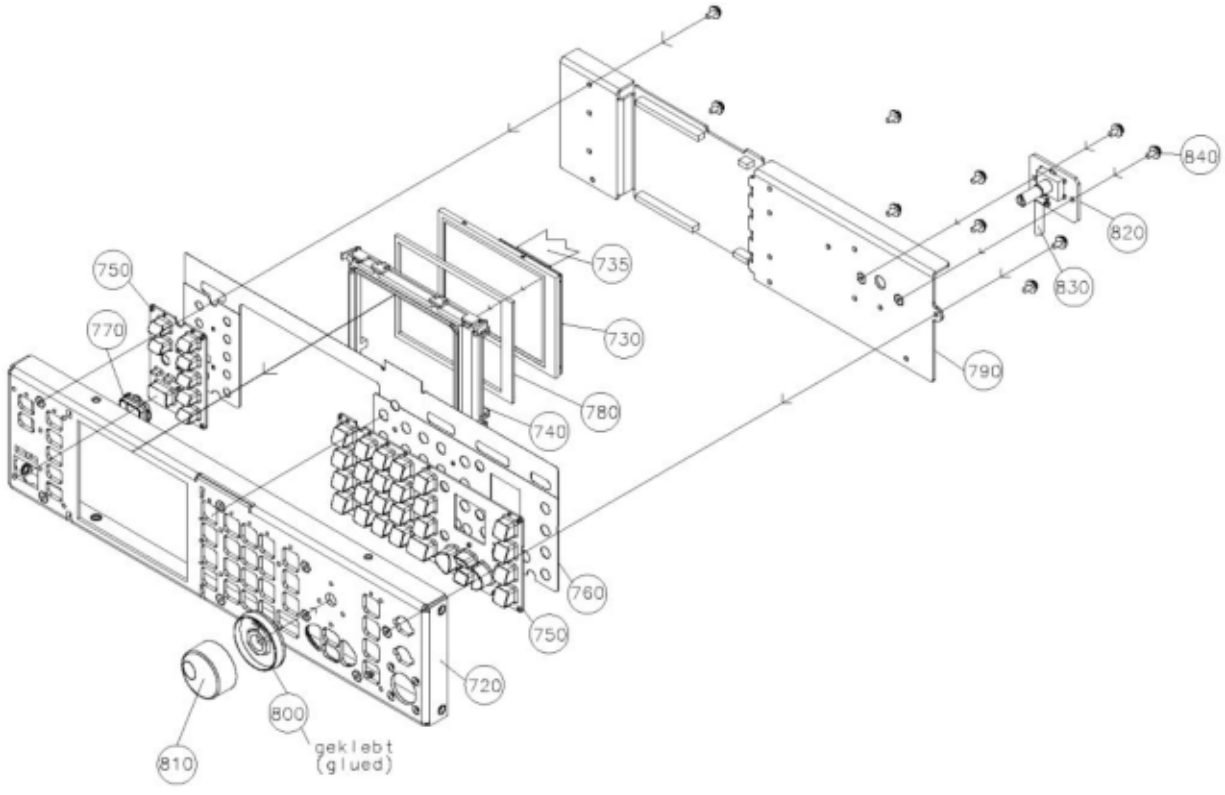
Mounting the Front Cover

- Mount the new front cover.
- Place the shock mounts (front right and front left) and fix them with four screws (1096.4896.00).
- Place the knob of the encoder board.

Replacing the TFT Display (A330), Encoder Board (A310), Flex. Switch Board and Pushbutton Board Set

It is recommended to replace the front unit as a whole. Principally, it is possible to replace the individual components of the front unit (see figure below).

(See chapter 5, drawing 1406.7507.01).

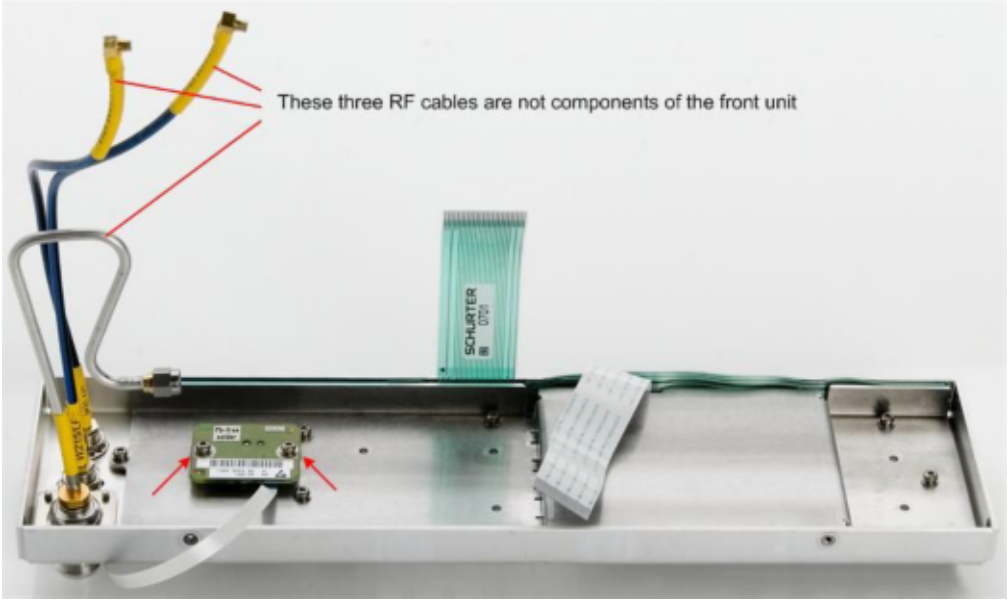


The TFT display is clipped in the display frame, which nestles in the mounting trough. The flex. switchboard and the pushbutton board are also lying in the mounting trough. These parts are fixed with the holding plate on the mounting trough. For replacement proceed as follows:

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws of the shock mounts (front right and front left) on both sides and take them off.
- Dismounting the case.
- Remove the front cover and the front unit (see above).
- Place the front unit together with the keys onto a clean surface.

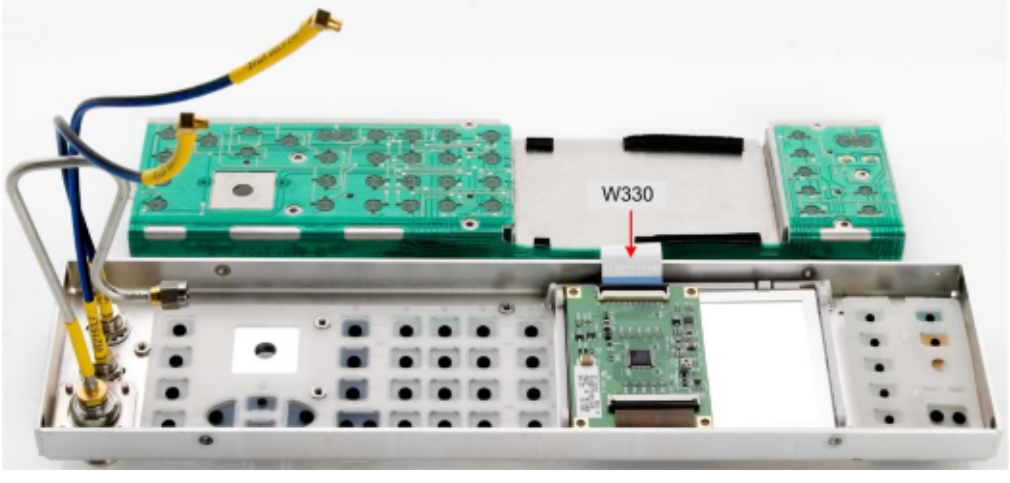
Replacing the Encoder Board

- Unscrew two combination screws (1148.3059.00).
- Replace the encoder board and fix it with two combination screws (1148.3059.00).



Replacing the TFT Display, Flex. Switch Board and Pushbutton Board Set

- Remove the encoder board.
- Unscrew the eight combination screws (1148.3059.00) and remove the holding plate (1406.7565.00).



- The pushbutton board set (1406.7542.00) and the flex. switch board (1406.7559.00) can now be replaced.
- Remove the display frame with the display and place it onto a clean surface.
- Remove the flex-strip (W 330).

NOTICE **Risk of damage to the board**

The ribbon cable connector must be carefully folded up.

- Open the clips from the display frame (1406.7594.00) and remove the display (1407.3586.00).
- Replace the powder seal (1406.7588.00) for a new one and clip the new display into the display frame.

NOTICE **Risk of damage to the board**

When installing the items, make sure they are free of dust.

- Connect the flex-strip (W 330) in the correct position.
- Fit the holding plate and fix it with eight combination screws (1148.3059.00).
- Fit the encoder board (W310) with two combination screws (1148.3059.00).

Replacing the Basis Board (A100)

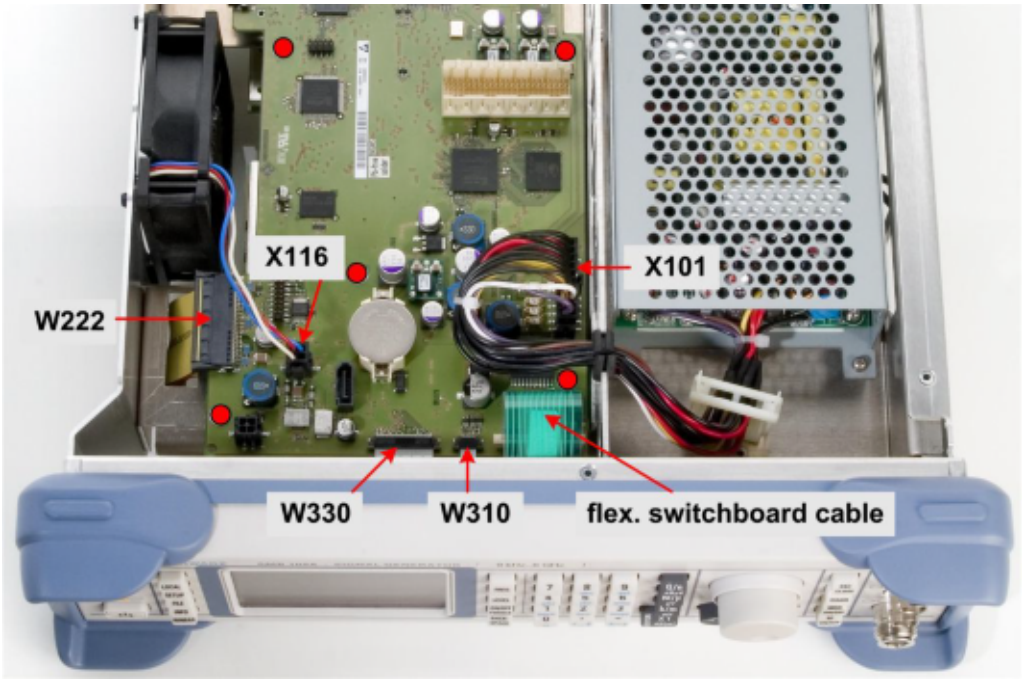
(See chapter 5, drawing 1406.6000.01).

Note: Different Basis Boards, order no. 1406.6600.02 or 1406.6700.02.

Removing the Basis Board

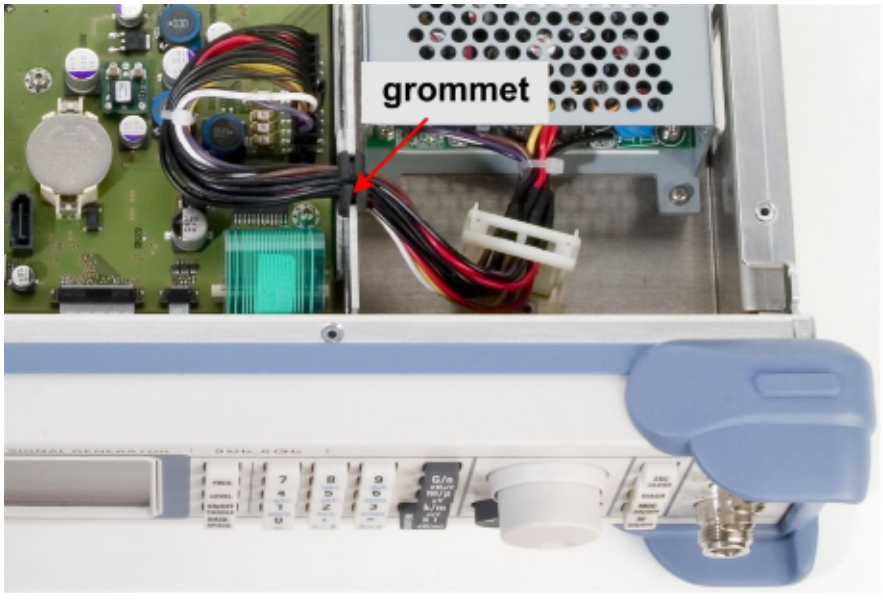
- Switch off the instrument and pull the mains plug.
- Dismounting the case (see page *3.36*).
- Unfasten lock of fan cable
- Disconnect the fan cable from X116 and the power supply cable from X101 (Remove the plastic tie before disconnect the cable).
- Disconnect the flex. cables W330, W310, W222 and the flex. switchboard cable.
- Unscrew one combination screw (0041.1653.00) and two screws (0041.1653.00) from the IEC-connector at the back of the instrument.

- Undo the five combination screws (red marked) on the basis board.
- Remove the basis board (by turning it up towards the front and pulling it out and upward).



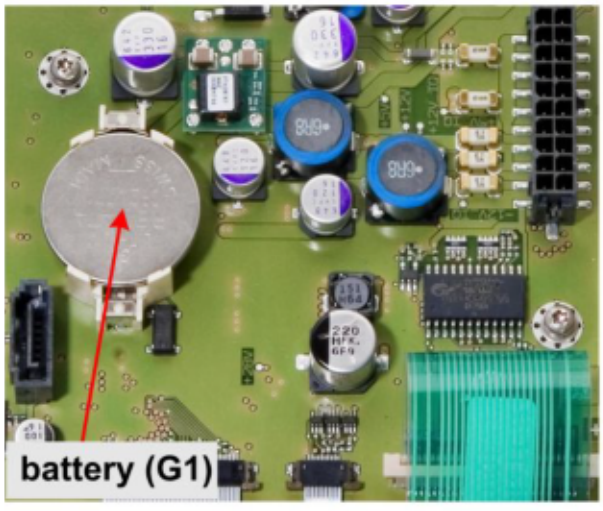
Installing the Basis Board

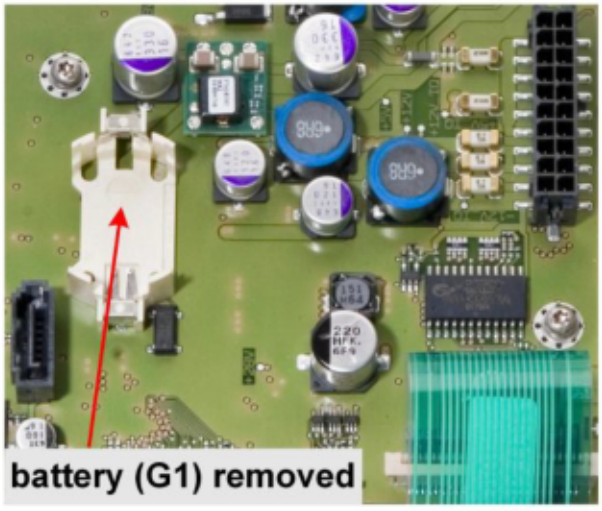
- Place the screw angle (1090.3230.00) on the IEC Connector.
- To insert the new basis board, proceed in the reverse order.
- Connect all cables (fan, power supply) and also the flex. cables W310, W330, W222 and the flex. switchboard cable.
- Place the grommet.



Replacing the Battery (G1)

➢ The lithium battery is accommodated on the basis board.





CAUTION **Danger of injury**

Lithium batteries must not be exposed to high temperatures or fire.

Keep away from children.

If the battery is replaced improperly, there is danger of explosion. Only replace the battery by R&S type (see also *"Overview of the Modules"*, page 3.36).

Lithium batteries are hazardous waste and must be disposed of in dedicated containers.

Do not short-circuit the battery!

➢ Carefully lift and pull out the battery.

Note: *3.0 V lithium battery (∅ 24,5 mm * 7,7 mm , type CR2477N), see also "Overview of the Modules", page 3.36.*

➢ Insert new battery into holder below the spring.

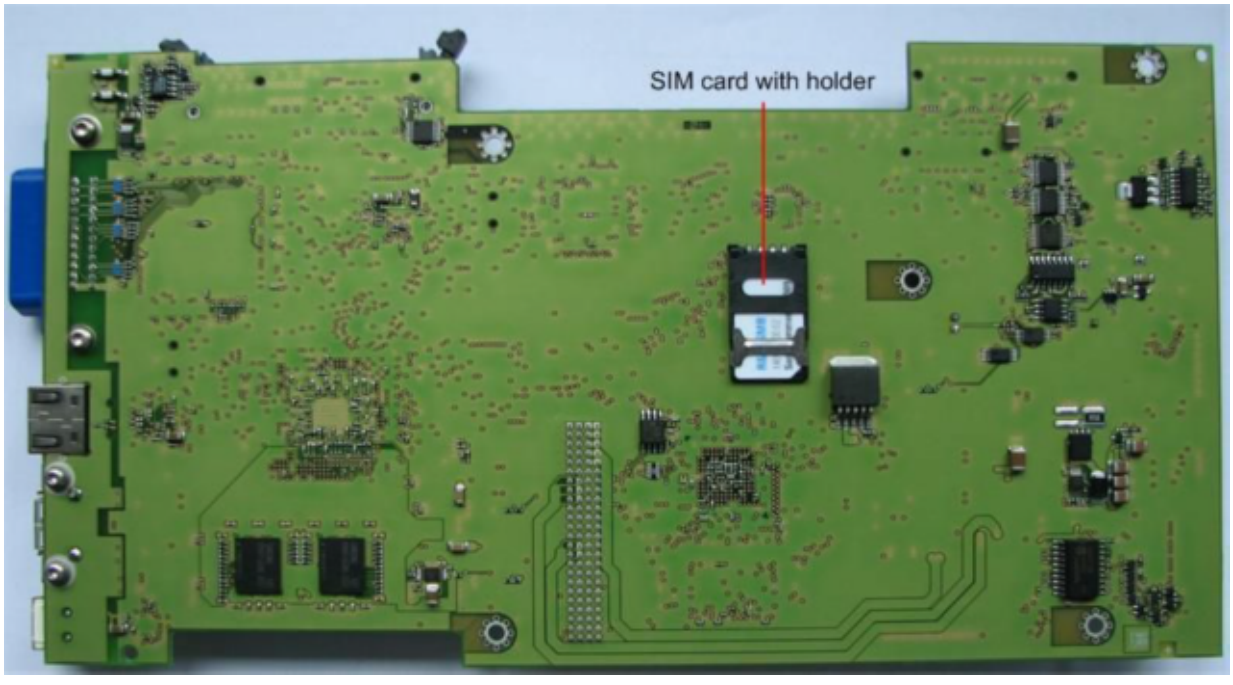
Note: *The positive pole (+) of the battery should point up.*

Replacing the SIM Card

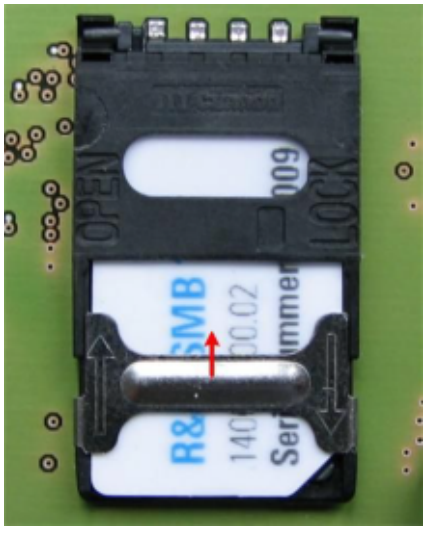
NOTICE When changing the basis board, you have to remove the SIM card.

The SIM card is part of your instrument and will not be replaced by Rohde & Schwarz if lost. Therefore, always keep the SIM card with you.

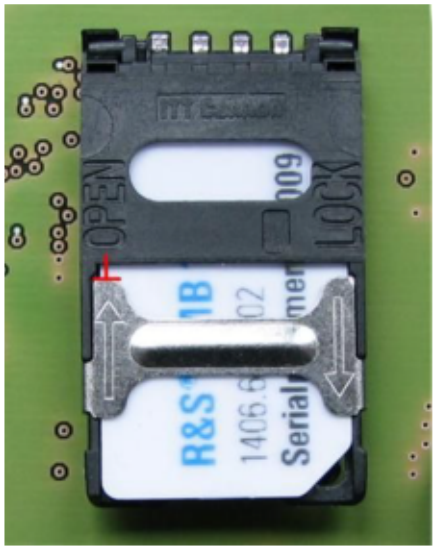
➢ Remove the basis board (see *3.45*).
The SIM card is located on the rear of the basis board.



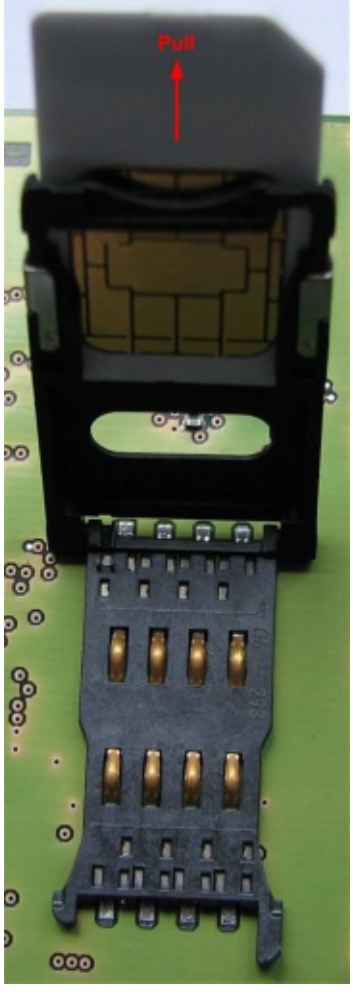
➢ Open the latch of the SIM card holder by sliding the retaining bracket toward OPEN.



The latch of the SIM card holder is open.



➢ Flip the SIM card holder upward and remove the SIM card.



➢ To install the SIM card, proceed in the reverse order.

Replacing the RF-Board (A200)

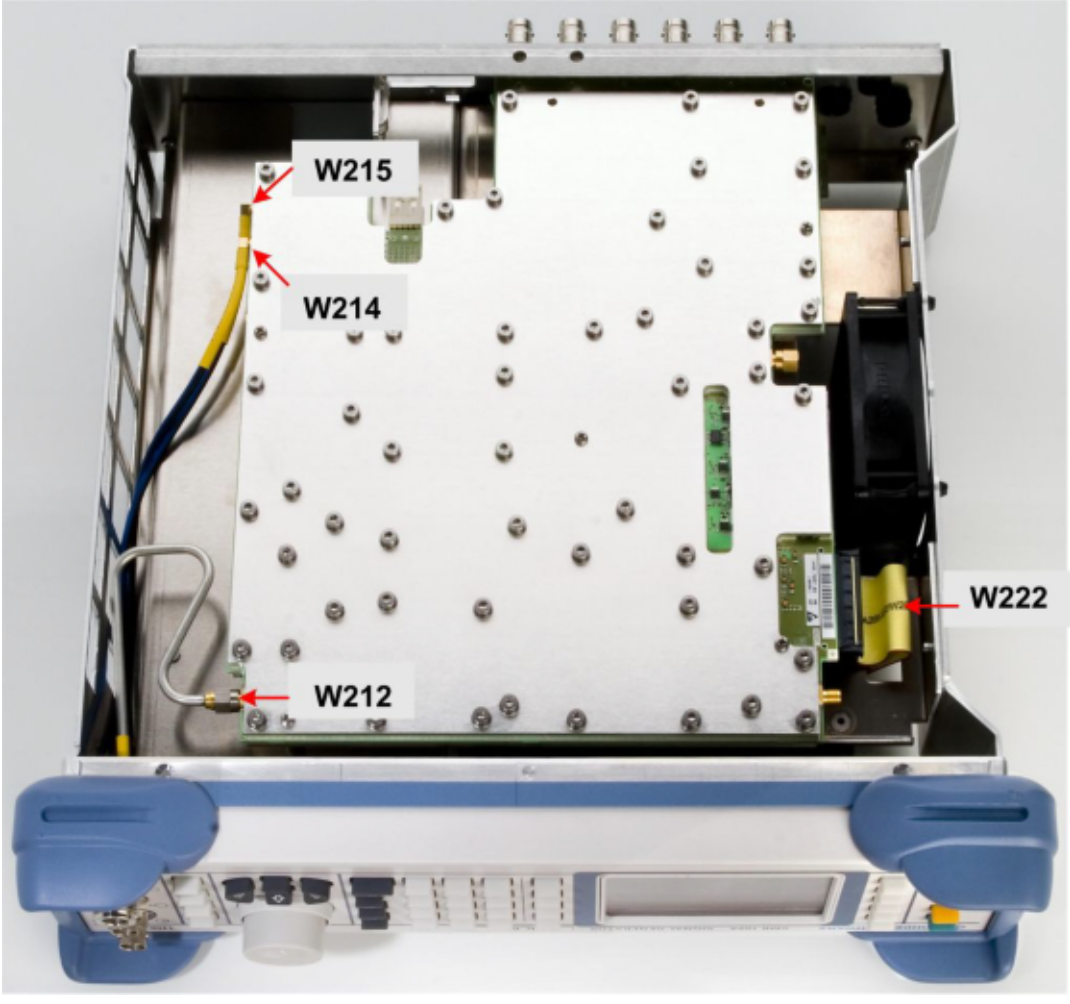
(See chapter 5, drawing 1406.6000.01).

Note: Different RF-Boards, order no. 1406.7007.13/.16 or 1406.7207.13/.16.

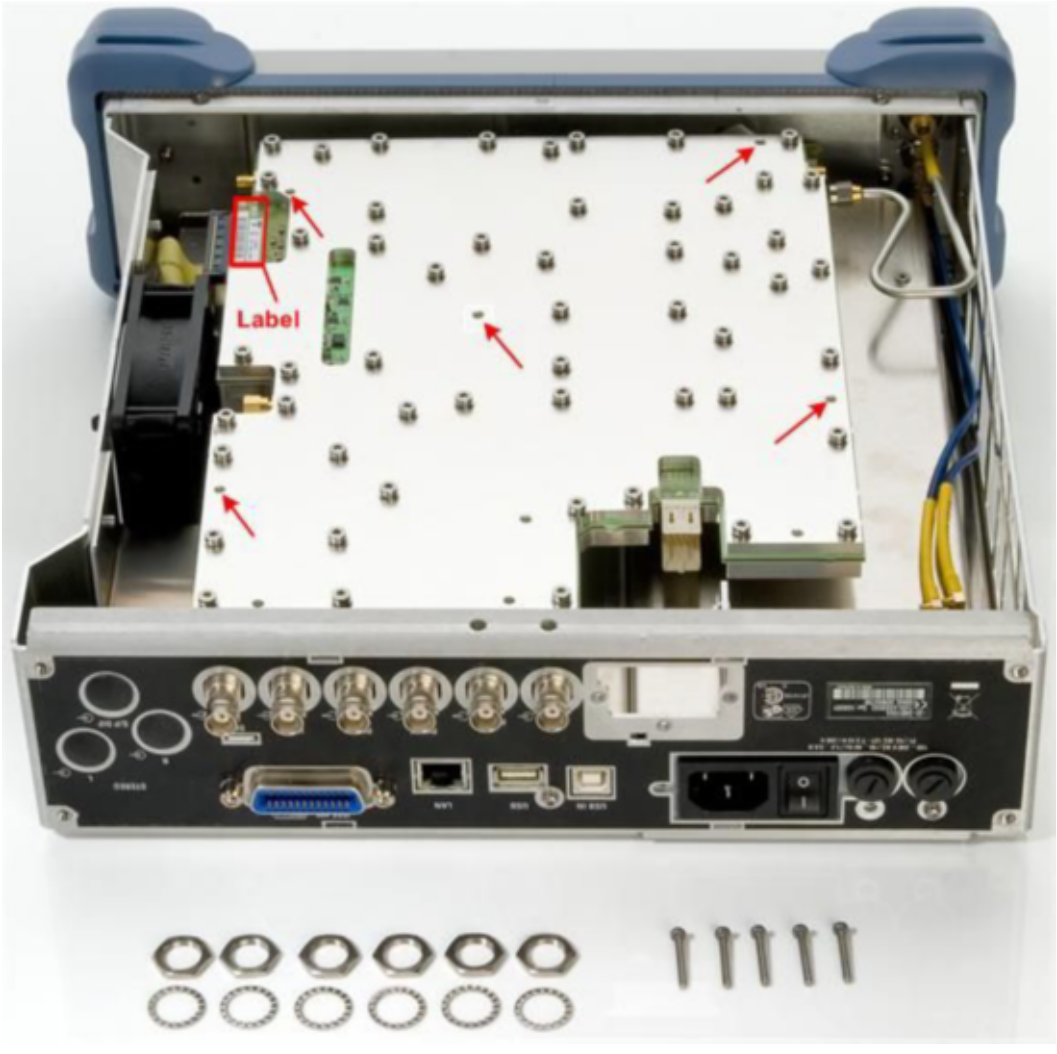
Removing the RF-Board

Note:
If the R&S SMB-B1 (Reference Oscillator) option is installed, uninstall this option first (see Replacing the Reference Oscillator Option R&S SMB-B1 (A210)).

- Switch off the instrument and pull the mains plug.
- Dismounting the case (see page *3.36*).
- Disconnect the RF-Cables W212, W214, W215 and the flex. strip W222.



- Remove the six nuts of the BNC-connectors.
- Undo five screws (1148.2946.00) on the RF-board and remove the board.



NOTICE **When ordering spare and replacement modules:**

Spare modules of the RF board are always delivered with the ending number .13 for .03 and the number .16 for .06 (see label).

Replacement modules of the RF board are always delivered with the ending number A13 for .03 and the number A16 for .06 (see label).

Installing the RF-Board

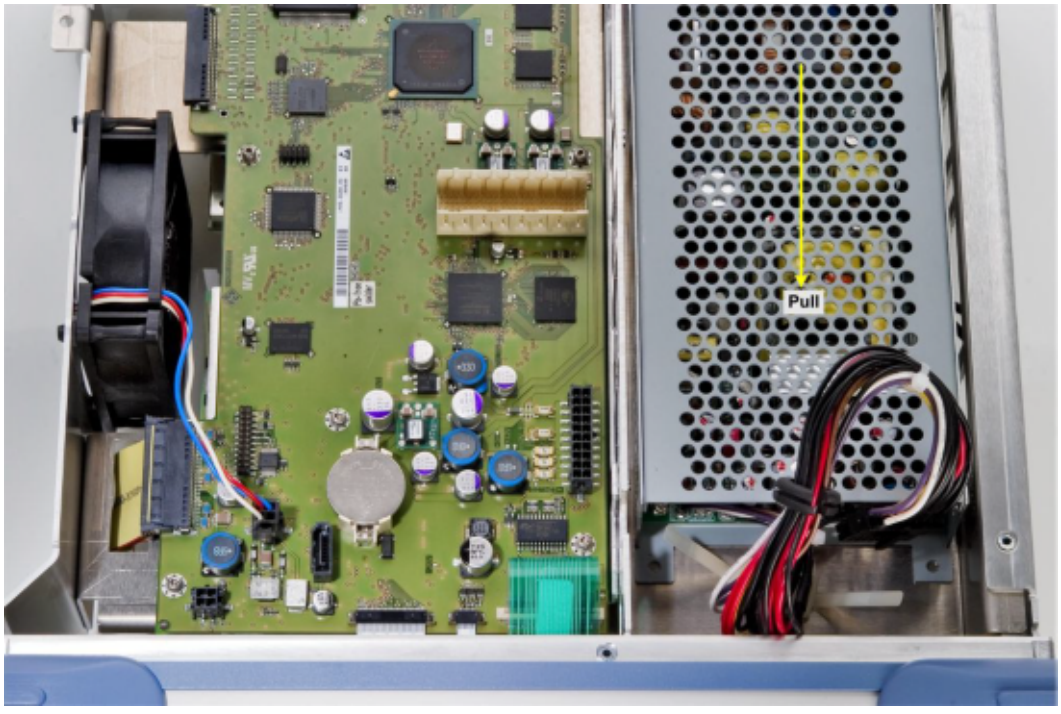
- Place the RF-Board into the R&S SMB-Frame in the right position and screw it with five screws (1148.2946.00).
- Screw the BNC-Connectors with the nuts and reconnect the RF-Cables (W212 (60 Ncm), W214, W215) and the flex. cable W222.

Replacing the Power Supply (A50)

(See chapter 5, drawing 1406.6000.01).

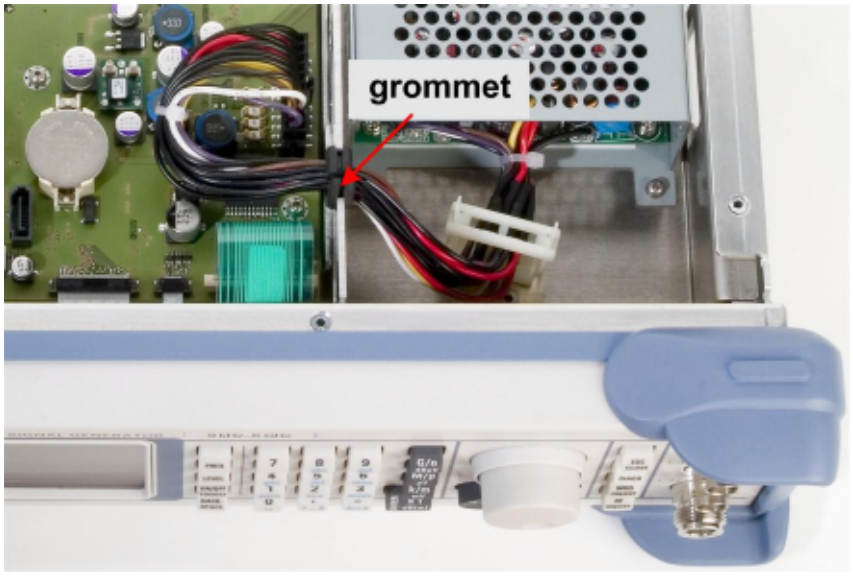
Removing the Power Supply

- Switch off the instrument and pull the mains plug.
- Dismounting the case (see page *3.36*).
- Remove connector X101 from the basis board.
- Open the flat cable holder and unscrew three combination screws (0041.1653.00) on the back of the instrument.
- Unscrew two combination screws (0041.1653.00) at the power supply, pull forward the module and remove it.



Installing the Power Supply

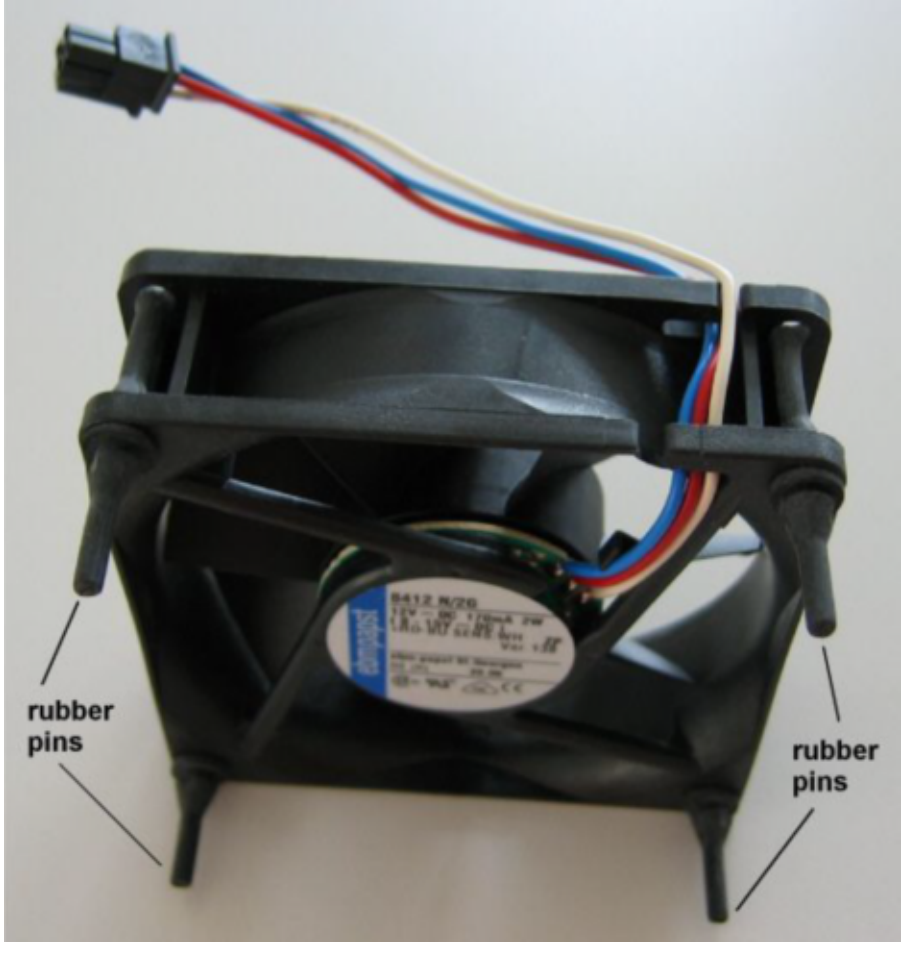
- Place the power supply in the instrument and screw it with two combination screws at the power supply trough.
- Fix the power supply at the back of the instrument with three combination screws.
- Fix the wires with the flat cable holder and connect them at X101 on the basis board.
- Place the grommet.



Replacing the Fan Unit (E1)

(See chapter 5, drawing 1406.6000.01).

- Switch off the instrument and pull the mains plug.
- Dismounting the case (see page *3.36*).
- Disconnect the fan at X 116 and push the rubber pins (1146.2161.00) through the trough.
- Install the new fan and proceed in the reverse order.
- Cut off the unnecessary rubber from the pins which extend outside the instrument casing.

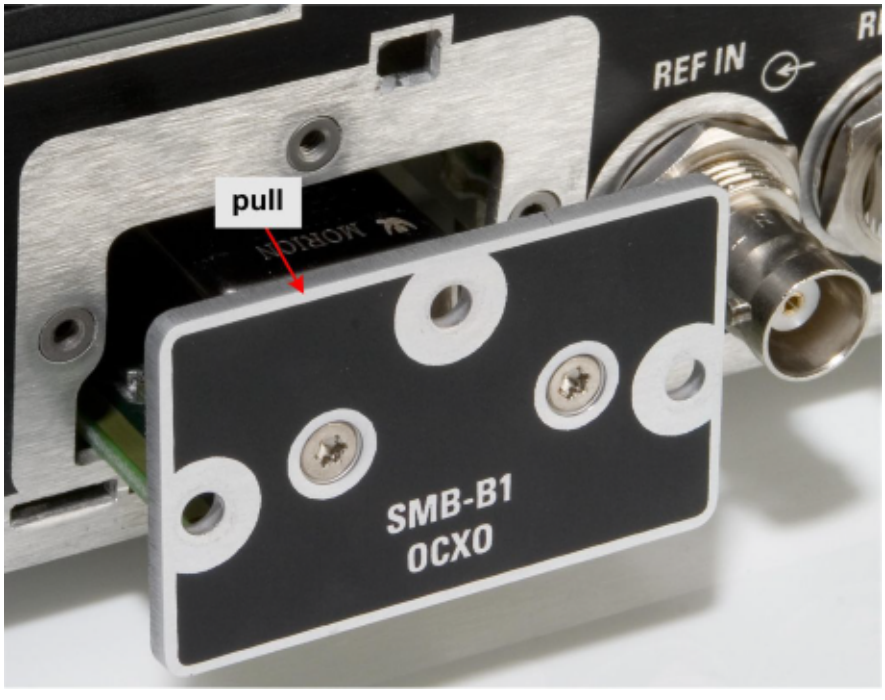


Fan Unit E1, see also *"Overview of the Modules"*, page 3.36.

Replacing the Reference Oscillator Option R&S SMB-B1 (A210)

➢ Unscrew the three screws (0041.1653.00) fixing the option.

➢ Carefully remove the reference oscillator (1300.3180.03).



Installing the Reference Oscillator

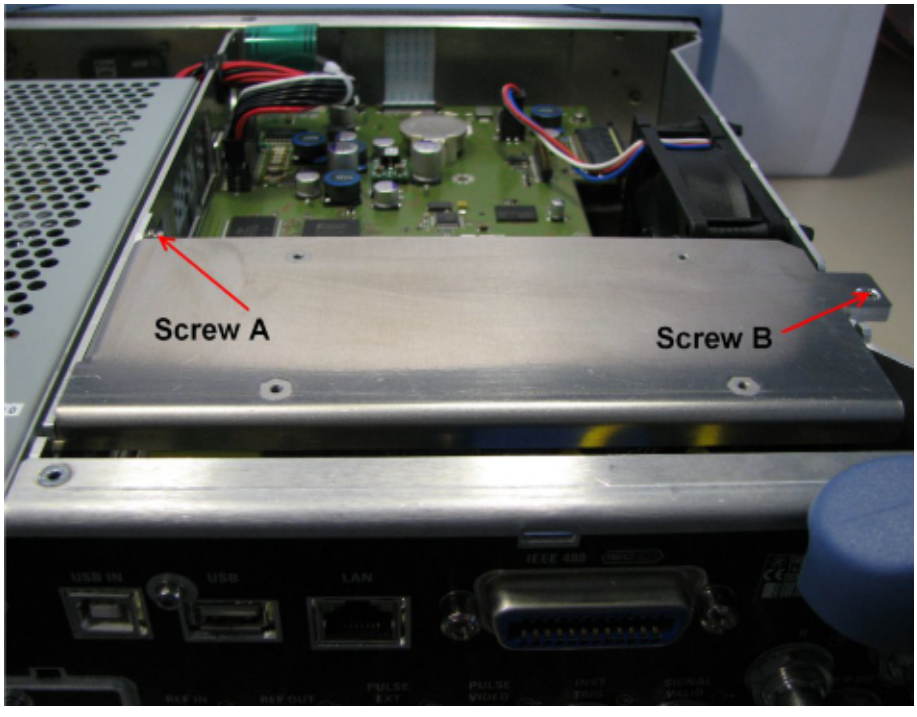
➢ Carefully plug in the reference oscillator as far as possible.

➢ Fix the option with three screws.

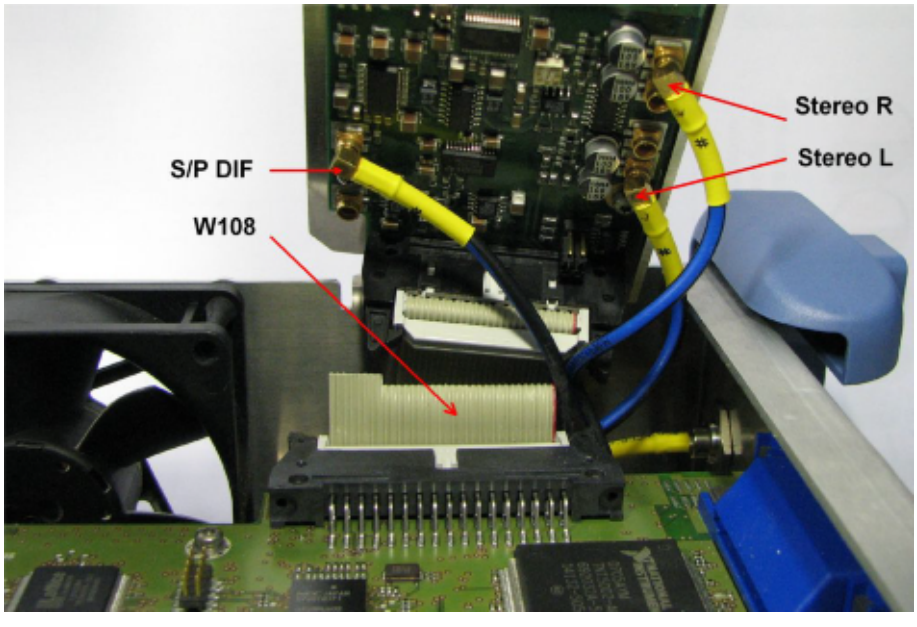
Replacing the Stereo/RDS-Coder Option R&S SMB-B5 (A400)

Removing the Stereo/RDS-Coder

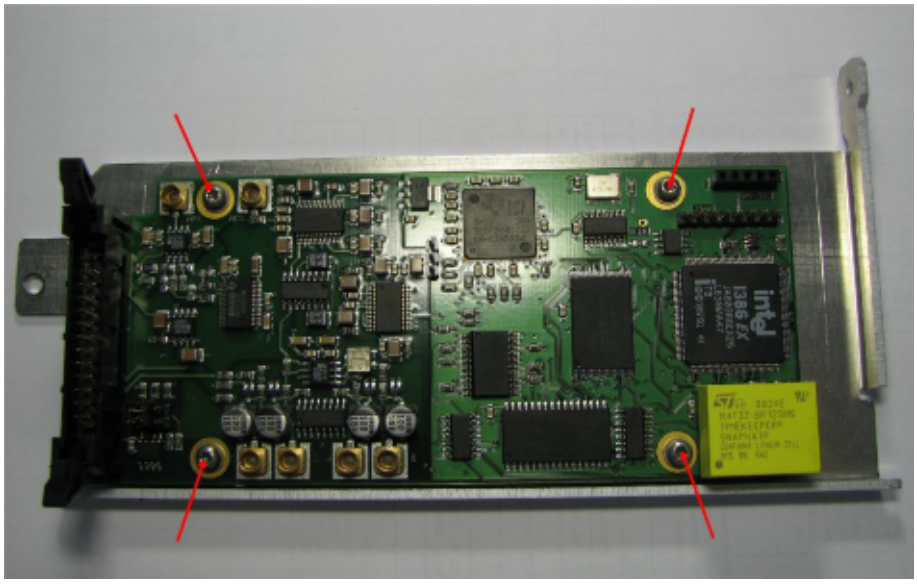
- Switch off the instrument and pull the mains plug.
- Dismounting the case (see page 3.36).
- Unscrew the two screws (A and B) fixing the option.



- Lift up the option at one side and unlock the three RF-Cables (1407.3334.00) from the RDS Stereo Coder.
- Unlock the Stereo / RDS-Coder Cable W108 (1407.3328.00) from the RDS Stereo Coder.



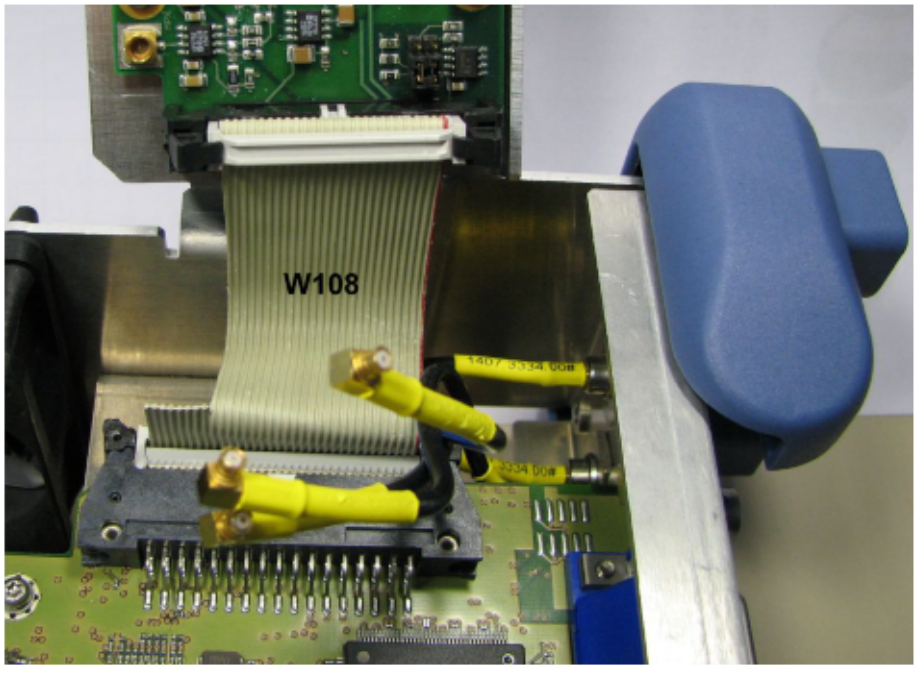
- Unlock the four combination screws on the RDS Stereo Coder Board and remove the holding plate (1406.6269.00).



Installing the Stereo/RDS-Coder

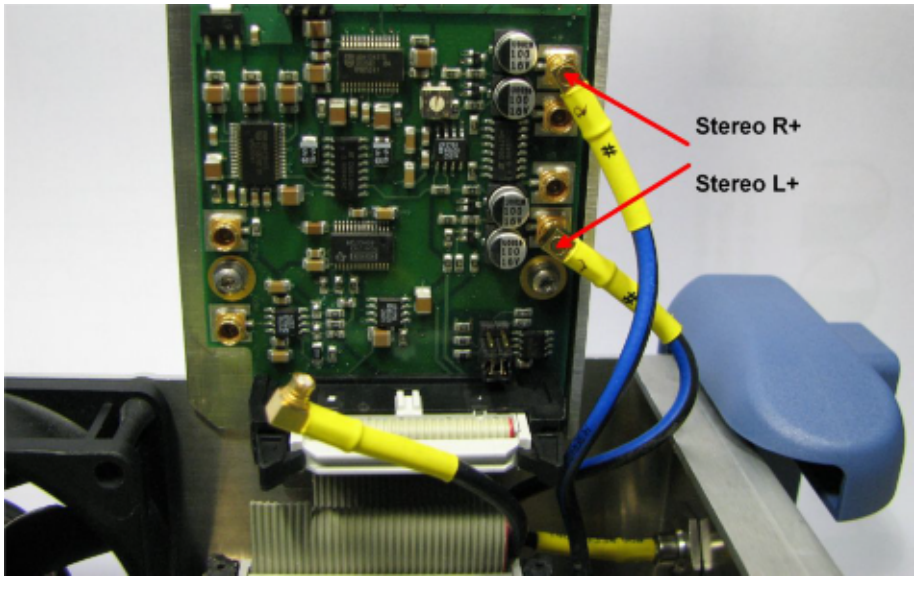
- Screw the RDS Stereo-Coder with the holding plate (1406.6269.00) using four combination screws (1148.3059.00), see.
- Connect the three RF-Cables W401 to W403 (1407.3334.00) with the nuts at the back of the R&S SMB-Frame.

➢ Connect the Stereo-Coder and the Base Board with the cable W108.

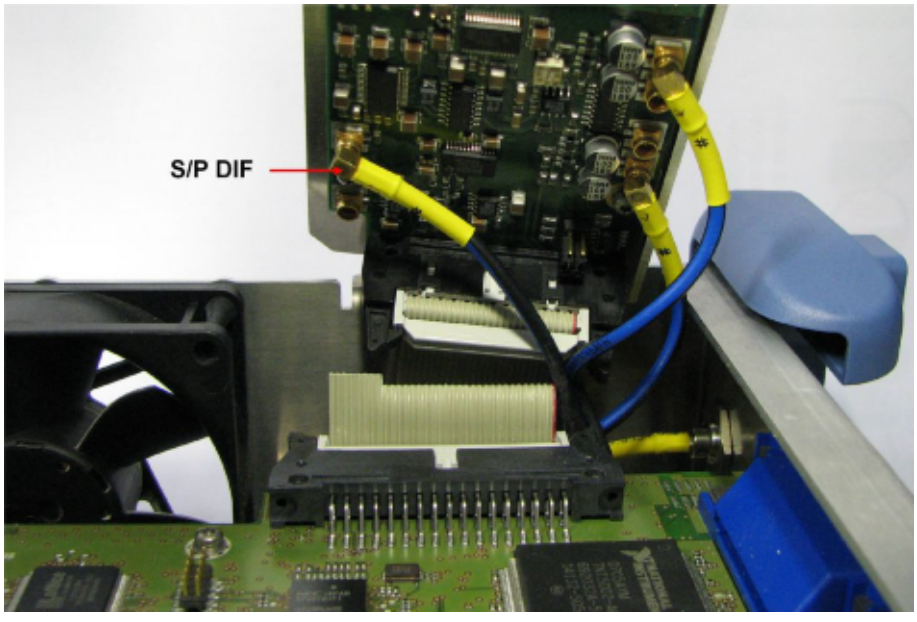


➢ Connect the two stereo RF-Cables on the right SMP-Socket.

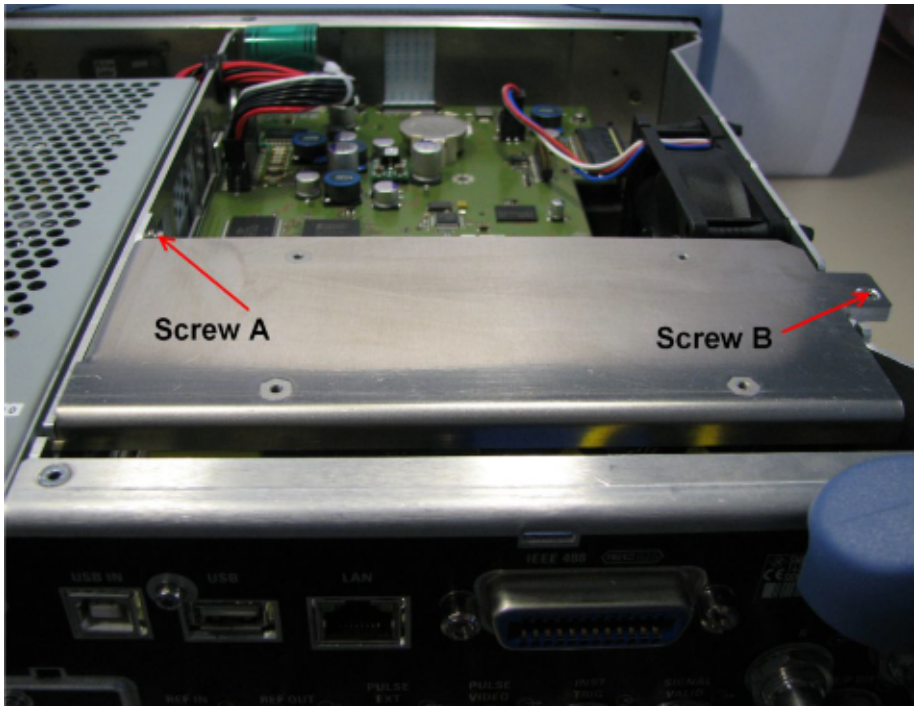
Stereo R on the back of the SMB-Frame to R+ on the Stereo-Coder Board
Stereo L on the back of the SMB-Frame to L+ on the Stereo-Coder Board



- Also connect the S/P DIF cable on the back of the SMB-Frame to the correct SMP-Socket on the Coder-Board.



- Turn the Stereo/RDS-Coder down to the SMB-Frame and connect it with two screws (screw A: 1148.3059.00, screw B: 1148.3288.00) to the SMB-Frame.



Contents - Chapter 4 "Software Update/Installing Options"

4 Software Update / Installing Options

This chapter contains information on firmware update, Linux operating system update and installing options to the R&S SMB. Additional manuals obtained together with a firmware update or with subsequently acquired options can be filed here.

NOTICE **Possible impairment of the functioning of the instrument**

The instrument is equipped with the Linux operating system. It is thus possible to install COTS software in the instrument. The use and installation of commercial off-the-shelf (COTS) software may impair the instrument function. For this reason, we recommend that you only execute programs tested by Rohde&Schwarz with regard to their compatibility with the instrument software. In certain cases, the use of these programs can impair the performance of the instrument.

The drivers and programs used in the instrument under Linux have been adapted to the test instrument. Existing instrument software must only be modified with update software released by Rohde & Schwarz.

Installation of New R&S SMB Firmware

Your R&S SMB is delivered with the latest firmware version available. Firmware updates as well as the Release Notes describing the improvements and modifications are provided on the Internet at the download site of the R&S SMB homepage http://www.rohde-schwarz.com/product/smb100a. This homepage always offers the latest information on your signal generator, e.g. also on **changes of the firmware update procedure**.

Firmware updates always are delivered in one single file with a filename starting with “SMB_” and ending in “.rsu”. The version numbers in the filename vary with each update.

Firmware update: SMB_x.xx.xx.rsu

The installation of a new firmware version is performed via the USB interface. A deinstallation of the old firmware is not necessary.
The update file has to be downloaded from the Internet to a PC. From there the file should be transferred to a memory stick which will later be plugged into the USB interface of the instrument. The firmware update is performed while the instrument is running. The new firmware will be loaded right after the update process.
If the instrument “sees” a memory stick at its USB interface, it offers all versions stored on the memory stick for selection. Thus, an upgrade or downgrade of the firmware is possible at any time.

Installing the firmware

NOTICE **Risk of impairment of instrument function!**

To avoid impairment of instrument functions, the update of the firmware must not be cancelled and the instrument must not be switched off during this update.

1. Switch on the instrument and wait until it is operational.
2. Plug in the memory stick which contains the update file (previously downloaded from the Internet) to the USB interface of the instrument.
3. Wait until the software update dialog appears and confirm the update.
4. Select the firmware version to be installed with the cursor up/down keys and press the rotary knob to activate your selection. The selected version will be installed.
5. Wait until the software update completed message appears.
6. Remove USB stick and press the rotary knob to reboot.
7. When the new/updated firmware is up and running, execute internal adjustments after a warmup time of approx. 10 minutes.

   ➢ Press the SETUP key on the instrument front panel, select **Internal Adjustments** and execute **Adjust All**.
   This process updates internal instrument adjustments and can take several minutes.
   Adjustments requiring external measurement equipment are not affected by the firmware update and need not to be performed.

Installing the Options

A list of all available R&S SMB options is provided in the data sheet and on the internet http://www.rohde-schwarz.com/product/smb100a.

Hardware Options

Installation and replacement of hardware options is described in chapter 3 of this service manual.

Please also note the mounting instructions enclosed with the options. These mounting instructions can be filed at this place in the service manual and are thus easily available whenever they are required.

DANGER **Danger of shock hazard**

For module replacement, ensure that the instrument is switched off and disconnected from the power supply by removing the plug from the AC and DC power connector.

Read all safety instructions at the beginning of this manual carefully before module replacement!

NOTICE **Danger of damage to components of the module**

Protect the operational site against electrostatic discharge to avoid damage to electronic components of the modules. For details refer to the safety instructions at the beginning of this manual.

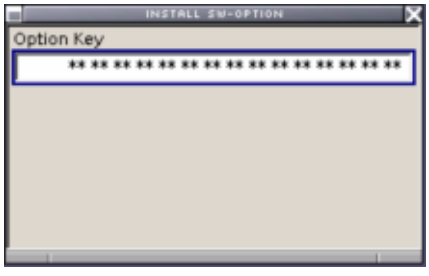
The SETUP **Installed Options** menu provides information on the already installed options.

Software Options

All available software options are already included in the latest firmware. They are ready to operate after they are enabled by means of a key code supplied with the option.

Only if the R&S SMB is equipped with an older firmware version, a firmware update prior to enabling the software option may be required. The information on the valid firmware versions for the purchased software option is provided together with the option.

The key code is to be entered into the SETUP **Install SW Option** menu.



The SETUP **Installed Options** menu provides information on the already installed options

Contents - Chapter 5 "Documents"

5 Documents

This chapter contains the spare parts list and the documents for the complete R&S SMB unit. For general information about spare parts for our products please refer to the sheet “Procedure in Case of Service and Ordering of Spare Parts” at the beginning of this manual.

Spare Parts

The stock numbers necessary for ordering replacement parts and modules can be found in the component lists further down.

DANGER **Danger of shock hazard**

For module replacement, ensure that the instrument is switched off and disconnected from the power supply by removing the plug from the AC and DC power connector.

Read all safety instructions at the beginning of this manual carefully before module replacement!

NOTICE **Risk of damage to the module**

When shipping a module be careful to provide for sufficient mechanical and antistatic protection.

Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013.00	BS1363: 1967' 10 A, 250 V complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12, 10 A, 250 V complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0006.7036.00	Type 498/13, 10 A, 250 V complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0041.4752.00	GB2099, GB1002, 10 A, 250 V approvals CCC	China
DS 0041.6232.00	JIS C 8303, 7A, 125 V AC approvals PSE (JET)	Japan
DS 0006.7107.00	Type SAA3, 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0099.1456.00	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight approvals VDE, ÖVE, CEBEC, KEMA, S, D, N, FI, LCIE, IMQ, UCIEE	Europe (except Switzerland)

ROHDE&SCHWARZ

Spare Parts List

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL VAR31=N-VARIANTE MOD31=N-MODEL VAR42=M-VARIANTE MOD42=M-MODEL					
7	0	S		ZS ERSATZTEILLISTE VORHANDEN SPARE PARTS LIST AVAILABLE Ersatzteilliste SMB ID.Nr. 1406.6030.01 ST		0999.9684.00		M	O
20	1	S		ZB ZUBEHOER SMB100M ACCESSORIES SMB100M VAR 42	Z	1407.0935.00		M	
100	1	S		ZM RAHMEN SMB FRAME SMB	Z	1406.6100.03		M	
110	.01	M		EK FEDER D-FORM SEALING SPRING VAR 02		2007.7632.00		B	O
140	2	S		MZ Dichtungsfeder L=12.05 MZ SEAL SPRING L=12.05	Z	1143.8881.00		M	
145	1	S		HS CHIPCARD PROGR. SMB CHIPCARD PROGR. SMB VAR 02 vor Einbau von A100 auf A100 Loetseite stecken	Z	1407.0593.00		M	
146	1	S		HS CHIPCARD PROGR. SMB100N CHIPCARD PROGR. SMB100N VAR 31 vor Einbau von A100 auf A100 Loetseite stecken	Z	1407.0606.00		M	
150	1	S	A100	ED BASISBOARD 2 BASIS BOARD2 VAR 02 31	Z	1406.6700.05	X	M	
155	1	S	A100	ED BASISBOARD 2 BASIS BOARD 2 VAR 42	Z	1406.6700.03	X	M	
157	1	S		EB 3.0V 0.95AH LI-MNO2 CR2477N LITHIUM BATTERY CR2477N VAR 02 Achtung! M- und N-Model (VAR31/42) immer ohne Batterie.		4052.5673.00		B	O
160	7	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
200	1	S	A50	NJ SCHALTNETZTEIL AC90-264V POWER SUPPLY		1406.7336.00	X	B	B
202	1	S		DZ FLBDK.HALTER 25/13 FLAT CABLE HOLDER		0099.7825.00		B	O
205	1	S		DZ DURCHF.TUELLE 11X14X19 GROMMET 11X14X19		0099.3542.00		B	O
210	5	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
245	1	S		FJ HF-ABSCHLUSSKAPPE SMA PROTECTION CAP		1066.2095.00		B	B

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
250	1	S	A200	ED RF BOARD RF BOARD VAR 02 31 Für/for 3GHz Model 1406.7207.03. Für/for 6GHz Model 1406.7207.06. Service: 1406.7207.03 => 1406.7207.13/A13 1406.7207.06 => 1406.7207.16/A16	Z	1406.7207.03	X	M	
255	1	S	A200	ED RF BOARD RF BOARD VAR 42	Z	1406.7207.02	X	M	
257	6	S		FJ FAECHERSCHEIBE SERRATED LOCKWASHER		3583.1578.00		B	O
260	8	S		VS 6900/ISR-M2.5X20-A2 SCREW		5302.0431.00		B	T
262	6	S		FJ FAECHERSCHEIBE SERRATED LOCKWASHER		3583.1578.00		B	O
265	6	S		FJ MUTTER HEX 16 1/2 -28UNEF HEX 16 NUT 1/2 -28UNEF		3585.2707.00		B	B
400	1	S	A300	ZM FRONTEINHEIT SMB100A NEUES DISPLAY FRONTUNIT SMB100A NEW DISPLAY VAR 02	Z	1406.7820.02	X	M	
405	1	S	A300	ZM FRONTEINHEIT SMB FRONTUNIT SMB VAR 31 42	Z	1406.7807.02	X	M	
410	1	S	W212	DW KABEL W212 RF FRONT - RFBOARD CABLE W212 RF FRONT - RFBOARD	Z	1406.8126.00		M	
420	1	S	W214	DV KABEL W214 MOD EXT - RFBOARD CABLE W214 MOD EXT - RFBOARD	Z	1406.8149.00		M	
430	1	S	W215	DV KABEL W215 LF - RFBOARD CABLE W215 LF - RFBOARD VAR 02 31	Z	1406.8132.00		M	
435	1	S	W215	DV KABEL W215 LF REAR - RFBOARD CABLE W215 LF REAR - RFBOARD VAR 42	Z	1406.8161.00		M	
440	1	S	W222	DY KABEL BB-RF-BOARD CABLE BB-RF-BOARD	Z	1406.8110.00		M	
443	1	S	W706	DV HF KABEL W706 RF BOARD - COUNTER RF CABLE W706 RF BOARD - COUNTER VAR 42	Z	1406.8178.00		M	
446	1	S	W289	DV KABEL W289 FRONT COUNTER - COUNTER CABLE W289 FRONT COUNTER - COUNTER VAR 42	Z	1406.8184.00		M	
450	1	S		MZ MONTAGEPLATTE MOUNTING PLATE		1093.4750.00		M	
460	4	S		VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
470	4	S		VS 965/ISR-M2.5X5-A4-PA SCREW		1148.2752.00		B	T
500	1	S		KB FRONTHAUBE BEDR. SMB FRONT COVER SMB VAR 02	Z	1406.7520.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
502	1	S		KB FRONTHAUBE BEDR. SMB100M FRONT COVER SMB100M VAR 42	Z	1406.6546.00		M	
503	1	S		KB FRONTHAUBE BEDR. SMB100N FRONT COVER SMB100N VAR 31	Z	1406.6569.00		M	
505	.25	S		MP KLEBEFOLIE 80X20 GRAU COVER VAR 02 31		1110.2403.00		B	O
507	1	S		KB RUECKWAND 2 REAR PANEL 2 VAR 02 31	Z	1406.6281.00		M	
508	3	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS VAR 02 31		0041.1653.00		B	T
510	1	S		KR BW2 TUBUS 2E3/4T350 SMB100A BW2 TUBE 2HU3/4D350 SMB100A VAR 02	Z	1406.6198.00		M	
515	1	S		KR BW2 TUBUS 2E3/4T350 SMB100M BW2 TUBE 2HU3/4D350 SMB100M VAR 31 42	Z	1406.6446.00		M	
520	1	S		KR BW2-SCHUTZECK VO.LI.2E HART PROTECTIVE CORNER FRONT LEFT VAR 02		1096.6618.00		B	O
530	1	S		KR BW2-SCHUTZECK VO.RE.2E HART PROTECTIVE CORNER FRONT RIGHT 2HU VAR 02		1096.6624.00		B	O
540	1	S		KR BW2-SCHUTZECK HI.LI.2E HART PROTECTIVE COVER REAR LEFT 2HU VAR 02		1096.6630.00		B	O
550	1	S		KR BW2-SCHUTZECK HI.RE.2E HART PROTECTIVE COVER REAR RIGHT 2HU VAR 02		1096.6647.00		B	O
560	2	S		KR BW2-FRONTGRIFF 2E FRONT HANDLE VAR 31 42		1096.1468.00		B	O
570	4	S		VS SCHR. M4X14-ISR-PA SCREW M4X14-ISR-PA VAR 31 42		1096.4896.00		B	T
580	4	S		KR BW2-RUECKWANDFUSS REAR WALL FOOT VAR 31 42		1096.2487.00		B	O
590	1	S		OS BW2-SCHILD F RUECKWAND BW2 LABEL F. REAR PANEL FOOT VAR 31 42		1096.2435.00		M	O
650	3	S		MP ABDECKKAPPE RD12.7 COVER VAR 02 31		0344.4591.00		B	O
655	2	S		MP ABDECKKAPPE RD12.7 COVER VAR 42		0344.4591.00		B	O
660	1	S	A210	EE OCXO OCXO VAR 42	Z	1300.3180.03	X	M	
665	3	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS VAR 42		0041.1653.00		B	T

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
670	1	S		ZN HALTEBLECH F. ERSATZSICHERUNGEN PANEL FOR SPARE FUSES VAR 31 42	Z	1406.6452.00		M	
675	2	S		MZ SI-SCHAUM-PLATTE 3MM DICK SI FOAM PANEL VAR 31 42	Z	1406.6469.00		M	
680	2	S	F1,F2	SS SCHMELZ. T3.15H IEC60127/V TIME LAG FUSE VAR 31 42		0099.6729.00		B	B
690	1	S		OS SCHILD FUER SICHERUNGSHAUBE LABEL FOR FUSE COVER VAR 31 42	Z	1406.6481.00		M	
691	1	S		VS DIN7985-M2.5X12-A4 SCREW VAR 31 42		0088.0060.00		B	V
692	1	S		VS DIN137-A2.6-A2 WAVE SPRING WASHER VAR 31 42		0005.0280.00		B	V
693	1	S		OS ID-SCHILD FUER SMB100M ID PLATE FOR SMB100M VAR 42	Z	1406.6475.00		M	
694	1	S		OS SCHILD REDSTONE CALIBRATION LABEL REDSTONE CALIBRATION VAR 42 Schild erst kurz vor Auslieferung fertigen, Datum muss mit tatsächlichem Lieferdatum übereinstimmen.		1406.8032.00		M	
695	1	S		OS SCHILD REDSTONE WARRANTY LABEL REDSTONE WARRANTY VAR 42 Schild erst kurz vor Auslieferung fertigen, Datum muss mit tatsächlichem Lieferdatum übereinstimmen.		1406.8049.00		M	
696	1	S		OS SCHILD F. LF (OUTP) AUF RUECKW LABEL FOR LF (OUTP) ON REAR PANEL VAR 42	Z	1406.6498.00		M	
697	1	S		OS ID-SCHILD FUER SMB100N ID PLATE FOR SMB100N VAR 31	Z	1406.6423.00		M	
700	1	S		HS FIRMWARE SMB FIRMWARE SMB VAR 02 31	Z	1407.0406.00		M	
705	1	S		HS FONT MICROSOFT ARIAL WGL FONT MICROSOFT ARIAL WGL		3584.9795.00		B	O
710	1	S		HS FIRMWARE SMB100M FIRMWARE SMB100M VAR 42	Z	1407.0412.00		M	
760	1	S		DZ HALTER KAB.BIND 2.4 HOLDER VAR 42		0066.0744.00		B	O
770	1	S		DZ KABELBI.RD 1 BIS 25 B2 CABLETIE VAR 42		0015.9038.00		B	O
780	1	S		OS LABELNLEGESCHILD 1.1 GHZ LABEL VAR 31	Z	1406.6346.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
720	1	S		MZ MONTAGEWANNE SMB MOUNTING THROUGH	Z	1406.7536.00		M	
730	1	S	A330	BP TFT 3.5 QVGA DRGB LED TFT 3.5 QVGA DRGB LED		1407.3586.00		B	V
735	1	S	W330	DF FLEX-STRIP.40P R=0.5 FLEX-STRIP.40P R=0.5		3584.1942.00		B	B
740	1	S		MM DISPLAY-RAHMEN SMB DISPLAY FRAME	Z	1406.7594.00		B	V
750	1	S		SF SILIKONMATTENSATZ SMB PUSH-BUTTON BOARD SET	Z	1406.7542.00		B	B
760	1	S	A320	SF SCHALTFOLIE SMB FLEX. SWITCHBOARD		1406.7559.00		B	O
770	1	S		MM SCHUTZKRAGEN 9.6X13.9 SHROUD		0852.1234.00		B	O
780	1	S		MZ STAUBABDICHTUNG SMB POWDER SEAL		1069.2421.00		M	
790	1	S		MZ HALTEBLECH SMB HOLDING PLATE SMB	Z	1406.7565.00		M	
800	1	S		OK KRAGEN M. KLEBEPAD -		0852.1205.00		B	B
810	1	S		OK DREH.RD28 ACHS-RD6 KNOB		0852.1086.00		B	V
820	1	S	A310	ED ENCODER BOARD ENCODER BOARD	Z	1300.3044.02		M	O
830	1	S	W310	DF FLEX-STRIP 10P. R=0.5 FLEX-STRIP		1146.9150.00		B	B
840	10	S		VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS		1148.3059.00		B	T

ROHDE&SCHWARZ

Benennung/*Designation*
FRONTEINHEIT SMB
FRONTUNIT SMB

Datum/*Date* 2008-10-24 | Abt./*Dept.* 1GPK | Name/*Name* FI

Sprach./Lang	Ä.I. / *C.I*	Blatt/Sheet
de en	07.00	1 of 1

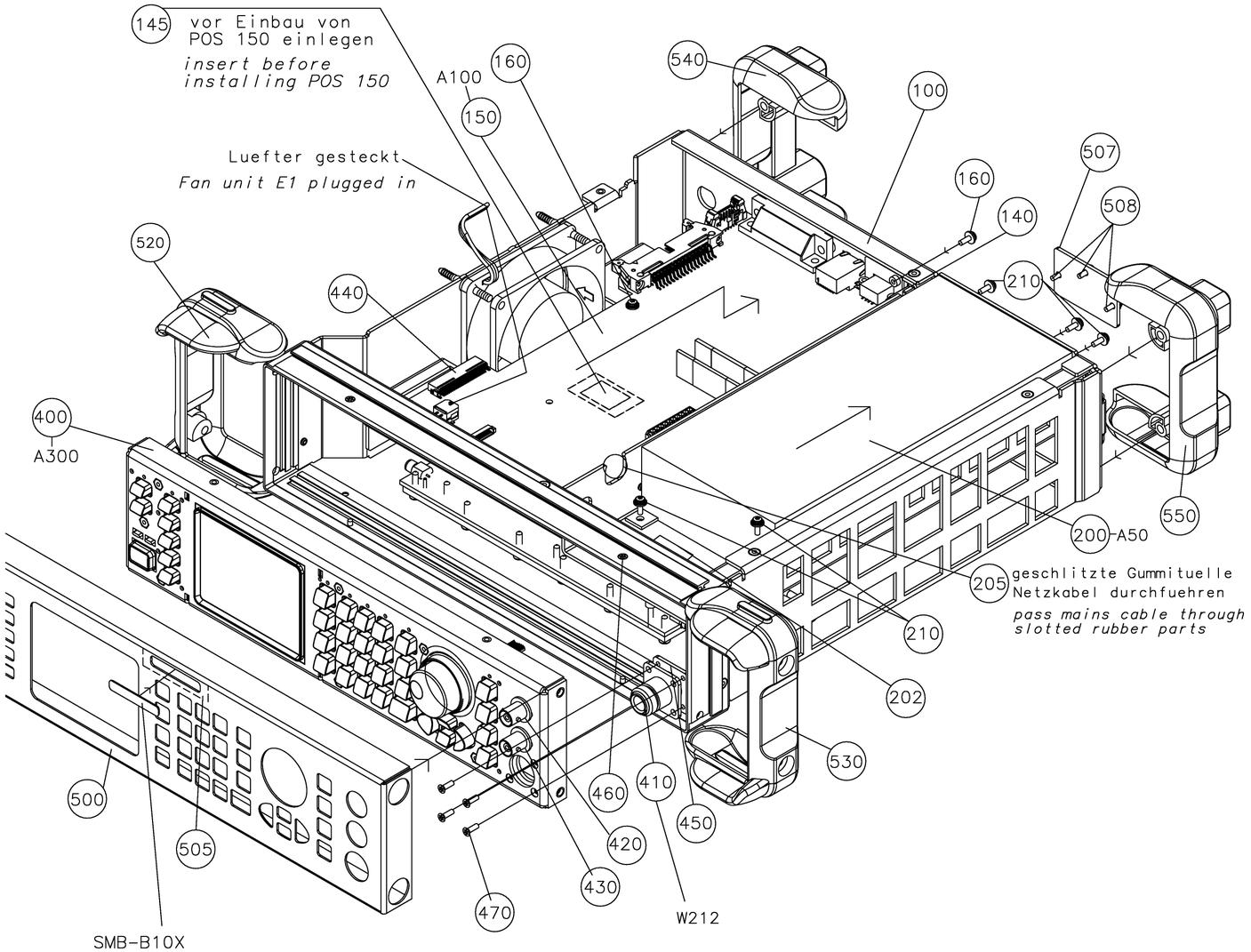
Dokument Nr. / Document No.
1406.7507.01 *ST*

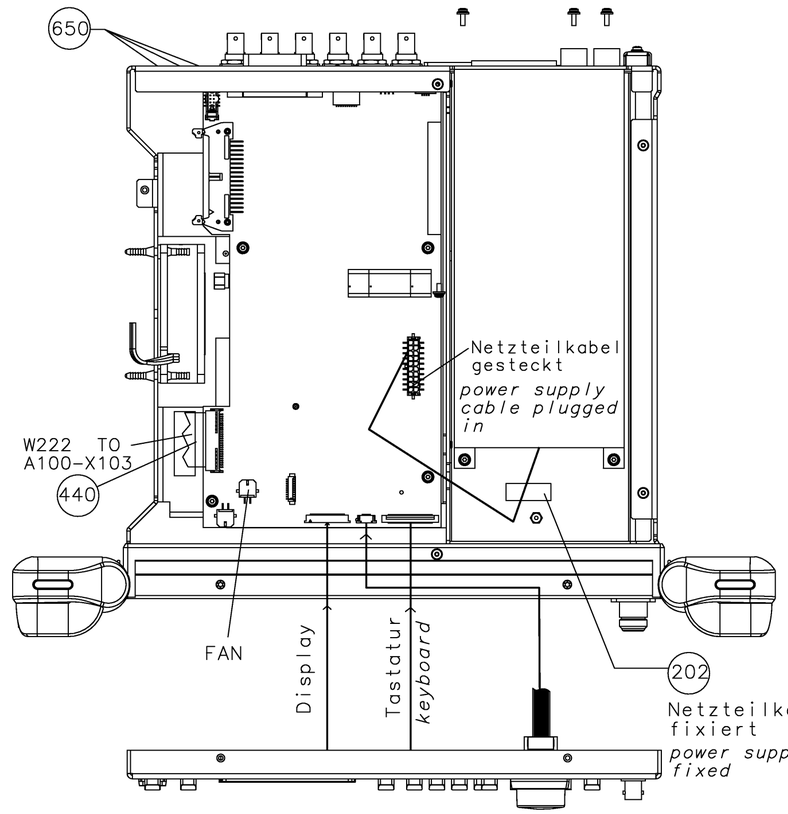
ROHDE&SCHWARZ

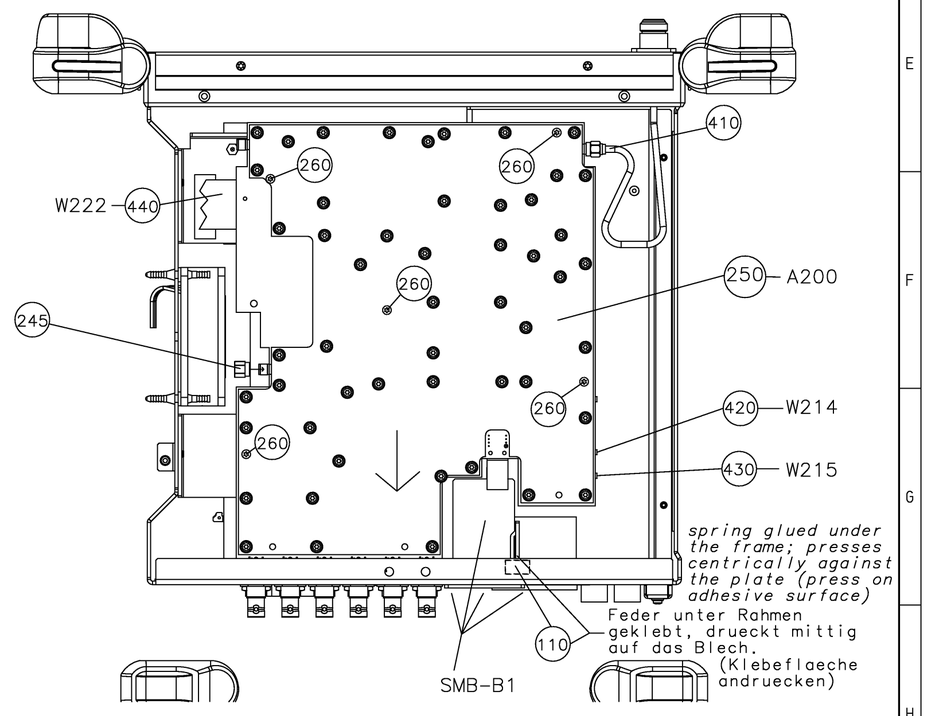
Mechanical Drawings

Nicht dargestellt: POS 510 (Tubus)

Not shown: POS 510 (body)

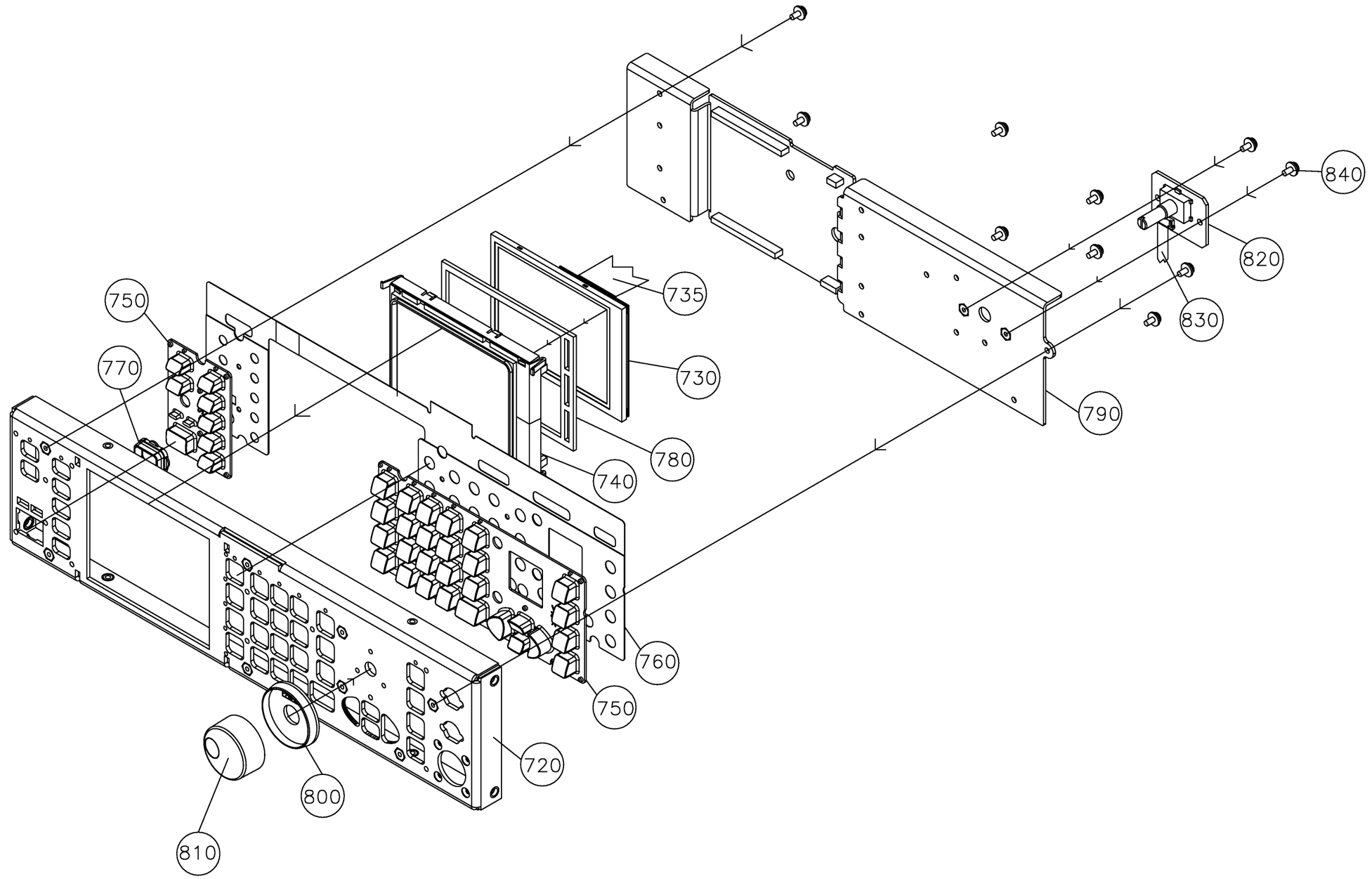






Projektions-methode
Projection Method

Maßstab *Scale*	Toleranz *Tol.*	Werkstoff *Material*			
ROHDE&SCHWARZ	Benennung / *Designation* SMB100A SIGNAL GENERATOR SMB100A SIGNAL GENERATOR			Sprache / *Lang.* de en	Aei. / *C.I.* 06.00	Blatt / *Sh.* 1
SMB	Datum *Date* 2007-02-12	Abteilung *Dept.* 1GPK	Name *Name* FI	Zeichn.Nr. / *Drawing No.* 1406.6000.01		D



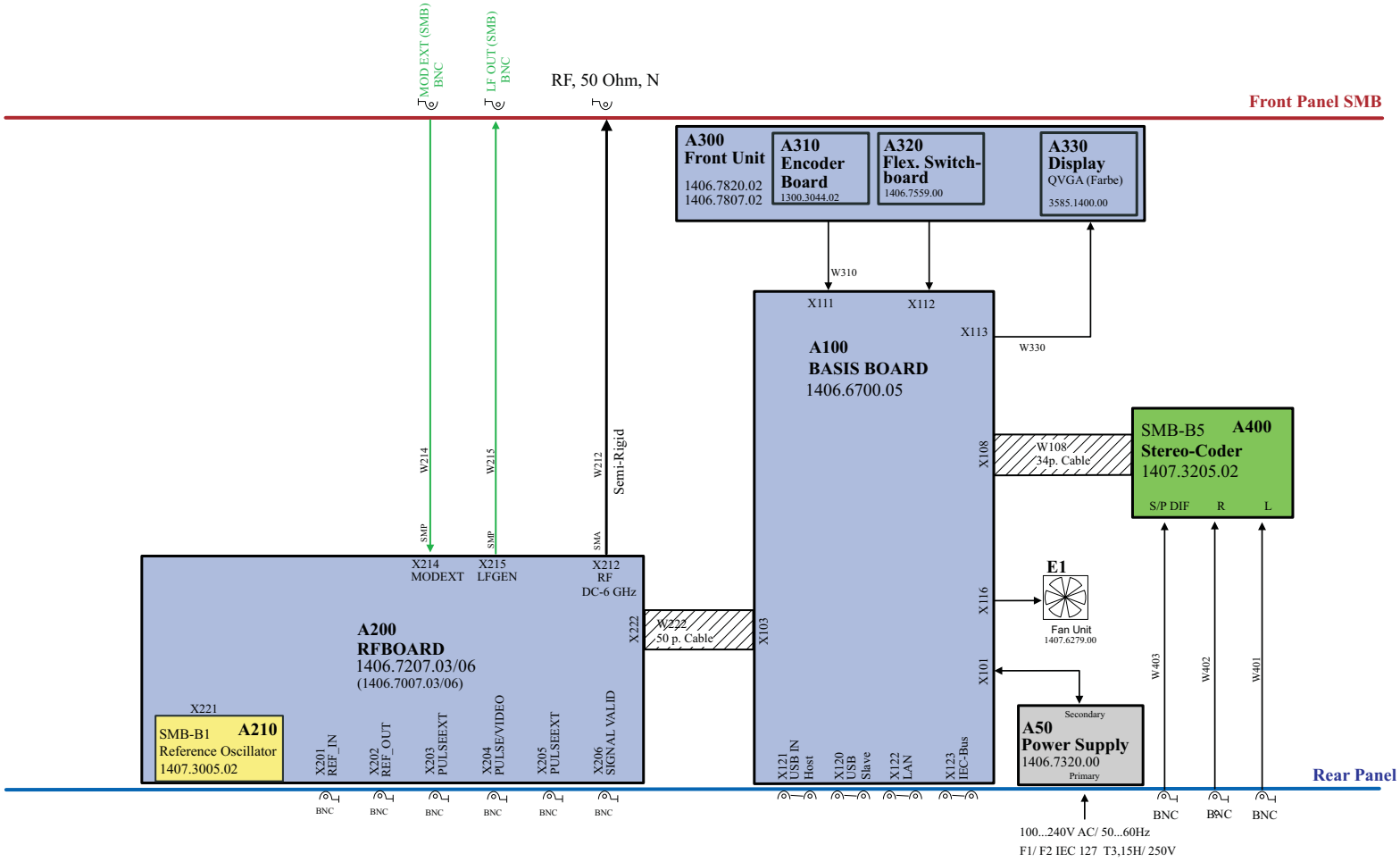
Projektions-methode
Projection Method

Maßstab *Scale*	Toleranz *Tol.*	Werkstoff *Material*		
ROHDE&SCHWARZ	Benennung / *Designation*: FRONTEINHEIT SMB / FRONTUNIT SMB		Sprache / *Lang.*: de en; Aei. / *C.I.*: 03.00; Blatt / *Sh.*: 1	
	Datum *Date*: 2007-02-19	Abteilung *Dept.*: 1GPK	Name *Name*: FI	Zeichn.Nr. / *Drawing No.*: 1406.7507.01 D

ROHDE&SCHWARZ

Block diagrams

SMB



Bindende Angaben zur Sachnummer siehe Schaltteilliste 1406.6000.01 SA.

For binding information to Stock No. see parts list 1406.6000.01 SA.

Maßstab: / *Scale:* Toleranz: / *Tol:*		Rauh.: / *Rouahn.:* Kanten: / *Edges:*		Werkstoff: / *Material:*		Werknormen: / *Company Standards:*
ROHDE&SCHWARZ		Benennung: / *Designation:*	SMB100A Signal Generator		Sprache: / *Lang.:* de en	Aei: / *C.I.:* 07.00	Blatt: / *Sh.:* 1 -
Typ: / *Type:*	SMB	Datum: / *Date:*	12.10.2009	Abteilung: / *Dept.:* MTEK	Name: / *Name:* WU	Zeichn. Nr.: / *Drawing Nr.:*	
1. Z.: / *used in:*	1406.6000.01					1406.6000.01 FS	

ISO-Projektion Methode E