

# Service Manual



## Signal Generator

**R&S® SMF100A**

1167.0000.02



**Dear Customer,**

throughout this manual, the Signal Generator R&S® SMF100A is abbreviated as R&S SMF.

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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 EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

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

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

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

## Safety labels on products

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

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

## Basic Safety Instructions

| Symbol                                                                              | Meaning                                                                                                                                                                                                             | Symbol                                                                             | Meaning                                                                                                                                                                |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | Caution ! Hot surface                                                                                                                                                                                               |   | Alternating current (AC)                                                                                                                                               |
|    | Protective conductor terminal<br>To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth |   | Direct/alternating current (DC/AC)                                                                                                                                     |
|    | Earth (Ground)                                                                                                                                                                                                      |   | Class II Equipment<br>to identify equipment meeting the safety requirements specified for Class II equipment (device protected by double or reinforced insulation)     |
|    | Frame or chassis Ground terminal                                                                                                                                                                                    |   | EU labeling for batteries and accumulators<br>For additional information, see section "Waste disposal/Environmental protection", item 1.                               |
|    | Be careful when handling electrostatic sensitive devices                                                                                                                                                            |  | EU labeling for separate collection of electrical and electronic devices<br>For additional information, see section "Waste disposal/Environmental protection", item 2. |
|  | Warning! Laser radiation<br>For additional information, see section "Operation", item 7.                                                                                                                            |                                                                                    |                                                                                                                                                                        |

### Signal words and their meaning

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



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



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



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



Indicates information considered important, but not hazard-related, e.g. messages relating to property damage.

In the product documentation, the word ATTENTION is used synonymously.

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

## Basic Safety Instructions

### Operating states and operating positions

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

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

### Electrical safety

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

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the mains-supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with a protective conductor contact and protective conductor.
3. Intentionally breaking the protective conductor either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If there is no power switch for disconnecting the product from the mains, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the mains. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 m. Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, the disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cables on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

## Basic Safety Instructions

6. The product may be operated only from TN/TT supply networks fuse-protected with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages  $V_{rms} > 30$  V, suitable measures (e.g. appropriate measuring equipment, fuse protection, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC 60950-1 / EN 60950-1 or IEC 61010-1 / EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

## Operation

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



## Basic Safety Instructions

2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal/Environmental protection", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).
8. EMC classes (in line with EN 55011/CISPR 11, and analogously with EN 55022/CISPR 22, EN 55032/CISPR 32)
  - Class A equipment:  
Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings  
Note: Class A equipment is intended for use in an industrial environment. This equipment may cause radio disturbances in residential environments, due to possible conducted as well as radiated disturbances. In this case, the operator may be required to take appropriate measures to eliminate these disturbances.
  - Class B equipment:  
Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings

## Repair and service

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

## Basic Safety Instructions

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

### Batteries and rechargeable batteries/cells

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

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

### 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.

## **Instrucciones de seguridad elementales**

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

### **Waste disposal/Environmental protection**

1. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.
2. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately.  
Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
3. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
4. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

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

## **Instrucciones de seguridad elementales**

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

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

## Instrucciones de seguridad elementales

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.

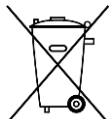
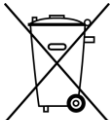
Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. 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. Los datos específicos del producto figuran en la hoja de datos y en la documentación del producto.

### Señalización de seguridad de los productos

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

| Símbolo                                                                             | Significado                                                               | Símbolo                                                                             | Significado                                          |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|
|  | Aviso: punto de peligro general<br>Observar la documentación del producto |  | Tensión de alimentación de PUESTA EN MARCHA / PARADA |
|  | Atención en el manejo de dispositivos de peso elevado                     |  | Indicación de estado de espera (standby)             |
|  | Peligro de choque eléctrico                                               |  | Corriente continua (DC)                              |
|  | Advertencia: superficie caliente                                          |  | Corriente alterna (AC)                               |
|  | Conexión a conductor de protección                                        |  | Corriente continua / Corriente alterna (DC/AC)       |

## Instrucciones de seguridad elementales

| Símbolo                                                                           | Significado                                                                             | Símbolo                                                                           | Significado                                                                                                                                                                               |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Conexión a tierra                                                                       |  | El aparato está protegido en su totalidad por un aislamiento doble (reforzado)                                                                                                            |
|  | Conexión a masa                                                                         |  | Distintivo de la UE para baterías y acumuladores<br><br>Más información en la sección "Eliminación/protección del medio ambiente", punto 1.                                               |
|  | Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)         |  | Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos<br><br>Más información en la sección "Eliminación/protección del medio ambiente", punto 2. |
|  | Advertencia: rayo láser<br><br>Más información en la sección "Funcionamiento", punto 7. |                                                                                   |                                                                                                                                                                                           |

### Palabras de señal y su significado

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



Indica una situación de peligro que, si no se evita, causa lesiones graves o incluso la muerte.



Indica una situación de peligro que, si no se evita, puede causar lesiones graves o incluso la muerte.



Indica una situación de peligro que, si no se evita, puede causar lesiones leves o moderadas.



Indica información que se considera importante, pero no en relación con situaciones de peligro; p. ej., avisos sobre posibles daños materiales.

En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

## Instrucciones de seguridad elementales

### 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, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de  $\pm 10\%$  sobre el voltaje nominal y de  $\pm 5\%$  sobre la frecuencia nominal. Categoría de sobrecarga eléctrica 2, índice de suciedad 2.
2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, se pueden causar lesiones o, en determinadas circunstancias, incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

### Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión. El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m). Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se

## Instrucciones de seguridad elementales

integran productos sin interruptor en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.

5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión  $U_{\text{eff}} > 30 \text{ V}$  se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.

## Instrucciones de seguridad elementales

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/protección del medio ambiente", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
  - Aparato de clase A:  
Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.  
Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos



## Instrucciones de seguridad elementales

pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.

– Aparato de clase B:

Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

### Reparación y mantenimiento

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

### Baterías y acumuladores o celdas

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

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

## **Instrucciones de seguridad elementales**

8. En caso de devolver baterías de litio a las filiales de Rohde & Schwarz, debe cumplirse las normativas sobre los modos de transporte (IATA-DGR, código IMDG, ADR, RID).

### **Transporte**

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

### **Eliminación/protección del medio ambiente**

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.
2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado.  
Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, diríjase a su servicio de atención al cliente de Rohde & Schwarz.
3. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
4. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

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

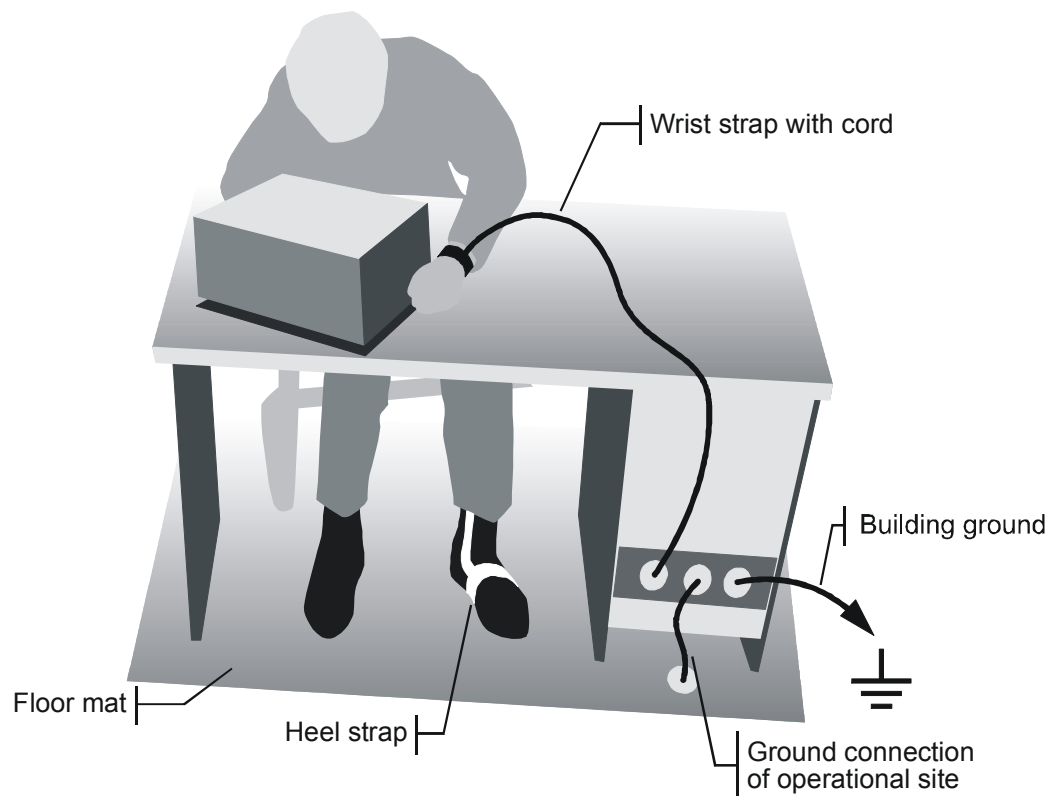
## Instructions for Electrostatic Discharge Protection

---

### **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:

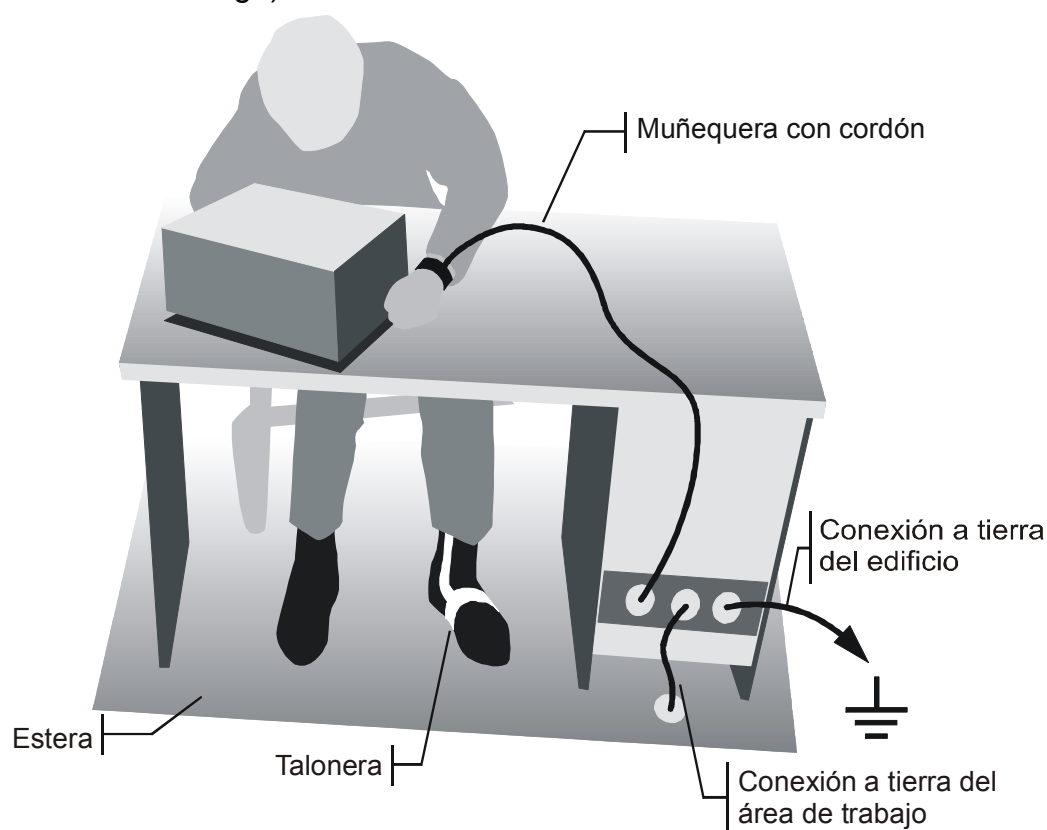
- Wrist strap with cord to ground connection
  - Conductive floor mat and heel strap combination
-

## 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

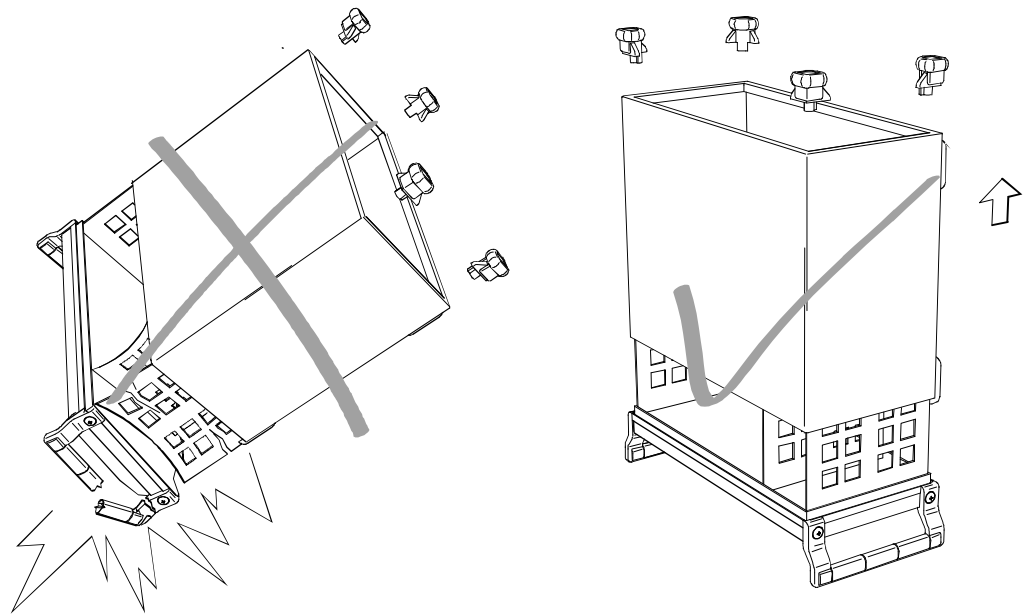
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### **WARNING**

#### **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.

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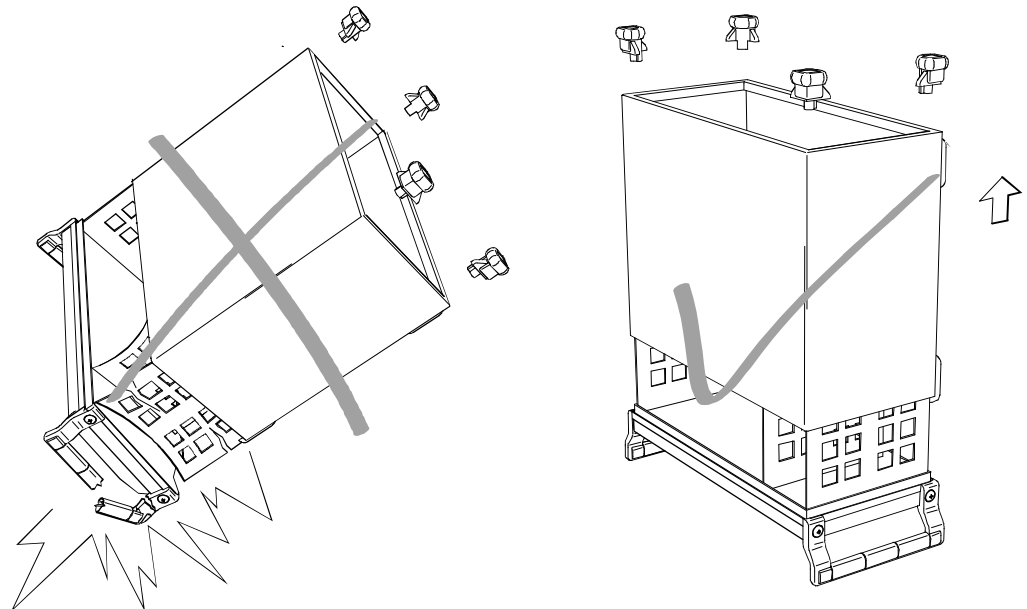
## Informaciones de seguridad para aparatos con tubo de quita y pon

### **⚠ ADVERTENCIA**

#### **Peligro de heridas**

Al sacar los pies 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 pies 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 pies de la pared posterior directamente despues de poner la caja. No muevan el aparato nunca sin que los pies 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. You can find the current address of your representative on our homepage [www.rohde-schwarz.com](http://www.rohde-schwarz.com).

## 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 electrostatic 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.*

## **O            S            P**

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

## **R**

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.

## **T                                            R**

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 - Chapter 1 "Performance Test"

1 Checking the Rated Characteristics .....1.1

    Measuring Equipment and Accessories .....1.1

    Test Assemblies .....1.2

        Standard Test Assembly for Analog Modulations .....1.2

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# 1 Checking the Rated Characteristics

This performance test describes the steps for testing the R&S SMF100A Signal Generator with respect to function and compliance with specifications.

In the following, the term DUT (Device Under Test) is used for the signal generator to be tested.

## 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<br>(included in item 18)   | 1 Hz to 43.5 GHz, resolution 0.1 Hz                                                                                                                                                                                                            |                                                    |                                              |
| 2    | Digital sampling oscilloscope                | 100 kHz to 43.5 GHz                                                                                                                                                                                                                            | Tektronix TDS8000B                                 |                                              |
| 3    | Storage oscilloscope                         | 300 M samples/s,<br>two channels                                                                                                                                                                                                               |                                                    |                                              |
| 4    | Controller                                   | Industry standard PC/XT/AT with<br>IEC-60625 interface and<br>USB interface                                                                                                                                                                    | R&S PSM17                                          | 1116.5004.70                                 |
| 5    | Signal generator                             | 100 kHz to 43.5 GHz                                                                                                                                                                                                                            | R&S SMF100A with<br>R&S SMF-B144 and<br>R&S SMF-B2 | 1167.0000.02<br>1167.7204.02<br>1167.4005.02 |
| 6    | Phase noise test assembly                    | Mixer: 10 MHz to 40 GHz,<br>branching filter 20 MHz, switchable<br>attenuator to 0 and 40 dB,<br>preamplifier with gain of approx.<br>30 dB, input noise < 2 nV (1 Hz),<br>bandwidth 10 MHz, DC decoupling<br>after the mixer for oscilloscope |                                                    |                                              |
| 7    | Oscilloscope (usually<br>included in item 3) | Bandwidth > 100 MHz,<br>two channels with DC coupling                                                                                                                                                                                          |                                                    |                                              |
| 8    | RF power meter                               | 100 kHz to 40 GHz<br><br>in addition for R&S SMF100A with<br>R&S SMF-B144<br><br>50 MHz to 43.5 GHz<br>-30 dBm to +20 dBm                                                                                                                      | R&S NRP with<br>R&S NRP-Z55                        | 1143.8500.02<br>1138.2008.02                 |
| 9    | Low-noise preamplifier                       | 10 MHz to 40 GHz, gain > 20 dB,<br>noise figure < 10 dB                                                                                                                                                                                        |                                                    |                                              |
| 10   | Feed-through termination                     | 50 $\Omega$ , BNC system                                                                                                                                                                                                                       | R&S RAD                                            | 0289.8966.00                                 |
| 11   | DC voltage source                            | Setting range 0 to 10 V                                                                                                                                                                                                                        | R&S NGMD35                                         | 0117.7127.02                                 |
| 12   | Zero Bias Schottky<br>Detector               | 50 $\Omega$ , 10 MHz to 40 GHz                                                                                                                                                                                                                 | Krytar 203SK                                       |                                              |
| 13   | Pulse generator<br>(included in item 5)      | Pulse repetition frequency up to<br>10 MHz                                                                                                                                                                                                     |                                                    |                                              |
| 14   | AC/DC voltmeter                              | 10 Hz to 10 MHz                                                                                                                                                                                                                                | R&S URE3                                           | 350.5315.03                                  |
| 15   | Broadband FM<br>demodulator                  | included in spectrum analyzer<br>item 18                                                                                                                                                                                                       |                                                    |                                              |
| 16   | Low frequency low-noise<br>preamplifier      | Low Noise Preamplifier<br>10 Hz to 30kHz, >30dB Gain                                                                                                                                                                                           |                                                    |                                              |

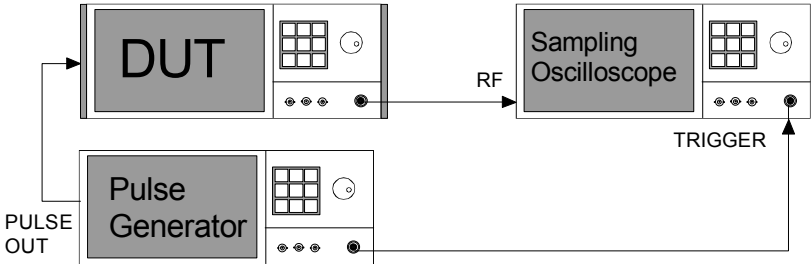
| Item | Type of Instrument                                                | Required Characteristics     | Suitable Instrument                         | R&S Order No.                |
|------|-------------------------------------------------------------------|------------------------------|---------------------------------------------|------------------------------|
| 17   | RF attenuator                                                     | DC to 40 GHz, 3 dB, system K |                                             |                              |
| 18   | RF analyzer & Demodulator for analog modulations & FM-demodulator | 100 kHz to 43.5 GHz          | R&S FSMR50 equipped with option R&S FSMR-B2 | 1166.3311.50<br>1157.1903.50 |

## Test Assemblies

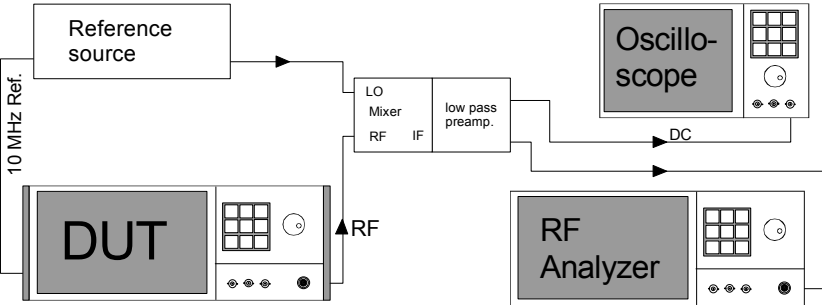
### Standard Test Assembly for Analog Modulations

|                |                                                                                                                                                                      |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment | <ul style="list-style-type: none"> <li>- RF analyzer (<a href="#">Table 1-1</a>, item 18)</li> <li>- Signal generator (<a href="#">Table 1-1</a>, item 5)</li> </ul> |
| 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 Rise and Fall Time

|                |                                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment | <ul style="list-style-type: none"><li>- Digital Sampling Oscilloscope (<a href="#">Table 1-1</a>, item 2)</li><li>- Pulse generator (<a href="#">Table 1-1</a>, item 13)</li></ul> |
| Test setup     | The DUT is pulse modulated by the pulse generator. The pulsed RF is analyzed with the digital sampling oscilloscope.                                                               |
|                |                                                                                                  |

Test Assembly for SSB Phase Noise

|                |                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment | <ul style="list-style-type: none"><li>- Reference signal source (<a href="#">Table 1-1</a> item 5),</li><li>- Phase noise test assembly consisting of mixer with lowpass filter and preamplifier (<a href="#">Table 1-1</a> item 6)</li><li>- Oscilloscope (<a href="#">Table 1-1</a> item 7)</li><li>- Spectrum analyzer (<a href="#">Table 1-1</a> item 18)</li></ul> |
| 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** and in the **performance test report**. Aging and temperature effect of the reference frequency are only 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 switchpoint frequencies and the recommended measurement frequencies derived from these frequencies. We recommend measurements at these frequencies unless particular test frequencies are specified.

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

a) R&S SMF100A with Option R&S SMF-B122

| Range         | Frequency                                | Hardware switching points                       | Recommended test frequencies in MHz |
|---------------|------------------------------------------|-------------------------------------------------|-------------------------------------|
| Divider /4    | $1 \text{ GHz} \leq f < 1.5 \text{ GHz}$ | Lowpass filter: 1.5 GHz                         | 1000, 1499                          |
| Divider /2    | $1.5 \text{ GHz} \leq f < 3 \text{ GHz}$ | Lowpass filters: 1.5 GHz, 2.2 GHz               | 1500, 2000, 2500, 2999              |
| Base band     | $3 \text{ GHz} \leq f < 11 \text{ GHz}$  | Lowpass filters: 3 GHz, 4.2 GHz, 6 GHz, 8.4 GHz | 3000, 3500, ...10999                |
| Multiplier x2 | $11 \text{ GHz} \leq f < 22 \text{ GHz}$ | Lowpass filters: 12 GHz, 16 GHz, 22 GHz         | 11000, 11500, ...22000              |

b) R&S SMF100A with Option R&S SMF-B144

| Range         | Frequency                                     | Hardware switching points                       | Recommended test frequencies in MHz |
|---------------|-----------------------------------------------|-------------------------------------------------|-------------------------------------|
| Divider /4    | $1 \text{ GHz} \leq f < 1.5 \text{ GHz}$      | Lowpass filter: 1.5 GHz                         | 1000, 1499                          |
| Divider /2    | $1.5 \text{ GHz} \leq f < 3 \text{ GHz}$      | Lowpass filters: 1.5 GHz, 2.2 GHz               | 1500, 2000, 2500, 2999              |
| Base band     | $3 \text{ GHz} \leq f < 11 \text{ GHz}$       | Lowpass filters: 3 GHz, 4.2 GHz, 6 GHz, 8.4 GHz | 3000, 3500, ...10999                |
| Multiplier x2 | $11 \text{ GHz} \leq f < 21 \text{ GHz}$      | Lowpass filters: 12 GHz, 16 GHz                 | 11000, 11500, ...20999              |
| Multiplier x4 | $21 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$ | Lowpass filters: 22 GHz, 27.2 GHz, 36.8 GHz     | 21000, 21500, ...43500              |

## c) R&amp;S SMF100A with Option R&amp;S SMF-B2 and R&amp;S SMF-B122

| Range         | Frequency                                   | Hardware switching points                                                                      | Recommended test frequencies in MHz                                                                                                                                   |
|---------------|---------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mixer         | $100 \text{ kHz} \leq f < 375 \text{ MHz}$  | Lowpass filters: 15.3 MHz, 23.4 MHz, 36.1 MHz, 56 MHz, 91.7 MHz, 133.5 MHz, 214 MHz, 331.6 MHz | 10, 12.6, 15.2, 15.4, 19.35, 23.3, 23.5, 29.75, 36, 36.2, 46.05, 55.9, 56.1, 73.85, 91.6, 91.8, 112.6, 133.4, 133.6, 173.75, 213.9, 214.1, 272.8, 331.5, 331.7, 374.9 |
| Divider /8    | $375 \text{ MHz} \leq f < 750 \text{ MHz}$  | Lowpass filters: 525 MHz                                                                       | 428.3, 524.9, 525.1, 637.5, 749.9                                                                                                                                     |
| Divider /4    | $750 \text{ MHz} \leq f < 1.5 \text{ GHz}$  | Lowpass filters: 750 MHz, 1 GHz                                                                | 750.1, 875, 999.9, 1000.1, 1499                                                                                                                                       |
| Divider /2    | $1.5 \text{ GHz} \leq f < 3 \text{ GHz}$    | Lowpass filters: 1.5 GHz, 2.2 GHz                                                              | 1500, 2000, 2500, 2999                                                                                                                                                |
| Base band     | $3 \text{ GHz} \leq f < 11 \text{ GHz}$     | Lowpass filters: 3 GHz, 4.2 GHz, 6 GHz, 8.4 GHz                                                | 3000, 3500, ...10999                                                                                                                                                  |
| Multiplier x2 | $11 \text{ GHz} \leq f \leq 22 \text{ GHz}$ | Lowpass filters: 12 GHz, 16 GHz, 22 GHz                                                        | 11000, 11500, ...22000                                                                                                                                                |

## d) R&amp;S SMF100A with Option R&amp;S SMF-B2 and R&amp;S SMF-B144

| Range         | Frequency                                     | Hardware switching points                                                                      | Recommended test frequencies in MHz                                                                                                                                   |
|---------------|-----------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mixer         | $100 \text{ kHz} \leq f < 375 \text{ MHz}$    | Lowpass filters: 15.3 MHz, 23.4 MHz, 36.1 MHz, 56 MHz, 91.7 MHz, 133.5 MHz, 214 MHz, 331.6 MHz | 10, 12.6, 15.2, 15.4, 19.35, 23.3, 23.5, 29.75, 36, 36.2, 46.05, 55.9, 56.1, 73.85, 91.6, 91.8, 112.6, 133.4, 133.6, 173.75, 213.9, 214.1, 272.8, 331.5, 331.7, 374.9 |
| Divider /8    | $375 \text{ MHz} \leq f < 750 \text{ MHz}$    | Lowpass filters: 525 MHz                                                                       | 428.3, 524.9, 525.1, 637.5, 749.9                                                                                                                                     |
| Divider /4    | $750 \text{ MHz} \leq f < 1.5 \text{ GHz}$    | Lowpass filters: 750 MHz, 1 GHz                                                                | 750.1, 875, 999.9, 1000.1, 1499                                                                                                                                       |
| Divider /2    | $1.5 \text{ GHz} \leq f < 3 \text{ GHz}$      | Lowpass filters: 1.5 GHz, 2.2 GHz                                                              | 1500, 2000, 2500, 2999                                                                                                                                                |
| Base band     | $3 \text{ GHz} \leq f < 11 \text{ GHz}$       | Lowpass filters: 3 GHz, 4.2 GHz, 6 GHz, 8.4 GHz                                                | 3000, 3500, ...10999                                                                                                                                                  |
| Multiplier x2 | $11 \text{ GHz} \leq f \leq 21 \text{ GHz}$   | Lowpass filters: 12 GHz, 16 GHz, 22 GHz                                                        | 11000, 11500, ...20999                                                                                                                                                |
| Multiplier x4 | $21 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$ | Lowpass filters: 22 GHz, 27.2 GHz, 36.8 GHz                                                    | 21000, 21500, ...43500                                                                                                                                                |

For **high-resolution measurements** in the entire frequency range, a logarithmic frequency grid in 1-2-5 sequence is recommended up to 1GHz; 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 mechanical attenuator of the DUT is switched depending on frequency, modulation parameters and level according to an internal stored table in approximately 10 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,  $P_{\min}$  is the lowest level before switching the attenuator, and  $P_{\max}$  the highest. For best measurement results, levels at the crossover from 0 to 10 dB attenuation are recommended.



## Test Procedures

### Reference Frequency

#### Output of Internal Reference

Important: Allow the DUT to warm up for at least 30 minutes before the measurement.

|                |                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment | <ul style="list-style-type: none"> <li>- RF power meter (<a href="#">Table 1-1</a>, item 8)</li> <li>- Frequency counter (<a href="#">Table 1-1</a>, item 1)</li> </ul>       |
| Test setup     | ➤ Connect an RF power meter to the REF OUT output (on rear panel).                                                                                                            |
| Measurement    | ➤ Measure the output level. It should be within $\pm 3$ dB of the data sheet specifications.                                                                                  |
| Test setup     | ➤ Connect a calibrated frequency counter to the REF OUT output (on rear panel).                                                                                               |
| Measurement    | ➤ Measure the frequency.<br>⇒ 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 | <ul style="list-style-type: none"> <li>- Frequency counter (<a href="#">Table 1-1</a>, item 1)</li> <li>- Signal generator (<a href="#">Table 1-1</a>, item 5)</li> </ul>                                                                                                                                                                                                                                                                                         |
| Test setup     | ➤ Connect the signal generator to the REF IN input for the external reference (on rear panel) and connect a calibrated frequency counter to the RF output.                                                                                                                                                                                                                                                                                                        |
| Measurement    | ➤ Measure the frequency with the setting <b>Reference Oscillator Settings/Source External</b> .<br>⇒ <i>The pull-in range has to be tested only at 10 MHz input frequency by measuring the output frequency (e.g. at 1 GHz). There must be no relative frequency error and no error message. At the other input frequencies, a function test at nominal frequency is sufficient. The level of the signal generator has to be varied over the specified range.</i> |

## Frequency

### Frequency Setting

|                |                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment | - Frequency counter ( <a href="#">Table 1-1</a> , item 1)                                                                                                                                                                                                                                                                                                                      |
| Test method    | The frequency setting is checked using a frequency counter whose reference frequency is synchronized with that of the DUT.                                                                                                                                                                                                                                                     |
| Measurement    | <ul style="list-style-type: none"> <li>➤ Setting on DUT:           <ul style="list-style-type: none"> <li>- <b>Frequency:</b> test frequency unmodulated, recommended frequencies: according to <a href="#">Table 1-2</a></li> <li>- <b>Level:</b> 0 dBm</li> </ul> </li> <li>⇒ The measured values must be exactly within the framework of the counter resolution.</li> </ul> |

## Spectral Purity

### Harmonics

|                                               |                                                                                                                                                                                                   |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment                                | Spectrum analyzer ( <a href="#">Table 1-1</a> , item 18)                                                                                                                                          |
| Test setup                                    | <ul style="list-style-type: none"> <li>➤ Connect the spectrum analyzer to the RF output of the DUT.</li> <li>➤ Synchronize reference frequencies of analyzer and DUT.</li> </ul>                  |
| Recommended settings on the spectrum analyzer | <ul style="list-style-type: none"> <li>➤ Reference level = test level + 3 dB, 10 dB/div.<br/>Span 0 Hz,<br/>Resolution bandwidth 1 kHz,<br/>Video bandwidth 30 Hz,<br/>Sample detector</li> </ul> |

#### NOTE:

*These values are typical values that depend on the analyzer used.*

*The necessary measurement resolution must be verified prior to the measurement.*

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measurement                             | <ul style="list-style-type: none"> <li>➤ Settings on DUT:           <ul style="list-style-type: none"> <li>- <b>Frequency:</b> test frequencies, unmodulated</li> <li>- <b>Level:</b> test level</li> </ul> </li> <li>➤ First measure the level of the fundamental as a reference. Then find signals at twice and three times the carrier frequency.           <ul style="list-style-type: none"> <li>⇒ The harmonic spacing is the measured level referred to the fundamental (dBc = referred to the carrier).</li> </ul> </li> </ul> |
| Recommended test frequencies and levels | test frequencies according to <a href="#">Table 1-2</a> for harmonics up to 22 GHz for R&S SMF with R&S <sup>®</sup> SMF-122 frequency option or up to 43.5 GHz for R&S SMF with R&S <sup>®</sup> SMF-144 frequency option)<br>levels: specified levels of data sheet                                                                                                                                                                                                                                                                  |

## Subharmonics

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment                          | Same as for harmonics measurement                                                                                                                                                                                                                                                                                                                                                                                  |
| Test setup                              | Same as for harmonics measurement                                                                                                                                                                                                                                                                                                                                                                                  |
| Measurement                             | <p>➤ First the level of the fundamental frequency <math>f</math> is measured as reference, then a signal is searched for at frequencies <math>0.25*f</math>, <math>0.5*f</math> and <math>1.5*f</math>. For test frequency <math>\geq 21</math> GHz additional at <math>0.75*f</math>.</p> <p>⇒ The subharmonic spacing is the measured level referred to the reference level (dBc = referred to the carrier).</p> |
| Recommended test frequencies and levels | <p>Test frequencies from 11 GHz for subharmonics up to 22 GHz for R&amp;S SMF with R&amp;S<sup>®</sup>SMF-122 frequency option or up to 43.5 GHz for R&amp;S SMF with R&amp;S<sup>®</sup>SMF-144 frequency option)</p> <p>level: specified levels of data sheet</p>                                                                                                                                                |

## Nonharmonics

|                |                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment | Same as for harmonics measurement                                                                                                                                                                                                                                                                                                                                                                  |
| Test setup     | Same as for harmonics measurement                                                                                                                                                                                                                                                                                                                                                                  |
| Measurement    | <p>➤ Setting on analyzer:<br/>AMPT/MIXER/MIXER LVL MANUAL –2 dBm</p> <p>➤ First the level is measured at the test frequency as reference, then a signal is searched for at the analyzer frequency.</p> <p>⇒ The nonharmonic spacing is the measured level referred to the reference level (dBc = referred to the carrier).</p>                                                                     |
|                | <p>Some of the nonharmonics suppression values to be measured are outside analyzer specifications. In case of doubt, the measurement should be repeated with a 3 dB attenuator at the analyzer input. If the nonharmonic spacing changes, the nonharmonic comes from the analyzer.</p> <p><b>Alternative:</b> Check with a second source (not R&amp;S SMF, or equipped with different options)</p> |

## Measurement

- Settings on DUT:
  - Test frequencies of [Table 1-2](#), for extensive tests use random frequencies in each band (mixer, divider,...).
  - Test level +3 dBm unmodulated
- Recommended settings on analyzer:
  - Max peak detector
  - Filter Type: FFT
  - Average count: 10

## Measurement range

- > 10 kHz offset from carrier
- Recommended settings for span and resolution bandwidth

| Offset in kHz | Span in kHz | RBW in Hz | Partitions |
|---------------|-------------|-----------|------------|
| 10 to 103     | 93          | 10        | 1          |
| 103 to 303    | 100         | 20        | 2          |
| 303 to 603    | 100         | 50        | 3          |
| 603 to 1103   | 500         | 200       | 1          |
| 1103 to 2103  | 1000        | 1000      | 1          |
| 2103 to 20000 | 1000        | 1000      | 18         |

During the scan, you should use an overlap of at least 1% for the measurement partitions.

**Note:** *Some of the nonharmonics suppression values to be measured are outside analyzer specifications. In case of doubt, the measurement must be repeated with a 3 dB attenuator at the analyzer input. If the nonharmonics suppression changes, the nonharmonics come from the analyzer. Because of the bell-shaped noise of the analyzer in the vicinity of the carrier, smaller resolution bandwidths may have to be used. To exclude amplitude independent nonharmonics of the analyzer, use a second generator with a different synthesis architecture.*

## SSB Phase Noise

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test assembly | See section " <a href="#">Test Assembly for SSB Phase Noise</a> ", page 1.3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 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, and due to the phase quadrature the mixer supplies a voltage corresponding to the phase difference between the input signals. This is measured by the LF spectrum analyzer and can be converted into SSB phase noise.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Measurement   | <ul style="list-style-type: none"> <li>➤ Set the levels of the two generators in accordance with the specifications of the mixer used.</li> <li>➤ For calibration, switch the attenuator of the test assembly to 40 dB and detune one signal generator by 20 kHz. Check the signal for harmonics; the 2nd and 3rd harmonic should be more than 30 dB below the fundamental. Measure the reference value at 20 kHz at the analyzer and note it down.</li> <li>➤ Set the detuned signal generator to the previous frequency and set the signal generators for phase quadrature. To this end, switch the attenuator to 0 dB and call <b>Delta Phase</b> in the <b>Frequency/Phase</b> menu. Observe the output voltage of the mixer on the oscilloscope and vary the phase until the voltage becomes zero.</li> <li>➤ Read the noise voltage, normalized to a bandwidth of 1 Hz (noise level) from the analyzer.</li> </ul>                                                                                                                                                                                                                            |
| Evaluation    | <ul style="list-style-type: none"> <li>➤ Determine the difference relative to the reference level and add to the value found 6 dB for the second (correlated) sideband and 40 dB for level switchover.<br/>If the S/N ratio of the reference source is not at least 10 dB better than that of the DUT, the noise component of the reference signal generator must be determined and subtracted as well. This will apply, when using a second R&amp;S SMF100A as reference source instead of item 2.</li> </ul> <p>⇒ The corrected S/N ratio is the wanted measured value.</p> <p><b>Example:</b> <i>The measured reference level is assumed to be 12 dBm. A noise level of -78 dBm (1 Hz) is determined at 20 kHz. The difference is 90 dB, plus the correction for the second sideband (6 dB) and level switchover (40 dB), yielding an S/N ratio of -136 dB or a noise level of -136 dBc (dB referred to the carrier power). If two identical signal generators have been used, the result must be reduced by 3 dB for the (uncorrelated) noise power of the reference signal generator.</i></p> <p><i>The final result is then -139 dBc.</i></p> |

## Level Data

## Level Flatness and Uncertainty

|             |                                                                                                                                                                                                                                                                                   |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test method | The level uncertainty is measured in two steps. First, the <b>level flatness</b> or <b>frequency response</b> is measured at a fixed level with high frequency resolution. Then the <b>level dependant uncertainty</b> is measured at fixed frequencies over the specified range. |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                |                                                                                                                                                                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment | <ul style="list-style-type: none"> <li>- Power meter (<a href="#">Table 1-1</a>, item 8)</li> <li>- Spectrum analyzer (<a href="#">Table 1-1</a>, item 18)</li> <li>- Low-noise preamplifier (<a href="#">Table 1-1</a>, item 9)</li> </ul> |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Test method for levels in measurement range of power meter

|                                                                              |                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test setup                                                                   | Connect power meter to RF output socket.                                                                                                                                                                                                                                        |
| Measurement                                                                  | <p>➤ Setting on DUT:</p> <ul style="list-style-type: none"> <li>- <b>Level</b> : 0dBm, Level Mode ALC ON</li> </ul> <p>➤ Measure the level at output frequencies of 100 kHz to 43.5 GHz</p> <p>⇒ The level error is the deviation of the measured level from the set value.</p> |
| Recommended test frequencies for the level frequency response measurement    | 100 kHz, 300 kHz, 1 MHz, 10 MHz, 20 MHz, ... 990 MHz, 999.9 MHz, 1 GHz, 1.1 GHz, ... 43.5GHz                                                                                                                                                                                    |
| Recommended test frequencies and levels for the level dependant measurement. | <p>100 kHz, 300 kHz, 1 MHz, 10 MHz, 20 MHz, ... 990 MHz, 999.9 MHz, 1 GHz, 1.1 GHz, ... 43.5 GHz</p> <p>Test level: from 0 dBm in 5 dB steps down to the minimum specified level and from 0 dBm in 5 dB steps up to the maximum specified level.</p>                            |

## Test method for low levels

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test principle | <p>Levels below the measurement range of the power meter can be determined by means of a relative measurement referred to the measurements performed with the power meter, using a high-linearity spectrum analyzer (digital IF).</p> <p>After switching the analyzer attenuator a continuity calibration is to be carried out. It is therefore recommended to switch the attenuator not until reaching approx. 50 dB under full scale, since the linearity errors are very small in the range up to -50 dBfs (referred to full scale). If the measurement is started at (<math>P_{\max} - 40</math>) dBm, no error occurs due to alternating internal impedance of the DUT.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Test setup     | <ul style="list-style-type: none"> <li>➤ Connect the spectrum analyzer to the RF output of the DUT with <b>hermetically sealed RF measurement cables</b>.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Measurement    | <ul style="list-style-type: none"> <li>➤ Settings on DUT <ul style="list-style-type: none"> <li><b>Frequency</b> test frequency</li> <li><b>Level</b> (<math>P_{\max} - 40</math>) dBm, unmodulated</li> </ul> </li> <li>➤ Setting on the analyzer <ul style="list-style-type: none"> <li>Test frequency</li> <li>SPAN 0 Hz</li> <li>RES BW 10 Hz</li> <li>SWEEP TIME 500 ms</li> <li>Read out marker as rms summary</li> <li>Reference level (<math>P_{\max} - 40</math>) dBm</li> </ul> </li> <li>➤ Read the level at the analyzer and define the correction factors as a function of the frequency from the measurements performed with the power meter.</li> <li>➤ Now the measurements between (<math>P_{\max} - 45</math>) dBm and (<math>P_{\max} - 100</math>) dBm can be carried out.</li> <li>➤ In order to obtain enough spacing to the noise limit of the analyzer, a low-noise preamplifier (<a href="#">Table 1-1</a>, item 9) is looped between the DUT and the analyzer (<b>Caution: hermetically sealed RF cables!</b>). A continuity calibration at (<math>P_{\max} - 100</math>) dBm is thus required, the reference level of the analyzer should be set such that the measured level is close to the reference level. The sweep time is to be increased with lower levels to maintain measurement accuracy.</li> <li>➤ Now the level steps down to the lowest can be measured.</li> </ul> |

## LF Generator

The R&S SMF100A signal generator includes two sine generators with a frequency range from DC to 10 MHz.

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment                                      | Spectrum analyzer ( <a href="#">Table 1-1</a> , item 18)<br>AC/DC voltmeter ( <a href="#">Table 1-1</a> , item 14)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Test setup                                          | <ul style="list-style-type: none"> <li>➤ Connect the spectrum analyzer to the LF socket of the DUT. For level measurement connect the AC/DC Voltmeter to the LF socket of the DUT.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Measurement of frequency settings and distortion    | <ul style="list-style-type: none"> <li>➤ Settings on DUT:<br/> <b>LF Output</b> menu:<br/> <b>State Path1</b> On<br/> <b>Source Path1</b> Generator 1<br/> <b>Path1 Output Voltage</b> 0.5 Vp<br/><br/> Vary <b>LF Frequency Gen.1</b> from 0.1 Hz to 10 MHz </li> <li>➤ Settings of the spectrum analyzer:<br/> <b>RF INPUT</b> DC<br/> <b>AMPT REF LEVEL</b> 10 dBm<br/> <b>FREQ CENTER</b> = LF Gen Frequency<br/> <b>SPAN</b> = LF Gen Frequency / 10 </li> <li>➤ Read the actual frequency from the spectrum analyzer using Marker function SIGNAL COUNT.</li> <li>➤ Settings of the spectrum analyzer:<br/> <b>FREQ START</b> = LF Gen Frequency / 2<br/> <b>STOP</b> = LF Gen Frequency * 5<br/> at higher frequencies use <b>TRACE AVERAGE</b> to smooth display </li> <li>➤ Use MARKER to read the power of the fundamental and the harmonic spectral lines. <ul style="list-style-type: none"> <li>⇒ The distortion is calculated from the summed power of the spectral lines of the harmonics related to the fundamental.</li> </ul> </li> </ul> |
| Recommended test frequencies for frequency settings | 1 kHz, 10 kHz, 100 kHz, 1 MHz, 10 MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Recommended test frequencies for distortion         | 1 kHz, 10 kHz, 20 kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Measurement of the level                            | <ul style="list-style-type: none"> <li>➤ Settings on DUT:<br/> <b>LF Output</b> menu:<br/> <b>LF Frequency Gen. 1</b> 1 kHz<br/> Set <b>Path1 Output Voltage</b> to 1 Vp </li> <li>➤ Measure the output level with the AC/DC voltmeter.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |



**Frequency response**

|                |                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment | AC voltmeter ( <a href="#">Table 1-1</a> , item 14)                                                                                                                                                                                                                                                                      |
| Test setup     | ➤ Connect the AC voltmeter to the LF socket of the DUT.                                                                                                                                                                                                                                                                  |
| Measurement    | <p>➤ Settings on DUT:<br/> <b>LF Output</b> menu:<br/>           Vary <b>LF Frequency Gen.1</b> from 10 Hz to 10 MHz.<br/>           Recommendation: logarithmic with 4 steps/decade.</p> <p>➤ Measure the output level.</p> <p>⇒ The frequency response is the difference between the highest and the lowest level.</p> |

## Amplitude Modulation

### AM Setting Uncertainty

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test assembly        | See section " <a href="#">Standard Test Assembly for Analog Modulations</a> ", page 1.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Measurement          | <ul style="list-style-type: none"> <li>➤ Settings on DUT:           <ul style="list-style-type: none"> <li><b>RF On</b></li> <li><b>RF Frequency</b> 22 GHz</li> <li><b>RF Level</b> 0 dBm</li> <li><b>Amplitude Modulation</b> menu:               <ul style="list-style-type: none"> <li><b>State Path1</b> On</li> <li><b>Source Path1</b> LF Generator 1</li> <li><b>LF Frequency Gen.1</b> 1 kHz</li> </ul> </li> </ul> </li> <li>➤ Settings on R&amp;S RF SPECTRUM ANALYZER:           <ul style="list-style-type: none"> <li>AMPTD / REF LEVEL test level + 6 dB ,</li> <li>FREQ / CENTER test frequency</li> <li>FMDEMOD,</li> <li>FMDEMOD ON,</li> <li>RESULT DISPLAY / AM</li> <li>DEMOM BW &gt; 3* fmod,</li> <li>RANGE / DEVIATION PER DIV 20 %</li> <li>MEAS TIME 3/fmod</li> <li>for distortion (up to 3<sup>rd</sup> harmonic)</li> <li>RESULT DISPLAY / AM / AF SPECTRUM</li> <li>DEMOM BW &gt; 7 * fmod,</li> <li>MEAS TIME 16/fmod</li> </ul> </li> </ul> |
| Recommended settings | <ul style="list-style-type: none"> <li>➤ AM Depth m = 10 % to 80 % in at least 10 steps</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### AM Distortion

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test assembly | See section " <a href="#">Standard Test Assembly for Analog Modulations</a> ", page 1.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Measurement   | <ul style="list-style-type: none"> <li>➤ Settings on DUT:           <ul style="list-style-type: none"> <li><b>RF On</b></li> <li><b>Level</b> 0 dBm</li> <li><b>Amplitude Modulation</b> menu:               <ul style="list-style-type: none"> <li><b>State Path1</b> On</li> <li><b>Source Path1</b> LF Generator 1</li> <li><b>AM depth Path1</b> 60%.</li> <li><b>LF Frequency Gen.1</b> 1 kHz</li> </ul> </li> </ul> </li> <li>➤ Vary the carrier frequency from 10 MHz to 40 GHz.</li> <li>➤ Read THD from the display. To convert to percent calculate<br/> <math display="block">\text{THDpct} = 100 * 10^{(\text{THDdB}/20)}.</math> </li> </ul> |

## AM Frequency Response

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test assembly | See section " <a href="#">Standard Test Assembly for Analog Modulations</a> ", page 1.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Measurement   | <ul style="list-style-type: none"> <li>➤ Settings on DUT:               <ul style="list-style-type: none"> <li><b>RF</b> On</li> <li><b>Level</b> 0 dBm</li> <li><b>Amplitude Modulation</b> menu:                   <ul style="list-style-type: none"> <li><b>State Path1</b> On</li> <li><b>Source Path1</b> EXT 1</li> <li><b>AM depth Path1</b> 60%.</li> <li><b>External Coupling</b> DC</li> </ul> </li> </ul> </li> <li>➤ Vary the carrier frequency from 10 MHz to 40 GHz. Recommended test frequencies 10 MHz; 100 MHz, 374.9 MHz; 375.1 MHz 1 GHz, 3 GHz, 11 GHz, 22 GHz, 40 GHz.</li> <li>➤ Setting on the signal generator:               <ul style="list-style-type: none"> <li>- LF Output ON</li> <li>- LFGen Voltage 1 V (<math>V_{peak}</math>).</li> </ul> </li> <li>➤ Vary the generator frequency to determine the modulation frequency response. Measure the modulation depth as described above under 'Uncertainties'.               <ul style="list-style-type: none"> <li>⇒ The modulation frequency response is the difference between the greatest and the smallest modulation depth.</li> </ul> </li> <li>➤ Repeat the measurement at RF = 1 GHz with the internal modulation generator with the setting <b>Source Internal</b>.</li> <li>➤ Repeat the measurement with the internal modulation generator at <math>f_{mod} = 100</math> kHz. Vary the carrier frequency from 10 MHz to 40 GHz. Measure the modulation depth as described above under 'Uncertainties'               <ul style="list-style-type: none"> <li>⇒ Check the modulation depth for 60%</li> </ul> </li> </ul> |

## Frequency Modulation

### Test Methodes

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test assembly                      | See section " <a href="#">Standard Test Assembly for Analog Modulations</a> ", page 1.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Test Method "Spectrum Measurement" | <ul style="list-style-type: none"> <li>• The FM/PhiM deviation is determined by a spectrum measurement. All relevant spectral components of the modulation spectrum are measured and modulation index <math>m</math> is computed via Bessel functions.<br/>To suppress AM components, left and right spectral lines are averaged. From the ratio of the averaged spectral components a recalculation is done to get the modulation index <math>m</math>. Since the ratio of the spectral lines is used, the result is correct, when a sufficient number of lines is used. Missing lines at the spectrum borders do not deteriorate the result.</li> <li>• Restrictions: This method is suitable only with sine shaped modulation signal. Measuring large deviations at low modulation frequencies tends to get time consuming, since many spectrum lines are to be measured and recalculation may be ambiguous. It is recommended to use this method up to modulation index 100.</li> </ul> <p>➤ Settings on spectrum analyzer:<br/>AMPT REF LEVEL test level<br/>FREQ CENTER test frequency<br/>Set SPAN to <math>f_{mod}/4</math>, maximal 80 kHz and resolution bandwidth to <math>f_{mod}/20</math>, maximal 20 kHz.</p> <p>➤ First measure the carrier amplitude as zero order of Bessel function, then determine the <math>n</math> orders up to <math>\text{int}(m + 1)</math> by measuring the spectral lines <math>CF + (n * f_{mod})</math> and <math>CF - (n * f_{mod})</math>. Calculate the average of the amplitude of both lines for each order. Now the measured modulation index <math>m</math> can be calculated by numerical search for the error minimum.</p> <p>⇒ The PhiM deviation equals the modulation index <math>m</math>, FM deviation is calculated as <math>m * f_{mod}</math>.</p> |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Method<br>"FFT Demodulation<br>(Option R&S FS-K7)" | <ul style="list-style-type: none"> <li>• The FM deviation and distortion are determined by digital signal processing in the spectrum analyzer.</li> <li>• Restrictions: At large deviations and low modulation rates the settable measuring time maybe insufficient to determine deviation (1 period minimum needed) or distortion. At high deviations and high modulation rates the settable demodulation bandwidth maybe insufficient. Missing lines at the spectrum borders deteriorate the result.</li> </ul> <p>➤ Settings on R&amp;S RF SPECTRUM ANALYZER:<br/> AMPTD / REF LEVEL test level,<br/> FREQ / CENTER test frequency<br/> FMDEMOD,<br/> FMDEMOD ON,<br/> RESULT DISPLAY / FM resp. PM<br/> DEMOD BW &gt; 2 * (deviation + fmod) for FM,<br/> DEMOD BW &gt; 2 * fmod * (1 + deviation) for PM,<br/> RANGE / DEVIATION PER DIV 0.5 * deviation<br/> MEAS TIME 3/fmod<br/> for distortion (up to 3<sup>rd</sup> harmonic)<br/> RESULT DISPLAY / FM resp. PM / AF SPECTRUM<br/> DEMOD BW &gt; 2 * (deviation + 3.5 * fmod) for FM,<br/> DEMOD BW &gt; 7 * fmod * (1 + deviation) for PM,<br/> MEAS TIME 16/fmod</p> |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## FM Setting Uncertainty

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Method          | ➤ Spectrum Measurement (see chapter " <a href="#">Test Methodes</a> ").                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Measurement          | <p>➤ Settings on DUT:<br/> <b>RF On</b><br/> <b>RF Frequency:</b> 3 GHz<br/> <b>Level:</b> 0 dBm<br/> <b>Frequency Modulation</b> menu:<br/> <b>State Path1</b> On<br/> <b>Source Path1</b> LF Generator 1<br/> <b>FM Mode</b> Normal</p>                                                                                                                                                                                                                                               |
| Recommended settings | <p>➤ LFGGen1 Freq = 1 kHz, 1 MHz<br/> FM Deviation = 100 kHz.</p> <p>➤ Deviation sweep<br/> Measurement at CF 3 GHz, <math>f_{mod} = 100</math> kHz,<br/> deviation 3 kHz to 500 kHz in logarithmic steps,<br/> 4 steps per decade (1, 1.8, 3.2, 5.6)</p> <p>➤ Repeat measurements with changing settings to<br/> <b>Source Path1</b> EXT 1<br/> <b>Coupling EXT1</b> AC<br/> <b>Impedance EXT1</b> 50 Ohm<br/> feed in a 100 kHz external modulation signal at FM/PM EXT connector</p> |

## FM Distortion

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Method          | FFT Demodulation (see chapter " <a href="#">Test Methodes</a> ").                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Measurement          | <ul style="list-style-type: none"> <li>➤ Settings on DUT:<br/> <b>RF On</b><br/> <b>RF Frequency</b> 3 GHz<br/> <b>Level</b> 0 dBm<br/> <b>Frequency Modulation</b> menu:<br/>           <b>State Path1</b>        On<br/>           <b>Source Path1</b>    Ext 1<br/>           <b>FM deviation Path1</b> 100 kHz<br/>           <b>FM Mode</b>         Normal</li> <li>➤ Settings on signal generator:<br/> Function Sinus<br/> Voltage 1 Vs</li> <li>➤ Settings on RF spectrum analyzer:<br/> DEMOM BW 5 MHz,<br/> RANGE / DEVIATION PER DIV Deviation/5,<br/> RESULT DISPLAY / FM, AF SPECTRUM,<br/> SWEEP / MEAS TIME 6.8 ms,<br/> FREQ / AF STOP 560 kHz.</li> <li>➤ Read THD from the display. To convert to percent calculate<br/> <math>THDpct = 100 * 10^{(THDdB/20)}</math>.</li> </ul> |
| Recommended settings | <ul style="list-style-type: none"> <li>➤ <b>LF Generator Frequencies:</b> 1 kHz, 20 kHz, 50 kHz.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## FM Frequency Response

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Method          | FFT Demodulation<br>Spectrum Measurement (see chapter " <a href="#">Test Methodes</a> ").                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Measurement          | <ul style="list-style-type: none"> <li>➤ Settings on DUT:               <ul style="list-style-type: none"> <li><b>RF On</b></li> <li><b>RF Frequency</b> 22 GHz</li> <li><b>Level</b> 0 dBm</li> <li><b>Frequency Modulation</b> menu:                   <ul style="list-style-type: none"> <li><b>State Path1</b> On</li> <li><b>Source Path1</b> EXT 1</li> <li><b>FM Mode</b> Normal</li> <li><b>FM deviation Path1</b> 100kHz</li> <li><b>Coupling EXT1</b> AC</li> <li><b>Impedance EXT1</b> 50 Ohm</li> </ul> </li> </ul> </li> <li>➤ Setting on the signal generator:               <ul style="list-style-type: none"> <li>for frequencies up to 300 kHz the internal LF generator of the signal generator is used, &gt;300 kHz the RF output. It is recommended to use an AC voltmeter (Item 14 of ) to control the correct input voltage.</li> <li>- LFGGen Voltage 2 V<sub>eff</sub> (equivalent to 1 V peak at 50 Ohm)</li> <li>- State ON</li> <li>- RF level 10 dBm (equivalent to 1 V peak voltage).</li> </ul> </li> <li>➤ Settings on R&amp;S RF SPECTRUM ANALYZER:               <ul style="list-style-type: none"> <li>Up to f<sub>mod</sub> = 300 kHz settings for FFT Demodulation</li> <li>f<sub>mod</sub> &gt; 300 kHz settings for Spectrum Measurement.</li> </ul> </li> <li>➤ Vary the signal generator frequency and measure the modulation depth.               <ul style="list-style-type: none"> <li>⇒ The modulation frequency response is the difference between the greatest and the smallest modulation depth.</li> </ul> </li> </ul> |
| Recommended settings | <ul style="list-style-type: none"> <li>➤ <b>LF Generator Frequencies:</b><br/>10 Hz to 10 MHz in logarithmic steps, 4 steps per decade (1, 1.8, 3.2, 5.6).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Carrier Frequency Offset with FM

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test assembly | See section " <a href="#">Standard Test Assembly for Analog Modulations</a> ", page 1.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| ➤ Measurement | <p>➤ Settings on DUT:</p> <p><b>RF On</b><br/> <b>Frequency</b> 22 GHz<br/> <b>Level</b> 0dBm<br/> <b>Frequency Modulation</b> menu:<br/> <b>FM Path1 State</b> On<br/> <b>FM Path1 Source</b> External<br/> <b>FM Mode</b> Normal<br/> <b>FM Path1 deviation</b> 10 MHz<br/> <b>Ext1 Impedance</b> 50 Ohm<br/> <b>Ext1 Coupling</b> DC</p> <p>➤ Settings on spectrum analyzer:<br/> AMPT / REF LEVEL 0 dBm<br/> FREQ / CENTER 40 GHz<br/> SPAN 10 kHz<br/> MKR / SIGNAL COUNT / NEXT / CNT RESOL 10 Hz</p> <p>➤ Execute a single sweep. Using MKR→ / PEAK, read counted marker frequency.</p> <p>⇒ The offset is the difference between marker frequency and set carrier frequency.</p> |



## Phase Modulation

### PhiM Setting Uncertainty

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Method          | Spectrum Measurement (see chapter " <a href="#">Test Methodes</a> ").                                                                                                                                                                                                                                                                                                                                                                                                            |
| Measurement          | <ul style="list-style-type: none"> <li>➤ Settings on DUT:<br/> <b>RF On</b><br/> <b>Level</b> 0 dBm<br/> <b>Phase Modulation</b> menu:<br/> <b>PhiM Path1 State</b> on<br/> <b>PhiM Path1 Source</b> EXT1<br/> <b>PhiM Mode</b> High Deviation<br/> <b>Ext1 Impedance</b> 50 Ohm<br/> <b>Ext1 Coupling</b> AC<br/> feed in external modulation signal at EXT1 connector </li> <li>➤ Settings on spectrum analyzer:<br/> see chapter "<a href="#">Test Methodes</a>". </li> </ul> |
| Recommended settings | <ul style="list-style-type: none"> <li>➤ RF Frequencies: 10 MHz, 3 GHz<br/> Modulation signal: 1 kHz, sine</li> <li>➤ Deviation sweep<br/> Measurement at RF Frequencies.<br/> Deviation 1 mrad to 10 rad in logarithmic steps,<br/> 4 steps per decade (1, 1.8, 3.2, 5.6)</li> </ul>                                                                                                                                                                                            |

### PhiM Distortion

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Method          | FFT Demodulation (see chapter " <a href="#">Test Methodes</a> ").                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Measurement          | <ul style="list-style-type: none"> <li>➤ Settings on DUT:<br/> <b>RF On</b><br/> <b>Level</b> 0 dBm<br/> <b>Phase Modulation</b> menu:<br/> <b>State</b> on<br/> <b>PhiM Path1 Source</b> EXT1<br/> <b>PhiM Path1 Mode</b> High Deviation<br/> <b>PhiM Path1 Deviation</b> 20 rad<br/> <b>Ext1 Impedance</b> 50 Ohm<br/> <b>Ext1 Coupling</b> AC<br/> feed in external modulation signal at EXT1 connector </li> <li>➤ Settings on RF spectrum analyzer:<br/> see chapter "<a href="#">Test Methodes</a>".<br/> SWEEP / MEAS TIME 2.5 ms,<br/> FREQ / AF STOP 50 kHz,<br/> AMPTD / REF LEVEL 0 dBm,<br/> FREQ / CENTER test frequency. </li> <li>➤ Read THD from the Display. To convert to percent calculate<br/> <math>THD_{pct} = 100 * 10^{(THD_{dB}/20)}</math>. </li> </ul> |
| Recommended settings | <ul style="list-style-type: none"> <li>➤ RF Frequency 3 GHz<br/> Modulation signal: 1 kHz, 20 kHz, 50 kHz, sine, 1 V<sub>peak</sub></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## PhiM Frequency Response

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test method          | Spectrum measurement (see chapter " <a href="#">Test Methodes</a> ").                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Measurement          | <ul style="list-style-type: none"> <li>➤ Settings on DUT:<br/> <b>RF On</b><br/> <b>Level</b> 0 dBm<br/> <b>Phase Modulation</b> menu:<br/>           <b>PhiM Path1 Source</b>        External<br/>           <b>PhiM Path1 Mode</b>        Low Noise<br/>           <b>PhiM Path1 Deviation</b>    5 rad<br/>           <b>Ext1 Impedance</b>        50 Ohm<br/>           <b>Ext1 Coupling</b>         AC</li> <li>➤ Setting on the signal generator:<br/> for frequencies up to 10 MHz the internal LF generator of the signal generator is used, &gt; 10 MHz the RF output. It is recommended to use an AC voltmeter (Item 14 of <a href="#">Table 1-1</a>) to control the correct input voltage.<br/> - LFGen Voltage 2 V<sub>emf</sub> (equivalent to 1 V peak at 50 Ohm)<br/> - State ON<br/> - RF level 10 dBm (equivalent to 1 V peak voltage).</li> <li>➤ Settings on R&amp;S RF SPECTRUM ANALYZER:<br/> see chapter "<a href="#">Test Methodes</a>".</li> <li>➤ Vary the signal generator frequency and measure the modulation depth.<br/> ⇒ The modulation frequency response is the difference between the greatest and the smallest modulation depth.</li> </ul> |
| Recommended settings | <ul style="list-style-type: none"> <li>➤ RF Frequency 22 GHz</li> <li>➤ LF in logarithmic steps from 100 Hz to 1 MHz, 4 steps per decade (1, 1.8, 3.2, 5.6).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## Pulse Modulation

### ON/OFF Ratio

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test equipment               | <ul style="list-style-type: none"> <li>- Spectrum analyzer (<a href="#">Table 1-1</a>, item 18)</li> <li>- Pulse generator (<a href="#">Table 1-1</a>, item 13)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                           |
| Test setup                   | <ul style="list-style-type: none"> <li>➤ To determine the ON/OFF ratio, connect the spectrum analyzer to the RF output socket of the DUT and the pulse generator to the PULSE EXT socket on the rear of the DUT.</li> </ul>                                                                                                                                                                                                                                                                                                                                                          |
| Measurement                  | <ul style="list-style-type: none"> <li>➤ Setting on DUT:<br/><b>Pulse Modulation</b> menu:<br/><b>Source</b> External<br/><b>State</b> On</li> <li>➤ Setting on Analyzer<br/>FREQ/CENTER test frequency<br/>SPAN 0 Hz<br/>AMPT/REF LEVEL test level<br/>BW/RES BW MANUAL 3 kHz<br/>BW/VID BW MANUAL 300 Hz</li> <li>➤ Determine the output level of the DUT at various carrier frequencies with a "high" and a "low" signal applied.<br/>⇒ The difference between the output level with a "high" signal applied and that with a "low" signal applied is the ON/OFF ratio.</li> </ul> |
| Recommended test frequencies | 500 MHz, 0.99 GHz, 1 GHz, 10.9 GHz, 11.1 GHz, 20.9 GHz, 21.1 GHz, 40 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Recommended test level       | 0 dBm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Rise and Fall Time

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test assembly                | See section <a href="#">“Test Assembly for Pulse Modulation Rise and Fall Time”</a> , page 1.3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Test method                  | The DUT is pulse modulated by an external pulse generator. The rise and fall time of the pulsed RF signal is measured by means of a digital sampling oscilloscope.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Measurement                  | <ul style="list-style-type: none"> <li>➤ Settings on pulse generator:<br/> <b>Pulse periode</b> 1 <math>\mu</math>s<br/> <b>Pulse width</b> 0.5 <math>\mu</math>s<br/> TTL level </li> <li>➤ Setting on DUT:<br/> <b>RF On</b><br/> <b>Level</b> 0dBm<br/> <b>Pulse Modulation</b> menu:<br/> <b>State</b> On<br/> <b>Source</b> External <b>State</b> On<br/><br/> <b>Source</b> External<br/> <b>Polarity</b> Normal<br/> <b>Input impedance</b> 50 <math>\Omega</math> </li> <li>➤ Setting on oscilloscope:<br/> Trigger external (use <b>sync</b> signal of pulse generator as trigger source) </li> <li>➤ Measurement: Evaluate the pulse-modulated RF signal on the oscilloscope.<br/><br/> ⇒ Rise time = time between 10% and 90% of RF amplitude<br/> Fall time = time between 90% and 10% of RF amplitude </li> </ul> |
| Recommended test frequencies | 500 MHz, 0.99 GHz, 1 GHz, 10.9 GHz, 11.1 GHz, 20.9 GHz, 21.1 GHz, 40 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

**Video Crosstalk**

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test assembly                | As above for ON/OFF Ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Measurement                  | <ul style="list-style-type: none"><li>➤ Setting on pulse generator:<br/>Squarewave pulse sequence with a frequency of 1 MHz,<br/>TTL level</li><li>➤ Setting on DUT:<br/><b>RF On</b><br/><b>Frequencies:</b> test frequency (see below)<br/><b>Level:</b> - 7dBm<br/><b>Pulse Modulation State:</b> On</li><li>➤ Settings on the Analyzer<br/>FREQ CENTER 1 MHz,<br/>SPAN 10 kHz.</li><li>➤ Evaluate the signal on the analyzer.<ul style="list-style-type: none"><li>⇒ The Video Crosstalk is the peak-to-peak amplitude of the spectral line found at 1 MHz.</li></ul></li></ul> |
| Recommended test frequencies | 500 MHz, 0.99 GHz, 1 GHz, 1.85 GHz, 2.6 GHz, 3.6 GHz, 5.1 GHz, 10.9 GHz, 11.1 GHz, 20.9 GHz, 21.1 GHz, 40 GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

# Performance Test Report

|                          |                                         |
|--------------------------|-----------------------------------------|
| <b>ROHDE&amp;SCHWARZ</b> | <b>R&amp;S SMF100A Signal Generator</b> |
| Serial number:           |                                         |
| Person testing:          |                                         |
| Date:                    |                                         |
| Signature:               |                                         |

For nominal data and limit values refer to the data sheet supplied with the instrument.

| Page | Characteristic                                                                                                            | Min.           | Actual | Max.           | Unit |
|------|---------------------------------------------------------------------------------------------------------------------------|----------------|--------|----------------|------|
| 1.6  | Reference Frequency                                                                                                       |                |        |                |      |
|      | Output Level                                                                                                              | typ. 2         | _____  | typ. 8         | dBm  |
|      | Reference Frequency, Drift,                                                                                               | see data sheet | _____  | see data sheet | Hz   |
|      | Input for External Reference                                                                                              | O.K.           | _____  |                | -    |
| 1.7  | Frequency Setting                                                                                                         | O.K.           | _____  |                | -    |
| 1.7  | Spectral Purity                                                                                                           |                |        |                |      |
|      | Harmonics Suppression with R&S®SMF-B122 frequency option, level +10 dBm (with R&S®SMF-B2 level +6 dBm for $f \geq 1$ GHz) |                |        |                |      |
|      | Without R&S®SMF-B31 high output power option                                                                              |                |        |                |      |
|      | 100 kHz $\leq f < 300$ kHz                                                                                                |                | _____  | typ. -25       | dBc  |
|      | 300 kHz $\leq f < 10$ MHz                                                                                                 |                | _____  | -30            | dBc  |
|      | 10 MHz $\leq f < 200$ MHz                                                                                                 |                | _____  | -40            | dBc  |
|      | 200 MHz $\leq f < 1$ GHz                                                                                                  |                | _____  | -50            | dBc  |
|      | 1 GHz $\leq f \leq 22$ GHz                                                                                                |                | _____  | -50            | dBc  |
|      | With R&S®SMF-B31 high output power option                                                                                 |                |        |                |      |
|      | 100 kHz $\leq f < 300$ kHz                                                                                                |                | _____  | typ. -25       | dBc  |
|      | 300 kHz $\leq f < 10$ MHz                                                                                                 |                | _____  | -30            | dBc  |
|      | 10 MHz $\leq f < 200$ MHz                                                                                                 |                | _____  | -40            | dBc  |
|      | 200 MHz $\leq f < 1$ GHz                                                                                                  |                | _____  | -50            | dBc  |
|      | 1 GHz $\leq f \leq 22$ GHz                                                                                                |                | _____  | -30            | dBc  |

| Page | Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Min. | Actual | Max.     | Unit |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|----------|------|
| 1.7  | <p>Spectral Purity</p> <p>Harmonics Suppression with R&amp;S®SMF-B144 frequency option,<br/>level +10 dBm (with R&amp;S®SMF-B2 level +6 dBm for <math>f \geq 1</math> GHz) or maximum specified level, whichever is lower</p> <p>Without R&amp;S®SMF-B31 high output power option</p> <p><math>100 \text{ kHz} \leq f &lt; 300 \text{ kHz}</math></p> <p><math>300 \text{ kHz} \leq f &lt; 10 \text{ MHz}</math></p> <p><math>10 \text{ MHz} \leq f &lt; 200 \text{ MHz}</math></p> <p><math>200 \text{ MHz} \leq f &lt; 1 \text{ GHz}</math></p> <p><math>1 \text{ GHz} \leq f \leq 22 \text{ GHz}</math></p> <p><math>21 \text{ GHz} \leq f \leq 43.5 \text{ GHz}</math></p> <p>With R&amp;S®SMF-B31 high output power option</p> <p><math>100 \text{ kHz} \leq f &lt; 300 \text{ kHz}</math></p> <p><math>300 \text{ kHz} \leq f &lt; 10 \text{ MHz}</math></p> <p><math>10 \text{ MHz} \leq f &lt; 200 \text{ MHz}</math></p> <p><math>200 \text{ MHz} \leq f &lt; 1 \text{ GHz}</math></p> <p><math>1 \text{ GHz} \leq f \leq 22 \text{ GHz}</math></p> <p><math>21 \text{ GHz} \leq f \leq 43.5 \text{ GHz}</math></p> |      |        |          |      |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | typ. -25 | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -30      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -40      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -50      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -50      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -40      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | typ. -25 | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -30      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -40      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -50      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -30      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -40      | dBc  |
| 1.7  | <p>Spectral Purity</p> <p>Subharmonics with R&amp;S®SMF-B122 frequency option,<br/>level +10 dBm</p> <p>Without R&amp;S®SMF-B31 high output power option</p> <p><math>f &lt; 11 \text{ GHz}</math></p> <p><math>11 \text{ GHz} \leq f \leq 22 \text{ GHz}</math></p> <p>With R&amp;S®SMF-B31 high output power option</p> <p><math>f &lt; 11 \text{ GHz}</math></p> <p><math>11 \text{ GHz} \leq f &lt; 22 \text{ GHz}</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |        |          |      |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | none     | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -55      | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | none     | dBc  |
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |        | -50      | dBc  |

| Page | Characteristic                                                                                   | Min. | Actual | Max.     | Unit   |
|------|--------------------------------------------------------------------------------------------------|------|--------|----------|--------|
| 1.7  | Spectral Purity                                                                                  |      |        |          |        |
|      | Subharmonics with R&S®SMF-B144 frequency option, level +10 dBm                                   |      |        |          |        |
|      | Without R&S®SMF-B31 high output power option                                                     |      |        |          |        |
|      | $f < 11 \text{ GHz}$                                                                             |      | _____  | none     | dBc    |
|      | $11 \text{ GHz} \leq f < 36 \text{ GHz}$                                                         |      | _____  | -50      | dBc    |
|      | $36 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$                                                    |      | _____  | -30      | dBc    |
|      | With R&S®SMF-B31 high output power option                                                        |      |        |          |        |
|      | $f < 11 \text{ GHz}$                                                                             |      | _____  | none     | dBc    |
|      | $11 \text{ GHz} \leq f < 36 \text{ GHz}$                                                         |      | _____  | -50      | dBc    |
|      | $36 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$                                                    |      | _____  | -30      | dBc    |
| 1.8  | Spectral Purity                                                                                  |      |        |          |        |
|      | Nonharmonics, CW, Offset > 3 kHz level +10 dBm or maximum specified level, whichever is lower    |      |        |          |        |
|      | $100 \text{ kHz} \leq f < 300 \text{ kHz}$                                                       |      | _____  | typ. -67 | dBc    |
|      | $300 \text{ kHz} \leq f < 40 \text{ MHz}$                                                        |      | _____  | -67      | dBc    |
|      | $40 \text{ MHz} \leq f < 375 \text{ MHz}$                                                        |      | _____  | -55      | dBc    |
|      | $375 \text{ MHz} \leq f < 1 \text{ GHz}$                                                         |      | _____  | -75      | dBc    |
|      | $1 \text{ GHz} \leq f < 3 \text{ GHz}$                                                           |      | _____  | -68      | dBc    |
|      | $3 \text{ GHz} \leq f < 11 \text{ GHz}$                                                          |      | _____  | -62      | dBc    |
|      | $11 \text{ GHz} \leq f < 21 \text{ GHz}$                                                         |      | _____  | -56      | dBc    |
|      | with R&S®SMF-B122 frequency option                                                               |      |        |          |        |
|      | $21 \text{ GHz} \leq f \leq 22 \text{ GHz}$                                                      |      | _____  | -56      | dBc    |
|      | with R&S®SMF-B144 frequency option                                                               |      |        |          |        |
|      | $21 \text{ GHz} \leq f \leq 43.5 \text{ GHz}$                                                    |      | _____  | -50      | dBc    |
| 1.10 | Spectral Purity                                                                                  |      |        |          |        |
|      | SSB Phase Noise without R&S®SMF-B1 option, carrier offset 100 Hz, measurement bandwidth 1 Hz, CW |      |        |          |        |
|      | $f = 250 \text{ MHz}$                                                                            |      | _____  | -90      | dBc/Hz |
|      | $f = 1 \text{ GHz}$                                                                              |      | _____  | -95      | dBc/Hz |
|      | $f = 2 \text{ GHz}$                                                                              |      | _____  | -89      | dBc/Hz |
|      | $f = 4 \text{ GHz}$                                                                              |      | _____  | -83      | dBc/Hz |
|      | $f = 10 \text{ GHz}$                                                                             |      | _____  | -75      | dBc/Hz |
|      | $f = 20 \text{ GHz}$                                                                             |      | _____  | -69      | dBc/Hz |
|      | $f = 40 \text{ GHz}$                                                                             |      | _____  | -63      | dBc/Hz |



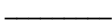
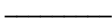
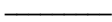
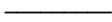
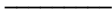
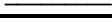
|      |                                                                                                                                                                                                                                  |  |                              |                                                      |                                                                    |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------|------------------------------------------------------|--------------------------------------------------------------------|
| 1.10 | Spectral Purity<br>SSB Phase Noise without R&S®SMF-B1 option, carrier offset 20 kHz, measurement bandwidth 1 Hz, CW<br>f = 250 MHz<br>f = 1 GHz<br>f = 2 GHz<br>f = 4 GHz<br>f = 10 GHz<br>f = 20 GHz<br>f = 40 GHz              |  | <br><br><br><br><br><br><br> | -130<br>-135<br>-129<br>-123<br>-115<br>-109<br>-103 | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz |
| 1.10 | Spectral Purity<br>SSB Phase Noise with R&S®SMF-B1 option, measurement bandwidth 1 Hz, CW<br>frequency offset from carrier 10 Hz<br>f = 250 MHz<br>f = 1 GHz<br>f = 2 GHz<br>f = 4 GHz<br>f = 10 GHz<br>f = 20 GHz<br>f = 40 GHz |  | <br><br><br><br><br><br><br> | -72<br>-77<br>-71<br>-65<br>-57<br>-51<br>-45        | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz |
|      | frequency offset from carrier 100 Hz<br>f = 250 MHz<br>f = 1 GHz<br>f = 2 GHz<br>f = 4 GHz<br>f = 10 GHz<br>f = 20 GHz<br>f = 40 GHz                                                                                             |  | <br><br><br><br><br><br><br> | -90<br>-95<br>-89<br>-83<br>-75<br>-69<br>-63        | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz |
|      | frequency offset from carrier 1 kHz<br>f = 250 MHz<br>f = 1 GHz<br>f = 2 GHz<br>f = 4 GHz<br>f = 10 GHz<br>f = 20 GHz<br>f = 40 GHz                                                                                              |  | <br><br><br><br><br><br><br> | -115<br>-120<br>-114<br>-108<br>-100<br>-94<br>-88   | dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz<br>dBc/Hz |

|      |                                                  |      |       |      |        |
|------|--------------------------------------------------|------|-------|------|--------|
|      | frequency offset from carrier 10 kHz             |      |       |      |        |
|      | f = 250 MHz                                      |      | _____ | -128 | dBc/Hz |
|      | f = 1 GHz                                        |      | _____ | -133 | dBc/Hz |
|      | f = 2 GHz                                        |      | _____ | -129 | dBc/Hz |
|      | f = 4 GHz                                        |      | _____ | -123 | dBc/Hz |
|      | f = 10 GHz                                       |      | _____ | -115 | dBc/Hz |
|      | f = 20 GHz                                       |      | _____ | -111 | dBc/Hz |
|      | f = 40 GHz                                       |      | _____ | -105 | dBc/Hz |
|      | frequency offset from carrier 100 kHz            |      |       |      |        |
|      | f = 250 MHz                                      |      | _____ | -128 | dBc/Hz |
|      | f = 1 GHz                                        |      | _____ | -133 | dBc/Hz |
|      | f = 2 GHz                                        |      | _____ | -127 | dBc/Hz |
|      | f = 4 GHz                                        |      | _____ | -121 | dBc/Hz |
|      | f = 10 GHz                                       |      | _____ | -113 | dBc/Hz |
|      | f = 20 GHz                                       |      | _____ | -107 | dBc/Hz |
|      | f = 40 GHz                                       |      | _____ | -101 | dBc/Hz |
| 1.10 | Level<br>Level Uncertainty, 100 kHz ≤ f ≤ 50 MHz |      |       |      |        |
|      | >+10 dBm                                         | -0.6 | _____ | 0.6  | dB     |
|      | +10 dBm to >-10 dBm                              | -0.6 | _____ | 0.6  | dB     |
|      | -10 dBm to >-70 dBm                              | -0.9 | _____ | 0.9  | dB     |
|      | -70 dBm to >-90 dBm                              | -1.0 | _____ | 1.0  | dB     |
|      | -90 dBm to -100 dBm                              | -1.6 | _____ | 1.6  | dB     |
|      | Level Uncertainty, 50 MHz ≤ f < 2 GHz            |      |       |      |        |
|      | >+10 dBm                                         | -0.6 | _____ | 0.6  | dB     |
|      | +10 dBm to >-10 dBm                              | -0.6 | _____ | 0.6  | dB     |
|      | -10 dBm to >-70 dBm                              | -0.7 | _____ | 0.7  | dB     |
|      | -70 dBm to >-90 dBm                              | -0.8 | _____ | 0.8  | dB     |
|      | -90 dBm to -100 dBm                              | -1.4 | _____ | 1.4  | dB     |
|      | Level Uncertainty, 2 GHz ≤ f < 22 GHz            |      |       |      |        |
|      | >+10 dBm                                         | -0.8 | _____ | 0.8  | dB     |
|      | +10 dBm to >-10 dBm                              | -0.8 | _____ | 0.8  | dB     |
|      | -10 dBm to >-70 dBm                              | -0.9 | _____ | 0.9  | dB     |
|      | -70 dBm to >-90 dBm                              | -1.0 | _____ | 1.0  | dB     |
|      | -90 dBm to -100 dBm                              | -1.7 | _____ | 1.7  | dB     |
|      | Level Uncertainty, 22 GHz ≤ f ≤ 40 GHz           |      |       |      |        |
|      | >+10 dBm                                         | -1.0 | _____ | 1.0  | dB     |
|      | +10 dBm to >-10 dBm                              | -1.2 | _____ | 1.2  | dB     |
|      | -10 dBm to >-70 dBm                              | -1.2 | _____ | 1.2  | dB     |
|      | -70 dBm to >-90 dBm                              | -2.0 | _____ | 2.0  | dB     |
|      | -90 dBm to -100 dBm                              | -2   | _____ | 2    | dB     |

|      |                                                                                                                                                                                                                            |                                                                                        |                                                                      |                                                                                        |                                      |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------|
|      | Level Uncertainty, 40 GHz < f ≤ 43.5 GHz<br>+10 dBm to >-10 dBm<br>-10 dBm to >-70 dBm<br>-70 dBm to >-90 dBm<br>-90 dBm to -100 dBm                                                                                       | -1.0<br>-1.5<br>-2.5<br>-4.2                                                           | _____<br>_____<br>_____<br>_____                                     | 1.0<br>1.5<br>2.5<br>4.2                                                               | dB<br>dB<br>dB<br>dB                 |
| 1.13 | Internal LF Generator (R&S®SMF-B20 option, waveform sine)<br>Frequency setting<br>f = 1 kHz<br>f = 10 kHz<br>f = 100 kHz<br>f = 1 MHz<br>f = 10 MHz                                                                        | see data sheet<br>see data sheet<br>see data sheet<br>see data sheet<br>see data sheet | _____<br>_____<br>_____<br>_____<br>_____                            | see data sheet<br>see data sheet<br>see data sheet<br>see data sheet<br>see data sheet | Hz<br>Hz<br>Hz<br>Hz<br>Hz           |
|      | Distortion<br>f = 1 kHz<br>f = 10 kHz<br>f = 20 kHz                                                                                                                                                                        |                                                                                        | _____<br>_____<br>_____                                              | 0.5<br>0.5<br>0.5                                                                      | %<br>%<br>%                          |
|      | Level Setting Accuracy, f = 1 kHz<br>Level (Vp) = 1 V                                                                                                                                                                      |                                                                                        | _____                                                                | 1.11                                                                                   | V                                    |
|      | Frequency response<br>10 Hz ≤ f ≤ 500 kHz<br>500 kHz < f ≤ 10 MHz                                                                                                                                                          |                                                                                        | _____<br>_____                                                       | 0.5<br>3                                                                               | dB<br>dB                             |
| 1.15 | Amplitude Modulation (R&S®SMF-B20 option)<br>AM Setting Uncertainty,<br>f <sub>RF</sub> = 22 GHz, f <sub>mod</sub> = 1 kHz<br>m = 10 %<br>m = 20 %<br>m = 30 %<br>m = 40 %<br>m = 50 %<br>m = 60 %<br>m = 70 %<br>m = 80 % | 8.5<br>18.0<br>27.5<br>37.0<br>46.5<br>56.0<br>65.5<br>75.0                            | _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | 11.50<br>22.0<br>32.5<br>43.0<br>53.5<br>64.0<br>74.5<br>85.0                          | %<br>%<br>%<br>%<br>%<br>%<br>%<br>% |
|      | AM Distortion,<br>f <sub>mod</sub> = 1 kHz, m = 60%<br><br>f = 1 MHz<br>f = 999 MHz<br>f = 1 GHz<br>f = 3 GHz<br>f = 11 GHz<br>f = 22 GHz<br>f = 40 GHz<br>f = 43.5 GHz                                                    |                                                                                        | _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | 2.5<br>1.0<br>1.0<br>1.0<br>1.0<br>1.0<br>1.0<br>1.0                                   | %<br>%<br>%<br>%<br>%<br>%<br>%<br>% |

|      |                                                                                                                                                                                                                                                                                                                                  |            |                                                                               |                                           |                                                    |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------|-------------------------------------------|----------------------------------------------------|
|      | AM Frequency Response<br>$10 \text{ Hz} \leq f_{\text{mod}} \leq 100 \text{ kHz}$ , $m = 60 \%$<br><br>$f = 10 \text{ MHz}$<br>$f = 100 \text{ MHz}$<br>$f = 374.9 \text{ MHz}$<br>$f = 375.1 \text{ MHz}$<br>$f = 1 \text{ GHz}$<br>$f = 3 \text{ GHz}$<br>$f = 11 \text{ GHz}$<br>$f = 22 \text{ GHz}$<br>$f = 40 \text{ GHz}$ |            | _____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | 3<br>3<br>3<br>3<br>3<br>3<br>3<br>3<br>3 | dB<br>dB<br>dB<br>dB<br>dB<br>dB<br>dB<br>dB<br>dB |
| 1.17 | Frequency Modulation (R&S®SMF-B20 option)<br><br>FM Setting Uncertainty<br>$f_{\text{RF}} = 3 \text{ GHz}$ , deviation = 100 kHz<br><br>$f_{\text{mod}} = 1 \text{ kHz}$<br>$f_{\text{mod}} = 1 \text{ MHz}$                                                                                                                     | 97<br>90   | _____<br>_____                                                                | 103<br>110                                | kHz<br>kHz                                         |
|      | FM Distortion<br>$f_{\text{RF}} = 3 \text{ GHz}$ , deviation = 100 kHz<br><br>$f_{\text{mod}} = 1 \text{ kHz}$<br>$f_{\text{mod}} = 20 \text{ kHz}$<br>$f_{\text{mod}} = 50 \text{ kHz}$                                                                                                                                         |            | _____<br>_____<br>_____                                                       | 0.5<br>0.5<br>0.5                         | %<br>%<br>%                                        |
|      | FM Frequency response<br>$f_{\text{RF}} = 22 \text{ GHz}$ , deviation = 100 kHz<br><br>$10 \text{ Hz} \leq f_{\text{mod}} \leq 10 \text{ MHz}$                                                                                                                                                                                   |            | _____                                                                         | 3                                         | dB                                                 |
|      | FM Carrier frequency offset<br>$f_{\text{RF}} = 22 \text{ GHz}$ , deviation = 10 MHz                                                                                                                                                                                                                                             | 9.98       | _____                                                                         | 10.020                                    | MHz                                                |
| 1.22 | Phase Modulation (R&S®SMF-B20 option)<br><br>PhiM Setting Uncertainty<br>$f_{\text{mod}} = 1 \text{ kHz}$ , deviation = 10 rad<br><br>$f = 10 \text{ MHz}$<br>$f = 3 \text{ GHz}$                                                                                                                                                | 9.5<br>9.5 | _____<br>_____                                                                | 10.5<br>10.5                              | rad<br>rad                                         |
|      | PhiM Distortion<br>$f_{\text{RF}} = 3 \text{ GHz}$ , deviation = 20 rad<br><br>$f_{\text{mod}} = 1 \text{ kHz}$<br>$f_{\text{mod}} = 20 \text{ kHz}$<br>$f_{\text{mod}} = 50 \text{ kHz}$                                                                                                                                        |            | _____<br>_____<br>_____                                                       | 0.5<br>0.5<br>0.5                         | %<br>%<br>%                                        |
|      | PhiM Frequency response<br>$f_{\text{RF}} = 22 \text{ GHz}$ , deviation = 5 rad<br><br>$100 \text{ Hz} \leq f_{\text{mod}} \leq 1 \text{ MHz}$                                                                                                                                                                                   |            | _____                                                                         | 3                                         | dB                                                 |

|      |                                                      |    |       |     |              |
|------|------------------------------------------------------|----|-------|-----|--------------|
|      | Pulse Modulation (R&S®SMF-K3 option)<br>On/Off Ratio |    |       |     |              |
|      | f = 500 MHz                                          | 80 | _____ |     | dB           |
|      | f = 990 MHz                                          | 80 | _____ |     | dB           |
|      | f = 1 GHz                                            | 80 | _____ |     | dB           |
|      | f = 10.9 GHz                                         | 80 | _____ |     | dB           |
|      | f = 11.1 GHz                                         | 80 | _____ |     | dB           |
|      | f = 20.9 GHz                                         | 80 | _____ |     | dB           |
|      | f = 21.1 GHz                                         | 80 | _____ |     | dB           |
|      | f = 40 GHz                                           | 80 | _____ |     | dB           |
| 1.24 | Rise and Fall Time                                   |    |       |     |              |
|      | f = 500 MHz                                          |    | _____ | 20  | ns           |
|      | f = 990 MHz                                          |    | _____ | 20  | ns           |
|      | f = 1 GHz                                            |    | _____ | 10  | ns           |
|      | f = 10.9 GHz                                         |    | _____ | 10  | ns           |
|      | f = 11.1 GHz                                         |    | _____ | 10  | ns           |
|      | f = 20.9 GHz                                         |    | _____ | 10  | ns           |
|      | f = 21.1 GHz                                         |    | _____ | 10  | ns           |
|      | f = 40 GHz                                           |    | _____ | 10  | ns           |
|      | Video Crosstalk<br>Without R&S®SMF-K3 option         |    |       |     |              |
|      | f = 500 MHz                                          |    | _____ | 150 | peak-to-peak |
|      | f = 990 MHz                                          |    | _____ | 150 | peak-to-peak |
|      | f = 1 GHz                                            |    | _____ | 75  | peak-to-peak |
|      | f = 1.85 GHz                                         |    | _____ | 75  | peak-to-peak |
|      | f = 2.6 GHz                                          |    | _____ | 75  | peak-to-peak |
|      | f = 3.6 GHz                                          |    | _____ | 5   | peak-to-peak |
|      | f = 5.1 GHz                                          |    | _____ | 5   | peak-to-peak |
|      | f = 10.9 GHz                                         |    | _____ | 5   | peak-to-peak |
|      | f = 11.1 GHz                                         |    | _____ | 5   | peak-to-peak |
|      | f = 20.9 GHz                                         |    | _____ | 5   | peak-to-peak |
|      | f = 21.1 GHz                                         |    | _____ | 5   | peak-to-peak |
|      | f = 40 GHz                                           |    | _____ | 5   | peak-to-peak |

|  |                                           |  |                                                                                    |     |              |
|--|-------------------------------------------|--|------------------------------------------------------------------------------------|-----|--------------|
|  | Video Crosstalk<br>With R&S®SMF-K3 option |  |                                                                                    |     |              |
|  | f = 500 MHz                               |  |  | 150 | peak-to-peak |
|  | f = 990 MHz                               |  |  | 150 | peak-to-peak |
|  | f = 1 GHz                                 |  |  | 150 | peak-to-peak |
|  | f = 1.85 GHz                              |  |  | 150 | peak-to-peak |
|  | f = 2.6 GHz                               |  |  | 150 | peak-to-peak |
|  | f = 3.6 GHz                               |  |  | 10  | peak-to-peak |
|  | f = 5.1 GHz                               |  |  | 10  | peak-to-peak |
|  | f = 10.9 GHz                              |  |  | 10  | peak-to-peak |
|  | f = 11.1 GHz                              |  |  | 10  | peak-to-peak |
|  | f = 20.9 GHz                              |  |  | 10  | peak-to-peak |
|  | f = 21.1 GHz                              |  |  | 10  | peak-to-peak |
|  | f = 40 GHz                                |  |  | 10  | peak-to-peak |



# Contents - Chapter 2 "Adjustments"

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## 2 Adjustments

This chapter describes all necessary measurements to restore the performance of the R&S SMF100A after module replacement.

### Preliminary Remark

**Setting a** defined **initial** state by pressing the **PRESET** key prior to adjustments is recommended. To ensure that the internal adjustments are valid at operating temperature, at least **30 minutes warm-up time** at this temperature must be observed.

## Manual Adjustments

### Maximum YIG Frequency

To adjust the maximum YIG oscillator frequency connect the RF-output of the R&S SMF100A with the RF input of a spectrum analyzer or frequency counter.

#### Settings R&S SMF100A:

Preset  
Frequency: 10.99 GHz  
Level: 0 dBm

#### Settings

##### Analyzer/Counter:

Frequency: 11 GHz  
Reference Level: 5 dBm  
Span: 500 MHz

Set the TMO-DAC 2% below maximum (64200 dec = FAC8 hex) via direct mode:

**TEST:DIR 'FSYN',#H011A,#HFAC8**

Read the Control register at address = 112 hex:

**TEST:DIR?'FSYN',#H0112**

Change the logical state of control bit 7 (counting starts with 0) to zero and write the modified value back:

**TEST:DIR'FSYN',#H0122,#Hxxxx**

xxxx is the modified value in hexadecimal format.

Tune the RF-Frequency by means of R34 to 11 GHz  $\pm$  50 MHz. Lower values of R34 do increase the frequency.

## FM Deviation / Frequency Response

To adjust FM deviation and FM frequency response connect the RF output of the R&S SMF100A to the RF input of a modulation analyzer with a demodulation bandwidth of  $\geq 10$  MHz. Preferred instrument: R&S FSUP with option R&S FS-K7.

### Settings R&S SMF100A:

|               |                |
|---------------|----------------|
| Preset        |                |
| Frequency:    | 10 GHz         |
| Level:        | 0 dBm          |
| FM State:     | On             |
| FM Source:    | LF Gen 1       |
| FM Deviation: | 500 kHz        |
| LF Frequency: | 200 kHz, 4 MHz |

First step: LF Frequency = 200 kHz. Adjust the measured FM deviation by means of R30 to  $500 \text{ kHz} \pm 3 \text{ kHz}$ .

Second step: LF Frequency = 4 MHz. Adjust the measured FM deviation by means of R28 to  $500 \text{ kHz} \pm 5 \text{ kHz}$ .

## CW Filter adjustment

For optimum frequency setting time and phase noise the CW filter must be adjusted (R29).

### Settings R&S SMF100A:

|            |           |
|------------|-----------|
| Preset     |           |
| Frequency: | 10.99 GHz |
| Level:     | 0 dBm     |

Measure the DC voltage at test point P1 (about 8.5 V).

Adjust (R29) the DC voltage at test point P3 to the previously measured value  $\pm 100 \text{ mV}$ .

## 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.

## 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 Loopgain Correction

The measuring program for external loopgain correction maximizes the internal level control bandwidth over frequency and level and stores the correction values inside the R&S SMF100A to achieve best AM accuracy and settling time. Connect the devices as shown in Figure 2-1. Install the software, execute the R&S SMF100A Loopgain Correction program and follow the instructions on the screen.

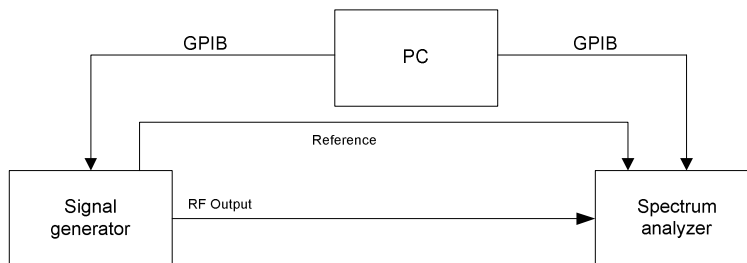


Fig. 2-1 External loopgain correction with spectrum analyzer

## External Level Correction

The measuring program for external level correction measures output power over frequency and level and stores the correction values inside the R&S SMF100A to maintain level accuracy. Besides the level deviations of the step attenuator from its nominal values are measured and are stored inside the device, too.

Connect the devices as shown in Fig. 2-2 and Fig. 2-3. Install the software, execute the R&S SMF100A Level Correction program and follow the instructions on the screen.

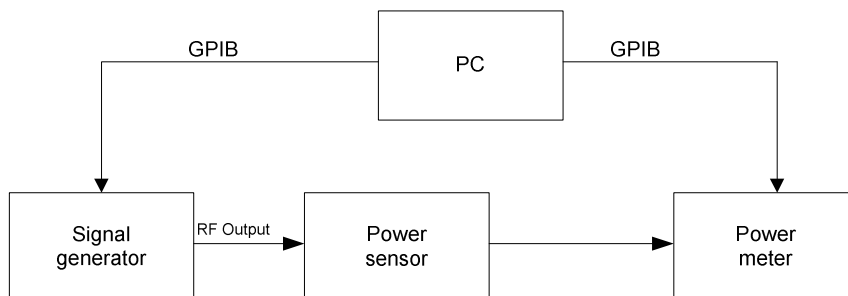


Fig. 2-2 External level correction with power sensor

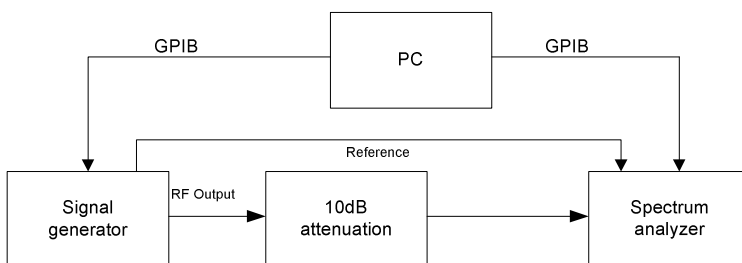


Fig. 2-3 External level correction with spectrum analyzer

## Measuring Equipment and Accessories

Table 2-1 Measuring equipment and accessories

| Item | Type of equipment | Required Characteristics                                       | Suitable Instrument                  | R&S Order No.         |
|------|-------------------|----------------------------------------------------------------|--------------------------------------|-----------------------|
| 1    | Signal generator  | 100 kHz to 43.5 GHz                                            | R&S SMF100A                          | 1167.0000.02          |
| 2    | RF power sensor   | 100 kHz to 40 GHz                                              | R&S NRP-Z55<br>(max. Freq. = 40 GHz) | 1138.2008.02          |
| 3    | RF power meter    | GPIO                                                           | R&S NRP                              | 1143.8500.02          |
| 4    | Spectrum analyzer | 100 kHz to 43.5 GHz                                            | R&S FSU50                            | 1166.1660.50          |
| 5    | 10 dB Attenuator  | 10 dB, 2.92 mm system, male, female,<br>2 W, VSWR <1.45@40 GHz | 0 to 40 GHz                          | 54A-10<br>(Weinschel) |
| 6    | Cable             | 2.92 mm system, male, male                                     |                                      |                       |
| 7    | Software          | For external level and loopgain<br>correction                  | R&S SMF_LevCor program               |                       |
| 8    | PC                | GPIO                                                           |                                      |                       |

## Adjustment of internal Reference Frequency

The frequency accuracy of the synthesizer is determined (set to internal reference) by a highly stable 10 MHz quartz oscillator that is set to a calibrated frequency standard at the R&S factory. This oscillator is subject to ageing and can usually be recalibrated; please contact your R&S representative.

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**Note:** The internal reference can be aligned 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.

---

## Adjustments after Module Replacement

| Changed module                               | Required adjustment/correction                                                                                                                               | Calibration necessary (refer to chapter "Checking the rated characteristics") |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Interface Board                              | None                                                                                                                                                         | None                                                                          |
| Motherboard                                  | None                                                                                                                                                         | None                                                                          |
| BNC Board                                    | None                                                                                                                                                         | None                                                                          |
| MW Interface Board                           | Setup/Internal Adjustments/Adjust All<br><br>External loopgain and level correction (external measurement equipment and special measuring software required) | Spectral Purity, Level Data, Amplitude Modulation, Pulse Modulation           |
| Controller Board                             | See below, <i>"Procedures after Replacing the Controller Board or the Lithium Battery"</i>                                                                   | None                                                                          |
| Reference Oscillator                         | None                                                                                                                                                         | Reference Frequency                                                           |
| AM/FM/Scan Modulator                         | Setup/Internal Adjustments/Adjust Modulation                                                                                                                 | LF Generator, Amplitude Modulation, Frequency Modulation, Phase Modulation    |
| Removable USB                                | None                                                                                                                                                         | None                                                                          |
| Removable GPIB                               | None                                                                                                                                                         | None                                                                          |
| Removable Compact Flash                      | Setup/Internal Adjustments/Adjust All                                                                                                                        | None                                                                          |
| Frequency Synthesis                          | Setup/Internal Adjustments/Adjust Frequency Synthesis                                                                                                        | Frequency, Spectral Purity                                                    |
| Down Converter                               | Setup/Internal Adjustments/Adjust All<br><br>External loopgain and level correction (external measurement equipment and special measuring software required) | Spectral Purity, Level Data, Amplitude Modulation, Pulse Modulation           |
| ALC/DDS Unit                                 | Setup/Internal Adjustments/Adjust All<br><br>External loopgain and level correction (external measurement equipment and special measuring software required) | Spectral Purity, Level Data, Amplitude Modulation, Pulse Generator            |
| TMO Unit<br>TMO Control Unit,<br>TMO Adapter | Manual adjustments: max. YIG frequency, FM deviation, CW filter.                                                                                             | Spectral Purity, Frequency Modulation                                         |
| DMA Module                                   | Setup/Internal Adjustments/Adjust All<br><br>External loopgain and level correction (external measurement equipment and special measuring software required) | Spectral Purity, Level Data, Amplitude Modulation, Pulse Modulation           |

| Changed module                                                                                                                                                                             | Required adjustment/correction                                                                                                                              | Calibration necessary (refer to chapter "Checking the rated characteristics") |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Switched Filter                                                                                                                                                                            | Setup/Internal Adjustments/Adjust All<br>External loopgain and level correction<br>(external measurement equipment and special measuring software required) | Spectral Purity, Level Data                                                   |
| Frequency Doubler                                                                                                                                                                          | Setup/Internal Adjustments/Adjust All<br>External loopgain and level correction<br>(external measurement equipment and special measuring software required) | Spectral Purity, Level Data                                                   |
| High Power Amplifier                                                                                                                                                                       | Setup/Internal Adjustments/Adjust All<br>External loopgain and level correction<br>(external measurement equipment and special measuring software required) | Spectral Purity, Level Data                                                   |
| Directional Coupler                                                                                                                                                                        | Setup/Internal Adjustments/Adjust All<br>External loopgain and level correction<br>(external measurement equipment and special measuring software required) | Level Data                                                                    |
| Detector                                                                                                                                                                                   | Setup/Internal Adjustments/Adjust All<br>External loopgain and level correction<br>(external measurement equipment and special measuring software required) | Level Data                                                                    |
| Step Attenuator                                                                                                                                                                            | Setup/Internal Adjustments/Adjust All<br>External loopgain and level correction<br>(external measurement equipment and special measuring software required) | Level Data                                                                    |
| Power Supply Unit                                                                                                                                                                          | Adjustment of STANDBY voltage<br>(see Fig. 2-4).                                                                                                            | None                                                                          |
| Front Panel Unit<br>FFT Display A110<br>Display Adapter Board<br>Inverter<br>Rotary Pulse Generator A125<br>Pushbutton Board Set<br>Flex. Switch Board A120<br>Front Panel Controller A130 | None                                                                                                                                                        | None                                                                          |
| Fan E1                                                                                                                                                                                     | None                                                                                                                                                        | None                                                                          |
| Compact Flash Card                                                                                                                                                                         | Setup/Internal Adjustments/Adjust All                                                                                                                       | None                                                                          |
| Lithium Battery                                                                                                                                                                            | See below, "Procedures after Replacing the Controller Board or the Lithium Battery"                                                                         | None                                                                          |

## Power Supply Unit

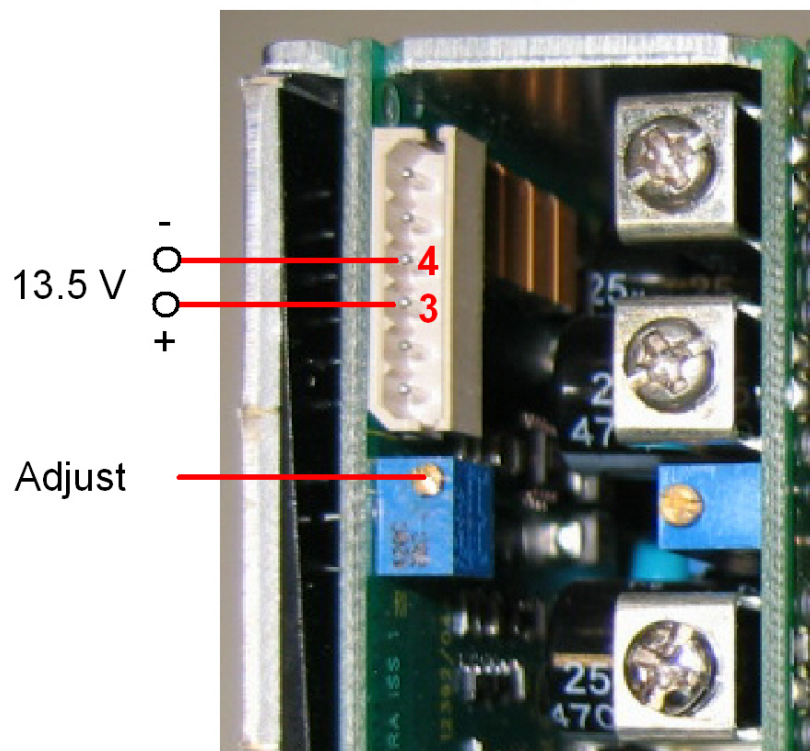


Fig. 2-4 Adjustment of STANDBY voltage



## Procedures after Replacing the Lithium Battery

1. Before switching on, connect an USB keyboard to the R&S SMF100A.
2. After switching on, the R&S logo does not disappear.



3. Wait about 10 seconds and afterwards press "F1".
4. The operating system (LINUX) and the R&S SMF100A firmware will start.
5. Set correct date and time at R&S SMF100A setup menu.
6. Enter time control key  
(to get the time control key, please contact your local Rohde & Schwarz service center).

## Procedures after Replacing the Controller Board

### Required equipment

External USB CD or DVD ROM Drive

### Required software:

BIOS\_SMFxxxx.iso (order number 1400.3651.00)

A burn program that can burn ISO images onto CD/DVD. Recommended program: **Nero Burning**

### Prepare CD Rom or DVD with full image of R&S SMF100A:

1. Start Nero on your PC.
2. From the program menu, select **File -> Burn CD image**.
3. Specify file type "all files" (\*.\*)
4. Select the ISO image file to be burned (BIOS\_SMFxxxx.iso).
5. Confirm the checkbox indicating that Nero does not recognize the format of the image file.
6. When the dialog appears, set the parameters specified above.
7. Click "burn".

### Install the new BIOS on the LPC processor

1. Switch off the instrument
2. Connect an external USB CD or DVD drive to the R&S SMF100A.
3. Insert the CD Rom or DVD with BIOS into the external drive.
4. Switch on the instrument.  
The CD or DVD boots the instrument and executes the following steps (approx. 1 min).  
The LED of the external USB Drive **is on**. The Flash Program and the BIN File are copied from the CD to the Ram drive. During transmission the USB drive is audible.  
The LED on the external USB Drive **is off**. The BIOS is installed in the EPROM of the R&S SMF100A.
5. Wait until the USB drive gets quiet.
6. Remove the external CD ROM/DVD drive
7. Switch instrument off and on  
The instrument reboots and the new BIOS is loaded on the instrument.

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## 3 Repair

### Instrument Design and Function Description

Block diagram of the entire R&S SMF100A refer to figure Chapter 5 (1167.000.01 S, Sheet 1 to 3).

The R&S SMF100A base unit consists of modules as follows:

- A900 Power Supply Unit,
- A100 Front Module,
- A200 Interface Board,
- A250 Processor Unit,
- A300 Motherboard,
- A205 Microwave Interface,
- A400 Frequency Synthesis,
- A500 ALC/DDS Unit,
- A720 Coupler,
- A725 Detector,
- A780 Switched Filter,
- A800 DMA Module,
- A820 TMO Unit,
- A450 Down Converter,
- A520 AM/FM/Scan Modulator,
- A575 Reference Oscillator,
- A740 Frequency Doubler,
- A600 Step Attenuator,
- A170 GPIB Board,
- A180 USB Board,
- A190 Removable Flash Board
- A760 High Power Amplifier

### A900 Power Supply Unit

The **power supply unit (A900)** is providing the most important stabilized supply voltages for the modules which are derived from the input line voltage. It additionally provides a 13.5 V standby voltage for the supply of the reference oscillators for frequency synthesis. Within the modules additional module-specific voltages are directly derived from the incoming voltages out of the power supply unit.

### A100 Front Module

The **front module unit (A100)** consists of **Display (A110)**, **Keyboard (A120)**, **Knob (A125)** and **Front Panel Controller (A130)**. It includes two USB and one Power Sensor connectors. The display is controlled by **Processor Unit (A250)** via a DVI-connection. User inputs via keyboard, roll key or mouse are directed to the **Processor Unit (A250)** via USB bus after having been pre-processed by the Front Panel Controller.

## A200 Interface Board

The **Interface Board (A200)** is distributing the Power Supply voltages to the modules and is additionally the electrical link in between the **Processor Unit (A250)**, the modules and the external interfaces. It is also the mechanical stabilizer of the Processor Unit. Data transfer in between modules and Processor Unit is performed via PCI-Bus. Format transformation from the PCI-Bus-Data to the module specific data format is performed by means of a Field Programmable Gate Array (FPGA) called SMF\_COM, which does provide functions as follows:

- PCI-Interface,
- Master Controller for serial bus,
- 8-bit-Parallel Bus,
- Interrupt Controller,
- ADC/DAC Interface,
- Configurations Interface (for FPGA configuration),
- Sweep Controller for analog ramp sweep,
- I/O Port,
- Fan Controller.

Output voltages from the Power Supply are protected by means of lead-fuses located on the Interface Board before directed to the specific modules. Noise critical lines are additionally filtered using low-pass circuits. The Interface Board additionally includes connectors for microwave modules, the diagnosis Analog-Digital-Converter (ADC), a double Digital-Analog-Converter (DAC) for the V/GHz-output and the X-output, a reset generator and the configuration EEPROM for the SMF\_COM FPGA.

## A250 Processor Unit

The **Processor Unit (A250)** is directly plugged onto the **Interface Board (A200)**. Its main function is the control of the modules and the communication to/from the input-output-interfaces. The Processor Unit includes a standard LAN-interface, four USB-interfaces and the Compact Flash card including the firmware. The Compact Flash card may be accessible from the rear panel as an option, which does need the **Removable Flash Board (A180)**.

## A300 Motherboard

The **Motherboard (A300)** is designed for a maximum of four modules to be stacked within three 19" height units. The modules are the *Frequency Synthesis*, *ALC/DDS Unit* and *Down Converter*. The fourth slot is left free for the purpose of additional options to be fitted in.

### NOTICE

#### Fixed module positions



The module positions are fixed and cannot be freely selected !

The motherboard is directly linked to the Interface Board by means of two connectors. Data transmission to the modules plugged onto the motherboard is performed via a parallel bus with 8 bits in width. The same bus is used for the configuration of the FPGAs when powering on the instrument. The ID-EEPROMS on the modules are controlled via the serial bus.

## A205 Microwave Interface

Microwave modules in the lower and middle position and the **Reference Oscillator (A575)**, i. e. the modules which are not directly connected with the Interface Board, are controlled via **Microwave Interface (A205)**. This module mainly provides functions as follows:

- Serial Bus Decoder (SerBus),
- Diagnose Multiplexer,
- Step Attenuators controller,
- Correction data EPROM

The Microwave Modules are serial controlled by the Interface Board by means of the SerBus-Decoder. The output voltages of the temperature sensors on the specific microwave modules can be selected by means of the diagnostic multiplexer. Instrument specific data, for instance level correction data, is stored within the EPROM on the **Microwave Interface**.

## A400 Frequency Synthesis

The **Frequency Synthesis module (A400)** provides the main function within frequency synthesis. It includes all phase locked loops which are critical in terms of phase noise and spurious emissions and the RF-stages of frequency synthesis:

- 10 MHz VTCXO
- 100 MHz VCXO
- Reference Loop
- Step Frequency Multiplier
- Coarse Frequency Loop
- TMO Loop and TMO Control

The **10 MHz VTCXO** is the standard reference oscillator, which is small-bandwidth linked via the **Reference Loop** to a **100 MHz VCXO** of low phase noise at frequency offsets above 500 Hz. If a better close-carrier phase noise or higher frequency precision is needed, the 100 MHz-VCXO may be linked to an optional **10 MHz OCXO (A575)** or to an external reference with higher control bandwidth. The reference output (REF OUT) may be either connected to the external 10 MHz-reference or to the internal 10 MHz reference.

By means of a low noise **Step Frequency Multiplier** a fixed frequency range of 700 to 1500 MHz in 100 MHz steps is generated out of the 100 MHz reference frequency. This signal is used as intermediate frequency for the *Coarse Frequency Loop*. The 100 MHz-signal is additionally directed to the modules *Down Converter* and *ALC/DDS Unit*.

The **Coarse Frequency Loop** does generate an in terms of spectrum very clean interims frequency for down mixing of the divided TMO-frequency within the TMO Loop. The interims frequency covers the range of 733 to 1493 MHz with a minimum resolution of 2 MHz.

By means of the **TMO Loop** the divided and transformed TMO-frequency will be directed to the fine adjustable DDS-frequency (from ALC/DDS unit). **TMO Control** is also included in TMO Loop. It provides the needed control voltages for the module **TMO Unit (A820)**. The basic setting of the TMO is done by means of a 16 bit DAC. The main coil control current for the quasi analog ramp sweep is additionally controlled by means of a ramp integrator.



## A500 ALC/DDS Unit

Following functions are provided by module **ALC/DDS-Unit (ADU)**:

- Direct Digital Synthesis (DDS),
- ALC and level reference signal,
- Interface to Modulation Board
- FPGA including DDS, pulse generator, modulation matrix, LF-generators, FM/φM-modulators

Fine adjustment of frequency settings is done by means of a DDS. The DDS signal is additively supplied to the TMO Loop. Additionally the frequency- and phase modulation is done by means of the DDS.

The digitally operating **Level Control Loop (Automatic Level Control = ALC)** is integrated within FPGA SMF\_MOD. Analog voltages of level- and reference-detector are digitised by means of two ADCs, directed to the FPGA and herein digitally processed. The settings of the control loop may be reprogrammed after having been universally and optimized adapted to the specific operation mode because the entire function is integrated in the FPGA.

The FPGA provides a digital reference signal to the reference detector, which is converted into analog sine wave with a fixed carrier frequency of 12.5 MHz by means of a 16 bit DAC. The amplitude of the reference signal, representing the output level of R&S SMF100A, may be fine trimmed within the FPGA and is switched in big steps by means of a step attenuator. This signal is amplified up to 20 dBm by means of a power amplifier and is directed to the reference detectors.

The ALC/DDS-Unit includes the interface to the option Modulator Board (AM/FM/Scan Modulator, A520).

In addition to the DDS and the ALC the FPGA SMF\_MOD includes a pulse generator, two LF generators and a modulation matrix. These units are enabled only along with the modulation board, i.e. the option Pulse Generator respectively.

## A720 Coupler / A725 Detector

Directional coupler (**Coupler, A720**) and level detector (**Detector, A725**) are combined to a compact unit. Using the directional coupler the RF signal is partially coupled out and directed to the level detector and rectified. The detector module includes a second detector which is rectifying the reference signal which is directed from module ALC/DDS Unit (A500). Both rectified signals are amplified and directed to the ALC control loop. The ALC is comparing both signals and is setting the RF level in order that both detected signals have same levels (ALC on). For frequencies below 1 GHz, a similar structure is integrated in the down converter.

## A780 Switched Filter

The filter unit (**Switched Filter, A780**) improves the suppression of unwanted harmonics and sub harmonics. It consists of a structure of some selectively switch able band passes in the range from 1 GHz to 22 GHz. It is switching the RF signal from Down Converter (100 kHz to 1 GHz) to the RF output. The digital control signals and the power supply voltages are directed from the Interface Board.

## A800 DMA Module

The **DMA Module (A800)** is the microwave core module. In addition to the RF output signal it is also providing the needed RF signal for frequency synthesis and down converter. The input signal is the output from YIG oscillator (3 to 11 GHz)

The DMA module includes functions as follows:

- Directional coupler for coupling the oscillator signal to the PLL,
- programmable divider and multiplier,
- Level-Preset,
- Level control unit for ALC and amplitude modulation,
- Pulse modulator,
- Power amplifier,

The RF output provides a frequency range from 1 to 22 GHz. Frequencies below 3 GHz are generated by the divider, frequencies above 11 GHz are generated by the multiplier. A second RF output included in the module is providing the input signal (11 to 22 GHz) for the multiplier module (**A740, Frequency Doubler**). The DMA module is controlled by the Interface Board (SerBus, digital control signals and analog control signals for level presets)

## A820 TMO Unit

Tuneable Microwave Oscillator, TMO is the variable main oscillator which may be operated in the frequency range in between 3 and 11 GHz. The **TMO Unit (A820)** consists of a YIG-Oscillator (YTO) and the TMO Control Unit. The fast controllable YTO has very low phase noise. The TMO Control unit converts the control voltages (from frequency synthesis) to the control currents needed within the FM- and main coils and creates the frequency compensation for broadband FM. Supply voltages and control signals are directed from the module Frequency Synthesis (A400) to the TMO Unit. Both are connected via a cable less connection.

## A450 Down Converter

The **Down Converter (A450)** is extending the lower frequency range of R&S SMF100A down to 100 kHz. The input signal in the range in between 375 kHz to 1.875 GHz is directed from DMA-Module. In order to get signals below 375 kHz the signal is mixed down by means of a 1.5 GHz LO signal. This is created by means of multiplying the 100 MHz reference signal from module A400 frequency synthesis. The down converter includes its special reference and level detector as well as a specific pulse modulator, which is electrically located on the signal behind the level detector.

## A520 AM/FM/Scan Modulator

The **AM/FM/Scan Modulator (A520)** makes modulations like AM lin, AM exp, FM, PhiM and digital modulations like ASK, FSK, PSK, BPSK possible along with FPGA SMF\_MOD, located on module ALC/DDS-Unit. In addition two LF generators with sinus, trapezoid, and noise signals are available along with an universal LF output. The modulation board is plugged on module ALC/DDS-Unit.

The modulation board includes two fast ADCs in order to convert external analog signals into digital ones, which are processed within FPGA SMF\_MOD. The digital modulation matrix, modulation setting and control are integrated in the FPGA.

The input impedance of the analog inputs are switch able in between (50  $\Omega$  | 600  $\Omega$  | 100 k $\Omega$ ). They may be coupled either by AC or DC.

A FM Feed Forward DAC is used for FM/PhiM. The FM Feed Forward DAC generates an appropriate modulation signal for the direct modulation of the TMO. Therefore frequency or phase modulation is possible also above the control bandwidth of the TMO-Loop. An additional DAC is providing a LF output for general purpose. This output may be, for instance, switched to the LF-generator or the analog modulation signals. The usable frequency range is in between 0 to 10 MHz. The signal amplitude may be set in fine steps within the FPGA and may be set in large steps by means of an external amplifier stage.

## A575 Reference Oscillator

The **Reference Oscillator (A575)** is improving the close carrier phase noise and does provide a better long term stability. It mainly consists of an highly precise oven controlled 10 MHz oscillator. The oven is active as long the instrument is switched on and off using the front switch while the rear side located power switch is in the on-position. Power supply and control is done by the **Microwave Interface (A205)**. The reference oscillator includes an ID-EEPROM which is storing the module ID as well as correction data for frequency correction.

## A740 Frequency Doubler

The module **Frequency Doubler (A740)** is doubling the frequency band 10.5 to 21.75 GHz up to 21 to 43.5 GHz. The input signal is directed from **DMA Module (A800)**. The module is consisting of a high bandwidth doubler followed by switch able band pass filters and a power amplifier in order to suppress unwanted spurious emissions. It is switching also the RF signal below 21 GHz to the RF output.

## A760 High Power Amplifier

The **High Power Amplifier (A760)** amplifies the output level in the range from 1 GHz to 22 GHz. If the Down Converter (A450) is fitted, it switch the RF signal 100 kHz to 1 GHz to the RF output.

## A600 Step Attenuator

This **step attenuator (A600)** makes an additional precise output attenuation possible by additional 110 db in 10 db steps. The step attenuator is controlled by **Microwave Interface (A205)**.

## A170 GPIB Board

By the **GPIB Board (A170)** the R&S SMF100A may be remote controlled via GPIB. This board includes a GPIB-to-PCI Controller. The GPIB Board is located in a slot at the rear side of the instrument and is directly plugged onto the **Interface Board (A200)**.

## **A180 USB Board**

By the **USB Board (A180)** the R&S SMF100A may be remote controlled via USB 2.0. This board includes a USB-to-PCI Controller. The USB Board is located in a slot at the rear side of the instrument and is directly plugged onto the **Interface Board (A200)**.

## **A190 Removable Flash Board**

The **Removable Flash Board (A190)** makes it possible to remove the compact flash memory card without the need to open the instrument. It is plugged into the second slot at the rear side of the instrument into the location of the **USB board (A180)**.

## 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.

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**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!

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

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.

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## Overview of the Modules

Overview – module replacement

| Module                                                                                                                                                                                                                   | Adjustment see chapter 2 | See page             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------|
| <b>Boards</b>                                                                                                                                                                                                            |                          |                      |
| Interface Board                                                                                                                                                                                                          |                          | <a href="#">3.11</a> |
| Motherboard                                                                                                                                                                                                              |                          | <a href="#">3.12</a> |
| BNC board                                                                                                                                                                                                                |                          | <a href="#">3.12</a> |
| MW interface Board                                                                                                                                                                                                       | x                        | <a href="#">3.13</a> |
| Controller board (Processor Unit)                                                                                                                                                                                        |                          | <a href="#">3.13</a> |
| Reference Oscillator                                                                                                                                                                                                     | x                        | <a href="#">3.15</a> |
| AM/FM scan modulator                                                                                                                                                                                                     | x                        | <a href="#">3.15</a> |
| Removable USB                                                                                                                                                                                                            |                          | <a href="#">3.16</a> |
| Removable GPIB                                                                                                                                                                                                           |                          | <a href="#">3.17</a> |
| Removable Compact flash                                                                                                                                                                                                  | x                        | <a href="#">3.17</a> |
| Frequency synthesis                                                                                                                                                                                                      | x                        | <a href="#">3.18</a> |
| Down converter                                                                                                                                                                                                           | x                        | <a href="#">3.19</a> |
| ALC/DDC unit                                                                                                                                                                                                             | x                        | <a href="#">3.19</a> |
| <b>Microwaves modules</b>                                                                                                                                                                                                |                          |                      |
| TMO unit: TMO Control Unit<br>TMO Adapter                                                                                                                                                                                | x                        | <a href="#">3.20</a> |
| DMA module unit                                                                                                                                                                                                          | x                        | <a href="#">3.21</a> |
| Switched Filter                                                                                                                                                                                                          | x                        | <a href="#">3.22</a> |
| Directional coupler                                                                                                                                                                                                      | x                        | <a href="#">3.22</a> |
| Detector                                                                                                                                                                                                                 | x                        | <a href="#">3.23</a> |
| High-Power Amplifier                                                                                                                                                                                                     | x                        | <a href="#">3.23</a> |
| Step attenuator                                                                                                                                                                                                          | x                        | <a href="#">3.24</a> |
| Frequency doubler                                                                                                                                                                                                        | x                        | <a href="#">3.25</a> |
| <b>Parts / units</b>                                                                                                                                                                                                     |                          |                      |
| Power supply unit: Switching Power Supply<br>Fan E3                                                                                                                                                                      |                          | <a href="#">3.26</a> |
| Front panel unit: TFT Display A110,<br>Display Connect FMR 6-SHARP,<br>Converter<br>Rotary Pulse Generator (A125)<br>Pushbutton Board Set (1167.0739.00),<br>Flex. Switch Board (A120),<br>Front Panel Controller (A130) |                          | <a href="#">3.28</a> |
| Fan E1                                                                                                                                                                                                                   |                          | <a href="#">3.32</a> |
| Compact flash card                                                                                                                                                                                                       | x                        | <a href="#">3.14</a> |
| Lithium battery                                                                                                                                                                                                          | x                        | <a href="#">3.14</a> |

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

## Safety Instructions, Dismounting the Case

**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.

## Replacing Fuses

**DANGER** Danger of shock hazard

For fuse 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.

**To replace the fuses:**

1. Open the lid of the AC power connector.
2. Lift the fuse holder out of its slot.
3. Exchange the two fuses.
4. Put the fuse holder back in its slot and close the lid.

## Replacing the Interface Board A200

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 and 1167.0416.01).

## Removing the Interface Board A200

- The interface board is located behind the display at the top of the instrument.
- Dismount fan E1 after disconnecting the fan cable.
- Unscrew all screws (14 x 1148.3059) from interface board.
- Unscrew all screws (6 x 0041.1653) from rear panel.
- Remove all options mounted on interface board from the rear, or remove insertion cover plate (2 x 1167.0497) by unscrewing the screws (8 x 1148.3271).
- Remove RJ45 coupler jack X215 from rear panel.
- Remove the controller LPC A250.
- Exchanging the controller LPC is described on the following pages.
- Disconnect W780, (W760\*), W200, W160, W800, fan cable from E3.
- Disconnect W904 (see drawing 1167.0416.01) from power supply.
- Pull the interface board toward the fan while raising the front of the board about 5 mm to free the on-board plugs. Then pull the board toward the front of the instrument and lift it out.

## Installing the Interface Board A200

- To insert the new interface board, proceed in the reverse order. Connect all cables in the correct position and tighten all screws (drawing 1167.0000.01).
- Perform internal adjustments as described in chapter 2, "Adjustments".

### NOTICE

#### Risk of damage to the board



Be careful when installing the interface board in order not to cause damage to any components. Make sure to connect the cables as indicated by their labeling.

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\* depending on installed options



## Replacing the Motherboard A300

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 and 1167.0500.01).

### Removing the Motherboard A300

- Remove the module hood by unscrewing the screws (3x 1148.3271).
- Remove the frequency synthesis if it is present – see "[Removing the Frequency Synthesis A400](#)".
- Remove the down converter if it is present – see "[Removing the Down Converter A450 \(R&S SMF-B2\)](#)".
- Remove the ALC/DDS unit if it is present – see "[Removing the ALC/DDS Unit A500](#)".
- Disconnect cables W310, W311, W313.
- Disconnect cables W312, W316 (included in 1167.0500.01).
- Unscrew the screws (10x 1148.3059).
- Remove the SMP Adaptors (10x 1093.6869) from the motherboard.

### Installing the Motherboard A300

- To insert the new motherboard, proceed in the reverse order. Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).
- Reinstall the frequency synthesis, down converter, ALC/DDS unit in the correct position.
- Reinstall the module hood (see above).

## Replacing the BNC Board A160

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01).

### Removing the BNC Board A160

- Unscrew the BNC nuts (10x).
- Disconnect cable W160.

### Installing the BNC Board A160

- To insert the new BNC board, proceed in the reverse order. Connect the cable in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).

## Replacing the MW Interface Board A205

(See chapter 5, spare parts list 1167.0039.01 and 1167.0416, parts list and drawings 1167.0000.01 and 1167.0416).

### Removing the MW Interface Board A205

- Disconnect cable W125, W200, W725, (W640\*), (W740\*), (W575\*).
- Disconnect cable W903 (included in 1167.0500.01).
- Disconnect the step attenuator (1167.5553.01).
- Unscrew the screws (6x 1148.3059).

### Installing the MW Interface Board A205

- To insert the new MW interface board, proceed in the reverse order. Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).
- After replacing the MW interface board, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the Controller LPC A250

(See chapter 5, spare parts list 1167.0039.01 and 1167.0500.00, parts list and drawings 1167.0000.01 and 1167.0500.00).

### Removing the Controller LPC A250

- Switch off the instrument and pull the mains plug.
- The LPC is fitted on top of the interface board A200 and fastened with six screws (2084.8000.00). Be careful when disconnecting the PCB from the interface board.
- Disconnect cable W127 (to keyboard controller) and W215 (LAN cable) to rear panel.
- Disconnect front panel cable W110 (1167.0374.00) included in 1167.0500.00.
- Carefully pull the CF card or CF card adapter (R&S SMF-B80) out of the defective controller LPC and plug it into the new LPC.

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**Note:** The controller LPC is tightly inserted on the interface board. Carefully pull off the board.

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\* depending on installed options

## Installing the Controller LPC A250

- Install the new controller LPC in the reverse order.
- Carefully plug the cable connectors to the controller LPC, taking care not to reverse the polarities.
- Connect cable W110 to the front panel.
- Connect cable W127 to the keyboard controller board, and connect W1215 (LAN cable) to rear panel).
- Carefully plug the new controller (A250) to the interface board (A200) and fasten it in place using the six screws.

## Replacing the Lithium Battery

- The lithium battery is accommodated on the controller LPC 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 with an R&S type (see chapter 5, spare parts list 1167.0039.01).
- Lithium batteries are hazardous waste and must be disposed of in special containers.
- Do not short-circuit the battery!

- Carefully lift and pull out the battery.

**Note:** 3.4 V lithium battery ( $\varnothing$  20 mm \* 3 mm, type CR2032), R&S Order No. 0858.2049.00.

- Insert new battery into holder below the spring.

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

- See chapter 2, "Procedures after Replacing the Lithium Battery".
- Carefully lift and pull out the battery.

## Replacing the CompactFlash™ Card A250

- The CompactFlash™ card is fitted into the controller LPC.
- Carefully pull the card out of the defective controller LPC and plug it into the new LPC.
- Perform internal adjustments as described in chapter 2, "Adjustments".

## Replacing the Reference Oscillator A575 (R&S SMF-B1)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.9159.01).

### Removing the Reference Oscillator A575 (R&S SMF-B1)

- Unscrew the screws (2x 1148.3059).
- Disconnect cable W405; W575.
- Pull the reference oscillator toward power supply unit.

### Installing the Reference Oscillator A575 (R&S SMF-B1)

- To insert the new reference oscillator A575, proceed in the reverse order.
- Lock in the hook of the oscillator to the TMO unit.
- Connect all cables in the correct position and tighten all screws (drawings 1167.9159.01 and 1167.0000.01 S).
- After replacing the reference oscillator A575, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the AM/FM Scan Modulator A480 (R&S SMF-B20)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01).

### Removing the AM/FM Scan Modulator A480 (R&S SMF-B20)

- Remove the module hood by unscrewing the screws (3x 1148.3271).
- Remove the ALC/DDS unit A500 – see "[Removing the ALC/DDS Unit A500](#)".
- Unscrew the screws (10x 1096.5205.00).
- Remove the RF cover from the board.
- Carefully disconnect the AM/FM scan modulator A480.

## Installing the AM/FM Scan Modulator A480 (R&S SMF-B20)

- To insert the new AM/FM scan modulator A480, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).
- After replacing the AM/FM scan modulator A480, perform adjustments as described in chapter 2, "Adjustments".

**NOTICE****Risk of damage to the board**

Be careful when installing the unit in order not to cause damage to any components. Make sure to connect the cables as indicated by their labeling.

## Replacing the USB Board A180 (R&S SMF-B84)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.6608.01).

## Removing the USB Board A180 (R&S SMF-B84)

- Unscrew the screws (4x 1148.3271).
- Carefully unlock the unit with a screwdriver.
- Remove the unit from the instrument.

## Installing the USB Board A180 (R&S SMF-B84)

- To insert the USB board A180, proceed in the reverse order.

**NOTICE****Risk of damage to the board**

Be careful when installing the unit in order not to cause damage to any components.

## Replacing the GPIB Board A170 (R&S SMF-B83)

(See chapter 5 spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.6608.01).

### Removing the GPIB Board A170 (R&S SMF-B83)

- Unscrew the screws (4x 1148.3271).
- Carefully unlock the unit with a screwdriver.
- Remove the unit from the instrument.

### Installing the GPIB Board A170 (R&S SMF-B83)

- To insert the GPIB board A170, proceed in the reverse order.

#### NOTICE

#### Risk of damage to the board



Be careful when installing the unit in order not to cause damage to any components.

## Replacing the Compact Flash A190 (R&S SMF-B85)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.6808.01).

### Removing the Compact Flash A190 (R&S SMF-B85)

- First remove the controller LPC – see "[Removing the Controller LPC A250](#)".
- Remove the CF adapter (1405.2102.02) from the LPC. To do this, lift up the spring panel from the CF board.
- Unscrew the screws (4x 1148.3271) from the rear panel.
- Pull the unit toward the rear about 100 mm – but not more!
- Disconnect cable W190.
- Remove cable W190 toward the inside of the instrument.

## Installing the Compact Flash A190 (R&S SMF-B85)

- To insert the compact flash A190, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.6808.01 and 1167.0000.01 S).
- After replacing the compact flash A190, perform adjustments as described in chapter 2, "Adjustments".

**NOTICE****Risk of damage to the board**

Be careful when installing the unit in order not to cause damage to any components.

## Replacing the Frequency Synthesis A400

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01 and 1167.4005.01).

## Removing the Frequency Synthesis A400

- Remove the module hood by unscrewing the screws (3x 1148.3271).
- Disconnect cables W406, W409, W410.
- Remove the frequency synthesis A400 from the instrument.
- Carefully use the hand gears to unplug the unit.

## Installing the Frequency Synthesis A400

- To insert the new frequency synthesis A400, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01, 1167.4005.01 and 1167.0000.01 S).
- After replacing the frequency synthesis A400, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the Down Converter A450 (R&S SMF-B2)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01 and 1167.4005.01).

### Removing the Down Converter A450 (R&S SMF-B2)

- Remove the module hood by unscrewing the screws (3x 1148.3271).
- Disconnect cables W409, W454, W455.
- Remove the down converter A450 from the instrument.
- Carefully use the hand gears to unplug the unit.

### Installing the Down Converter A450 (R&S SMF-B2)

- To insert the new down converter A450, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01, 1167.4005.01 and 1167.0000.01 S).
- After replacing the down converter A450, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the ALC/DDS Unit A500

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01 and 1167.4005.01).

### Removing the ALC/DDS Unit A500

- Remove the module hood by unscrewing the screws (3x 1148.3271).
- Disconnect cables W412, W511, W512, W513, W524, W525, W526.
- Disconnect cable W410.
- Remove the ALC/DDS unit A500 from the instrument.
- Carefully use the hand gears to unplug the unit.

### Installing the ALC/DDS Unit A500

- To insert the new ALC/DDS unit A500, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01, 1167.4005.01 and 1167.0000.01 S).
- After replacing the ALC/DDS unit A500, perform adjustments as described in chapter 2, "Adjustments".



## Replacing the TMO Unit A820

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01 and 1167.1987.00).

### Removing the TMO Unit A820

- Remove the Reference Oscillator A575 – see "[Removing the Reference Oscillator A575 \(R&S SMF-B1\)](#)".
- Unscrew the screws (4x 0041.1653).
- Disconnect cable W821.
- Pull the TMO unit toward the power supply unit.

### Installing the TMO Unit A820

- To insert the new TMO unit A820, proceed in the reverse order.
- Connect all cables and options in the correct position and tighten all screws (drawings 1167.0000.01, 1167.1987.00 and 1167.0000.01 S).
- After replacing the TMO unit A820, perform adjustments as described in chapter 2, "[Adjustments](#)".

## Replacing TMO CONTROL Unit A821

### Removing TMO CONTROL Unit A821

- First remove TMO Unit A820 - see "[Removing the TMO Unit A820](#)".
- Disconnect cable W821
- Unscrew the screws (4x 1148.3059.00) on the board.
- Unscrew the screw (0041.1653.00) on transistor holding panel.

### Installing TMO Control Unit A821

- To insert the new TMO Control unit A820, proceed in the reverse order.
- After replacing the TMO Control unit A820, perform adjustments as described in chapter 2, "[Adjustments](#)".

## Replacing TMO with Adapter A822

### Removing TMO with Adapter A822

- First remove TMO Unit A820 – see "[Removing the TMO Unit A820](#)".
- Disconnect cable W821
- Unscrew the screws (4x 1148.2630.00).

### Installing TMO with Adapter A822

- To insert the new TMO with Adapter A822, proceed in the reverse order.
- After replacing the TMO Control unit A820, perform adjustments as described in chapter 2, "[Adjustments](#)".

## Replacing the DMA Module Unit A800

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01).

### Removing the DMA Module Unit A800

- Disconnect cables W406, (W454\*), W800, W802, (W803\*), W821.
- Unscrew the screws (4x 0455.5966).

### Installing the DMA Module Unit A800

- To insert the new DMA module unit A800, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).
- After replacing the DMA module unit A800, perform adjustments as described in chapter 2, "[Adjustments](#)".

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\* depending on installed options

## Replacing the Switched Filter A780

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S).

### Removing the Switched Filter A780

- Disconnect cables W780, W802, (W455\*), (W782\* or W783\* or W784\* or W743\*).
- Unscrew the screws (4x 1148.3059).

### Installing the Switched Filter A780

- To insert the new switched filter A780, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).
- After replacing the switched filter A780, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the Directional Coupler A720 in R&S SMF-B144 (Var. 03)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.7204.01 D2). If the step attenuator is inserted, see drawing no. 1167.5776.01 D2.

### Removing the Directional Coupler A720 in R&S SMF-B144 (Var. 03)

- Disconnect cables W727, W101, W742.
- Unscrew the screws (2x 1148.3059).
- If the step attenuator is inserted, unscrew the coupler from the step attenuator.
- Unscrew the screws (2x 0275.5830).

### Installing the Directional Coupler A720

- To insert the new directional coupler A720, proceed in the reverse order.
- If the step attenuator is inserted, relocate the step attenuator coupler without force.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).
- After replacing the directional coupler A720, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the Detector A725 in R&S SMF-B144 (Var. 03)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.7204.01 D2).

### Removing the Detector A725 in R&S SMF-B144 (Var. 03)

- Disconnect all connected cables depending on mounted options. Disconnect cables W310, W311, W507, W725, W727.
- Unscrew the screws (4x 0048.8218).

### Installing the Detector A725

- To insert the new detector, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.7204.01 D2 and 1167.0000.01 S).
- After replacing the detector, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the High-Power Amplifier A760 (R&S SMF-B32/-B34)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01S, 1167.0000.01 and 1415.2304.01).

### Removing the High-Power Amplifier A760 (R&S SMF-B32/-B34)

- Disconnect all connected cables depending on mounted options. Disconnect cables W760, W784, (W762\* or W763\*), (W455\*).
- Unscrew the screws (4x 1096.5205).

---

\* depending on installed options

## Installing the High-Power Amplifier A760 (R&S SMF-B32/-B34)

- To insert the new high-power amplifier A760, proceed in the reverse order.
- Connect all cables and options in the correct position and tighten all screws (drawings 1167.0000.01, 1415.2304.01 and 1167.0000.01S).
- After replacing the high-power amplifier A760, perform adjustments as described in chapter 2, "Adjustments and Calibration".

**NOTICE****Risk of damage to the board**

Be careful when installing the unit in order not to cause damage to any components.  
Connector X760 is mounted facing the front.

## Replacing the Step Attenuator A600 22 GHz

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01 and 1167.5553.01).

## Removing the Step Attenuator A600 22 GHz

- Disconnect cables W720, W100, W600.
- Unscrew the screws (2x 0041.1653).

## Installing the Step Attenuator A600 22 GHz

- To insert the new step attenuator A600, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01, 1167.5553.01 and 1167.0000.01 S).
- After replacing the step attenuator A600, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the Step Attenuator A610 43.5 GHz in R&S SMF-B144 (Var. 03)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01S, 1167.0000.01 and 1167.5776.01 D2).

## Removing the Step Attenuator A610 43.5 GHz

- Disconnect cables W100, W600.
- Unscrew the screws (2x 0041.1630).
- Carefully remove the connection directional coupler from the step attenuator.
- Unscrew the screws ( 2x 1148.2630).

## Installing the Step Attenuator A610 43.5 GHz

- To insert the new step attenuator 43.5 GHz A610, proceed in the reverse order.
- Attention: Relocate the connection directional coupler – step attenuator without force.
- Connect all cables and options in the correct position and tighten all screws (drawings 1167.0000.01, 1167.5553.01 and 1167.0000.01S).
- After replacing the step attenuator A610, perform adjustments as described in chapter 2, *"Adjustments and Calibration"*.

## Replacing the Frequency Doubler A740 (R&S SMF-B144, Var. 03 )

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01, 1167.7204.01).

## Removing the Frequency Doubler A740 (R&S SMF-B144, Var. 03 )

- Remove the switched filter A780 – see "[Removing the Switched Filter A780](#)".
- Disconnect the cables W740, W803, W742, (W743\* or W763\*).
- Unscrew the screws (7x).

## Installing the Frequency Doubler A740 (R&S SMF-B144, Var. 03)

- To insert the new frequency doubler A740 (Var. 03), proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).
- After replacing the frequency doubler A740, perform adjustments as described in chapter 2, *"Adjustments"*.

---

\* depending on installed options

## Replacing the Power Supply Unit A900

The Power Supply Unit A900 consist of this spare parts:

- Switching Power Supply A910
- Fan E3

*(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01 and 1167.0416.01).*

## Removing the Power Supply Unit A900

- Disconnect the cable W904 – pull very strongly on the connector body.
- Disconnect the cable W903.
- Disconnect the cables from power input connectors W910, W911, W913.
- Disconnect the fan cable from the interface board A200.
- Unscrew the screws (6x 1148.2646).
- Unscrew the screw (1x 1148.3271).
- Move the power supply unit toward the middle of the instrument and lift it out.

## Installing the Power Supply Unit A900

- To insert the new power Supply unit A900, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01, 1167.0416.01 and 1167.0000.01 S).
- After replacing the power supply unit A900, perform adjustments as described in chapter 2, "Adjustments".

## Replacing the Switching Power Supply A910

### Removing the Switching Power Supply A910

- First removing the Power Supply Unit A900 - see "[Removing the Power Supply Unit A900](#)".
- Pull out the Switching Power Supply, on the open side from screening case.

### Installing the Switching Power Supply A910

- To insert the new Switching Power Supply A910, proceed in the reverse order.

## Replacing the Fan E3

(See chapter 5, spare parts list 1167.0039.01 and 1167.0416.0, parts list and drawings 1167.0000.01 and 1167.0416.01)

### Removing the Fan E3

- Remove the power supply A900 – see "[Removing the Power Supply Unit A900](#)".
- Unlock the rubber pins.
- Now you can change the fan E3, but do not forget to unplug the fan cable.

### Installing the new Fan E3

- Mount the new fan E3.
- Connect the fan cable at the interface board A200 (X203).

#### NOTICE

#### Danger of damage to the instrument



Please note the direction of the airflow printed on the fan. The arrow on the fan must point to the inside of the instrument! The fan must blow the cool air in the instrument in order to cool the components and prevent overheating.

Make sure to route the cable so that it cannot get into the fan.

- Replace the power supply – see "[Replacing the Power Supply Unit A900](#)".
- Reinstall the tube and the rear panel feet.



## Replacing the Front Panel Unit A100

The Front Panel Unit A100 consist of following this spare parts:

- TFT Display A110
- Display Connect
- Converter
- Rotary Pulse Generator
- Push button Board Set
- Flex Switch Board
- Front Panel Controller

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01).

## Removing the Front Panel Unit A100

- Unscrew the handle screws (4x 1096.4896).
- Dismount the handles (2x 1096.1474).
- Remove the front cover (1167.0700).
- Unscrew the screws (6x 1148.3288).
- Disconnect cable W100.
- Disconnect cables W110, W125, W127, W312, W316, W512, W524, W525, W526.
- Remove the controller LPC – see "[Removing the Controller LPC A250](#)".
- Disconnect the display connection cable (1167.0374).

## Installing the Front Panel Unit A100

- To insert the new front panel unit A100, proceed in the reverse order.
- Connect all cables in the correct position and tighten all screws (drawings 1167.0000.01 and 1167.0000.01 S).
- After replacing the front panel unit A100, perform adjustments as described in chapter 2, "[Adjustments](#)".

## Replacing the TFT Display A110, Display Connect FMR 6-SHARP, Converter

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01 S, 1167.0000.01 and 1167.0500.01, 1167.0500.01 S).

## Removing the TFT Display A110, Display Connect FMR 6-SHARP, Converter

Remove the front panel unit A100 – see "[Removing the Front Panel Unit A100](#)".

### Removing the TFT Display A110

- Unscrew the screw (1x 1300.4457).
- Unscrew the screws (2x 1148.3059).
- Remove the holding bracket (1167.0568.00).
- Unscrew the screws (4x 1300.4457).
- Disconnect the display cables.

### Removing Converter

- Disconnect the display cable.
- Unscrew the screw (2 x 1148.2923.00).

### Removing Display Connect FMR 6-SHARP

- First Remove Converter
- Disconnect the display cable.
- Unscrew the screw (2 x 1148.2923.00).
- Pull off the Display Connect FMR 6-SHARP from TFT Display.
- Disconnect the cable from Controller LPC - see "[Removing the Controller LPC A250](#)".

### Installing the Display Connect FMR 6-SHARP, Converter

- To insert the new Display Connect FMR 6-SHARP or Converter, proceed in the reverse order.
- Connect all cables and options in the correct position and tighten all screws (drawings 1167.0000.01, 1167.0500.01 and 1167.0000.01 S).

## Installing the TFT Display A110

- To insert the new display A110, proceed in the reverse order.
- Connect all cables and options in the correct position and tighten all screws (drawings 1167.0000.01, 1167.0500.01 and 1167.0000.01 S).
- After replacing the display A110, perform adjustments as described in chapter 2, "Adjustments".

---

**NOTICE Risk of damage to the display**

Make sure to mount the display dust-free.

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## Replacing Rotary Pulse Generator (A125), the Pushbutton Board Set, Flex. Switch Board (A120) and Front Panel Controller (A130)

(See chapter 5, spare parts list 1167.0039.01, parts list and drawing 1167.0500.01).

The rotary pulse generator, pushbutton board set, flex. switch board and Front Panel Controller are located behind the front panel unit and the keyboard frame

## Removing Rotary Pulse Generator (A125)

- Remove front Panel Unit A100 – see "[Removing the Front Panel Unit A100](#)".
- Pull off the knob (0852.1086.00) of the rotary pulse generator. The rotary pulse generator can be replaced after undoing the hexagon nut.

## Installing Rotary Pulse Generator (A125)

- Complete unit in reverse order.

## Removing the Pushbutton Board Set, the Flex. Switch Board and Front Panel Controller

- Remove front Panel Unit A100 – see "[Removing the Front Panel Unit A100](#)".
- Unscrew the screw (1x 1300.4457)
- Unscrew the screws (2x 1148.3059)
- Disconnect Display Cables
- Remove holding bracket (1167.0568.00)
- Place the front panel unit onto a clean surface with the keys pointing upwards.
- Remove cable to the front panel controller.
- Unscrew the two screws (1148.3313.00) and remove the front panel controller.
- Unscrew the screws (6x 1148.2752.00)
- Remove Key holding Plate1
- Unscrew the screws (2x 1148.2752.00)
- Remove Key holding Plate2
- The pushbutton board set (1400.0717.00), the flex. switch board (A355), as well as the front panel controller can now be replace.

## Installing the Pushbutton Board Set, the Flex. Switch Board and Front Panel Controller

- Complete units in reverse order.

## Replacing the Fan E1

(See chapter 5, spare parts list 1167.0039.01, parts list and drawings 1167.0000.01)

### Removing the Fan E1

- Disconnect the fan cable at the interface board connector E1.
- Unlock the rubber pins.
- Now you can change the fan E1, but do not forget to unplug the fan cable.

### Installing the New Fan E1

- Mount the new fan.
- Connect the fan cable to the interface board (X202).

**NOTICE****Danger of damage to the instrument**

Please note the direction of the airflow printed on the fan. The arrow on the fan must point to the outside of the instrument! The fan must blow the air out of the instrument in order to cool the components and prevent overheating.

Make sure to route the cable so that it cannot get into the fan.

- Reinstall the tube and the rear panel feet.

## 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 centres (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



Disconnect boards from the AC supply before you plug or unplug them!

Be careful not to cause short-circuits when measuring voltages!

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

- 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 meter                |                                           | R&S URE2              | 0350.5315.02  |
| 2    | Spectrum analyzer       | Frequency range 0 to 43.5 GHz             | R&S FSUP50            | 1166.3505.51  |
| 3    | Microwave adapter cable | 1 m long<br>K-male to-K-male connection   |                       |               |
| 4    | Microwave adapter cable | 1 m long<br>QMA-male to-K-male connection |                       |               |
| 5    | RF Adapter cable        | BNC-male-to-BNC-male-connection           |                       |               |
| 6    | Oscilloscope            | 100 MHz                                   | TDS 220               |               |

## Switch-On Problems

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

- Power supply
- Interface board (IFBO)
- CPU (LPC6/1L+)
- Front module with keyboard controller board and switching pad
- Microwave Interface board

To analyze switch-on and switch-off problems that occur with the R&S SMF100A, the interplay of the individual modules is summarized in the following.

### Switch-on

In standby mode the ON/OFF button on the front panel is monitored by the front panel controller (FPC; A130). As soon as the ON/OFF button on the front panel is pressed, the output of the FPC (signal PWR\_OFF) switches from HIGH Z to LOW and the power supply then starts up its output voltages.

When the +5 V output passes the 4.75 V threshold, the PWRGOOD signal (IFBO X251.A23) from the power supply is set and the CPU on the processor unit (A250) is now started up. Within four seconds after switch-on, the CPU must pull the PWR\_OFF line (IFBO X251.B9) to LOW -level, since the output of the FPC is subsequently switched to HIGH Z mode again.

If the green LED on the front panel lights up for only a short time (approx. four seconds) and then the orange standby LED lights up again, this means that the CPU is not booting properly. This may be caused by a defective or overheated power supply, processor or interface board (check fuse F7).

### Switch-off

The instrument can be switched off in three different ways:

The CPU's PWR\_BUTTON input signal (IFBO X251.A21) is routed via a pull-up resistor directly to the ON/OFF button on the front panel. Briefly pressing this button generates a low pulse, which tells the BIOS or operating system to shut down. Prior to shutdown, all instrument settings (frequency, level, modulation, etc) are saved on the CompactFlash™ card. When the operating system has been completely shut down, the CPU's PWR\_OFF signal (IFBO X251.B9) is switched to tristate (HIGH Z), which turns off the power supply.

Pressing and holding the button on the front panel for longer than four seconds leads directly to a hard reset of the CPU and sets the PWR\_OFF signal to HIGH Z, which also switches off the power supply. If the CPU is switched off in this way, this status is saved in the CPU and expects a low signal on the PWR\_BUTTON line when the instrument is switched on again. It is therefore necessary to set this signal to low for at least one second the next time the instrument is switched on.

The instrument can also be switched off by means of the temperature monitoring circuits in the power supply. If the sensors detect an over temperature (e.g. in the event that a fan fails), the power supply switches off by itself. The instrument can only be restarted by switching off and on the power switch at the instruments rear panel after the power supply has cooled down.

- Error: Instrument cannot be switched on.

| Error discretion                           | Possible error causes and further steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yellow standby-LED is dark.                | <ul style="list-style-type: none"> <li>➤ Check power-on switch on the rear:</li> <li>➤ Switch on power supply.</li> <li>➤ Check fuses on the rear.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Yellow standby-LED remains dark.           | <ul style="list-style-type: none"> <li>➤ Measure standby voltage of power supply at X903.4 on the microwave interface board.<br/>Rated value: <math>13.5\text{ V} \pm 0.4\text{ V}</math></li> <li>No voltage: First check cable W903 from power supply to microwave interface, then the power supply unit itself.</li> <li>➤ Measure standby voltage at fuse F1 (between F1 and R5/R6) on the microwave interface board.<br/>Rated value: <math>+13.5\text{ V} \pm 0.5\text{ V}</math></li> <li>No voltage: Check and replace fuse F1. The standby voltage as well is routed to the modules Frequency Synthesis (A400) and Ref. Oscillator (A575). Check these modules, if there is a short on the 13.5V-standby line. Replace the defective module.</li> <li>➤ Measure regulated standby voltage at C2.<br/>Rated value: <math>+5\text{ V} \pm 0.25\text{ V}</math></li> <li>Faulty voltage: The +5 V-standby voltage is routed to the processor unit (A250) and the Front Panel Controller (A130). Check these modules, if there is a short on the +5V-standby line. Replace the defective Module.</li> <li>Voltage ok: Check cabling (W125) from Microwave Interface board to Front Panel Controller (A130)</li> </ul> |
| Green LED lights up for approx. 4 seconds. | <p>Power supply overheated: check fan E3.</p> <p>Fuse F7 on the interface board is blown: replace fuse F7.</p> <p>Processor unit defective: Replace processor unit.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



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

| Error description                        | Possible error causes and further steps                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CPU does not boot correctly              | <ul style="list-style-type: none"> <li>➤ Check DVI signals on IF board X342 <ul style="list-style-type: none"> <li>Pins 23 to 26: <math>3.3\text{ V} \pm 0.1\text{ V}</math></li> <li>Pins 29 to 34: <math>5.0\text{ V} \pm 0.2\text{ V}</math></li> <li>Pin 15: DVI clock signal 25.2 MHz</li> <li><math>U_{PP} = 0.7\text{ V} \pm 0.1\text{ V}</math></li> </ul> </li> </ul> <p>Faulty DVI signals: Change CPU</p> |
| CPU does boot, but display remains black | <ul style="list-style-type: none"> <li>➤ Check cabling between Processor Unit (A250), Display Adapter board (A110) and display inverter</li> </ul> <p>No backlight: Backlight inverter or fluorescent tube defective. Replace the defective parts.</p> <p>Backlight ok: Check the Display Adapter board and TFT display. Replace the defective parts</p>                                                             |

After power-up the fans should blow during the boot process. It is a normal behavior, that the left side fan stops after the boot sequence has finished, if the ambient temperature is rather low or the R&S SMF100A has not warmed up.

- **Error: Fan does not work**

| Error description                   | Possible error causes and further steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Left front fan (E1) does not work   | <ul style="list-style-type: none"> <li>➤ Disconnect the fan and check the voltage on Interface Board (A200) X202 between pin 1 and pin 2 :<br/>Rated voltage: <math>11.7\text{ V} \pm 0.5\text{ V}</math></li> </ul> <p>Voltage ok: Check the fan. If the fan works, replace the Interface board (A200), otherwise replace the defective fan.</p> <p>Faulty/no voltage: Check +12 V voltage at fuse F10 on the Interface board (A200).<br/>Replace the fuse if necessary and check, whether there is a short on the +12 V-line.</p> |
| Power supply fan (E3) does not work | <ul style="list-style-type: none"> <li>➤ Disconnect the fan and check the voltage on Interface Board (A200) X203 between pin 1 and pin 2 :<br/>Rated voltage: <math>11.7\text{ V} \pm 0.5\text{ V}</math></li> </ul> <p>Voltage ok: Check the fan. If the fan works, replace the Interface board (A200), otherwise replace the defective fan.</p> <p>Faulty/no voltage: Check +12 V voltage at fuse F10 on the Interface board (A200).<br/>Replace the fuse if necessary and check, whether there is a short on the +12V-line.</p>  |

## Problems with Booting

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

After switch-on, the signal generator first boots the computer BIOS. After successful initialization of the computer, the LINUX operating system starts up. During this boot sequence, an R&S logo is displayed. Subsequently, the application is loaded as a start-up program. Simultaneously, several FPGAs are loaded on the modules and self-tests are performed at various locations.

| Normal action                   | Error, possible causes and corrective action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>➤ Start signal generator</p> | <div data-bbox="837 536 1409 959" data-label="Image"> </div> <p>R&amp;S logo does not disappear</p> <p>The operating system (LINUX) can't be started</p> <ul style="list-style-type: none"> <li>• Connection of CompactFlash™ card became looser           <ul style="list-style-type: none"> <li>→ Make sure the CompactFlash™ card or the CompactFlash adapter (option R&amp;S SMA-B80) is properly connected on the CPU board. (LPC6/1L+). To do this, you have to remove the CPU board from the IF board.</li> </ul> </li> <li>• CMOS failure of BIOS (after battery change)           <ul style="list-style-type: none"> <li>→ Connect a USB keyboard and press F1 to resume</li> <li>→ If the signal generator starts up correctly now, you have to update date and time in the R&amp;S SMA setup menu.</li> </ul> </li> </ul> |

# 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<br><b>SETUP</b> - Check Front Panel...                                                                                                                                                |                                                                                                                                                                                                                                                                       |
| An image of the front panel appears with gray keys.<br>When a key is pressed once or the knob is moved, the field changes to green.<br>If the key is pressed more than once, the field changes to red. | <b>Note:</b> <i>Be careful with the rotary knob! Turn only slightly in the specified direction, otherwise the field will change to red.</i>                                                                                                                           |
| 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).<br>If the color of the corresponding field remains the same after actuation, the function is defective.<br>In either case:<br>Change the switching pad and/or rotary knob. |
| A message is output when all keys have been pressed:<br>"All Front Panel Keys were accessed correctly"                                                                                                 | <b>Note:</b> <i>No error message is output even if a number of keys are red. The user must decide whether a malfunction has occurred.</i>                                                                                                                             |

## Troubleshooting with Internal Test Points

A diagnostic A/D converter on the Interface board allows you to measure voltages at internal test points, which are located on all important modules of the instrument.

Diagnostic test points are located on following modules:

- Interface board (IFBO)
- Microwave Interface board (MWIFC)
- Frequency Synthesis (FSYN)
- ALC DDS Unit (ADU)
- Modulation board (MOD)
- Down converter (DCON)
- DMA module (DMA)
- Reference Oscillator (OCXO)

All modules (Step Attenuator excluded) have temperature sensors for temperature monitoring purposes. Additionally the rotation speed of both fans can be monitored.

| Normal action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Error, possible causes and corrective action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Internal diagnosis switched on with:<br/> <b>SETUP</b> - <b>Test Points...</b></p> <p>Select the desired test point under <b>Select Test Point</b>.</p> <p>To operate, set <b>State</b> ON</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>The measured voltage is displayed under Voltage.</p> <p>"99.9999 V" means that the test point does not exist.</p> <p>This value is also returned for queries concerning the IEC/IEEE bus if a non-existent test point is queried.</p> <p>The diagnostic system operates with multiplexers on each board to switch the desired test point to the common line named DIAG on the motherboard. Each test point is switched to the line only for the time of a measurement and switched off after it. The A/D converter is located on the IF board.</p> <p>It is advisable to begin by checking the test points on the IF board, since the diagnostic converter is located on this module.</p> | <p>➤ For troubleshooting refer to the following chapters.</p> <p>➤ Compare the displayed values with the values specified in the respective sections concerning troubleshooting on the module.</p> <p>Major deviations from the named values indicate a defect:<br/>Change the module.</p> <p>If all test points are out of tolerance, maybe only one of the modules is defective and disturbs the diagnostic system. To determine which module is defective, remove all modules that include test points one after another, except the Interface board. If values are still out of tolerance, replace the Interface board.</p> <hr/> <p><b>Note:</b> <i>Temperatures are not always output directly in °C. The measured value often has to be multiplied by 100.</i></p> <hr/> |

## 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 modules are the Frequency Synthesis module (FSYN), the ALC DDS unit (ADU) and the AM/FM/Scan Modulator board (MOD).

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

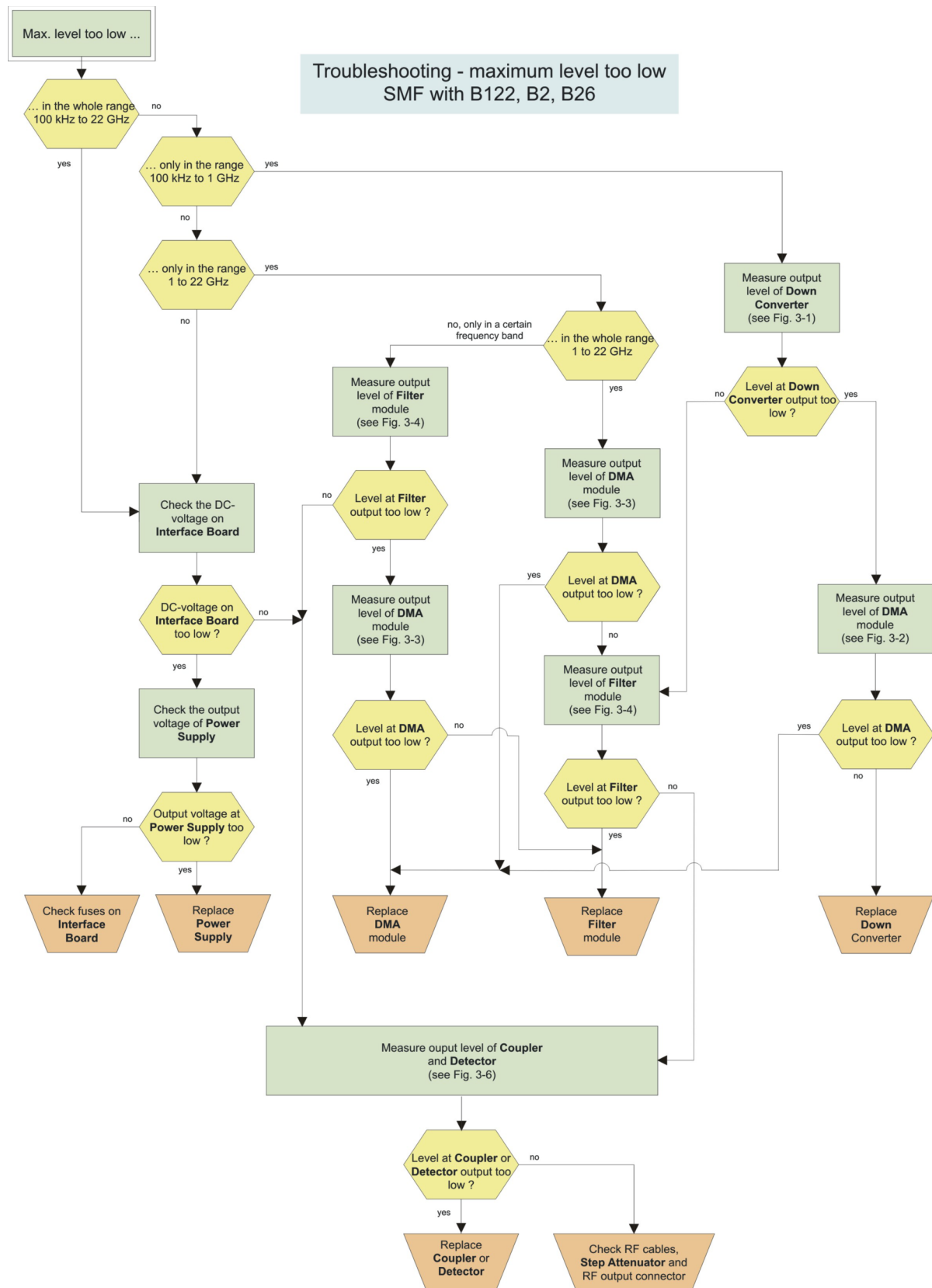
| Normal action                                                                                         | Error, possible causes and corrective action                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal adjustments called:<br><b>SETUP</b> - Internal Adjustments...                                | <b>Note:</b> When <b>Adjust All</b> is called, all internal calibration operations are performed. When troubleshooting, however, it is advisable to start the calibration operations individually and also to monitor their progress. |
| <b>Adjust Frequency Synthesis</b><br>Internal adjustment of synthesis module FSYN is executed.        | Abort during adjustment:<br><br>See section " <a href="#">Troubleshooting – Frequency Synthesis (FSYN, A400)</a> ".                                                                                                                   |
| <b>Adjust Level</b><br>Internal adjustment of ALC DDS Board is executed.                              | Abort during adjustment:<br><br>See " <a href="#">Troubleshooting – Interface Board (IFBO, A200)</a> ".                                                                                                                               |
| <b>Adjust Modulation/ LF Generator</b><br>Internal adjustment of modulation/LF generator is executed. | Abort during adjustment:<br><br>See " <a href="#">Troubleshooting – AM/FM/Scan Modulator (MOD, A520)</a> ".                                                                                                                           |

## Faulty RF Output Signal

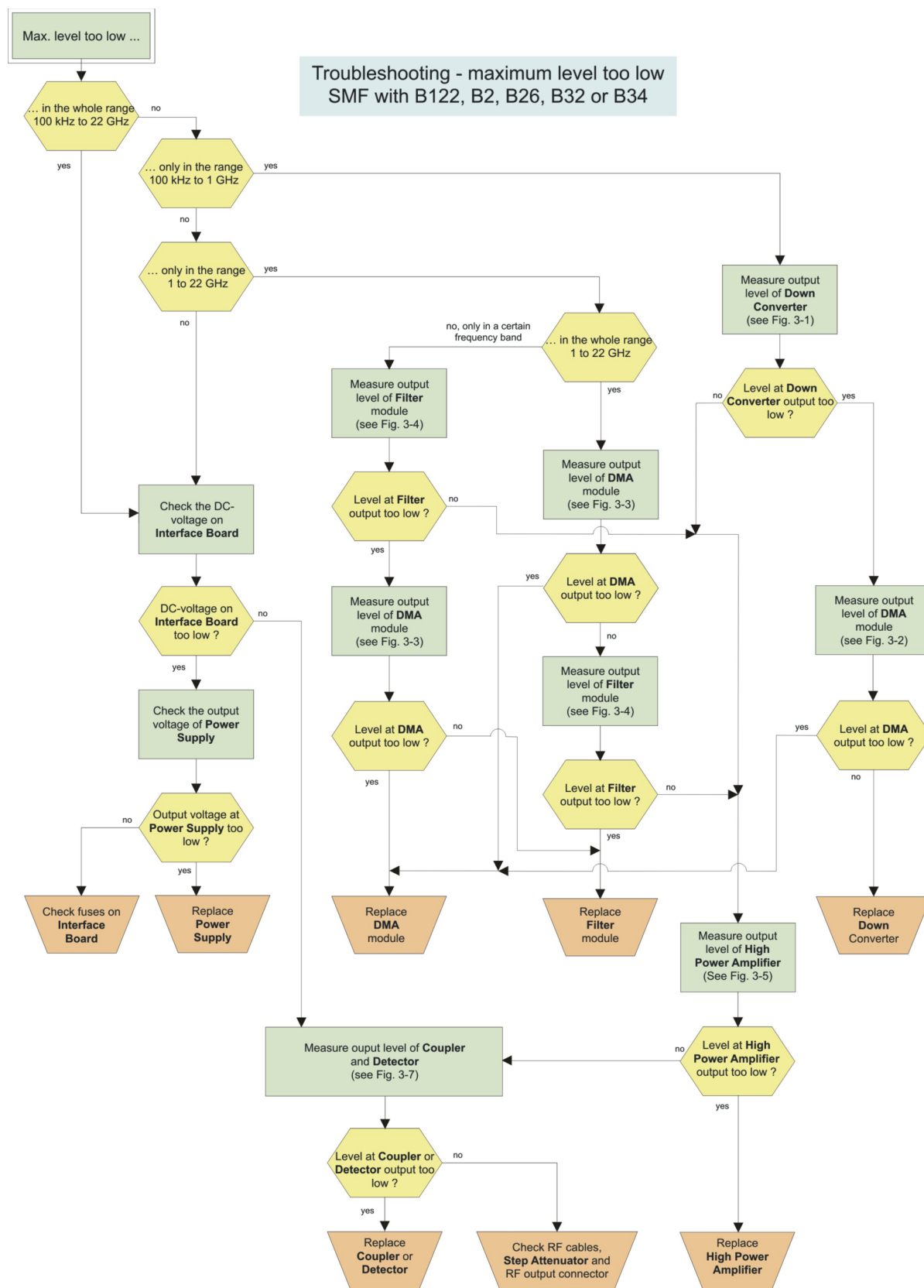
- **Error:** Signal generator supplies faulty signal or none at all at the RF output.

| Error                                                              | Actions to perform                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No RF signal or a signal with insufficient level at the RF output. | <p>Run internal adjustments (see <a href="#">"Troubleshooting with Internal Adjustments"</a>).</p> <p>After internal adjustment, follow the <a href="#">Flow Chart</a> and check all probably defective modules. Change any defective module:</p> <ul style="list-style-type: none"> <li>➤ Check attenuator (see <a href="#">"Troubleshooting – Step attenuator (A600)"</a>).</li> <li>➤ Check Filter Bank (see <a href="#">"Troubleshooting – Switched Filter (A780)"</a>).</li> <li>➤ Check Down Converter (see <a href="#">"Troubleshooting – Down Converter (DCON, A450)"</a>).</li> <li>➤ Check DMA Module (see <a href="#">"Troubleshooting – DMA module (A800)"</a>).</li> <li>➤ Check YIG Oscillator.</li> </ul> |
| The frequency at the RF output is not correct.                     | <ul style="list-style-type: none"> <li>➤ Run internal adjustments (see <a href="#">"Troubleshooting with Internal Adjustments"</a>).</li> <li>➤ After internal adjustment, check FSYN (see <a href="#">"Troubleshooting – Frequency Synthesis (FSYN, A400)"</a>).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                             |

# Flow Chart 1

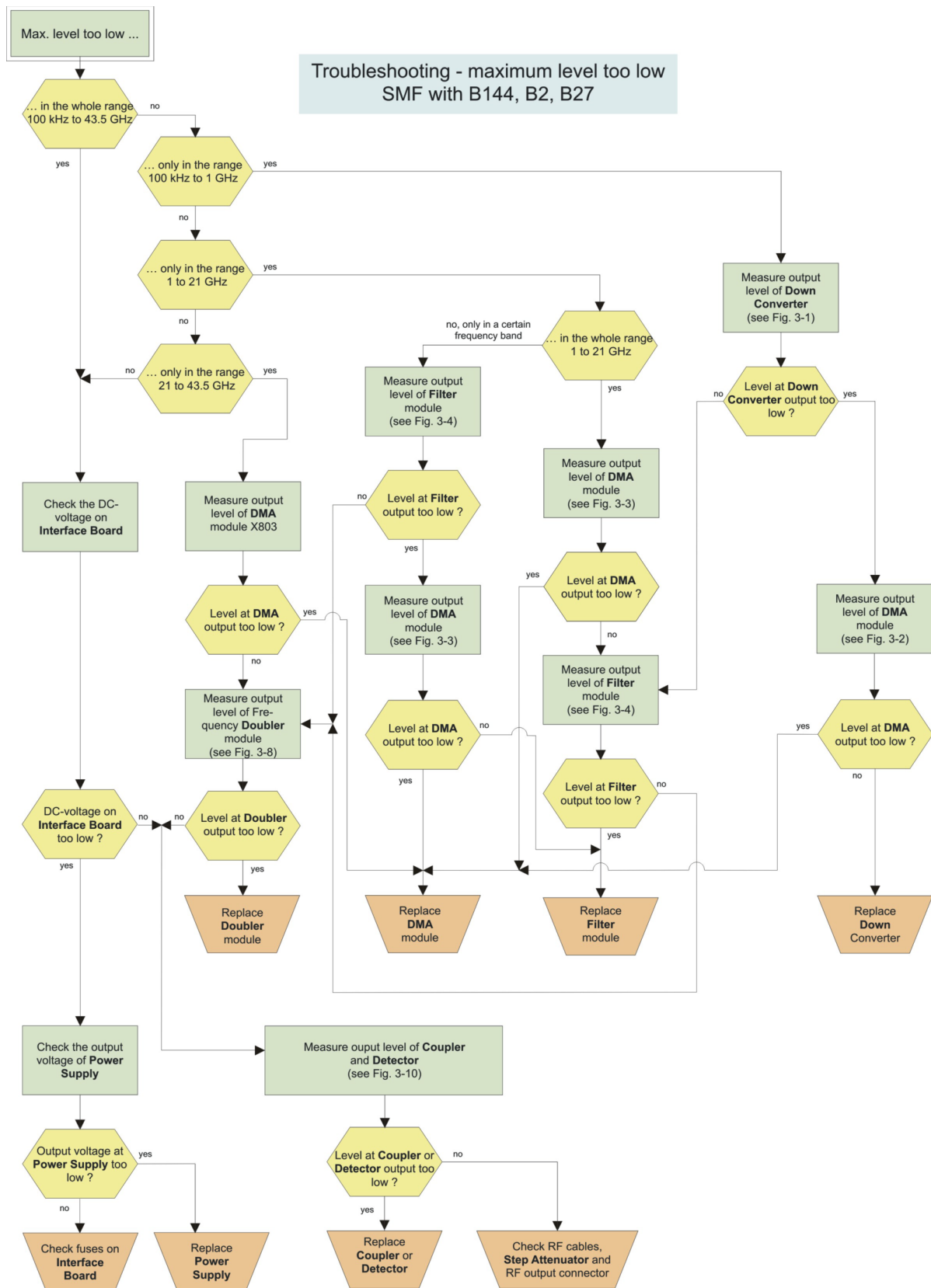


## Flow Chart 2

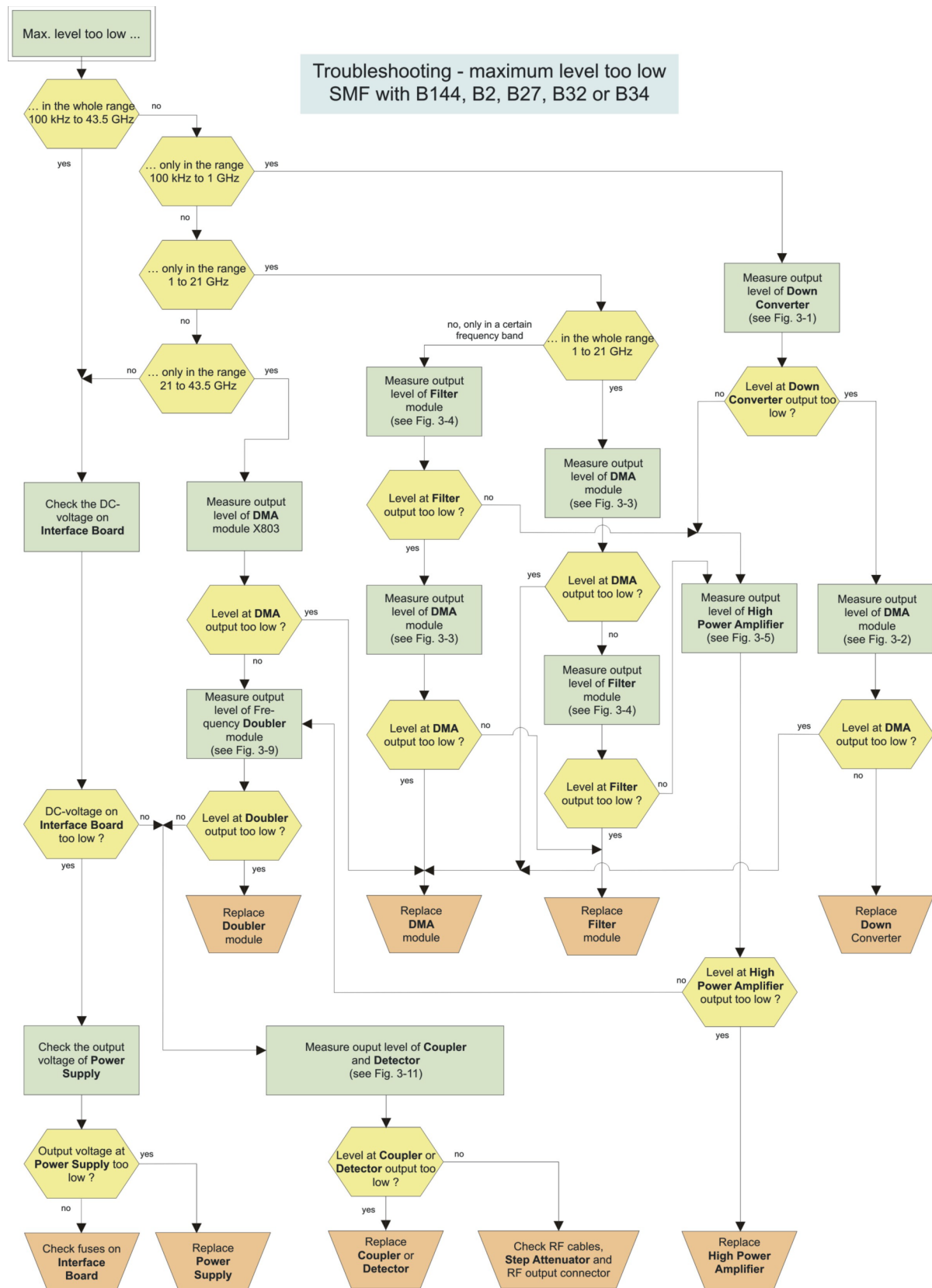




# Flow Chart 3



## Flow Chart 4



## Measurement of Typical Output Power

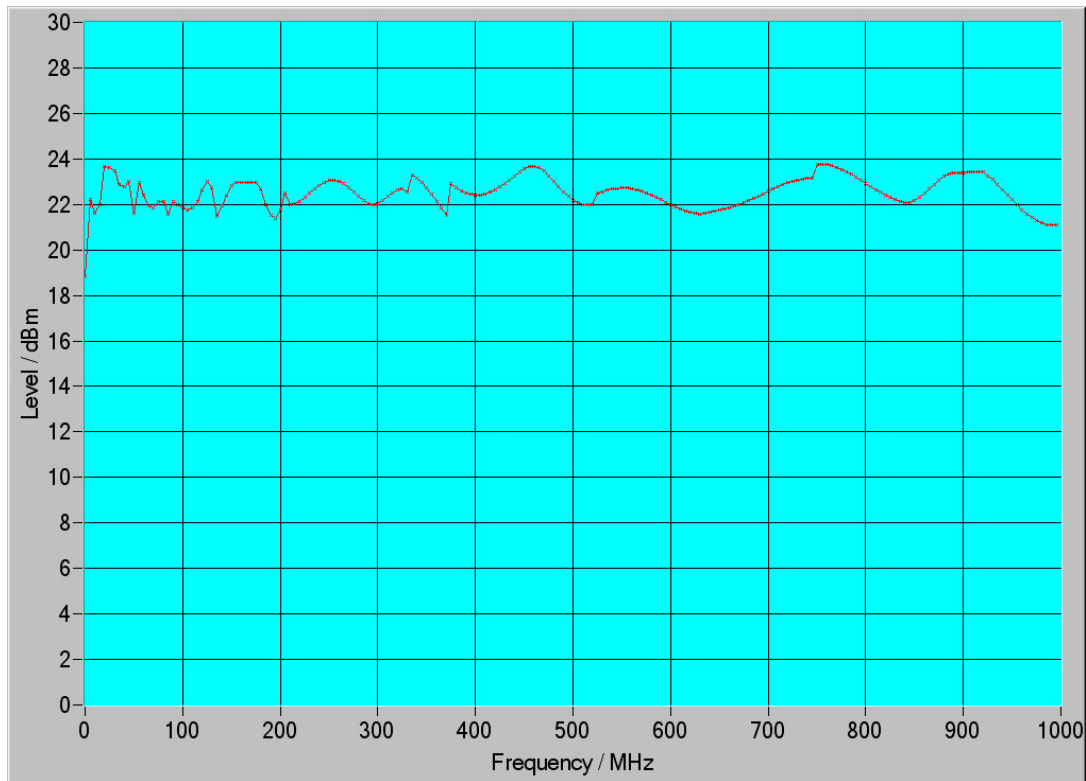


Fig. 3-1 X455 of Down Converter

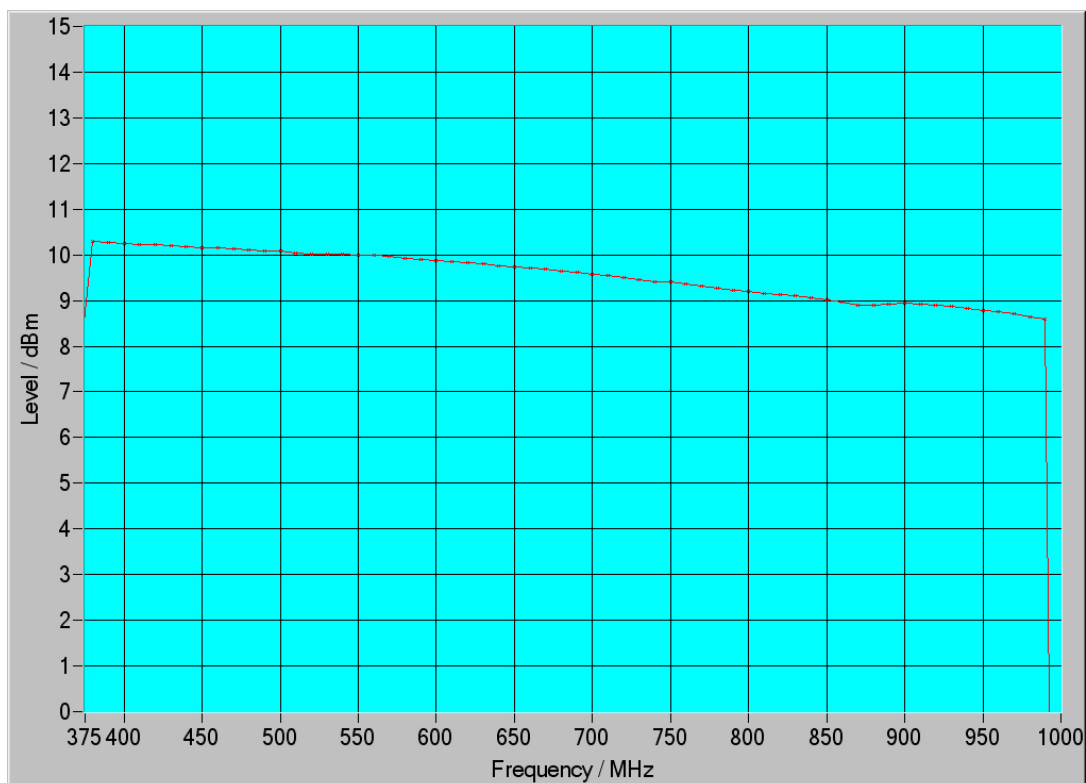


Fig. 3-2 X805 of DMA Module

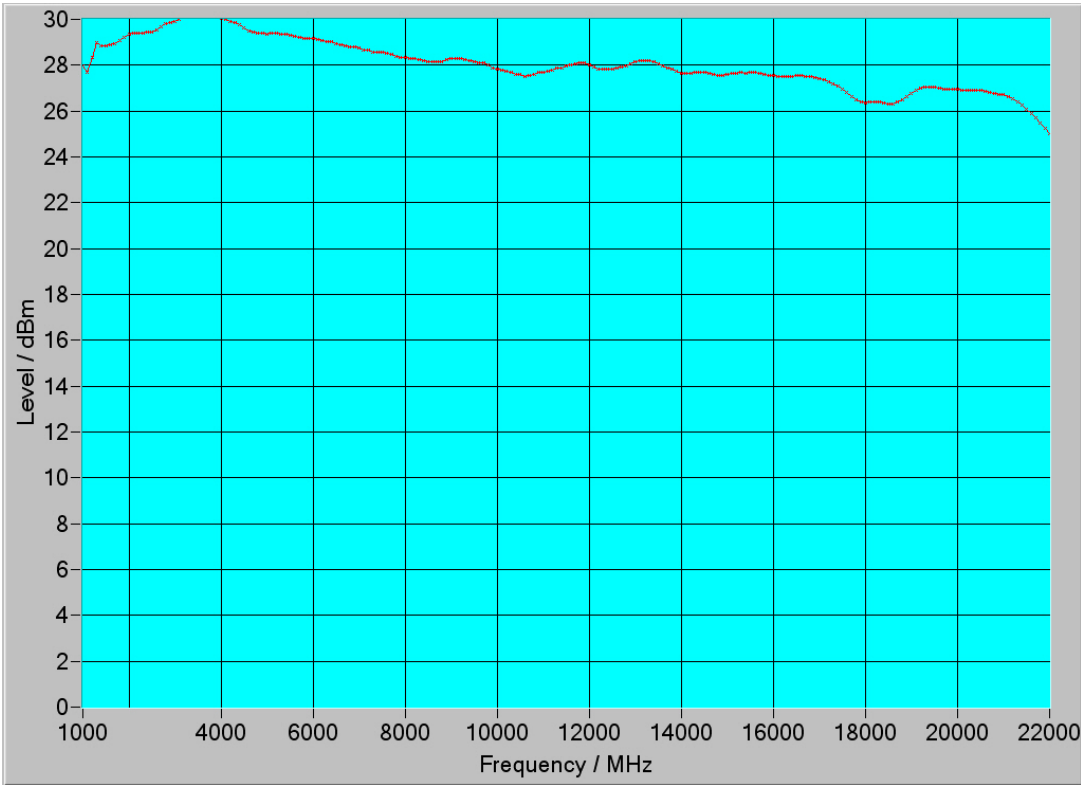


Fig. 3-3 X803 of DMA Module

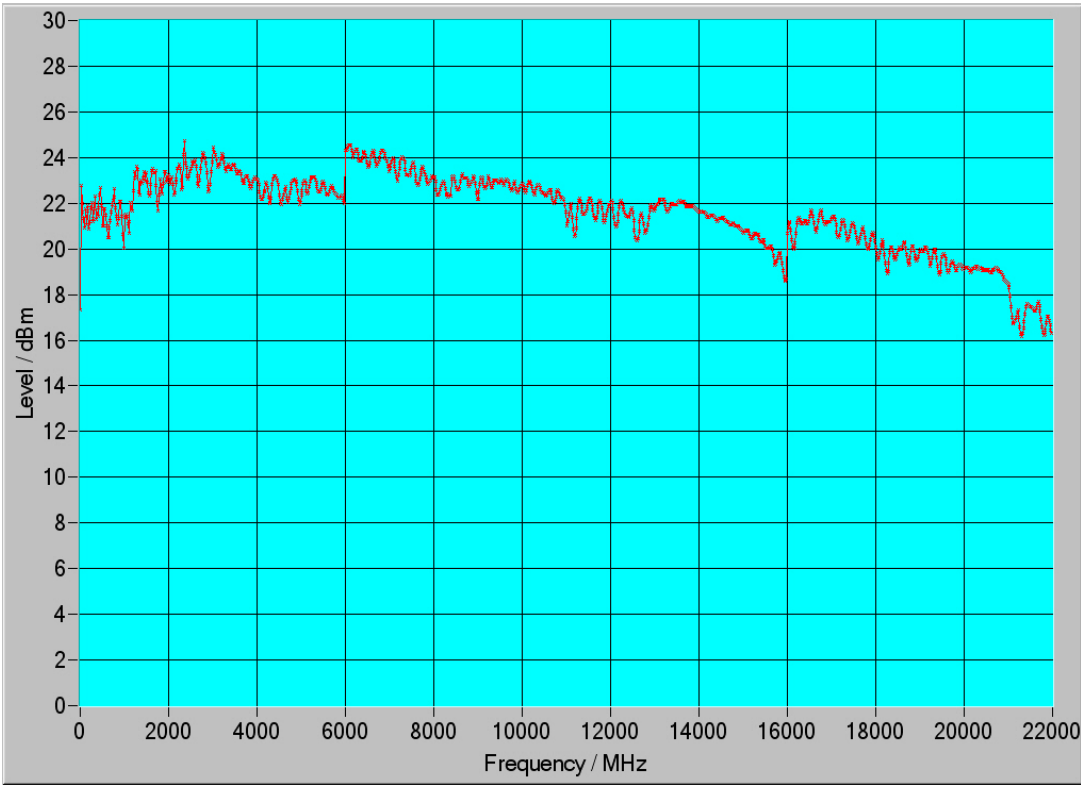


Fig. 3-4 X782 of Switched Filter

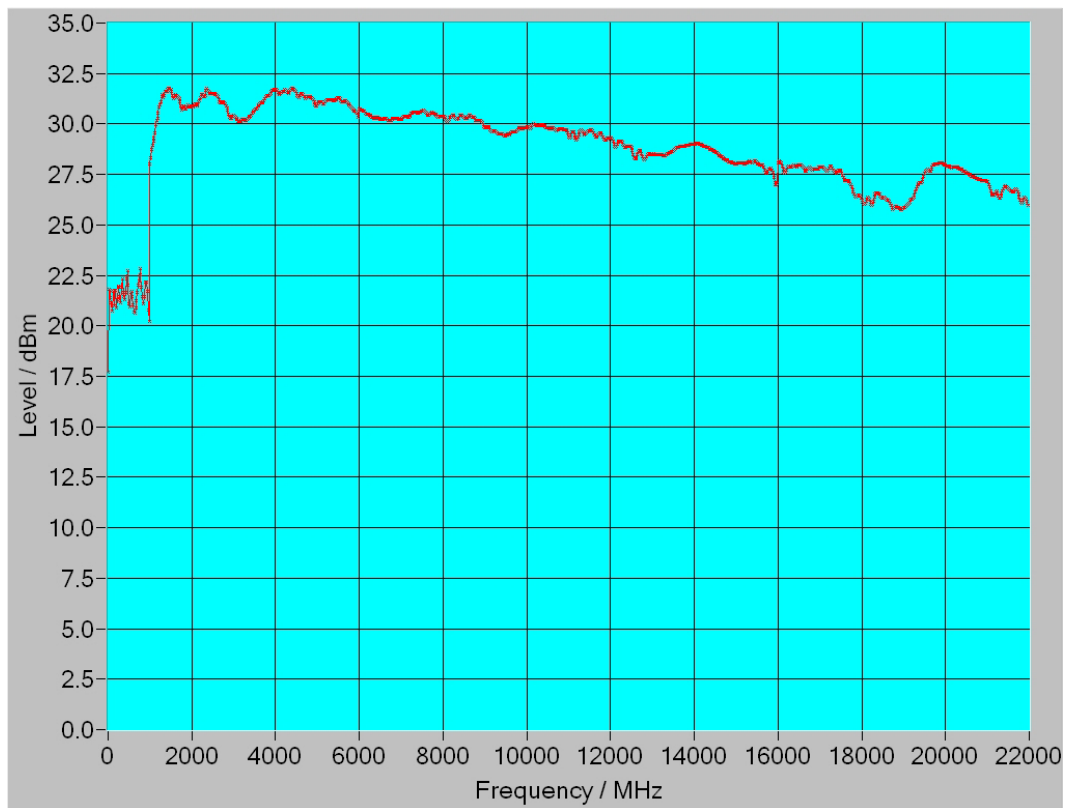


Fig. 3-5 X762 of High Power Amplifier

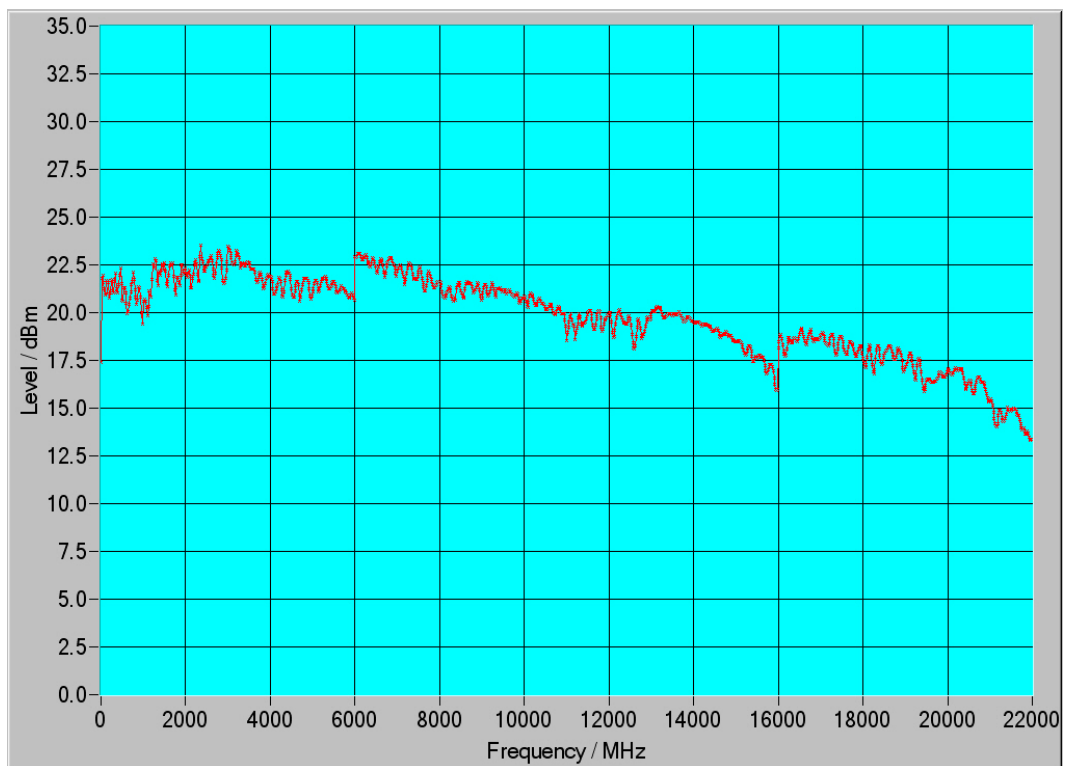


Fig. 3-6 X720 of Coupler

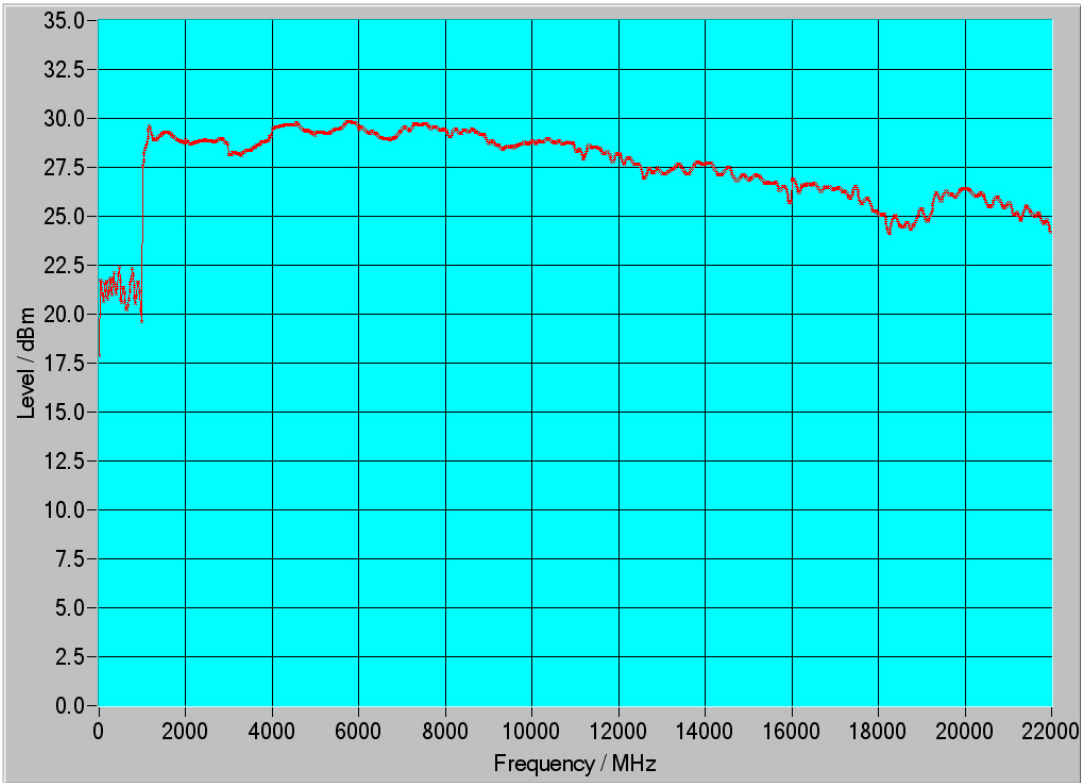


Fig. 3-7 X720 of Coupler with High Power Amplifier

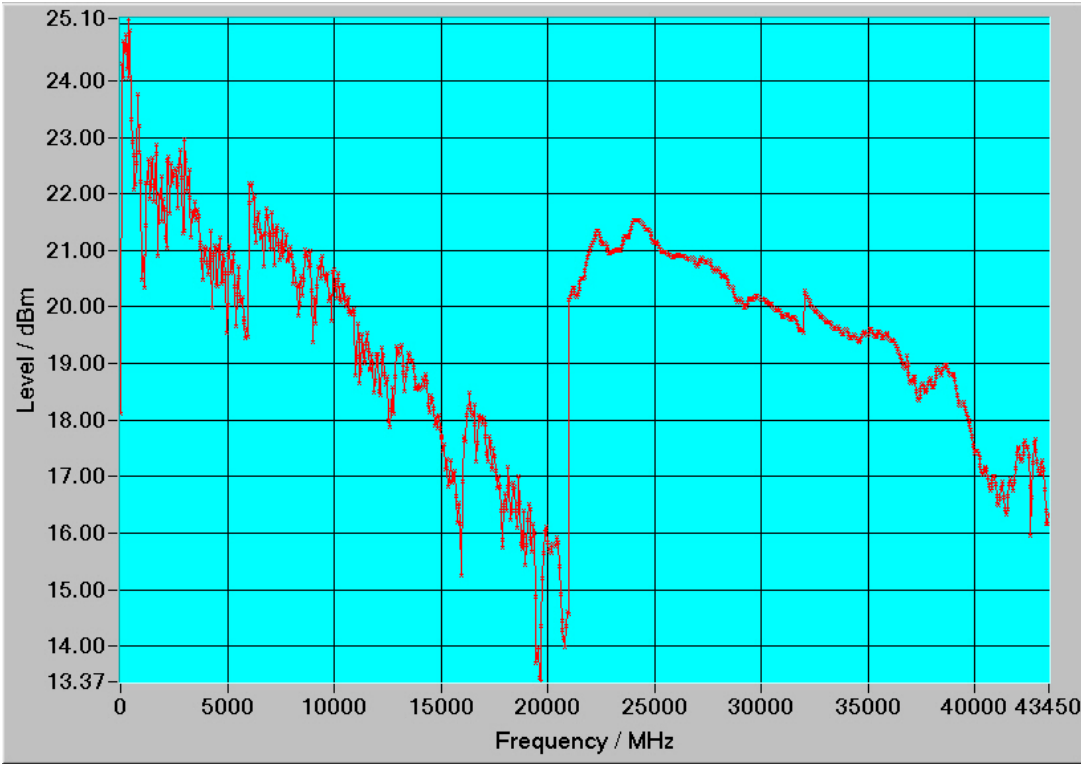


Fig. 3-8 X742 of Frequency Doubler

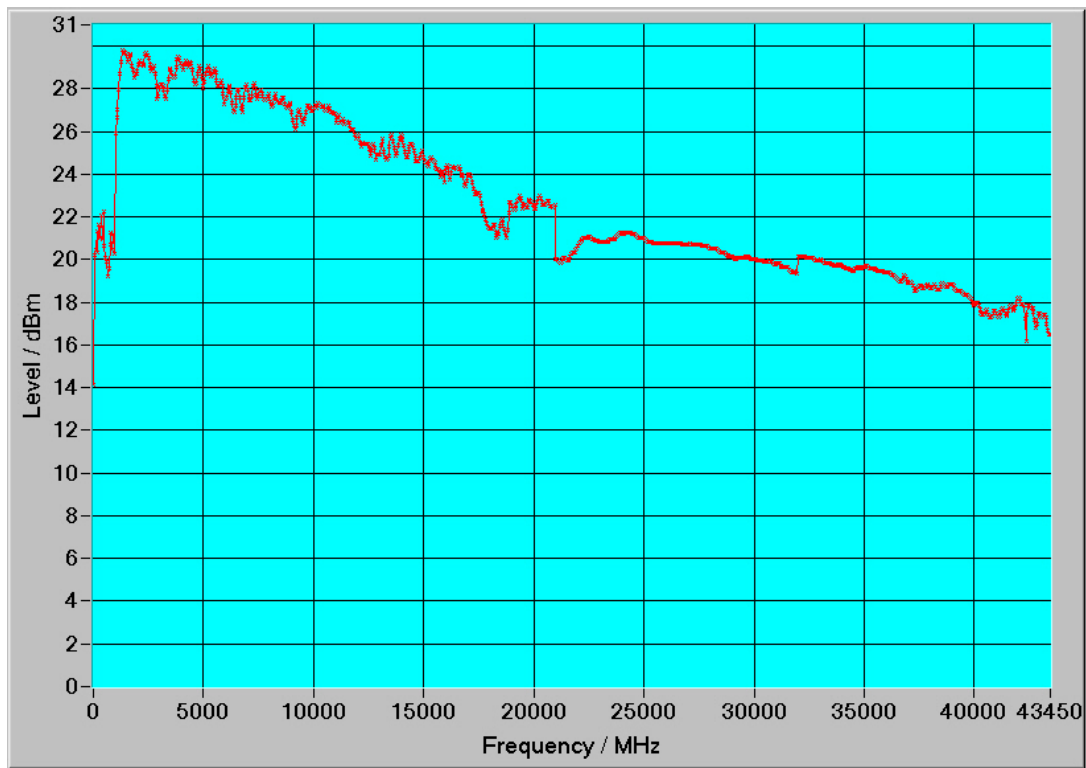


Fig. 3-9 X742 of Frequency Doubler with High Power Amplifier

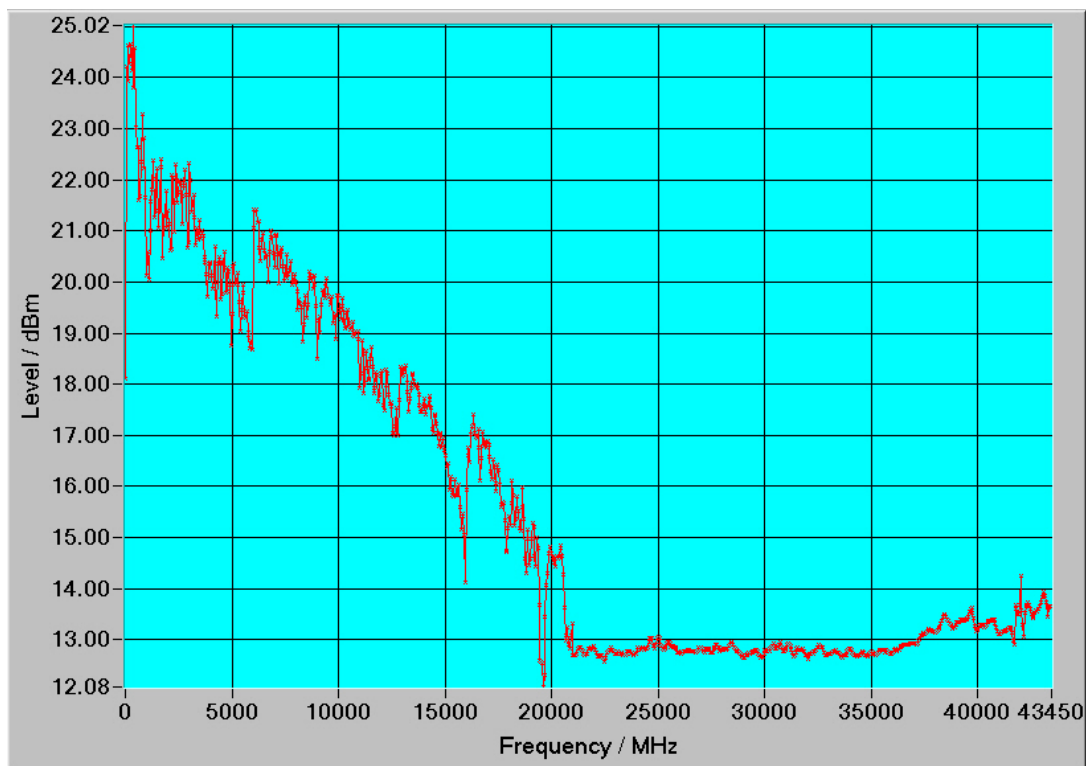


Fig. 3-10 X720 of Coupler with Frequency Doubler

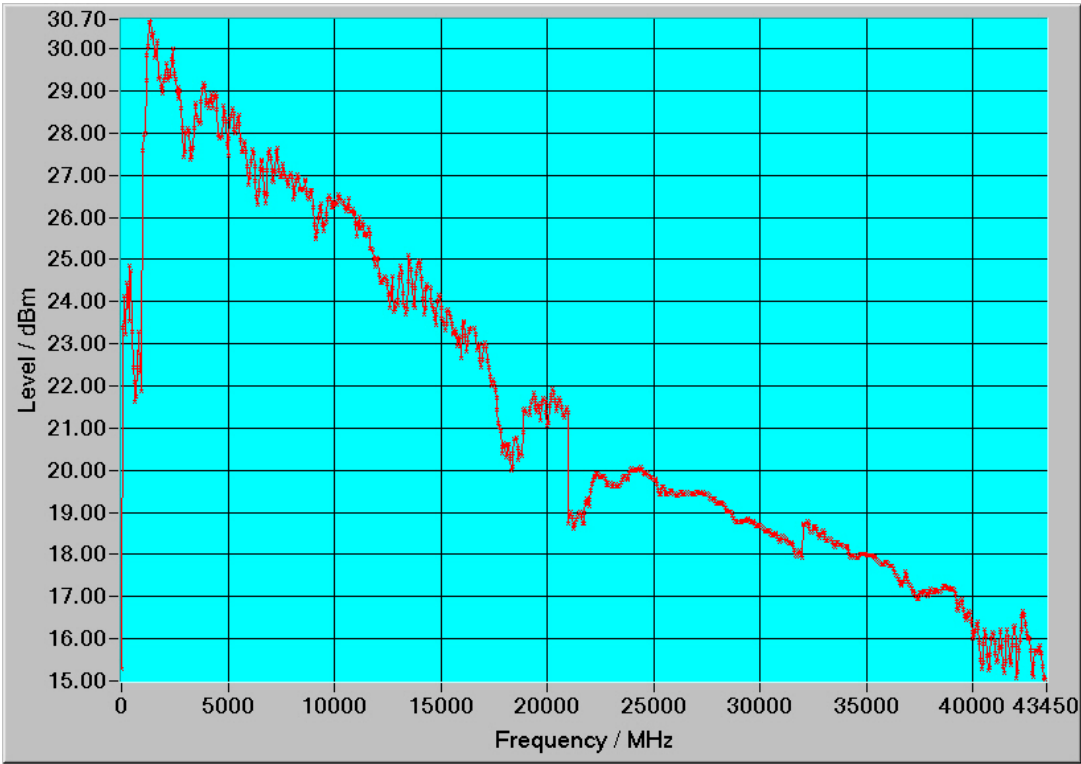


Fig. 3-11 X720 of Coupler with Frequency Doubler and High Power Amplifier



## Faulty LF Output Signal Faulty Pulse Output Signal

The signals of LF-Generator and pulse generator are generated in the FPGA on the ALC DDS Unit (A500). For proper working of the FPGA a correct reference clock is needed at the ALC DDS Unit. (X505).

| Error                      | Actions                                                                                                                                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Faulty LF Output Signal    | <ul style="list-style-type: none"> <li>➤ Run internal adjustment: Adjust Modulation/LF Generator.</li> </ul> <p>If internal adjustment fails see <a href="#">"Troubleshooting – Interface Board (IFBO, A200)"</a>.</p> |
| Faulty Pulse Output Signal | <ul style="list-style-type: none"> <li>➤ See <a href="#">"Troubleshooting – Interface Board (IFBO, A200)"</a></li> </ul>                                                                                               |

## Faulty AM

The amplitude modulation AM is generated by using the level control loop (ALC). The level control loop consists of the DMA module, the level detector and mainly the ALC DDS Unit.

The internal modulation generator is implemented on the AM/FM/Scan Modulation board (A520).

| Error                      | Actions                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AM is faulty               | <ul style="list-style-type: none"> <li>➤ Run internal adjustment: Adjust Level. Run loop gain calibration program</li> <li>➤ Check ALC DDS Unit, detector, DMA module</li> </ul>                                                                                                                                                                                     |
| Only external AM is faulty | <ul style="list-style-type: none"> <li>➤ Activate external AM and feed in a modulation signal (1 kHz, 1 V<sub>peak</sub>) at EXT1 or EXT2 BNC connector of the signal generator. Check cable from BNC connector to motherboard.</li> <li>➤ Run internal adjustments: Adjust Modulation/LF Generator.</li> <li>➤ Check AM/FM/Scan Modulation board (A520).</li> </ul> |

## Faulty FM/PM

The FM/PM modulation is generated at the ALC DDS Unit (A500)

The internal modulation generator is implemented on the AM/FM/Scan Modulation board (A520).

| Error                                              | Corrective action                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FM is faulty (with modulation frequency < 100 kHz) | <ul style="list-style-type: none"> <li>➤ Run internal adjustment: Adjust Frequency Synthesis.</li> <li>➤ Activate internal FM with 1 kHz modulation frequency and check the modulated RF signal. If the modulated signal is bad, check Frequency Synthesis module and TMO unit.</li> <li>➤ Replace the defective module.</li> </ul>                                                                                                     |
| FM is faulty (with modulation frequency > 100 kHz) | <ul style="list-style-type: none"> <li>➤ Run internal adjustment: Adjust Frequency Synthesis.</li> <li>➤ Activate internal FM with 1 MHz and 4 MHz modulation frequency and check the modulated RF signal.</li> <li>➤ First by shure the FM frequency response and FM deviation is adjusted at the TMO unit.</li> <li>➤ If these adjustments are not successfully, check Modulation board, Frequency Synthesis and TMO Unit.</li> </ul> |
| Only external FM/PhiM is faulty                    | <ul style="list-style-type: none"> <li>➤ Activate external FM and feed in a modulation signal (1 kHz, 1 V<sub>peak</sub>) at EXT1 or EXT2 BNC connector of the signal generator. Check cable from BNC connector to motherboard.</li> <li>➤ Run internal adjustments: Adjust Modulation/LF Generator.</li> <li>➤ Check AM/FM/Scan Modulation board (A520).</li> </ul>                                                                    |

## Faulty Pulse Modulation

The signal for internal pulse modulation is generated by the pulse generator FPGA on the ALC DDS Unit (ADU). The external pulse modulation signal is also feed into the pulse generator FPGA.

The output signal of this FPGA is feed to the pulse modulators of DMA Module and Down converter.

| Error                                                                | Corrective action                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal pulse modulation is faulty in the whole RF frequency range. | <ul style="list-style-type: none"> <li>➤ Activate internal pulse modulation with 1 ms pulse period and 500 μs pulse width and check for correct output signal at the PULSE OUTPUT (square 1 kHz, 3.3 V<sub>peak</sub>). If the signal is bad, troubleshoot ALC DDS Unit first.</li> </ul>                                               |
| Internal pulse modulation is faulty (RF < 1 GHz)                     | <ul style="list-style-type: none"> <li>➤ Replace Down Converter (A450).</li> </ul>                                                                                                                                                                                                                                                      |
| Internal pulse modulation is faulty (RF ≥ 1 GHz)                     | <ul style="list-style-type: none"> <li>➤ Replace the DMA Module (A800)..</li> </ul>                                                                                                                                                                                                                                                     |
| Only external pulse modulation is faulty                             | <ul style="list-style-type: none"> <li>➤ Activate external pulse modulation and feed in a modulation signal (square 1 kHz, TTL level) at PULSE IN BNC connector of the signal generator. Check cable W316 from BNC connector to motherboard (X316).</li> <li>➤ If the signal at X316 is ok, replace the ALC DDS Unit (A500).</li> </ul> |

# Troubleshooting – Interface Board (IFBO, A200)

## Supply Voltages

Before troubleshooting on the Interface board, measure the supply voltages on its connector (X904) and compare them to the values specified in the table. If one or more voltages are not of the required level, first check for a fault of the power supply.

Check the fuses listed in the table below:

| Supply Voltage | Pin at connector X904 | Fuse              |                                                                                                                                                  |
|----------------|-----------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| + 5.2 V        | 1, 2, 3               | F2<br>F7          | ALC DDS Unit, Frequency Synthesis, Down Converter<br>Processor Unit                                                                              |
| + 12 V         | 5                     | F9<br>F10<br>F1   | ALC DDS Unit, Frequency Synthesis, Down Converter<br>Interface Board, Microwave Modules<br>Step Up Converter 15 V, 24 V, 40 V on Interface Board |
| - 12 V         | 9                     | F11<br>F12        | Interface Board, Microwave Modules<br>ALC DDS Unit, Frequency Synthesis, Down Converter                                                          |
| + 6.5 V        | 13                    | F14               | Interface Board, ALC DDS Unit, Frequency Synthesis, Down Converter                                                                               |
| - 6.5 V        | 14                    | F15               | Interface Board, ALC DDS Unit, Frequency Synthesis, Down Converter                                                                               |
| + 3.4 V        | 17, 18, 19            | F17<br>F18        | Interface Board, Microwave Modules<br>Interface Board, ALC DDS Unit, Frequency Synthesis, Down                                                   |
| + 8 V          | 21, 22, 23            | F19<br>F20<br>F21 | Interface Board, Microwave Modules<br>Down Converter<br>DMA Module                                                                               |

## Test Points

The following test points are accessible via **SETUP** - Test Points.... .

| Test Point |                                | MIN [V] | MAX [V] | Fuse |
|------------|--------------------------------|---------|---------|------|
| 000        | Reference ground               | -0.01   | +0.01   |      |
| 001        | Temperature sensor             | -0.10   | +0.70   |      |
| 002        | +4 V reference voltage         | +3.95   | +4.15   |      |
| 003        | +1.2 V core Voltage (FPGA)     | +1.15   | +1.25   |      |
| 004        | -5 V supply voltage            | -5.20   | -4.80   |      |
| 005        | +15 V-step up converter        | +14.5   | +15.5   | F5   |
| 006        | +24 V-step up converter        | +23.5   | +25.5   | F3   |
| 007        | +40 V-step up converter        | +38     | +42     | F4   |
| 008        | V/GHz-output                   | 0       | 22      |      |
| 009        | X-Axis-output                  | 0       | 10      |      |
| 010        | Z-Axis-output                  | -10     | +5.5    |      |
| 011        | +2.5 V-V_AUX-voltage (FPGA)    | +2.40   | +2.60   |      |
| 013        | Diagnosis DMA-Module           | -10     | +10     |      |
| 014        | Temperature sensor Filter Bank | -0.10   | +0.70   |      |

Check all DC voltages. The measured values of the temperature sensors have to be multiplied by 100 to get the temperature in °C.

**Errors**

| Error                                | Action to perform                                                                                                                                            |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15 V voltage at test point 005 fails | ➤ Check/replace fuse F5 on interface board. Check TMO Unit, Frequency Synthesis and Motherboard for short on the 15V line.                                   |
| 24 V voltage at test point 006 fails | ➤ Check/replace fuse F3 on interface board. Check TMO Unit, Frequency Synthesis, Motherboard, Step attenuator, Microwave interface for short on the 24V-line |
| 40 V voltage at test point 007 fails | ➤ Check/replace fuse F4 on interface board. Check TMO Unit, Frequency Synthesis and Motherboard for short on the 12V/40V-line                                |
| Failure at test point 002, 003, 011  | ➤ Replace Interface board.                                                                                                                                   |

# Troubleshooting – Frequency Synthesis (FSYN, A400)

The tests listed below ensure that an assumed error on the Frequency Synthesis module (FSYN) is not caused by a defective or incorrectly connected cable, incorrect adjustment or another module

Before troubleshooting on the Frequency Synthesis, measure the supply voltages on its connectors (X400, X401) and compare them to the values specified in the table. If one or more voltages are not of the required level, first check for a fault of the power supply or Interface board.

## Supply Voltages

| Pin           | Min. Voltage/V | Max. Voltage/V |
|---------------|----------------|----------------|
| X401 A to D5  | +23.9          | +24.1          |
| X400.A to D22 | +11.4          | +12.6          |
| X400.A to D20 | +6.3           | +6.7           |
| X400.A to D24 | +5.0           | + 5.4          |
| X400.A to D1  | +3.3           | +3.5           |
| X400.A to D18 | -6.7           | -6.3           |
| X400.A to B16 | -12.6          | -11.4          |

## Input and Output Signals

| Connector, system | Signal name | Frequency       | Level      | Signal flow       |
|-------------------|-------------|-----------------|------------|-------------------|
| X409, QMA         | REF100B     | 100 MHz         | +4 ± 2 dBm | To Down Converter |
| X410, QMA         | REF100A     | 100 MHz         | +4 ± 2 dBm | To ALC/DDS Unit   |
| X406, QMA         | FPLL        | 750 to 1500 MHz | +3 ± 2 dBm | From DMA Module   |

## Test Points

The following test points are accessible via **SETUP** - Test Points.... .

| Test Point |                             | MIN [V] | MAX [V] |  |
|------------|-----------------------------|---------|---------|--|
| 100        | Reference ground            | -0.05   | +0.05   |  |
| 101        | Temperature sensor          | -0.10   | +0.70   |  |
| 102        | +2.5 V-supply voltage       | +2.45   | +2.55   |  |
| 103        | +5 V_A supply voltage       | +4.95   | +5.05   |  |
| 104        | +5 V_B-supply voltage       | +4.95   | +5.05   |  |
| 105        | +5 V_C-supply voltage       | +4.35   | +4.65   |  |
| 106        | +6 V_A-supply voltage       | +5.93   | +6.07   |  |
| 107        | +10 V_A-supply voltage      | +9.92   | +10.08  |  |
| 108        | -5 V-supply voltage         | -5.10   | -4.90   |  |
| 109        | (reserved)                  |         |         |  |
| 110        | Reference voltage +8 V      | +7.92   | +8.08   |  |
| 111        | Reference voltage -8 V      | -8.08   | -7.92   |  |
| 112        | Tuning voltage to TCXO/OCXO | 0       | +8      |  |

Check all DC voltages from test point 102 to 111. Replace the module if one or more voltages fail.  
The measured values of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

## Error Messages

|                                               |                                                                                                                       |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| "Synthesis OCXO 10 MHz oven cold"             | ➤ If this message does not disappear after 10 minutes, OCXO is defective. Change the module.                          |
| "Synchronization error on external reference" | ➤ Check for correct External Reference Frequency setting and corresponding input signal.                              |
| "Synthesis Reference PLL unlocked"            | ➤ If the input signal and frequency settings are correct and the error message is still displayed, change the module. |

## Internal Adjustment "Adjust Synthesis"

A comprehensive test of the module is to run the internal adjustment ( **SETUP** - **Internal Adjustment Adjust Frequency Synthesis**). VCO bank, step frequency multiplier filters and TMO loop are adjusted in sequence.

### Error during internal adjustment

| Error                                                                                | Action to perform                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal adjustment "Adjust Synthesis" aborts at <b>FSYN_CFL_VCO Adjustment</b> .    | ➤ Replace the Frequency Synthesis module.                                                                                                                                                                                                                                                                                                                                                                   |
| Internal adjustment "Adjust Synthesis" aborts at <b>FSYN_SFM_FILTER Adjustment</b> . | ➤ Replace the Frequency Synthesis module.                                                                                                                                                                                                                                                                                                                                                                   |
| Internal adjustment "Adjust Synthesis" aborts at <b>FSYN_YTO Adjustment</b> .        | <ul style="list-style-type: none"> <li>➤ Check adjustment of TMO Unit</li> <li>➤ Check RF output of YIG oscillator (cable W821).<br/>If no signal is preset (3 to 11 GHz, &gt; 10 dBm) change YIG-oscillator</li> <li>➤ Check RF output of DMA module (cable W406)<br/>If no signal is preset (750 to 1500 MHz, &gt; 0 dBm) change DMA module</li> <li>➤ Replace the Frequency Synthesis module.</li> </ul> |

## Troubleshooting – Reference Oscillator (OCXO, A575)

Before a Go/NoGo decision on the OCXO, measure the supply voltage at connector X575. If the voltage is out of tolerance, first look for bad cables and connections and check the 13.5 V-standby voltage of the power supply.

### Supply Voltage

| Pin              | Min. voltage/V | Max. voltage/V |
|------------------|----------------|----------------|
| X575.1<br>X575.2 | +13.2          | +13.8          |

### Input and Output Signals

| Connector, system | Signal name | Frequency | Level      | Signal flow            |
|-------------------|-------------|-----------|------------|------------------------|
| X576, SMP         | REF10       | 10 MHz    | +0 ± 2 dBm | To Frequency Synthesis |

### Test Points

The following test point is accessible via **SETUP** - Test Points.... .

| Test Point |                      | MIN [V] | MAX [V] |  |
|------------|----------------------|---------|---------|--|
| 019        | +12 V supply voltage | +11.4   | +12.6   |  |

Measure the supply voltage at test point 019.

### Errors

| Error                                                                | Error correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal reference frequency:<br>Frequency error > $2 \cdot 10^{-6}$ | <ul style="list-style-type: none"> <li>➤ The frequency accuracy of the synthesizer is determined (set to internal reference) by a highly stable 10 MHz quartz oscillator that is set to a calibrated frequency standard at the R&amp;S factory. This oscillator is subject to ageing and can usually be recalibrated; please contact your R&amp;S representative.</li> </ul> <hr/> <p><b>Note:</b> The internal reference can be aligned by up to approx. <math>\pm 10^{-6}</math> under the menu <b>Setup - Reference Oscillator - Adjustment</b>. This setting does not affect the factory adjustment and can be reset at any time by means of deactivation.</p> <hr/> |
| "Synthesis OCXO 10 MHz oven cold"                                    | <ul style="list-style-type: none"> <li>➤ If this message does not disappear after 10 minutes, OCXO is defective. Change the module.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## Troubleshooting – ALC DDS Unit (ADU, A500)

The tests listed below ensure that an assumed error on the ALC DDS unit (ADU) is not caused by a defective or incorrectly connected cable, incorrect adjustment or another module

Before troubleshooting on the ADU, measure the supply voltages at connector X500 and compare them to the values specified in the table. If one or more voltages are not of the required level, first check for a fault of the power supply or Interface board.

### Supply Voltages

| Pin           | Min. voltage/V | Max. voltage/V |
|---------------|----------------|----------------|
| X500.A to D22 | +11.4          | +12.6          |
| X500.A to D20 | +6.3           | +6.7           |
| X500.A to D24 | +5             | +5.4           |
| X500.A to D1  | +3.3           | +3.5           |
| X500.A to D18 | -6.7           | -6.3           |
| X500.A to B16 | -12.6          | -11.4          |

### Input and Output Signals

| Connector, system | Signal name | Frequency | Level      | Signal flow              |
|-------------------|-------------|-----------|------------|--------------------------|
| X505, QMA         | REF100A     | 100 MHz   | +4 ± 2 dBm | From Frequency Synthesis |

### Test Points

The following test points are accessible via **SETUP** - Test Points.... .

| Test Point |                               | MIN [V] | MAX [V] |  |
|------------|-------------------------------|---------|---------|--|
| 200        | Reference ground              | -0.05   | +0.05   |  |
| 201        | Temperature sensor            | -0.10   | +0.70   |  |
| 202        | +7.5 V reference voltage      | +7.47   | +7.52   |  |
| 203        | -5 V supply voltage           | -5.10   | -4.90   |  |
| 204        | -7.5 V reference voltage      | -7.57   | -7.43   |  |
| 205        | +2.4 V reference voltage      | +1.92   | +2.88   |  |
| 206        | +2.4 V reference voltage      | +1.92   | +2.88   |  |
| 207        | +1.5 V FPGA supply voltage    | +1.45   | +1.55   |  |
| 208        | +5 V_A supply voltage         | +4.95   | +5.05   |  |
| 209        | -5 V_A supply voltage         | -5.05   | -4.95   |  |
| 229        | +3.5 V supply voltage         | +3.10   | +3.60   |  |
| 232        | +11 V filtered supply voltage | +10.89  | +11.11  |  |
| 233        | -11 V filtered supply voltage | -11.11  | -10.89  |  |
| 234        | +5 V DDS supply voltage       | +4.95   | +5.05   |  |
| 235        | +5 V DDS supply voltage       | -5.05   | -4.95   |  |
| 210        | Clock signal ADC DAC          | 0.35    | 2.00    |  |
| 222        | Clock signal FPGA             | 0.04    | 1.00    |  |



Check all DC voltages. Replace the module if one or more voltages fail.

The measured values of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

Check the clock signals at test point 210 and 222.

## Error Messages

| Error message                                                                                      | Action to perform                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Calibration data missing; Missing ...                                                              | ➤ If this message appears, the internal adjustment ( <b>SETUP</b> - <b>Internal Adjustment - Adjust Level</b> ) must be executed.                                                                                                                                                                                                                                                                                                                                                                                                  |
| Calibration failed; Level Offset (Dcon) ...failed                                                  | ➤ Check Down Converter and ADU.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Calibration failed; Level Offset (DMA) ...failed<br>Calibration failed; Level Offset (Doubler) ... | ➤ Check Detector module and ADU.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Calibration failed; Level gain preamplifier adjustment failed                                      | ➤ Check connectors ADU to Motherboard and DCON to Motherboard. Check DCON, detector and ADU.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Calibration failed; Level preset adjustment failed                                                 | ➤ Check DMA module, Filter module, Down converter, Detector, ADU                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Calibration failed; Linearization data measurement failed                                          | ➤ Check DMA module, Frequency Doubler, and ADU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Output unleveled: Gain control on upper limit                                                      | <ul style="list-style-type: none"> <li>➤ If this message appears, the level control (ALC) cannot set the desired output level. Check whether the error appears in the entire frequency range or only in certain bands.</li> <li>➤ If the desired output level is below the specified maximum output level, look at the <a href="#">Flow Chart</a> for further troubleshooting.</li> <li>➤ If the error only appears in certain frequency bands below 1GHz, the Down Converter module is defective and must be replaced.</li> </ul> |

## Troubleshooting – AM/FM/Scan Modulator (MOD, A520)

The tests listed below ensure that an assumed error on the AM/FM/Scan Modulator (MOD) is not caused by a defective or incorrectly connected cable, incorrect adjustment or another module.

Before troubleshooting on the MOD, measure the supply voltages at connector X500 of the ALC/DDS unit and compare them to the values specified in the table. If one or more voltages are not of the required level, first check for a fault of the power supply or Interface board.

## Supply Voltages

| Pin           | Min. voltage/V | Max. voltage/V |
|---------------|----------------|----------------|
| X500.A to D22 | +11.4          | +12.6          |
| X500.A to D20 | +6.3           | +6.7           |
| X500.A to D24 | +5.0           | +5.4           |
| X500.A to D1  | +3.3           | +3.5           |
| X500.A to D18 | -6.7           | -6.3           |
| X500.A to B16 | -12.6          | -11.4          |

## Test Points

The following test points are accessible via **SETUP** - Test Points.....

| Test Point |                                   | MIN<br>[V] | MAX<br>[V] |  |
|------------|-----------------------------------|------------|------------|--|
| 250        | Reference ground                  | -0.05      | +0.05      |  |
| 251        | Temperature sensor                | -0.10      | +0.70      |  |
| 252        | -5 V supply voltage               | -5.10      | -4.90      |  |
| 259        | -2.4 V reference voltage EXT1-ADC | -2.88      | -1.92      |  |
| 260        | -2.4 V reference voltage EXT2 ADC | -2.88      | -1.92      |  |

Check all DC voltages. Replace the module if one or more voltages fail.

The measured values of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

## Internal Adjustment "Adjust Modulation/LF Generator"

Errors in the internal LF generators are indicated by the internal adjustment procedure.

**Important: During internal adjustment the LF output has to be left open!**

| Error message                                                                                                                 | Error correction                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Missing LfGen adjustment data                                                                                                 | ➤ Execute internal adjustment "Adjust Modulation/LF Generator"                                            |
| LfGen adjustment failed (disconnect load to calibrate)                                                                        | ➤ Be sure , that the LF output is left open. Execute internal adjustment "Adjust Modulation/LF Generator" |
| LfGen adjustment failed (internal hardware problems)<br>LfGen adjustment failed (no convergence)<br>ExtAna calibration failed | ➤ Replace the module.                                                                                     |

## Troubleshooting – Down Converter (DCON, A450)

The tests listed below ensure that a supposed fault on the Down converter is not caused by a defective or incorrectly connected cable, incorrect adjustment or another module.

Before further troubleshooting on the Down Converter unit ensure that internal adjustments (**SETUP** - Internal Adjustment - Adjust Frequency Synthesis) work correctly.

Before a Go/NoGo decision on the Down Converter, measure the supply voltages at connector X450 and compare them to the values specified in the table. If one or more voltages are not of the required level, first check for a fault on the power supply or Interface board.

### Supply Voltages

| Pin           | Min. voltage/V | Max. voltage/V |
|---------------|----------------|----------------|
| X450.A to D22 | +11.4          | +12.6          |
| X450.A to D14 | +7.76          | +8.24          |
| X450.A to D20 | +6.3           | +6.7           |
| X450.A to D24 | +5.0           | +5.4           |
| X450.A to D1  | +3.3           | +3.5           |
| X450.A to D18 | -6.7           | -6.3           |
| X450.A to B16 | -12.6          | -11.4          |

### Input and Output Signals

| Connector, system | Signal name | Frequency           | Level        | Signal flow                                                      |
|-------------------|-------------|---------------------|--------------|------------------------------------------------------------------|
| X453, QMA         | REF100B     | 100 MHz             | +4 ± 2 dBm   | From Frequency Synthesis                                         |
| X454, QMA         | DCON_IN     | 375 MHz to 1875 MHz | +8 ± 2 dBm   | From DMA Module                                                  |
| X455, QMA         | DCON_OUT    | 100 kHz to 1000 MHz | 19 to 25 dBm | To Switched Filter or High Power Amplifier (typ. maximum level). |

### Test Points

The following test points are accessible via **SETUP** - Test Points.... .

| Test Point |                                           | MIN [V] | MAX [V] |            |
|------------|-------------------------------------------|---------|---------|------------|
| 300        | Reference ground                          | -0.05   | +0.05   |            |
| 301        | Temperature sensor                        | -0.10   | +0.75   |            |
| 302        | +11V supply voltage                       | +9.50   | +11.00  |            |
| 303        | Supply voltage for Pulse modulator switch | -2.70   | -2.30   |            |
| 305        | Driver stage                              | +7.20   | +7.70   |            |
| 307        | Power amplifier                           | +10.3   | +11.0   |            |
| 317        | -11V supply voltage                       | -11.3   | -10.5   |            |
| 322        | Supply voltage for Pulse modulator switch | 4.40    | 4.80    |            |
| 323        | Supply voltage for Pulse modulator switch | 3.90    | 4.30    |            |
| 309        | 500 MHz Reference                         | 0.05    | 1.00    | f < 375MHz |

Check all DC voltages. Replace the module if one or more voltages fail. The measured values of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

## Error Messages

| Error message                            | Action to perform                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output unlevelled: ALC ....              | <ul style="list-style-type: none"><li>➤ If the error only appears in certain frequency bands below 1GHz, the Down Converter module is defective and must be replaced.</li><li>➤ Before removing the Down Converter module, you can also try new external level correction. If this does not work, the Down Converter module is definitely defective.</li></ul> |
| No RF level at frequencies below 375 MHz | <ul style="list-style-type: none"><li>➤ Check voltage at test point 309.</li></ul> <p>Voltage too low: Check REF100B signal at X453.</p>                                                                                                                                                                                                                       |

## Troubleshooting – DMA module (A800)

The tests listed below ensure that a supposed error in the DMA Module is not due to a defective or incorrectly connected cable, an incorrect adjustment, or another module.

The error causes described below relate exclusively to error symptoms occurring at frequencies above or equal 1 GHz. If errors occur at frequencies less than 1 GHz, follow the troubleshooting steps described under Troubleshooting – Down Converter.

Before proceeding with additional troubleshooting on the DMA module, ensure that the internal adjustments ( **SETUP** – Internal Adjustment - Adjust Frequency Synthesis ) can be completed without any errors. Measure the supply voltages at connector X800 and compare them to the values specified in the table. If one or more voltages are not of the required level, check first for a fault on the power supply or Interface board.

### Supply Voltages

| Pin               | Min. voltage/V | Max. voltage/V |
|-------------------|----------------|----------------|
| X800.1<br>X800.2  | +11.4          | +12.6          |
| X800.3 to 6       | +7.76          | +8.24          |
| X800.9<br>X800.10 | -12.6          | -11.4          |
| X800.19           | +3.3           | +3.5           |
| X800.16 to 18     | +6.3           | +6.7           |
| X800.15           | -6.7           | -6.3           |

### Input and Output Signals

| Connector, system | Signal name | Frequency         | Level        | Signal flow                             |
|-------------------|-------------|-------------------|--------------|-----------------------------------------|
| X801, SMA         | FTMO        | 3 to 11 GHz       | 11 to 17     | From YIG Oscillator                     |
| X802, K           | ODMA_1      | 1 to 21 (22)* GHz | 23 to 30 dBm | To Filter Bank (typ. maximum level).    |
| X803, K           | ODMA_2      | 10.5 to 21.75 GHz | 17 to 21 dBm | To Doubler module (typ. maximum level). |
| X804, SMA         | FPLL        | 750 to 1500 GHz   | > 3 dBm      | To Frequency Synthesis                  |
| X805, SMA         | FDCON       | 375 to 1875 GHz   | > 6 dBm      | To Down Converter                       |

\* 1 to 21 GHz with Doubler module / 1 to 22 GHz without Doubler module

## Test Points

The following test points are accessible via **SETUP** - Test Points.... .

| Test Point |                       | MIN<br>[V] | MAX<br>[V] |  |
|------------|-----------------------|------------|------------|--|
| 800        | Reference ground      | -0.05      | +0.05      |  |
| 801        | Temperature sensor    | -0.10      | +0.75      |  |
| 802        | +5 V_A supply voltage | +4.80      | +5.20      |  |
| 803        | -5 V_A supply voltage | -5.20      | -4.80      |  |
| 804        | +11 V_ supply voltage | +10.0      | +11.5      |  |
| 805        | -11 V_ supply voltage | -11.5      | -10.0      |  |
| 806        | +5 V_ supply voltage  | +4.80      | +5.20      |  |
| 807        | +7.5 V supply voltage | +7.30      | +7.70      |  |
| 808        | +9.6 V supply voltage | +9.40      | +9.80      |  |
| 809        | Drain voltage #1      | +6.50      | +6.90      |  |
| 810        | Gate voltage #1       | -1.20      | -0.40      |  |
| 811        | Drain voltage #2      | +6.90      | +7.30      |  |
| 812        | Gate voltage #2       | -1.20      | -0.40      |  |
| 813        | Drain voltage #3      | +7.10      | +7.50      |  |
| 814        | Gate voltage #3       | -1.20      | -0.50      |  |
| 815        | Drain voltage #4      | +7.40      | +7.80      |  |
| 817        | Drain voltage PA      | +8.90      | +9.30      |  |
| 818        | Gate voltage PA       | -4.10      | -1.37      |  |
| 819        | Drain voltage PA      | +4.30      | +4.70      |  |
| 820        | Gate voltage PA       | -1.50      | -1.30      |  |

Check all DC supply voltages, drain and gate voltages. Replace the module if one or more voltages fail. The measured values of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

## Troubleshooting – Switched Filter (A780)

The tests listed below ensure that a supposed error in the Filter module is not due to a defective or incorrectly connected cable, an incorrect adjustment, or another module.

The error causes described below relate exclusively to error symptoms occurring in the frequency range 1 to 21 (22)\* GHz.

If errors occur at frequencies less than 1 GHz, follow the troubleshooting steps described under *Troubleshooting – Down Converter*. If High Power Amplifier is fitted, follow *Troubleshooting – High Power Amplifier*.

If errors occur at frequencies more than 21 GHz, follow the troubleshooting steps described under *Troubleshooting – Frequency Doubler*.

Before proceeding with additional troubleshooting on the Filter module, ensure that the internal adjustments ( **SETUP** – Internal Adjustment - Adjust Frequency Synthesis ) can be completed without any errors. Measure the supply voltages at connector X780 on the Interface board and compare them to the values specified in the table. If one or more voltages are not of the required level, check first for a fault on the power supply or Interface board.

### Supply Voltages

| Pin         | Min. voltage/V | Max. voltage/V |
|-------------|----------------|----------------|
| X780.2 to 4 | +11.4          | +12.6          |
| X780.5 to 8 | +7.76          | +8.24          |
| X780.11,12  | -12.6          | -11.4          |
| X780.21     | +3.3           | +3.5           |

### Input and Output Signals

| Connector, system | Signal name | Frequency               | Level        | Signal flow                                                                |
|-------------------|-------------|-------------------------|--------------|----------------------------------------------------------------------------|
| X781, SMA         | IFILT       | 1 to 21 (22)* GHz       | 22 to 30 dBm | From DMA Module (typ. maximum level).                                      |
| X782, SMA         | OFILT       | 100 kHz to 21 (22)* GHz | 18 to 25 dBm | To Coupler or High Power Amplifier or Doubler module (typ. maximum level). |
| X783, SMA         | DCON        | 100 kHz to 1 GHz        | 18 to 25 dBm | From Down Converter (if not High Power Amplifier is fitted).               |

### Test Point

The following test point is accessible via **SETUP** - Test Points.... .

| Test Point |                    | MIN [V] | MAX [V] |
|------------|--------------------|---------|---------|
| 014        | Temperature sensor | -0.10   | +0.75   |

The measured value of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

\* 1 to 21 GHz with Doubler module / 1 to 22 GHz without Doubler module

## Bandswitch frequencies

| Band # <sup>1</sup> | Control Signals @ X780 |        |        |       | Frequency Range    |
|---------------------|------------------------|--------|--------|-------|--------------------|
|                     | Pin 20                 | Pin 19 | Pin 18 | Pin17 |                    |
| 0                   | H                      | H      | H      | H     | 100 kHz to 1 GHz   |
| 1                   | L                      | L      | L      | H     | 1 to 1.5 GHz       |
| 2                   | L                      | L      | H      | L     | 1.5 to 2.2 GHz     |
| 3                   | L                      | L      | H      | H     | 2.2 to 3.0 GHz     |
| 4                   | L                      | H      | L      | L     | 3.0 to 4.2 GHz     |
| 5                   | L                      | H      | L      | H     | 4.2 to 6.0 GHz     |
| 6                   | L                      | H      | H      | L     | 6.0 to 8.4 GHz     |
| 7                   | L                      | H      | H      | H     | 8.4 to 12 GHz      |
| 8                   | H                      | L      | L      | L     | 12 to 16 GHz       |
| 9                   | H                      | L      | L      | H     | 16 to 21 (22)* GHz |

## Errors

| Error                                                                                                             | Action to perform                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Maximum output level is too low in one or more of the frequency ranges listed in the table above.                 | <ul style="list-style-type: none"> <li>• Measure the corresponding control signals at connector X780 on the interface board.</li> <li>• If the signals are correct, check cable W780.</li> <li>• If the cable is ok, change the Filter module.</li> </ul> |
| Maximum output level is too low in the complete frequency range 1 to 21 GHz (1 to 22 GHz without Doubler module). | <ul style="list-style-type: none"> <li>• Check modules in the following sequence: DMA module → Filter module.</li> </ul>                                                                                                                                  |
| Maximum output level is too low in the frequency range 100 kHz to 1 GHz.                                          | <ul style="list-style-type: none"> <li>• Check modules in the following sequence: Down Converter → Filter module.</li> </ul>                                                                                                                              |

\* 16 to 21 GHz with Doubler module / 16 to 22 GHz without Doubler module



## Troubleshooting – Frequency Doubler (A740)

The tests listed below ensure that a supposed error in the Doubler module is not due to a defective or incorrectly connected cable, an incorrect adjustment, or another module.

The error causes described below relate exclusively to error symptoms occurring at frequencies above or equal 21 GHz. If errors occur at frequencies less than 21 GHz, follow the troubleshooting steps described under Troubleshooting – Switched Filter and Troubleshooting – DMA Module.

Before proceeding with additional troubleshooting on the Frequency Doubler module, ensure that the internal adjustments ( **SETUP** – Internal Adjustment - Adjust Frequency Synthesis ) can be completed without any errors.

### Supply Voltages

Measure the supply voltages at connector X740 on the Microwave Interface board:

| Pin         | Min. voltage/V | Max. voltage/V |
|-------------|----------------|----------------|
| X740.2 to 4 | +11.4          | +12.6          |
| X740.5 to 8 | +7.76          | +8.24          |
| X740.11,12  | -12.6          | -11.4          |
| X740.21     | +3.3           | +3.5           |

### Input and Output Signals

| Connector, system | Signal name | Frequency           | Level        | Signal flow                                 |
|-------------------|-------------|---------------------|--------------|---------------------------------------------|
| X741, K           | IDOUB_2     | 10.5 to 21.75 GHz   | 16 to 21 dBm | From DMA Module (typ. maximum level).       |
| X742, K           | ODOUB       | 100 kHz to 43.5 GHz | 18 to 23 dBm | To Coupler (typ. maximum level).            |
| X743, K           | IDOUB_1     | 100 kHz to 21 GHz   | 15 to 30 dBm | From Filter module or High Power Amplifier. |

### Test Point

The following test point is accessible via **SETUP** - Test Points..... .

| Test Point |                    | MIN [V] | MAX [V] |
|------------|--------------------|---------|---------|
| 017        | Temperature sensor | -0.10   | +0.75   |

The measured value of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

## Bandswitch frequencies

| Band # | Control Signals @ connector X740 |        |        |       | Frequency Range   |
|--------|----------------------------------|--------|--------|-------|-------------------|
|        | Pin 20                           | Pin 19 | Pin 18 | Pin17 |                   |
| 0      | H                                | H      | L      | L     | 100 kHz to 21 GHz |
| 1      | H                                | L      | L      | H     | 21 to 24 GHz      |
| 2      | L                                | L      | L      | H     | 24 to 27.2 GHz    |
| 3      | L                                | L      | H      | L     | 27.2 to 32 GHz    |
| 4      | L                                | H      | H      | L     | 32 to 36.8 GHz    |
| 5      | L                                | H      | H      | H     | 36.8 to 43.5 GHz  |

## Errors

| Error                                                                                             | Corrective action                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Maximum output level is too low in one or more of the frequency ranges listed in the table above. | <ul style="list-style-type: none"> <li>• Measure the corresponding control signals at connector X740 on the interface board.</li> <li>• If the signals are correct, check cable W740.</li> <li>• If the cable is ok, change the Frequency Doubler module.</li> </ul> |
| Maximum output level is too low in the complete frequency range 21 to 43.5 GHz.                   | <ul style="list-style-type: none"> <li>• Check modules in the following sequence:<br/>DMA module → Frequency Doubler module.</li> </ul>                                                                                                                              |
| Maximum output level is too low in the frequency range less than 21 GHz.                          | <ul style="list-style-type: none"> <li>• Check modules in the following sequence:<br/>Filter module → High Power Amplifier → Doubler module.</li> </ul>                                                                                                              |

## Troubleshooting – Coupler/Detector (A720/A725)

The tests listed below ensure that a supposed error in the Coupler/Detector is not due to a defective or incorrectly connected cable, an incorrect adjustment, or another module.

Before proceeding with additional troubleshooting on the DMA module, ensure that the internal adjustments ( **SETUP** – Internal Adjustment - Adjust Frequency Synthesis ) can be completed without any errors.

### Supply Voltages

Measure the supply voltages at connector X725 on the Microwave Interface board:

| Pin    | Min. voltage/V | Max. voltage/V |
|--------|----------------|----------------|
| X725.1 | +11.4          | +12.6          |
| X725.2 | +3.3           | +3.5           |
| X720.4 | -12.6          | -11.4          |

### Input and Output Signals

| Connector, system | Signal name | Frequency                 | Level         | Signal flow                                                                                                             |
|-------------------|-------------|---------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------|
| X721, K           | ICPL        | 100 kHz to 22 (43.5)* GHz | 10 to 28 dBm  | (depending on installed options):<br>from Filter module or High Power Amplifier or Doubler module (typ. maximum level). |
| X720, K           | OCPL        | 100 kHz to 22 (43.5)* GHz | 9 to 28 dBm   | To Step Attenuator (typ. maximum level).                                                                                |
| X727, K           | RF_DET      | 100 kHz to 22 (43.5)* GHz | -11 to 18 dBm | From Coupler (typ. maximum level).                                                                                      |
| X728, SMA         | REF_LVL2    | 15 MHz                    | > 20 dBm      | From ALC/DDS Unit                                                                                                       |
| X729, SMP         | DET2_REF    |                           |               | To ALC/DDS Unit                                                                                                         |
| X730, SMP         | DET2        |                           |               | To ALC/DDS Unit                                                                                                         |

### Test Point

The following test point is accessible via **SETUP** - Test Points.... .

| Test Point |                    | MIN [V] | MAX [V] |  |
|------------|--------------------|---------|---------|--|
| 018        | Temperature sensor | -0.10   | +0.75   |  |

The measured value of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

\* 100 kHz to 22 GHz without Doubler module / 100 kHz to 43.5 GHz with Doubler module

## Troubleshooting – Step attenuator (A600)

### Supply Voltages

Measure the supply voltage at connector X601 on the Microwave Interface board:

| Pin    | Min. voltage/V | Max. voltage/V |
|--------|----------------|----------------|
| X601.6 | +23.5          | +25.5          |

| Error                             | Error correction                                                                                                                                                                                                                                                  |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step attenuator does not switch   | <ul style="list-style-type: none"> <li>➤ Check the +24V supply voltage and the connection at connector X600/X601 on the Microwave Interface board.</li> </ul> <p>Supply voltage faulty: Check fuse F3 on the Interface board.</p>                                 |
| Some attenuator steps do not work | <ul style="list-style-type: none"> <li>➤ Check the control signals at connector X600/X601 on the microwave interface board.</li> </ul> <p>Control signals ok: Replace the step attenuator.<br/>Control signals faulty: Replace the Microwave Interface board.</p> |
| Attenuation out of tolerance      | <ul style="list-style-type: none"> <li>➤ Replace the step attenuator</li> </ul>                                                                                                                                                                                   |

### Input and Output Signals

| Connector, system | Signal name   | Frequency                 | Level   | Signal flow                                                       |
|-------------------|---------------|---------------------------|---------|-------------------------------------------------------------------|
| X600              | Logic signals | static                    | TTL     | Control interface and power supply from Microwave Interface board |
| X601, K           | RF_IN         | 100 kHz to 22 (43.5)* GHz | <30 dBm | RF Input (from directional coupler)                               |
| X602, K           | RF_OUT        | 100 kHz to 22 (43.5)* GHz | <30 dBm | RF output (to N output connector of the R&S SMF100A)              |

\* 100 kHz to 22 GHz without Doubler module / 100 kHz to 43.5 GHz with Doubler module

## Troubleshooting – High Power Amplifier (A760)

The tests listed below ensure that a supposed error in the High Power Amplifier is not due to a defective or incorrectly connected cable, an incorrect adjustment, or another module.

The error causes described below relate exclusively to error symptoms occurring in the frequency range 1 to 21 (22)\* GHz. If errors occur at frequencies less than 1 GHz, follow the troubleshooting steps described under *Troubleshooting – Down Converter*.

If errors occur at frequencies more than 21 GHz, follow the troubleshooting steps described under *Troubleshooting – Frequency Doubler*.

Before proceeding with additional troubleshooting on the Filter module, ensure that the internal adjustments ( **SETUP** – **Internal Adjustment - Adjust Frequency Synthesis** ) can be completed without any errors. Measure the supply voltages at connector X760 on the Interface board and compare them to the values specified in the table. If one or more voltages are not of the required level, check first for a fault on the power supply or Interface board.

### Supply Voltages

| Pin         | Min. voltage/V | Max. voltage/V |
|-------------|----------------|----------------|
| X760.2 to 4 | +11.4          | +12.6          |
| X760.5 to 8 | +7.76          | +8.24          |
| X760.11,12  | -12.6          | -11.4          |
| X760.21     | +3.3           | +3.5           |

### Input and Output Signals

| Connector, system | Signal name | Frequency               | Level        | Signal flow                                        |
|-------------------|-------------|-------------------------|--------------|----------------------------------------------------|
| X761, K           | IHPA        | 1 to 21 (22)* GHz       | 16 to 23 dBm | From Filter module (typ. maximum level).           |
| X762, K           | OHPA        | 100 kHz to 21 (22)* GHz | 24 to 30 dBm | To Coupler or Doubler module (typ. maximum level). |
| X783, SMA         | DCON        | 100 kHz to 1 GHz        | 18 to 25 dBm | From Down Converter.                               |

### Test Point

The following test point is accessible via **SETUP** - **Test Points....** .

| Test Point |                    | MIN [V] | MAX [V] |
|------------|--------------------|---------|---------|
| 015        | Temperature sensor | -0.10   | +0.75   |

The measured value of the temperature sensor has to be multiplied by 100 to get the temperature in °C.

\* 1 to 21 GHz with Doubler module / 1 to 22 GHz without Doubler module

## Control Signals @ X760

| Pin 18 | Pin17 | Function                   |
|--------|-------|----------------------------|
| -      | L     | High Power Amplifier - off |
| -      | H     | High Power Amplifier - on  |
| L      | -     | 1 to 21 (22)* GHz          |
| H      | -     | 100 kHz to 1 GHz           |

( - ) = arbitrary logic state

## Errors

| Error                                                                                                             | Action to perform                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Maximum output level is too low in one or more of the frequency ranges listed in the table above.                 | <ul style="list-style-type: none"> <li>• Measure the corresponding control signals at connector X760 on the interface board.</li> <li>• If the signals are correct, check cable W760.</li> <li>• If the cable is ok, change the High Power Amplifier.</li> </ul> |
| Maximum output level is too low in the complete frequency range 1 to 21 GHz (1 to 22 GHz without Doubler module). | <ul style="list-style-type: none"> <li>• Check modules in the following sequence: Filter module → High Power Amplifier.</li> </ul>                                                                                                                               |
| Maximum output level is too low in the frequency range 100 kHz to 1 GHz.                                          | <ul style="list-style-type: none"> <li>• Check modules in the following sequence: Down Converter → High Power Amplifier.</li> </ul>                                                                                                                              |

\* 16 to 21 GHz with Doubler module / 16 to 22 GHz without Doubler module



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## 4 Software Update / Installing Options

This chapter contains information on firmware update, Linux operating system update and installing options to the R&S SMF100A. Additional manuals obtained together with a firmware update or with subsequently acquired options can be filed here.

The firmware/software update always consists of one file with a filename extension of “.trs”. The version numbers in the filename vary with each update. Since there are two possibilities for updating, the names of the files are significant. You will either update only the instrument’s firmware or you will update both the firmware and the operating system. Filenames starting with SMF\_..... contain images for the instrument’s firmware only, while filenames starting with RESCUE\_..... contain images for updating the firmware and the operating system.

### NOTICE



Drivers and programs used in the instrument under Linux have been adapted to the signal generator. Existing software must only be modified with update software released by Rohde & Schwarz. Likewise, only programs authorized by Rohde & Schwarz for use on the instrument must be executed

## Installation of New R&S SMF Firmware

Your R&S SMF100A 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 SMF homepage (<http://www.rohde-schwarz.com>). 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 “SMF\_” and ending in “.trs”. The version numbers in the filename vary with each update.

### Note:

*In addition, a file with ending “.iso” is provided. It contains a full image of the instrument firmware and operating system. It can be used e.g. to create a spare CompactFlash™ card (see following section).*

Firmware update: SMF\_x.xx.xx.trs

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 during instrument’s boot sequence. The new firmware will be loaded right after the update process; a reboot of the instrument is not necessary.

If the instrument “sees” a memory stick at its USB interface during boot sequence, it offers all versions stored on the memory stick (\*.trs files) for selection. Thus, an upgrade or downgrade of the firmware is possible at any time.

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Installing the firmware

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**Note:** The update process can be cancelled at any time during the update process before step 5 (below).

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1. Switch off the instrument.
2. Plug in the memory stick which contains the update file(s) (previously downloaded from the Internet) to the USB interface of the instrument.
3. Switch on the instrument.
4. Wait until the selection menu for the available firmware version(s) appears.
5. Select the firmware version to be installed with the cursor up/down keys and press ENTER to activate your selection. A 'Yes/No' question will appear. When you selected 'Yes' the selected version will be installed.
6. At the first start of the new firmware check if an update of the PCI-FPGA is required. This is reported during the boot process. A PCI-FPGA update is started in the **Setup-System-Update** menu by pressing the **PCI-FPGA** button.

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**NOTICE**

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

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7. When the new/updated firmware is up and running, execute internal adjustments after a warm-up 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.

## Using an Image for the Installation of New Linux Operating System and R&S SMF Firmware

A full image of the current firmware and operating system is provided on the Internet at the download site of the Rohde & Schwarz SMF homepage.

The image is delivered in one single file with a file ending ".iso". The version numbers in the filename vary with each update.

### Required equipment

External USB CD ROM or DVD Drive.

### Required software:

A Burn program that can burn ISO images onto CD/DVD. Examples: **Nero Burning, Win on CD**

### Prepare CD Rom or DVD with full image of R&S SMF100A:

1. Download the image file from the Internet to a PC
2. Start Nero on your PC.
3. From the program menu, select **File -> Burn CD image**.
4. Specify file type "all files" (\*.\*)
5. Select the ISO image file to be burned (\*.iso).
6. Confirm the checkbox indicating that Nero does not recognize the format of the image file.
7. When the dialog appears, set the parameters specified above.
8. Click "burn".

### Install the new firmware on the CompactFlash™ card

1. Switch off the instrument
2. Connect an external USB CD or DVD drive to the R&S SMF100A.
3. Insert the CD Rom or DVD with full image into the external drive.
4. Switch on the instrument  
The CD or DVD boots the instrument and automatically executes the installation steps (approx. 5 min). The program informs about the installation progress.
5. Wait until the installation is finished.
6. Remove external CD ROM/DVD drive.
7. Reboot the Instrument.  
The new firmware is now loaded on the instrument.
8. Execute internal adjustments after a warm-up 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 will 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 SMF100A options is provided in the data sheet and on the internet (<http://www.rohde-schwarz.com>).

### 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**

Disconnect the instrument from the mains before opening the casing. Also note the safety instructions at the beginning of this manual.

**NOTICE****Risk of damage to the instrument**

The components used in the instrument are sensitive to electrostatic discharges which is why they are to be dealt with according to the ESD regulations.

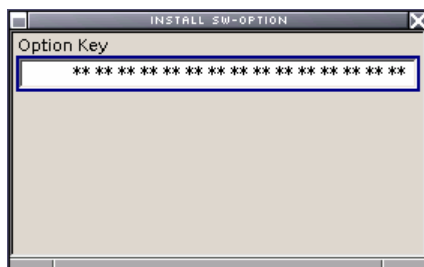
The **[SETUP] Installed Options** menu provides information on the already installed options.

### 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 SMF100A 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**.....5.1

**Spare Parts**.....5.1

**Available Power Cables** .....5.2



## 5 Documents

This chapter provides information on the ordering of spare parts and contains the spare part list and the documents for the complete R&S SMF100A unit.

### 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<br>complying with<br>IEC 83: 1975 standard B2                                                                    | Great Britain               |
| DS 0006.7020.00                    | Type 12, 10 A, 250 V<br>complying with<br>SEV-regulation 1011.1059,<br>standard sheet S 24 507                                             | Switzerland                 |
| DS 0006.7036.00                    | Type 498/13, 10 A, 250 V<br>complying with<br>US-regulation UL 498, or with IEC 83                                                         | USA/Canada                  |
| DS 0041.4752.00                    | GB2099, GB1002, 10 A, 250 V<br>approvals CCC                                                                                               | China                       |
| DS 0041.6232.00                    | JIS C 8303, 7A, 125 V AC<br>approvals PSE (JET)                                                                                            | Japan                       |
| DS 0006.7107.00                    | Type SAA3, 10 A, 250 V,<br>complying with AS C112-1964 Ap.                                                                                 | Australia                   |
| DS 0025.2365.00<br>DS 0099.1456.00 | DIN 49 441, 10 A, 250 V, angular<br>DIN 49 441, 10 A, 250 V, straight<br>approvals VDE, ÖVE, CEBEC, KEMA,<br>S, D, N, FI, LCIE, IMQ, UCIEE | Europe (except Switzerland) |

## Spare Parts List

## Mechanical Drawings

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**Note:**



*The designation "2nd GENERATION RF MODULES" in the spare parts lists, circuit diagrams, and mechanical drawings is valid for signal generators R&S SMF100A from series 101 001.*

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| Pos.-Nr.<br>ItemNo                                                       | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des.                                                                        | Benennung / Bezeichnung<br>Designation                                                                                          | Z               | Sachnummer<br>Stock No.                        | Ersatzteil<br>Subst.part | BA                    | VH |
|--------------------------------------------------------------------------|-------------------|------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------------------|--------------------------|-----------------------|----|
|                                                                          |                   |            |                                                                                             | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |                 |                                                |                          |                       |    |
| 5                                                                        | 0                 | S          |                                                                                             | PB BEMERKUNG<br>NOTE<br>Diese Ersatzteilliste gilt fur SMF100A,<br>SMF-B122, SMF-B144                                           |                 | 0999.9610.00                                   |                          | B                     | O  |
| 20                                                                       | .02               | S          |                                                                                             | ED INTERFACE BOARD<br>INTERFACE BOARD                                                                                           | Z               | 1167.1206.02                                   |                          | M                     |    |
| 30                                                                       | .02               | S          |                                                                                             | EE MOTHERBOARD<br>MOTHERBOARD                                                                                                   | Z               | 1167.1606.02                                   |                          | M                     |    |
| 40                                                                       | .02               | S          |                                                                                             | ED BNC BOARD<br>BNC BOARD                                                                                                       | Z               | 1167.1270.02                                   |                          | M                     |    |
| 50                                                                       | .02               | S          |                                                                                             | ED MW-INTERFACE<br>MW-INTERFACE                                                                                                 | Z               | 1167.1135.02                                   |                          | M                     |    |
| 60                                                                       | .02               | S          |                                                                                             | GR LPC6/1L+<br>CONTROLLER LPC6/1L+                                                                                              | Z               | 1091.3127.00                                   |                          | B                     | V  |
| 70                                                                       | .02               | S          |                                                                                             | EE FREQUENCY SYNTHESIS<br>FREQUENCY SYNTHESIS                                                                                   | Z               | 1167.0800.02                                   |                          | M                     |    |
| 72                                                                       | .02               | S          |                                                                                             | EE FREQUENCY SYNTHESIS<br>FREQUENCY SYNTHESIS                                                                                   | Z               | 1167.0800.04                                   |                          | M                     |    |
| 75                                                                       | .01               | S          |                                                                                             | EE FREQUENCY SYNTHESIS<br>FREQUENCY SYNTHESIS<br>SMF-B22                                                                        | Z               | 1167.0800.06                                   |                          | M                     |    |
| 80                                                                       | .02               | S          |                                                                                             | EE DOWN CONVERTER<br>DOWN CONVERTER<br>SMF-B2                                                                                   | Z               | 1167.4105.02                                   |                          | M                     | M  |
| 90                                                                       | .02               | S          |                                                                                             | EE ALC/DDS UNIT<br>ALC/DDS UNIT                                                                                                 | Z               | 1167.1006.02                                   |                          | M                     |    |
| 95                                                                       | .02               | S          |                                                                                             | EE MODULATIONSBOARD<br>MODULATIONS-BOARD<br>SMF-B20                                                                             | Z               | 1167.9788.02                                   |                          | M                     |    |
| 100                                                                      | .02               | S          |                                                                                             | ED TMO ADAPTER<br>TMO ADAPTER                                                                                                   | Z               | 1167.2054.02                                   |                          | M                     |    |
| 105                                                                      | .02               | S          |                                                                                             | ZE YIG OSZI. 3-11 GHZ<br>YIG OSZI. 3-11 GHZ<br>Ersatz für<br>1167.2054.00                                                       | Z               | 1306.6000.02                                   |                          | M                     |    |
| 110                                                                      | .02               | S          |                                                                                             | ED TMO CONTROL UNIT<br>TMO CONTROL UNIT                                                                                         | Z               | 1167.1993.02                                   |                          | M                     | M  |
| 120                                                                      | .02               | S          |                                                                                             | ZE DMA MODUL UNIT<br>DMA MODUL UNIT                                                                                             | Z               | 1167.2502.02                                   |                          | M                     |    |
| 130                                                                      | .02               | S          |                                                                                             | ZE SWITCHED FILTER 22<br>SWITCHED FILTER 22<br>SMF-B122/SMF-B144<br>SMF100A S/N<101001                                          | Z               | 1301.6001.02                                   |                          | M                     |    |
| 135                                                                      | .02               | S          |                                                                                             | ZE SWITCHED FILTER 22-2<br>SWITCHED FILTER 22-2<br>SMF-B122/SMF-B144<br>SMF100A S/N>=101001                                     | Z               | 1310.2505.02                                   |                          | M                     |    |
| 140                                                                      | .02               | S          |                                                                                             | ER RICHTKOPPLER 1-22GHZ<br>DIRECTIONAL COUPLER                                                                                  |                 | 1167.8869.00                                   |                          | B                     | O  |
| <div><div><div></div><div></div></div><div>ROHDE&amp;SCHWARZ</div></div> |                   |            | Benennung/Designation<br>ERSATZTEILLISTE SMF100A + OPTIONEN<br>SPAREPARTS SMF100A + OPTIONS |                                                                                                                                 |                 | Sprach./Lang<br>de en                          | Ä.I. / C.I<br>07.00      | Blatt/Sheet<br>1 of 5 |    |
|                                                                          |                   |            |                                                                                             |                                                                                                                                 |                 | Dokument Nr. / Document No.<br>1167.0039.01 ST |                          |                       |    |
| SMA100A                                                                  |                   |            | Datum/<br>Date                                                                              | 2009-03-10                                                                                                                      | Abt. /<br>Dept. | 1GPK                                           | Name /<br>Name           | MS                    |    |

| Pos.-Nr.<br>ItemNo                                                                                             | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des.                                                                                      | Benennung / Bezeichnung<br>Designation                                                                                      | Z               | Sachnummer<br>Stock No.                               | Ersatzteil<br>Subst.part | BA                   | VH                    |
|----------------------------------------------------------------------------------------------------------------|-------------------|------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------|--------------------------|----------------------|-----------------------|
| 142                                                                                                            | .02               | S          |                                                                                                           | SMF-B122<br>SMF100A S/N<101001<br><br>ER RICHTKOPPLER 1-44GHZ 10DB<br>DIRECTIONAL COUPLER<br>SMF-B144<br>SMF100A S/N<101001 |                 | 1167.8898.00                                          |                          | B                    | B                     |
| 144                                                                                                            | .02               | S          |                                                                                                           | ER RICHTKOPPLER 1-44GHZ 10DB<br>DIRECTIONAL COUPLER<br>SMF-B144<br>SMF100A S/N>=101001                                      |                 | 1167.8898.00                                          |                          | B                    | B                     |
| 150                                                                                                            | .02               | S          |                                                                                                           | ZE DETECTOR 44 GHZ<br>DETECTOR 44 GHZ                                                                                       | Z               | 1167.0339.02                                          |                          | M                    |                       |
| 160                                                                                                            | .02               | S          |                                                                                                           | ZE FREQUENCY DOUBLER<br>FREQUENCY DOUBLER<br>SMF-B144<br>SMF100A S/N<101001                                                 | Z               | 1301.8010.02                                          |                          | M                    |                       |
| 165                                                                                                            | .02               | S          |                                                                                                           | ZE FREQUENCY DOUBLER 44<br>FREQUENCY DOUBLER 44<br>SMF-B144<br>SMF100A S/N>=101001                                          | Z               | 1310.3001.02                                          |                          | M                    |                       |
| 180                                                                                                            | .02               | S          |                                                                                                           | ZE NETZTEIL + KABEL<br>POWER SUPPLY + CABLE                                                                                 | Z               | 1167.2031.00                                          |                          | M                    |                       |
| 190                                                                                                            | .02               | S          |                                                                                                           | SF SILIKONMATTE 44T SMF<br>PUSH-BUTTON BOARD SET                                                                            |                 | 1167.0739.00                                          |                          | B                    | V                     |
| 200                                                                                                            | .02               | S          |                                                                                                           | SF SCHALTFOLE SMF<br>FLEX. SWITCH BOARD                                                                                     |                 | 1167.0745.00                                          |                          | B                    | O                     |
| 210                                                                                                            | .02               | S          |                                                                                                           | BP TFT 6.5 VGA DRGB CCFL<br>TFT DISPLAY                                                                                     |                 | 0041.6932.00                                          |                          | B                    | V                     |
| 220                                                                                                            | .02               | S          |                                                                                                           | EM DREHIMP.4 (MIT TASTE)<br>ROTARY PULS-GENERATOR                                                                           |                 | 0852.2730.00                                          |                          | B                    | V                     |
| 230                                                                                                            | .02               | S          |                                                                                                           | ED FRONT PANEL CONTR.<br>FRONT PANEL CONTR.                                                                                 | Z               | 1167.1341.02                                          |                          | M                    |                       |
| 240                                                                                                            | .02               | S          |                                                                                                           | KR FRONTHAUBE SMF BEDR<br>FRONT COVER SMF                                                                                   | Z               | 1167.0700.00                                          |                          | M                    | O                     |
| 250                                                                                                            | .02               | S          |                                                                                                           | EV 119X119X25 47L/S 12V<br>FAN 119X119X25                                                                                   |                 | 3584.1607.00                                          |                          | B                    | O                     |
| 260                                                                                                            | .02               | S          |                                                                                                           | DX LUEFTER 80X80X25 MIT KABEL<br>BLOWER 80X80X25 WITH CABLE                                                                 | Z               | 1167.0922.00                                          |                          | M                    |                       |
| 270                                                                                                            | .02               | S          |                                                                                                           | GP COMPACTFLASH 256MB TOSHIBA<br>256MB COMPACT FLASH CARD                                                                   |                 | 2095.8788.00                                          |                          | B                    | A                     |
| 280                                                                                                            | .02               | S          |                                                                                                           | GE 3.0V 230MAH LI-MNO2 CR2032<br>LITHIUM BATTERY CR2032                                                                     |                 | 0858.2049.00                                          |                          | B                    | V                     |
| 400                                                                                                            | .02               | S          |                                                                                                           | DW HF KABEL W101 22GHZ REAR<br>RF CABLE W101 22GHZ REAR<br>SMF-B81<br>SMF100A S/N<101001                                    | Z               | 1167.2902.00                                          |                          | M                    |                       |
| 410                                                                                                            | .02               | S          |                                                                                                           | DW HF KABEL W100<br>RF CABLE W100<br>SMF-B26<br>SMF100A S/N<101001                                                          | Z               | 1167.2954.00                                          |                          | M                    |                       |
| 420                                                                                                            | .02               | S          |                                                                                                           | DW HF KABEL W720<br>RF CABLE W720<br>SMF-B26<br>SMF100A S/N<101001                                                          | Z               | 1167.3638.00                                          |                          | M                    |                       |
| 430                                                                                                            | .02               | S          |                                                                                                           | DW HF KABEL W802                                                                                                            | Z               | 1167.3750.00                                          |                          | M                    |                       |
|  <b>ROHDE &amp; SCHWARZ</b> |                   |            | Benennung/Designation<br><b>ERSATZTEILLISTE SMF100A + OPTIONEN</b><br><b>SPAREPARTS SMF100A + OPTIONS</b> |                                                                                                                             |                 | Sprach./Lang<br>de en                                 |                          | Ä.I. / C.I.<br>07.00 | Blatt/Sheet<br>2 of 5 |
|                                                                                                                |                   |            |                                                                                                           |                                                                                                                             |                 | Dokument Nr. / Document No.<br><b>1167.0039.01 ST</b> |                          |                      |                       |
| SMA100A                                                                                                        |                   |            | Datum/<br>Date                                                                                            | 2009-03-10                                                                                                                  | Abt. /<br>Dept. | 1GPK                                                  | Name /<br>Name           | MS                   |                       |

| Pos.-Nr.<br>ItemNo                                                       | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des.                                                                        | Benennung / Bezeichnung<br>Designation                                          | Z               | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA                  | VH                                             |  |
|--------------------------------------------------------------------------|-------------------|------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------|-------------------------|--------------------------|---------------------|------------------------------------------------|--|
|                                                                          |                   |            |                                                                                             | RF CABLE W802<br>SMF-B122<br>SMF100A S/N<101001                                 |                 |                         |                          |                     |                                                |  |
| 440                                                                      | .02               | S          |                                                                                             | DW HF KABEL W784<br>RF CABLE W784<br>SMF-B31<br>SMF100A S/N<101001              | Z               | 1167.3967.00            |                          | M                   |                                                |  |
| 450                                                                      | .02               | S          |                                                                                             | DW HF-KABEL W762<br>RF CABLE W762<br>SMF-B31<br>SMF100A S/N<101001              | Z               | 1167.3696.00            |                          | M                   |                                                |  |
| 460                                                                      | .02               | S          |                                                                                             | DW HF KABEL W763<br>RF CABLE W763<br>SMF-B31<br>SMF100A S/N<101001              | Z               | 1167.3709.00            |                          | M                   |                                                |  |
| 470                                                                      | .02               | S          |                                                                                             | DW HF KABEL W782<br>RF CABLE W782<br>SMF-B122<br>SMF100A S/N<101001             | Z               | 1167.3738.00            |                          | M                   |                                                |  |
| 490                                                                      | .02               | S          |                                                                                             | DW HF KABEL W742<br>RF CABLE W742<br>SMF-B144<br>SMF100A S/N<101001             | Z               | 1167.3621.00            |                          | M                   |                                                |  |
| 500                                                                      | .02               | S          |                                                                                             | DW HF HF-KABEL W783<br>RF CABLE W783<br>SMF-B2<br>SMF100A S/N<101001            | Z               | 1167.3744.00            |                          | M                   |                                                |  |
| 510                                                                      | .02               | S          |                                                                                             | DW HF-KABEL W644<br>RF CABLE W644<br>SMF-B122<br>SMF100A S/N<101001             | Z               | 1167.3521.00            |                          | M                   |                                                |  |
| 520                                                                      | .02               | S          |                                                                                             | ZE SCHALTER DC-44<br>SWITCH DC-44<br>SMF-B144<br>SMF100A S/N<101001             | Z               | 1301.7008.02            |                          | M                   |                                                |  |
| 525                                                                      | .02               | S          |                                                                                             | ZE SUBHARMONICS FILTER<br>SUBHARMONICS FILTER<br>SMF-B144<br>SMF100A S/N<101001 | Z               | 1167.1670.02            |                          | M                   |                                                |  |
| 530                                                                      | .02               | S          |                                                                                             | DW HF KABEL W803<br>RF CABLE W803<br>SMF-B144                                   | Z               | 1167.3773.00            |                          | M                   |                                                |  |
| 540                                                                      | 1                 | S          |                                                                                             | DW HF KABEL W742<br>RF CABLE W742<br>SMF-B144<br>SMF100A S/N<101001             | Z               | 1167.3621.00            |                          | M                   |                                                |  |
| 550                                                                      | 1                 | S          |                                                                                             | DW HF KABEL W101 44GHZ<br>RF CABLE W101 44GHZ<br>SMF-B144<br>SMF100A S/N<101001 | Z               | 1167.2983.00            |                          | M                   |                                                |  |
| 560                                                                      | 1                 | S          |                                                                                             | DW HF KABEL W644 44GHZ<br>RF CABLE W644 44GHZ<br>SMF-B144<br>SMF100A S/N<101001 | Z               | 1167.3538.00            |                          | M                   |                                                |  |
| 570                                                                      | 1                 | S          |                                                                                             | DW HF HF-KABEL W783<br>RF CABLE W783<br>SMF-B2<br>SMF100A S/N<101001            | Z               | 1167.3744.00            |                          | M                   |                                                |  |
| 580                                                                      | 1                 | S          |                                                                                             | DW HF KABEL W802 44GHZ<br>RF CABLE W802 44GHZ                                   | Z               | 1167.3780.00            |                          | M                   |                                                |  |
| <div><div><div></div><div></div></div><div>ROHDE&amp;SCHWARZ</div></div> |                   |            | Benennung/Designation<br>ERSATZTEILLISTE SMF100A + OPTIONEN<br>SPAREPARTS SMF100A + OPTIONS |                                                                                 |                 | Sprach./Lang<br>de en   |                          | Ä.I. / C.I<br>07.00 | Blatt/Sheet<br>3 of 5                          |  |
| SMA100A                                                                  |                   |            | Datum/<br>Date                                                                              | 2009-03-10                                                                      | Abt. /<br>Dept. | 1GPK                    | Name /<br>Name           | MS                  | Dokument Nr. / Document No.<br>1167.0039.01 ST |  |

| Pos.-Nr.<br>ItemNo                                                                                                     | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des.                                               | Benennung / Bezeichnung<br>Designation                                               | Z               | Sachnummer<br>Stock No.                               | Ersatzteil<br>Subst.part | BA          | VH |
|------------------------------------------------------------------------------------------------------------------------|-------------------|------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------|--------------------------|-------------|----|
| 700                                                                                                                    | .02               | S          |                                                                    | SMF-B144<br>SMF100A S/N<101001                                                       |                 |                                                       |                          |             |    |
|                                                                                                                        |                   |            |                                                                    | ZM HIGH POWER AMP. 22<br>HIGH POWER AMP. 22<br>SMF-B31<br>SMF100A S/N<101001         | Z               | 1301.4009.02                                          |                          | M           |    |
| 710                                                                                                                    | .02               | S          |                                                                    | ZE HIGH POWER AMP 22-2<br>HIGH POWER AMP 22-2<br>SMF-B32<br>SMF100A S/N>=101001      | Z               | 1310.2011.03                                          |                          | M           |    |
| 720                                                                                                                    | .02               | S          |                                                                    | ZE HIGH POWER AMP 22-2<br>HIGH POWER AMP 22-2<br>SMF-B34<br>SMF100A S/N>=101001      | Z               | 1310.2011.02                                          |                          | M           |    |
| 730                                                                                                                    | .02               | S          |                                                                    | ED IEC-BUS<br>IEC-BUS<br>SMF-B83                                                     | Z               | 1167.6437.02                                          |                          | M           |    |
| 740                                                                                                                    | .02               | S          |                                                                    | EE USB BOARD<br>USB BOARD<br>SMF-B84                                                 | Z               | 1167.6637.02                                          |                          | M           | M  |
| 750                                                                                                                    | .02               | S          |                                                                    | EE FLASH CARD BOARD<br>FLASH CARD BOARD<br>SMF-B85                                   | Z               | 1167.6843.02                                          |                          | M           | M  |
| 760                                                                                                                    | .02               | S          |                                                                    | ED OCXO REF. OSCILLATOR<br>OCXO REF. OSCILLATOR<br>SMF-B1                            | Z               | 1167.9188.02                                          |                          | M           |    |
| 770                                                                                                                    | .02               | S          |                                                                    | ED LOW NOISE OCXO<br>LOW NOISE OCXO<br>SMF-B22                                       | Z               | 1167.9188.04                                          |                          | M           |    |
| 800                                                                                                                    | .02               | S          |                                                                    | DW HF KABEL W802_2<br>RF CABLE W802_2<br>SMF-B122/SMF-B144<br>SMF100A S/N>=101001    | Z               | 1167.1293.00                                          |                          | M           |    |
| 810                                                                                                                    | .02               | S          |                                                                    | DW HF KABEL W782_2<br>RF CABLE W782_2<br>SMF-B122/SMF-B144<br>SMF100A S/N>=101001    | Z               | 1167.1306.00                                          |                          | M           |    |
| 820                                                                                                                    | .02               | S          |                                                                    | DW HF-KABEL W762_2<br>RF CABLE W762_2<br>SMF-B32/SMF-B34<br>SMF100A S/N>=101001      | Z               | 1167.1312.00                                          |                          | M           |    |
| 830                                                                                                                    | .02               | S          |                                                                    | DW HF KABEL W784_2<br>RF CABLE W784_2<br>SMF-B32/SMF-B34<br>SMF100A S/N>=101001      | Z               | 1167.1329.00                                          |                          | M           |    |
| 840                                                                                                                    | .02               | S          |                                                                    | DW HF KABEL W743_2<br>RF CABLE W743_2<br>SMF-B144<br>SMF100A S/N>=101001             | Z               | 1167.3467.00                                          |                          | M           |    |
| 850                                                                                                                    | .02               | S          |                                                                    | DW HF KABEL W742_2 44GHZ<br>RF CABLE W742_2 44GHZ<br>SMF-B144<br>SMF100A S/N>=101001 | Z               | 1167.3944.00                                          |                          | M           |    |
| 870                                                                                                                    | .02               | S          |                                                                    | DW HF KABEL W763_2<br>RF CABLE W763_2<br>SMF-B32/SMF-B34<br>SMF100A S/N>=101001      | Z               | 1167.3473.00                                          |                          | M           |    |
| 880                                                                                                                    | .02               | S          |                                                                    | DW HF KABEL W727_2<br>RF CABLE W727_2                                                | Z               | 1167.3950.00                                          |                          | M           |    |
| <div><b>ROHDE&amp;SCHWARZ</b></div> |                   |            | Benennung/Designation                                              |                                                                                      |                 | Sprach./Lang                                          | Ä.I. / C.I               | Blatt/Sheet |    |
|                                                                                                                        |                   |            | ERSATZTEILLISTE SMF100A + OPTIONEN<br>SPAREPARTS SMF100A + OPTIONS |                                                                                      |                 | de en                                                 | 07.00                    | 4 of 5      |    |
| SMA100A                                                                                                                |                   |            | Datum/<br>Date                                                     | 2009-03-10                                                                           | Abt. /<br>Dept. | 1GPK                                                  | Name /<br>Name           | MS          |    |
|                                                                                                                        |                   |            |                                                                    |                                                                                      |                 | Dokument Nr. / Document No.<br><b>1167.0039.01 ST</b> |                          |             |    |

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**ROHM**



| Pos.-Nr.<br>ItemNo                                                                                                      | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des.                                              | Benennung / Bezeichnung<br>Designation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Z               | Sachnummer<br>Stock No.                               | Ersatzteil<br>Subst.part | BA          | VH |
|-------------------------------------------------------------------------------------------------------------------------|-------------------|------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------|--------------------------|-------------|----|
| 10                                                                                                                      | 0                 | S          |                                                                   | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL<br><br>PB BEMERKUNG<br>NOTE<br>Die Montage der Optionen SMF -B1,<br>SMF-B2, SMF-B26, SMF-B31, SMF-B81,<br>SMF-B83, SMF-B84, SMF-B85 und SMF-<br>B122 ist in der jew. zugeh. Optionszeichnung<br>dargestellt.<br>The mounting instruction of the options<br>SMF-B1, SMF-B2, SMF-B26, SMF-B31,<br>SMF-B81, SMF-B83, SMF-B84, SMF-B85<br>and SMF-B122 has show on the respective<br>option drawings |                 | 0999.9610.00                                          |                          | B           | O  |
| 20                                                                                                                      | 0                 | S          |                                                                   | PB ERSATZTEILLISTE VORHANDEN<br>SPARE PARTS LIST AVAILABLE<br>ZS ERSATZTEILLISTE VORHANDEN<br>SPARE PARTS LIST AVAILABLE<br>Sachnr./Part No. 1167.0039.01                                                                                                                                                                                                                                                                                                                                                                        |                 | 0999.9684.00                                          |                          | M           | O  |
| 200                                                                                                                     | 1                 | S          |                                                                   | ZM CHASSIS<br>CHASSIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Z               | 1167.0174.02                                          |                          | M           | O  |
| 250                                                                                                                     | 1                 | S          | A100                                                              | ZM FRONTEINHEIT SMF<br>FRONT PANEL UNIT SMF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Z               | 1167.0500.02                                          |                          | M           |    |
| 260                                                                                                                     | 6                 | S          |                                                                   | VS 965/ISR-M2.5X6-A4-PA<br>965/ISR-M2.5X6-A4-PA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 1148.3288.00                                          |                          | B           | T  |
| 300                                                                                                                     | 1                 | S          | A900                                                              | ZE POWER SUPPLY UNIT<br>POWER SUPPLY UNIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Z               | 1167.0416.02                                          |                          | M           |    |
| 310                                                                                                                     | 6                 | S          |                                                                   | VS 7985/ISR-M4X6-A4-PA<br>SCREW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 1148.2646.00                                          |                          | B           | T  |
| 315                                                                                                                     | 1                 | S          |                                                                   | DZ FLBDK.HALTER 14/13<br>DZ FLAT CABLE HOLDER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | 0254.2055.00                                          |                          | B           | O  |
| 320                                                                                                                     | 1                 | S          |                                                                   | MZ STUEZWINKEL<br>HOLDER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Z               | 1167.1887.00                                          |                          | M           |    |
| 330                                                                                                                     | 2                 | S          |                                                                   | VS 7985/ISR-M2.5X6-A4-PA<br>SCREW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | 1143.5630.00                                          |                          | B           | T  |
| 340                                                                                                                     | 1                 | S          |                                                                   | KR RUECKWANDBLENDE (BEDR.)<br>REAR PLATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Z               | 1167.0380.00                                          |                          | M           |    |
| 350                                                                                                                     | 2                 | S          |                                                                   | VS 6900/ISR-M2.5X8-A2<br>COMBINATION SCREWS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | 0041.1653.00                                          |                          | B           | T  |
| 400                                                                                                                     | 1                 | S          | A400                                                              | EE FREQUENCY SYNTHESIS<br>FREQUENCY SYNTHESIS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Z               | 1167.0800.04                                          | X                        | M           |    |
| 500                                                                                                                     | 1                 | S          | A500                                                              | EE ALC/DDS UNIT<br>ALC/DDS UNIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Z               | 1167.1006.02                                          |                          | M           |    |
| 600                                                                                                                     | 1                 | S          | A200                                                              | ED INTERFACE BOARD<br>INTERFACE BOARD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Z               | 1167.1206.02                                          | X                        | M           |    |
| 610                                                                                                                     | 14                | S          |                                                                   | VS 6900/ISR-M2.5X6-A2<br>COMBINATION SCREWS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | 1148.3059.00                                          |                          | B           | T  |
| 611                                                                                                                     | 6                 | S          |                                                                   | VS 6900/ISR-M2.5X8-A2<br>COMBINATION SCREWS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | 0041.1653.00                                          |                          | B           | T  |
| 615                                                                                                                     | 1                 | S          | E1                                                                | EV 119X119X25 47L/S 12V<br>FAN 119X119X25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 3584.1607.00                                          | X                        | B           | O  |
| <div></div> <b>ROHDE&amp;SCHWARZ</b> |                   |            | Benennung/Designation                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Sprach./Lang                                          | Ä.I. / C.I               | Blatt/Sheet |    |
|                                                                                                                         |                   |            | <b>SMF100A SIGNALGENERATOR</b><br><b>SMF100A SIGNAL GENERATOR</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | de en                                                 | 15.00                    | 1 of 5      |    |
| SMF                                                                                                                     |                   |            | Datum/<br>Date                                                    | 2009-01-23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Abt. /<br>Dept. | 1GPK                                                  | Name /<br>Name           | DR          |    |
|                                                                                                                         |                   |            |                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Dokument Nr. / Document No.<br><b>1167.0000.01 ST</b> |                          |             |    |

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| Pos.-Nr.<br><i>ItemNo</i> | Menge<br><i>Quantity</i> | ME<br><i>Unit</i> | El.Kennz<br><i>Ref.Des.</i> | Benennung / Bezeichnung<br><i>Designation</i>                                                      | Z          | Sachnummer<br><i>Stock No.</i>                        | Ersatzteil<br><i>Subst.part</i> | BA                    | VH |
|---------------------------|--------------------------|-------------------|-----------------------------|----------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------|---------------------------------|-----------------------|----|
| 2110                      | 1                        | S                 |                             | OS BW2-SCHILD F RUECKWAND<br>BW2 LABEL F. REAR PANEL FOOT                                          |            | 1096.2435.00                                          |                                 | M                     | O  |
| 2120                      | 20                       | S                 |                             | DZ KABELBI.RD 1 BIS 25 B2<br>CABLETIE                                                              |            | 0015.9038.00                                          |                                 | B                     | O  |
| 3010                      | 1                        | S                 |                             | HS SOFTWARE SMF (.ISO IMAGE)<br>SOFTWARE SMF (.ISO IMAGE)                                          | Z          | 1167.2783.00                                          |                                 | M                     |    |
| 3020                      | 1                        | S                 |                             | HS FONT MICROSOFT ARIAL WGL<br>FONT MICROSOFT ARIAL WGL                                            |            | 3584.9795.00                                          |                                 | B                     | O  |
|                           |                          |                   |                             |                                                                                                    |            |                                                       |                                 |                       |    |
|                           |                          |                   |                             | Benennung/ <i>Designation</i><br><b>SMF100A SIGNALGENERATOR</b><br><b>SMF100A SIGNAL GENERATOR</b> |            | Sprach./Lang<br>de en                                 | Ä.I. / C./<br>15.00             | Blatt/Sheet<br>5 of 5 |    |
| SMF                       |                          |                   |                             | Datum/<br><i>Date</i>                                                                              | 2009-01-23 | Abt. /<br><i>Dept.</i>                                | 1GPK                            | Name /<br><i>Name</i> | DR |
|                           |                          |                   |                             |                                                                                                    |            | Dokument Nr. / Document No.<br><b>1167.0000.01 ST</b> |                                 |                       |    |

| Pos.-Nr.<br>ItemNo | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des. | Benennung / Bezeichnung<br>Designation                                                                                         | Z | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA | VH |
|--------------------|-------------------|------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------|---|-------------------------|--------------------------|----|----|
|                    |                   |            |                      | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLÄRUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |   |                         |                          |    |    |
| 20                 | 1                 | S          |                      | MZ MONTAGEWANNE 1<br>MOUNTING TROUGH                                                                                           | Z | 1167.0522.00            |                          | M  | O  |
| 30                 | 1                 | S          |                      | MF FRAESWANNE SMF<br>COVER SMF                                                                                                 | Z | 0284.3866.00            |                          | M  | O  |
| 40                 | 1                 | S          |                      | MZ MONTAGEWANNE 2<br>MOUNTING TROUGH                                                                                           | Z | 1167.0539.00            |                          | M  | O  |
| 50                 | 6                 | S          |                      | VS 965/ISR-M2.5X6- A4<br>965/ISR-M2.5X6- A4                                                                                    |   | 4060.5362.00            |                          | B  | V  |
| 60                 | 2                 | S          |                      | MZ DICHTUNGSFEDER L=142.2<br>SEALING SPRING L=142.2                                                                            | Z | 1167.0774.00            |                          | M  |    |
| 70                 | 2                 | S          |                      | MZ DICHTUNGSFEDER L=84.35<br>SEALING SPRING L=84.35                                                                            | Z | 1167.0780.00            |                          | M  |    |
| 80                 | 1                 | S          |                      | MM SCHUTZKRAGEN 9.6X13.9<br>SHROUD                                                                                             |   | 0852.1234.00            |                          | B  | O  |
| 90                 | 1                 | S          |                      | SF SILIKONMATTE 44T SMF<br>PUSH-BUTTON BOARD SET                                                                               |   | 1167.0739.00            |                          | B  | V  |
| 100                | 1                 | S          | A120                 | SF SCHALTFOLE SMF<br>FLEX. SWITCH BOARD                                                                                        |   | 1167.0745.00            |                          | B  | O  |
| 110                | 1                 | S          |                      | MZ TASTATURHALTEBLECH 1<br>KEY HOLDING PLATE                                                                                   |   | 1167.0545.00            |                          | M  | O  |
| 120                | 2                 | S          |                      | VS 965/ISR-M2.5X5-A4- PA<br>SCREW                                                                                              |   | 1148.2752.00            |                          | B  | T  |
| 130                | 1                 | S          |                      | MZ TASTATURHALTEBLECH 2<br>KEY HOLDING PLATE                                                                                   | Z | 1167.0551.00            |                          | M  | O  |
| 140                | 6                 | S          |                      | VS 965/ISR-M2.5X5-A4- PA<br>SCREW                                                                                              |   | 1148.2752.00            |                          | B  | T  |
| 150                | 1                 | S          |                      | OP FILTERSCHEIBE SMF<br>SCREENED FILTER GLASS                                                                                  |   | 1167.0768.00            |                          | B  | V  |
| 160                | 1                 | S          |                      | MZ STAUBABDICHTUNG<br>POWDER SEAL                                                                                              |   | 1300.3321.00            |                          | M  |    |
| 170                | 1                 | S          | A110                 | BP TFT 6.5 VGA DRGB CCFL<br>TFT DISPLAY                                                                                        |   | 0041.6932.00            |                          | B  | T  |
| 180                | 4                 | S          |                      | VS SCHRAUBE F.DG 2.5X6<br>DIE CAST SCREW 2.5X6                                                                                 |   | 1300.4457.00            |                          | B  | O  |
| 190                | 1                 | S          |                      | MZ HALTEWINKEL<br>HOLDING BRACKET                                                                                              | Z | 1167.0568.00            |                          | M  | O  |
| 200                | 1                 | S          |                      | VS SCHRAUBE F.DG 2.5X6<br>DIE CAST SCREW 2.5X6                                                                                 |   | 1300.4457.00            |                          | B  | O  |
| 210                | 2                 | S          |                      | VS 6900/ISR-M2.5X6- A2<br>COMBINATION SCREWS                                                                                   |   | 1148.3059.00            |                          | B  | T  |
| 220                | 1                 | S          |                      | GR DISPL.VERB.FMR6- SHARP<br>DISPL.CONNECT FMR6-SHARP<br>Kabellänge 600                                                        |   | 1091.2743.00            |                          | B  | V  |
| 230                | 2                 | S          |                      | VS 6900/ISR-M2.5X6- A2<br>COMBINATION SCREWS                                                                                   |   | 1148.3059.00            |                          | B  | T  |



**ROHDE & SCHWARZ**

Benennung / Designation  
**FRONT-EINHEIT SMF**  
**FRONT PANEL UNIT SMF**

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**1167.0500.01 ST**

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| Pos.-Nr.<br>ItemNo                                                                                                     | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des.                                        | Benennung / Bezeichnung<br>Designation                                                                                          | Z               | Sachnummer<br>Stock No.      | Ersatzteil<br>Subst.part | BA                         | VH                                                    |  |
|------------------------------------------------------------------------------------------------------------------------|-------------------|------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------|--------------------------|----------------------------|-------------------------------------------------------|--|
|                                                                                                                        |                   |            |                                                             | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |                 |                              |                          |                            |                                                       |  |
| 20                                                                                                                     | 1                 | S          |                                                             | MZ HALTEBLECH<br>HOLDER                                                                                                         | Z               | 1167.0216.00                 |                          | M                          | O                                                     |  |
| 30                                                                                                                     | 1                 | S          | W823                                                        | DY KABEL W823<br>CABEL W823                                                                                                     | Z               | 1167.2025.00                 |                          | M                          | O                                                     |  |
| 40                                                                                                                     | 1                 | S          | A821                                                        | ED TMO CONTROL UNIT<br>TMO CONTROL UNIT                                                                                         | Z               | 1167.1993.02                 |                          | M                          | M                                                     |  |
| 45                                                                                                                     | 5                 | S          |                                                             | VS 6900/ISR-M2.5X6-A2<br>COMBINATION SCREWS                                                                                     |                 | 1148.3059.00                 |                          | B                          | T                                                     |  |
| 46                                                                                                                     | 1                 | S          |                                                             | VS 6900/ISR-M2.5X8-A2<br>COMBINATION SCREWS                                                                                     |                 | 0041.1653.00                 |                          | B                          | T                                                     |  |
| 60                                                                                                                     | 4                 | S          |                                                             | VS ZYL6-32UNCX 1/4ZOLL A2<br>SCREW                                                                                              |                 | 0531.6605.00                 |                          | B                          | V                                                     |  |
| 100                                                                                                                    | .3                | S          | A822                                                        | ED TMO ADAPTER<br>TMO ADAPTER                                                                                                   | Z               | 1167.2054.02                 |                          | M                          |                                                       |  |
| 110                                                                                                                    | .7                | S          | A822                                                        | ZE YIG OSZI. 3-11 GHZ<br>YIG OSZI. 3-11 GHZ<br>ab 2Q/2008 bevorzugt<br>verwenden, wenn<br>Funktion zuverlaessig.                | Z               | 1306.6000.02                 |                          | M                          |                                                       |  |
| <div><b>ROHDE&amp;SCHWARZ</b></div> |                   |            | Benennung/Designation<br><b>TMO UNIT</b><br><b>TMO UNIT</b> |                                                                                                                                 |                 | Sprach./Lang<br><b>de en</b> |                          | Ä.I. / C.I<br><b>06.00</b> | Blatt/Sheet<br><b>1 of 1</b>                          |  |
| SMF100A                                                                                                                |                   |            | Datum/<br>Date                                              | 2007-11-28                                                                                                                      | Abt. /<br>Dept. | 1GPK                         | Name /<br>Name           | DR                         | Dokument Nr. / Document No.<br><b>1167.1987.01 ST</b> |  |



| Pos.-Nr.<br><i>ItemNo</i>                                                                                      | Menge<br><i>Quantity</i> | ME<br><i>Unit</i> | El.Kennz<br><i>Ref.Des.</i>                                                   | Benennung / Bezeichnung<br><i>Designation</i>                                                                                  | Z               | Sachnummer<br><i>Stock No.</i>                        | Ersatzteil<br><i>Subst.part</i> | BA                  | VH                    |
|----------------------------------------------------------------------------------------------------------------|--------------------------|-------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------|---------------------------------|---------------------|-----------------------|
|                                                                                                                |                          |                   |                                                                               | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLÄRUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |                 |                                                       |                                 |                     |                       |
| 20                                                                                                             | 1                        | S                 |                                                                               | MZ NETZTEILBLECH<br>POWER SUPPLY PANEL                                                                                         | Z               | 1167.0222.00                                          |                                 | M                   |                       |
| 30                                                                                                             | 1                        | S                 |                                                                               | MZ NETZTEIL SCHIRM. OBEN<br>SCREENING OFF TOP                                                                                  | Z               | 1167.0439.00                                          |                                 | M                   | O                     |
| 40                                                                                                             | 1                        | S                 |                                                                               | MZ NETZTEIL SCHIRM. UNTEN<br>SCREENING OFF BOTTOM                                                                              | Z               | 1167.0422.00                                          |                                 | M                   | O                     |
| 50                                                                                                             | 1                        | S                 | E2                                                                            | DX LUEFTER 80X80X25 MIT KABEL<br>BLOWER 80X80X25 WITH CABLE                                                                    | Z               | 1167.0922.00                                          | X                               | M                   |                       |
| 60                                                                                                             | 4                        | S                 |                                                                               | EV GUMMISTIFT F. LUE.BEF.<br>RUBBER PIN                                                                                        |                 | 1146.2161.00                                          |                                 | B                   | T                     |
| 70                                                                                                             | 1                        | S                 | A910                                                                          | ZE NETZTEIL + KABEL<br>POWER SUPPLY + CABLE                                                                                    | Z               | 1167.2031.00                                          | X                               | M                   |                       |
| 80                                                                                                             | 1                        | S                 | W903                                                                          | DY DY KABEL W903<br>DY CABLE W903                                                                                              | Z               | 1167.3873.00                                          |                                 | M                   |                       |
| 90                                                                                                             | 4                        | S                 |                                                                               | VS 7985/ISR-M4X6-A4-PA<br>SCREW                                                                                                |                 | 1148.2646.00                                          |                                 | B                   | T                     |
|  <b>ROHDE &amp; SCHWARZ</b> |                          |                   | Benennung/Designation<br><b>POWER SUPPLY UNIT</b><br><b>POWER SUPPLY UNIT</b> |                                                                                                                                |                 | Sprach./Lang<br>de en                                 |                                 | Ä.I. / C.I<br>07.00 | Blatt/Sheet<br>1 of 1 |
|                                                                                                                |                          |                   |                                                                               |                                                                                                                                |                 | Dokument Nr. / Document No.<br><b>1167.0416.01 ST</b> |                                 |                     |                       |
|                                                                                                                |                          |                   | Datum/<br>Date                                                                | 2007-02-02                                                                                                                     | Abt. /<br>Dept. | 1GPK                                                  | Name /<br>Name                  | MS                  |                       |

| Pos.-Nr.<br><i>ItemNo</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Menge<br><i>Quantity</i> | ME<br><i>Unit</i> | El.Kennz<br><i>Ref.Des.</i>                                                                              | Benennung / Bezeichnung<br><i>Designation</i>                                                                                  | Z                     | Sachnummer<br><i>Stock No.</i>                               | Ersatzteil<br><i>Subst.part</i> | BA                          | VH                             |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                          |                   |                                                                                                          | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLÄRUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |                       |                                                              |                                 |                             |                                |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                        | S                 | A575                                                                                                     | ED OCXO REF. OSCILLATOR<br>OCXO REF. OSCILLATOR                                                                                | Z                     | 1167.9188.02                                                 |                                 | M                           |                                |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
| 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                        | S                 |                                                                                                          | MZ HALTEWINKEL FUER OCXO<br>HOLDER                                                                                             | Z                     | 1167.0445.00                                                 |                                 | M                           | O                              |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
| 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4                        | S                 |                                                                                                          | EV GUMMISTIFT F. LUE.BEF.<br>RUBBER PIN                                                                                        |                       | 1146.2161.00                                                 |                                 | B                           | T                              |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
| 60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                        | S                 |                                                                                                          | VS 6900/ISR-M2.5X6- A2<br>COMBINATION SCREWS                                                                                   |                       | 1148.3059.00                                                 |                                 | B                           | T                              |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
| 70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                        | S                 | W575                                                                                                     | DY KABEL W575<br>CABLE W575                                                                                                    | Z                     | 1167.3450.00                                                 |                                 | M                           |                                |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
| <table> <tr> <td colspan="3" rowspan="2">  <b>ROHDE&amp;SCHWARZ</b> </td><td colspan="3" rowspan="2"> Benennung / <i>Designation</i><br/> <b>SMF-B1 REFERENZOSZILLATOR</b><br/> <b>SMF-B1 REFERENCE OSCILLATOR</b> </td><td colspan="2"> Sprach. / <i>Lang</i><br/> de en </td><td> Ä.I. / <i>C. /</i><br/> 03.00 </td><td> Blatt / <i>Sheet</i><br/> 1 of 1 </td></tr> <tr> <td colspan="4"> Dokument Nr. / <i>Document No.</i><br/> <b>1167.9159.01 ST</b> </td></tr> </table> |                          |                   |                                                                                                          |                                                                                                                                |                       |                                                              |                                 |                             |                                |  <b>ROHDE&amp;SCHWARZ</b> |  |  | Benennung / <i>Designation</i><br><b>SMF-B1 REFERENZOSZILLATOR</b><br><b>SMF-B1 REFERENCE OSCILLATOR</b> |  |  | Sprach. / <i>Lang</i><br>de en |  | Ä.I. / <i>C. /</i><br>03.00 | Blatt / <i>Sheet</i><br>1 of 1 | Dokument Nr. / <i>Document No.</i><br><b>1167.9159.01 ST</b> |  |  |  |
|  <b>ROHDE&amp;SCHWARZ</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                          |                   | Benennung / <i>Designation</i><br><b>SMF-B1 REFERENZOSZILLATOR</b><br><b>SMF-B1 REFERENCE OSCILLATOR</b> |                                                                                                                                |                       | Sprach. / <i>Lang</i><br>de en                               |                                 | Ä.I. / <i>C. /</i><br>03.00 | Blatt / <i>Sheet</i><br>1 of 1 |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                          |                   |                                                                                                          |                                                                                                                                |                       | Dokument Nr. / <i>Document No.</i><br><b>1167.9159.01 ST</b> |                                 |                             |                                |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |
| SMF-B1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                          |                   | Datum / <i>Date</i> 2007-01-22                                                                           | Abt. / <i>Dept.</i> 1GPK                                                                                                       | Name / <i>Name</i> DR |                                                              |                                 |                             |                                |                                                                                                              |  |  |                                                                                                          |  |  |                                |  |                             |                                |                                                              |  |  |  |

| Pos.-Nr.<br>ItemNo | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des. | Benennung / Bezeichnung<br>Designation                                                                                          | Z | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA | VH |
|--------------------|-------------------|------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------|---|-------------------------|--------------------------|----|----|
|                    |                   |            |                      | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |   |                         |                          |    |    |
| 20                 | 1                 | S          | A450                 | EE DOWN CONVERTER<br>DOWN CONVERTER                                                                                             | Z | 1167.4105.02            |                          | M  | M  |
| 100                | 1                 | S          | W454                 | DV KABEL W454<br>CABLE W454                                                                                                     | Z | 1167.3215.00            |                          | M  |    |
| 110                | 1                 | S          | W409                 | DV KABEL W409<br>CABLE W409                                                                                                     | Z | 1167.3167.00            |                          | M  |    |
| 120                | 1                 | S          | W455                 | DV KABEL W455<br>CABLE W455                                                                                                     | Z | 1167.3221.00            |                          | M  |    |
| 130                | 1                 | S          | A640                 | ZE SCHALTER DC-44<br>SWITCH DC-44                                                                                               | Z | 1301.7008.02            |                          | M  |    |
| 140                | 1                 | S          |                      | OS EINLEGESCHILD 100KHZ...22GHZ                                                                                                 | Z | 1167.1787.00            |                          | M  |    |
| 150                | 1                 | S          |                      | OS EINLEGESCHILD 100KHZ...44GHZ                                                                                                 | Z | 1167.1793.00            |                          | M  |    |
| 160                | 1                 | S          | W783                 | DW HF HF-KABEL W783<br>RF CABLE W783                                                                                            | Z | 1167.3744.00            |                          | M  |    |
| 170                | 1                 | S          | W644                 | DW HF-KABEL W644<br>RF CABLE W644                                                                                               | Z | 1167.3521.00            |                          | M  |    |
| 180                | 1                 | S          |                      | DY KABEL W640<br>CABLE W640                                                                                                     | Z | 1167.3496.00            |                          | M  |    |
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| Pos.-Nr.<br>ItemNo | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des. | Benennung / Bezeichnung<br>Designation                                                                                          | Z | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA | VH |
|--------------------|-------------------|------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------|---|-------------------------|--------------------------|----|----|
|                    |                   |            |                      | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |   |                         |                          |    |    |
| 100                | 1                 | S          | W720                 | DW HF Kabel W720 44 GHZ<br>RF Cable W720 44 GHZ<br>only VAR 02 SMF- B144                                                        | Z | 1167.5847.00            |                          | M  |    |
| 110                | 1                 | S          | W100                 | DW HF Kabel W100 44GHZ<br>RF Cable W100 44GHZ<br>only VAR 02 SMF- B144                                                          | Z | 1167.2960.00            |                          | M  |    |
| 115                | 1                 | S          | W100                 | DW HF KABEL W100_2 44GHZ<br>RF CABLE W100_2 44GHZ<br>only VAR 03 SMF- B144                                                      | Z | 1167.3973.00            |                          | M  |    |
| 120                | 1                 | S          |                      | MZ BODENPLATTE EICHLEIT.<br>ATTENUATOR PANEL<br>only VAR 02 SMF- B144                                                           | Z | 1167.4657.00            |                          | M  | O  |
| 125                | 1                 | S          |                      | MZ EICHLEITUNG HALTER_2<br>ATTENUATOR PANEL<br>only VAR 03 SMF- B144                                                            | Z | 1167.7279.00            |                          | M  |    |
| 130                | 1                 | S          |                      | ZE EICHLEITUNG SMF 110DB<br>ATTENUATOR SMF 110DB                                                                                | Z | 1046.5101.04            |                          | M  |    |
| 140                | 2                 | S          |                      | VS 7985/ISR-M3X6-A4-PA<br>SCREW                                                                                                 |   | 1148.2630.00            |                          | B  | O  |
| 150                | 2                 | S          |                      | VS 6900/ISR-M2.5X5-A2<br>COMBINATION SCREWS                                                                                     |   | 0041.1630.00            |                          | B  | T  |
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| Pos.-Nr.<br>ItemNo | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des. | Benennung / Bezeichnung<br>Designation                                                                                                                                                 | Z | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA | VH |
|--------------------|-------------------|------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------|--------------------------|----|----|
|                    |                   |            |                      | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL<br>VAR03=OHNE DCON SWITCH<br>MOD03=WITHOUT DCON SWITCH |   |                         |                          |    |    |
| 110                | 1                 | S          | A760                 | ZE HIGH POWER AMP 22-2<br>HIGH POWER AMP 22-2                                                                                                                                          | Z | 1310.2011.03            |                          | M  |    |
| 115                | 4                 | S          |                      | VS HVC/ISR-M2.5X12-A2<br>COMBINATION SCREWS                                                                                                                                            |   | 1096.5205.00            |                          | B  | B  |
| 120                | 4                 | S          |                      | VS 6900/ISR-M2.5X8-A2<br>COMBINATION SCREWS                                                                                                                                            |   | 0041.1653.00            |                          | B  | T  |
| 130                | 1                 | S          | W762                 | DW HF-KABEL W762_2<br>RF CABLE W762_2<br>ONLY SMF-B122                                                                                                                                 | Z | 1167.1312.00            |                          | M  |    |
| 140                | 1                 | S          | W763                 | DW HF KABEL W763_2<br>RF CABLE W763_2<br>ONLY SMF-B144                                                                                                                                 | Z | 1167.3473.00            |                          | M  |    |
| 150                | 1                 | S          | W760                 | DY KABEL W760<br>CABLE W760                                                                                                                                                            | Z | 1167.3673.00            |                          | M  |    |
| 160                | 1                 | S          | W784                 | DW HF KABEL W784_2<br>RF CABLE W784_2                                                                                                                                                  | Z | 1167.1329.00            |                          | M  |    |
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| Pos.-Nr.<br>ItemNo | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des. | Benennung / Bezeichnung<br>Designation                                                                                          | Z | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA | VH |
|--------------------|-------------------|------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------|---|-------------------------|--------------------------|----|----|
|                    |                   |            |                      | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |   |                         |                          |    |    |
| 100                | 1                 | S          | A760                 | ZE HIGH POWER AMP 22-2<br>HIGH POWER AMP 22-2<br>Montage siehe<br>1415.2304.01 D                                                | Z | 1310.2011.02            |                          | M  |    |
| 115                | 4                 | S          |                      | VS HVC/ISR-M2.5X12-A2<br>COMBINATION SCREWS                                                                                     |   | 1096.5205.00            |                          | B  | B  |
| 120                | 4                 | S          |                      | VS 6900/ISR-M2.5X8-A2<br>COMBINATION SCREWS                                                                                     |   | 0041.1653.00            |                          | B  | T  |
| 130                | 1                 | S          | W762                 | DW HF-KABEL W762_2<br>RF CABLE W762_2<br>ONLY SMF-B122                                                                          | Z | 1167.1312.00            |                          | M  |    |
| 140                | 1                 | S          | W763                 | DW HF KABEL W763_2<br>RF CABLE W763_2<br>ONLY SMF-B144                                                                          | Z | 1167.3473.00            |                          | M  |    |
| 150                | 1                 | S          | W760                 | DY KABEL W760<br>CABLE W760                                                                                                     | Z | 1167.3673.00            |                          | M  |    |
| 160                | 1                 | S          | W784                 | DW HF KABEL W784_2<br>RF CABLE W784_2                                                                                           | Z | 1167.1329.00            |                          | M  |    |
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| Pos.-Nr.<br>ItemNo | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des. | Benennung / Bezeichnung<br>Designation                                                                                                                                                                                                                             | Z | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA | VH |
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| 10                 | 0                 | S          | A170                 | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL<br><br>PB BEMERKUNG<br>NOTE<br>Pos. 50 entfällt bei werkseitigem Einbau<br>Item 50 missing because already assembled<br>in factory |   | 0999.9610.00            |                          | B  | O  |
| 20                 | 1                 | S          |                      | ED IEC-BUS<br>IEC-BUS                                                                                                                                                                                                                                              | Z | 1167.6437.02            |                          | M  |    |
| 40                 | 1                 | S          |                      | VS 965/ISR-M2.5X4-A4-PA<br>965/ISR-M2.5X4-A4-PA                                                                                                                                                                                                                    |   | 1148.3271.00            |                          | B  | T  |
| 50                 | 1                 | S          |                      | PD MONTAGEANWEISUNG SMF-B83<br>MOUNTING INSTRUCTION SMF-B83                                                                                                                                                                                                        |   | 1167.6420.00            |                          | M  |    |
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| Pos.-Nr.<br>ItemNo                                                                                                     | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des.                                                                                | Benennung / Bezeichnung<br>Designation                                                                                                                                                                                                                              | Z               | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA                  | VH                                                    |  |
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| 10                                                                                                                     | 0                 | S          | A190                                                                                                | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL<br><br>PB BEMERKUNG<br>NOTE<br>Pos 160 entfällt bei werkseitigem Einbau<br>Item 160 missing because already assembled<br>in factory |                 | 0999.9610.00            |                          | B                   | O                                                     |  |
| 20                                                                                                                     | 1                 | S          |                                                                                                     | EE FLASH CARD BOARD<br>FLASH CARD BOARD                                                                                                                                                                                                                             | Z               | 1167.6843.02            |                          | M                   | M                                                     |  |
| 30                                                                                                                     | 1                 | S          |                                                                                                     | MZ BLENDEHALTER CF<br>HOLDER CF                                                                                                                                                                                                                                     | Z               | 1167.6872.00            |                          | M                   |                                                       |  |
| 40                                                                                                                     | 2                 | S          |                                                                                                     | VS 7985/ISR-M2.5X8-A4-PA<br>7985/ISR-M2.5X8-A4-PA                                                                                                                                                                                                                   |                 | 1148.2730.00            |                          | B                   | T                                                     |  |
| 50                                                                                                                     | 1                 | S          |                                                                                                     | KB BLENDE CF BEDRUCKT<br>PANEL CF PRINTED                                                                                                                                                                                                                           | Z               | 1167.6920.00            |                          | M                   |                                                       |  |
| 60                                                                                                                     | 2                 | S          |                                                                                                     | VS 965/ISR-M2.5X4-A4-PA<br>965/ISR-M2.5X4-A4-PA                                                                                                                                                                                                                     |                 | 1148.3271.00            |                          | B                   | T                                                     |  |
| 70                                                                                                                     | 1                 | S          |                                                                                                     | MZ Klappe CF + SCHRAUBE<br>LID CF + SCREW                                                                                                                                                                                                                           | Z               | 1167.6914.00            |                          | M                   |                                                       |  |
| 100                                                                                                                    | 1                 | S          |                                                                                                     | EE CF ADAPTER AN LPC<br>CF ADAPTER TO LPC                                                                                                                                                                                                                           | Z               | 1405.2101.02            |                          | M                   | O                                                     |  |
| 110                                                                                                                    | 1                 | S          |                                                                                                     | KM LP-FUEHRUNG<br>GUIDE RAIL F_CIRC BOAR                                                                                                                                                                                                                            | Z               | 1405.2176.00            |                          | B                   | O                                                     |  |
| 120                                                                                                                    | 2                 | S          |                                                                                                     | VS 6900/ISR-M2.5X5-A2<br>COMBINATION SCREWS                                                                                                                                                                                                                         |                 | 0041.1630.00            |                          | B                   | T                                                     |  |
| 130                                                                                                                    | 1                 | S          | W190                                                                                                | ZN SICHERUNGSBUEGEL F. CF-BOARD<br>PANEL FOR CF BOARD                                                                                                                                                                                                               | Z               | 1405.2318.00            |                          | M                   |                                                       |  |
| 140                                                                                                                    | 1                 | S          |                                                                                                     | DY CABLE FLASH-CARD<br>CABLE FLASH-CARD                                                                                                                                                                                                                             | Z               | 1167.2919.00            |                          | M                   |                                                       |  |
| 150                                                                                                                    | .06               | M          |                                                                                                     | WT KTSCH.PROF PE NATUR<br>KTSCH.PROF PE NATUR                                                                                                                                                                                                                       |                 | 0001.9447.00            |                          | B                   | O                                                     |  |
| 160                                                                                                                    | 1                 | S          |                                                                                                     | PB MONTAGEANWEISUNG SMF-B85<br>MOUNTING INSTRUCTION SMF-B85                                                                                                                                                                                                         |                 | 1167.6814.00            |                          | M                   |                                                       |  |
| <div><b>ROHDE&amp;SCHWARZ</b></div> |                   |            | Benennung/Designation<br><b>SMF-B85 REMOVABLE-FLASH-CARD</b><br><b>SMF-B85 REMOVABLE FLASH CARD</b> |                                                                                                                                                                                                                                                                     |                 | Sprach./Lang<br>de en   |                          | Ä.I. / C.I<br>06.00 | Blatt/Sheet<br>1 of 1                                 |  |
| SMF-B85                                                                                                                |                   |            | Datum/<br>Date                                                                                      | 2007-05-23                                                                                                                                                                                                                                                          | Abt. /<br>Dept. | 1GPK                    | Name /<br>Name           | MS                  | Dokument Nr. / Document No.<br><b>1167.6808.01 ST</b> |  |

| Pos.-Nr.<br>ItemNo | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des. | Benennung / Bezeichnung<br>Designation                                                                                          | Z | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA | VH |
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|                    |                   |            |                      | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL |   |                         |                          |    |    |
| 30                 | 1                 | S          | A720                 | ER RICHTKOPPLER 1-22GHZ<br>DIRECTIONAL COUPLER                                                                                  |   | 1167.8869.00            |                          | B  | O  |
| 35                 | 2                 | S          |                      | VS DIN137-A3-A2<br>WAVE SPRING WASHER DIN 137-A3                                                                                |   | 0005.0296.00            |                          | B  | V  |
| 40                 | 2                 | S          |                      | VS ZYL4-40UNCX 1/4ZOLL A1<br>SCREW                                                                                              |   | 0275.5830.00            |                          | B  | B  |
| 100                | 1                 | S          | X1A                  | FJ TESTPORT GEH.ADAPTER<br>ADAPTOR                                                                                              |   | 1021.0493.00            |                          | B  | O  |
| 110                | 1                 | S          | X1B                  | FJ TESTPORT-ADAPT.F.PC3.5<br>ADAPTER RPC-3.5 FEMALE                                                                             |   | 1021.0512.00            |                          | B  | O  |
| 120                | 1                 | S          |                      | OS EINLEGESCHILD 1 GHZ...22GHZ<br>LABEL 1 GHZ...22GHZ                                                                           | Z | 1167.1764.00            |                          | M  |    |
| 130                | 1                 | S          | W101                 | DW HF KABEL W101<br>RF CABLE W101                                                                                               | Z | 1167.2977.00            |                          | M  |    |
| 140                | 1                 | S          | W782                 | DW HF Kabel W782<br>RF Cable W782                                                                                               | Z | 1167.3738.00            |                          | M  |    |
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|                    |                   |            |                      |                                                                                                                                 |   |                         |                          |    |    |

| Pos.-Nr.<br>ItemNo                                                                                                                    | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des.                                                               | Benennung / Bezeichnung<br>Designation                                                                                                                                                                | Z               | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part | BA                  | VH                                             |  |
|---------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------|--------------------------|---------------------|------------------------------------------------|--|
|                                                                                                                                       |                   |            |                                                                                    | ACHTUNG EGB/ATTENTION ESD<br><br>*VARIANTENERKLAERUNG<br>*EXPLANATION OF MODELS<br><br>VAR02=GRUNDVARIANTE<br>MOD02=BASIC MODEL<br>VAR03=2ND GENERATION RF MODULES<br>MOD03=2ND GENERATION RF MODULES |                 |                         |                          |                     |                                                |  |
| 40                                                                                                                                    | 1                 | S          |                                                                                    | MZ EICHL.-RICHTKOPPLER BLECH<br>STEP ATTENUATOR-COUPLER PANEL<br>VAR 03                                                                                                                               | Z               | 1167.7256.00            |                          | M                   |                                                |  |
| 42                                                                                                                                    | 4                 | S          |                                                                                    | VS DIN9021-B3.2-A4<br>PLAIN WASHER DIN 9021-B3.2<br>VAR 03                                                                                                                                            |                 | 0031.5185.00            |                          | B                   | O                                              |  |
| 44                                                                                                                                    | 4                 | S          |                                                                                    | VS 6900/ISR-M2.5X8-A2<br>COMBINATION SCREWS<br>VAR 03                                                                                                                                                 |                 | 0041.1653.00            |                          | B                   | T                                              |  |
| 50                                                                                                                                    | 1                 | S          | X1A                                                                                | FJ GEHAEUSE-ADAPTER<br>TESTPORT-ADAPTOR                                                                                                                                                               |                 | 1036.4702.00            |                          | B                   | O                                              |  |
| 70                                                                                                                                    | 1                 | S          | X1B                                                                                | GB FSE-Z5 ADAPTER 2.4 BU<br>FSE-Z5 ADAPTOR<br>X1B<br>ANSCHRAUBEN                                                                                                                                      |                 | 1088.1627.02            |                          | B                   | O                                              |  |
| 100                                                                                                                                   | 1                 | S          | A720                                                                               | ER RICHTKOPPLER 1-44GHZ 10DB<br>DIRECTIONAL COUPLER<br>VAR 02                                                                                                                                         |                 | 1167.8898.00            |                          | B                   | B                                              |  |
| 101                                                                                                                                   | 1                 | S          | A720                                                                               | ER RICHTKOPPLER 1-44GHZ 10DB<br>DIRECTIONAL COUPLER<br>VAR 03                                                                                                                                         |                 | 3585.4839.00            |                          | B                   | B                                              |  |
| 102                                                                                                                                   | 1                 | S          |                                                                                    | MZ RICHTKOPPLER HALTER<br>COUPLER PANEL<br>VAR 03                                                                                                                                                     | Z               | 1167.7262.00            |                          | M                   |                                                |  |
| 103                                                                                                                                   | 2                 | S          |                                                                                    | VS 6900/ISR-M2.5X6-A2<br>COMBINATION SCREWS<br>VAR 03                                                                                                                                                 |                 | 1148.3059.00            |                          | B                   | T                                              |  |
| 104                                                                                                                                   | 2                 | S          |                                                                                    | VS DIN137-A3-A2<br>WAVE SPRING WASHER DIN 137-A3                                                                                                                                                      |                 | 0005.0296.00            |                          | B                   | V                                              |  |
| 105                                                                                                                                   | 2                 | S          |                                                                                    | VS ZYL4-40UNCX 1/4ZOLL A1<br>SCREW                                                                                                                                                                    |                 | 0275.5830.00            |                          | B                   | V                                              |  |
| 110                                                                                                                                   | 1                 | S          | A640                                                                               | ZE SCHALTER DC-44<br>SWITCH DC-44<br>VAR 02                                                                                                                                                           | Z               | 1301.7008.02            |                          | M                   |                                                |  |
| 115                                                                                                                                   | 4                 | S          |                                                                                    | VS 6900/ISR-M2.5X8-A2<br>COMBINATION SCREWS<br>VAR 02                                                                                                                                                 |                 | 0041.1653.00            |                          | B                   | T                                              |  |
| 120                                                                                                                                   | 1                 | S          | A740                                                                               | ZE FREQUENCY DOUBLER<br>FREQUENCY DOUBLER<br>VAR 02                                                                                                                                                   | Z               | 1301.8010.02            |                          | M                   |                                                |  |
| 130                                                                                                                                   | 1                 | S          | A740                                                                               | ZE FREQUENCY DOUBLER 44<br>FREQUENCY DOUBLER 44<br>VAR 03                                                                                                                                             | Z               | 1310.3001.02            |                          | M                   |                                                |  |
| 135                                                                                                                                   | 7                 | S          |                                                                                    | VS 7985/ISR-M3X8-A4-PA<br>7985/ISR-M3X8-A4-PA                                                                                                                                                         |                 | 1148.2875.00            |                          | B                   | O                                              |  |
| 200                                                                                                                                   | 1                 | S          | W640                                                                               | DY KABEL W640<br>CABLE W640<br>VAR 02                                                                                                                                                                 | Z               | 1167.3496.00            |                          | M                   |                                                |  |
| <div><div></div><div>ROHDE&amp;SCHWARZ</div></div> |                   |            | Benennung/Designation<br>SMF-B144 1 GHZ BIS 43.5 GHZ<br>SMF-B144 1 GHZ TO 43.5 GHZ |                                                                                                                                                                                                       |                 | Sprach./Lang<br>de en   |                          | Ä.I. / C.I<br>16.00 | Blatt/Sheet<br>1 of 3                          |  |
| SMF-B144                                                                                                                              |                   |            | Datum/<br>Date                                                                     | 2009-01-16                                                                                                                                                                                            | Abt. /<br>Dept. | 1GPK                    | Name /<br>Name           | DR                  | Dokument Nr. / Document No.<br>1167.7204.01 ST |  |

| Pos.-Nr.<br>ItemNo                                                                                           | Menge<br>Quantity | ME<br>Unit | El.Kennz<br>Ref.Des. | Benennung / Bezeichnung<br>Designation                                                           | Z | Sachnummer<br>Stock No. | Ersatzteil<br>Subst.part                              | BA                  | VH                    |
|--------------------------------------------------------------------------------------------------------------|-------------------|------------|----------------------|--------------------------------------------------------------------------------------------------|---|-------------------------|-------------------------------------------------------|---------------------|-----------------------|
| 210                                                                                                          | 1                 | S          | W740                 | DY KABEL W740<br>CABLE W740                                                                      | Z | 1167.3667.00            |                                                       | M                   |                       |
| 215                                                                                                          | 1                 | S          |                      | DY KABEL W740 V2<br>CABLE W740 V2                                                                | Z | 1167.2890.00            |                                                       | M                   |                       |
| 220                                                                                                          | 1                 | S          | W803                 | DW HF KABEL W803<br>RF CABLE W803                                                                | Z | 1167.3773.00            |                                                       | M                   |                       |
| 230                                                                                                          | 1                 | S          | W742                 | DW HF KABEL W742<br>RF CABLE W742<br>VAR 02                                                      | Z | 1167.3621.00            |                                                       | M                   |                       |
| 235                                                                                                          | 1                 | S          | W742                 | DW HF KABEL W742_2 44GHZ<br>RF CABLE W742_2 44GHZ<br>VAR 03                                      | Z | 1167.3944.00            |                                                       | M                   |                       |
| 240                                                                                                          | 1                 | S          | W101                 | DW HF KABEL W101 44GHZ<br>RF CABLE W101 44GHZ<br>VAR 02                                          | Z | 1167.2983.00            |                                                       | M                   |                       |
| 245                                                                                                          | 1                 | S          | W101                 | DW HF KABEL W101_2 44GHZ<br>RF CABLE W101_2 44GHZ<br>VAR 03                                      | Z | 1167.3850.00            |                                                       | M                   |                       |
| 250                                                                                                          | 1                 | S          | W644                 | DW HF KABEL W644 44GHZ<br>RF CABLE W644 44GHZ<br>VAR 02                                          | Z | 1167.3538.00            |                                                       | M                   |                       |
| 260                                                                                                          | 1                 | S          |                      | OS EINLEGESCHILD 1 GHZ...43.5GHZ<br>LABLE 1 GHZ...43.5GHZ                                        | Z | 1167.1770.00            |                                                       | M                   |                       |
| 270                                                                                                          | 1                 | S          | W783                 | DW HF HF-KABEL W783<br>RF CABLE W783<br>VAR 02                                                   | Z | 1167.3744.00            |                                                       | M                   |                       |
| 280                                                                                                          | 1                 | S          | A745                 | ZE SUBHARMONICS FILTER<br>SUBHARMONICS FILTER<br>VAR 02                                          | Z | 1167.1670.02            |                                                       | M                   |                       |
| 290                                                                                                          | 4                 | S          |                      | VS 7985/ISR-M3X8-A4-PA<br>7985/ISR-M3X8-A4-PA<br>VAR 02                                          |   | 1148.2875.00            |                                                       | B                   | O                     |
| 300                                                                                                          | 1                 | S          |                      | MZ DOUBLER BLECH 44GHZ<br>DOUBLER METAL SHEET 44GHZ                                              | Z | 1167.1912.00            |                                                       | M                   |                       |
| 305                                                                                                          | 1                 | S          |                      | MZ DOUBLER BLECH_2<br>DOUBLER METAL SHEET_2<br>VAR 03                                            | Z | 1167.7310.00            |                                                       | M                   |                       |
| 320                                                                                                          | 4                 | S          |                      | VS 6900/ISR-M2.5X5-A2<br>COMBINATION SCREWS                                                      |   | 0041.1630.00            |                                                       | B                   | T                     |
| 330                                                                                                          | 1                 | S          |                      | ZB ZUBEHOER SMF-B144<br>ACCESSORY SMF-B144                                                       | Z | 1167.7227.00            |                                                       | M                   |                       |
| 340                                                                                                          | 1                 | S          | A780                 | ZE SWITCHED FILTER 22<br>SWITCHED FILTER 22<br>VAR 02                                            | Z | 1301.6001.02            |                                                       | M                   |                       |
| 350                                                                                                          | 1                 | S          | A780                 | ZE SWITCHED FILTER 22-2<br>SWITCHED FILTER 22-2<br>VAR 03                                        | Z | 1310.2505.02            |                                                       | M                   |                       |
| 360                                                                                                          | 4                 | S          |                      | VS 7985/ISR-M2.5X25-A4-PA<br>7985/ISR-M2.5X25-A4-PA                                              |   | 2084.8000.00            |                                                       | B                   | T                     |
| 370                                                                                                          | 1                 | S          | W802                 | DW HF KABEL W802 44GHZ<br>RF CABLE W802 44GHZ<br>VAR 02                                          | Z | 1167.3780.00            |                                                       | M                   |                       |
| 380                                                                                                          | 1                 | S          | W802                 | DW HF KABEL W802_2<br>RF CABLE W802_2<br>VAR 03                                                  | Z | 1167.1293.00            |                                                       | M                   |                       |
|  <b>ROHDE&amp;SCHWARZ</b> |                   |            |                      | Benennung/Designation<br><b>SMF-B144 1 GHZ BIS 43.5 GHZ</b><br><b>SMF-B144 1 GHZ TO 43.5 GHZ</b> |   |                         | Sprach./Lang<br>de en                                 | Ä.I. / C.I<br>16.00 | Blatt/Sheet<br>2 of 3 |
|                                                                                                              |                   |            |                      | Datum/<br>Date 2009-01-16                                                                        |   |                         | Abt. /<br>Dept. 1GPK                                  |                     |                       |
| SMF-B144                                                                                                     |                   |            |                      | Name /<br>Name DR                                                                                |   |                         | Dokument Nr. / Document No.<br><b>1167.7204.01 ST</b> |                     |                       |



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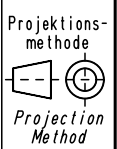
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Montage Reihenfolge:  
mounting order:

1. Pos. 600 Interface Board
2. Pos. 700 Mother Board
3. Pos. 300 Power Supply Unit
4. Pos. 800 BNC Board
5. Pos. 615 Lüfter / FAN
6. Pos. 1810 Detector und \*) Richtkoppler zusammenschrauben vor dem Einbau  
Detector and directional coupler screw together before mounting
7. Pos. 320 Stuetzwinkel /holder
8. Pos. 1290 Adapterwinkel /holder
9. beliebig /in any order

Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.0000.01

The parts/items mentioned in this drawing are included  
in the corresponding parts list 1167.0000.01

VARIANTENERKLAERUNG  
EXPLANATION OF MODELS

VAR02 = GRUNDVARIANTE  
MOD02 = BASIC MODEL

| Modell<br>Model | Skizze<br>Des.           | Werkstoff<br>Material | Sprache / Lang.<br>Lang. / C.I. | Blatt / Stk.<br>Sheet / Pcs. |
|-----------------|--------------------------|-----------------------|---------------------------------|------------------------------|
| ROHDE&SCHWARZ   | SMF100A SIGNAL GENERATOR |                       | de en 04.00                     | 1                            |
| SMF             | 2006-06-24               | 16PK                  | ms/sr                           | 1167.0000.01 D               |



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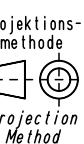
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Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stückliste 1167.0000.01

The parts / items mentioned in this drawing are included  
in the corresponding parts list 1167.6608.01

\*) enthalten in  
SMF-B122  
1167.7004.02

included in  
SMF-B122  
1167.7004.02

\*) enthalten in  
SMF-B122  
1167.7004.02

included in  
SMF-B122  
1167.7004.02

| Modell<br>Type | Bezeichnung<br>Designation | Werkstoff<br>Material | Sprache / Lang.<br>Lang. / C.I. | Blatt / Stk.<br>Sheet / Pcs. |
|----------------|----------------------------|-----------------------|---------------------------------|------------------------------|
| ROHDE&SCHWARZ  | SMF100A SIGNAL GENERATOR   |                       | de en                           | 04.00 2                      |
| SMF            | 2006-06-24                 | 16PK                  | ms/sr                           | 1167.0000.01 D               |

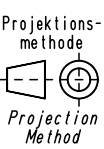
VARIANTENERKLÄRUNG  
EXPLANATION OF MODELS

VAR02 = GRUNDVARIANTE  
MOD02 = BASIC MODEL



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Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stückliste 1167.0000.01

The parts / items in this drawing are included  
in the corresponding parts list 1167.0000.01

VARIANTENERKLÄRUNG  
EXPLANATION OF MODELS  
VAR02 = GRUNDVARIANTE  
MOD02 = BASIC MODEL

| Modell<br>Scale | Zeichnung<br>Fig.                                    | Werkstoff<br>Material   | Sprache / Lang.<br>Lang. / C.I. | Blatt / 26                                 |
|-----------------|------------------------------------------------------|-------------------------|---------------------------------|--------------------------------------------|
| ROHDE&SCHWARZ   | SMF100A SIGNAL GENERATOR<br>SMF100A SIGNAL GENERATOR |                         | de en 05.00                     | 3                                          |
| SMF             | Datum<br>Date 2006-08-05                             | Abteilung<br>Dept. 16PK | Name<br>Name SF                 | Zeichn.Nr. / Drawing No.<br>1167.0000.01 D |



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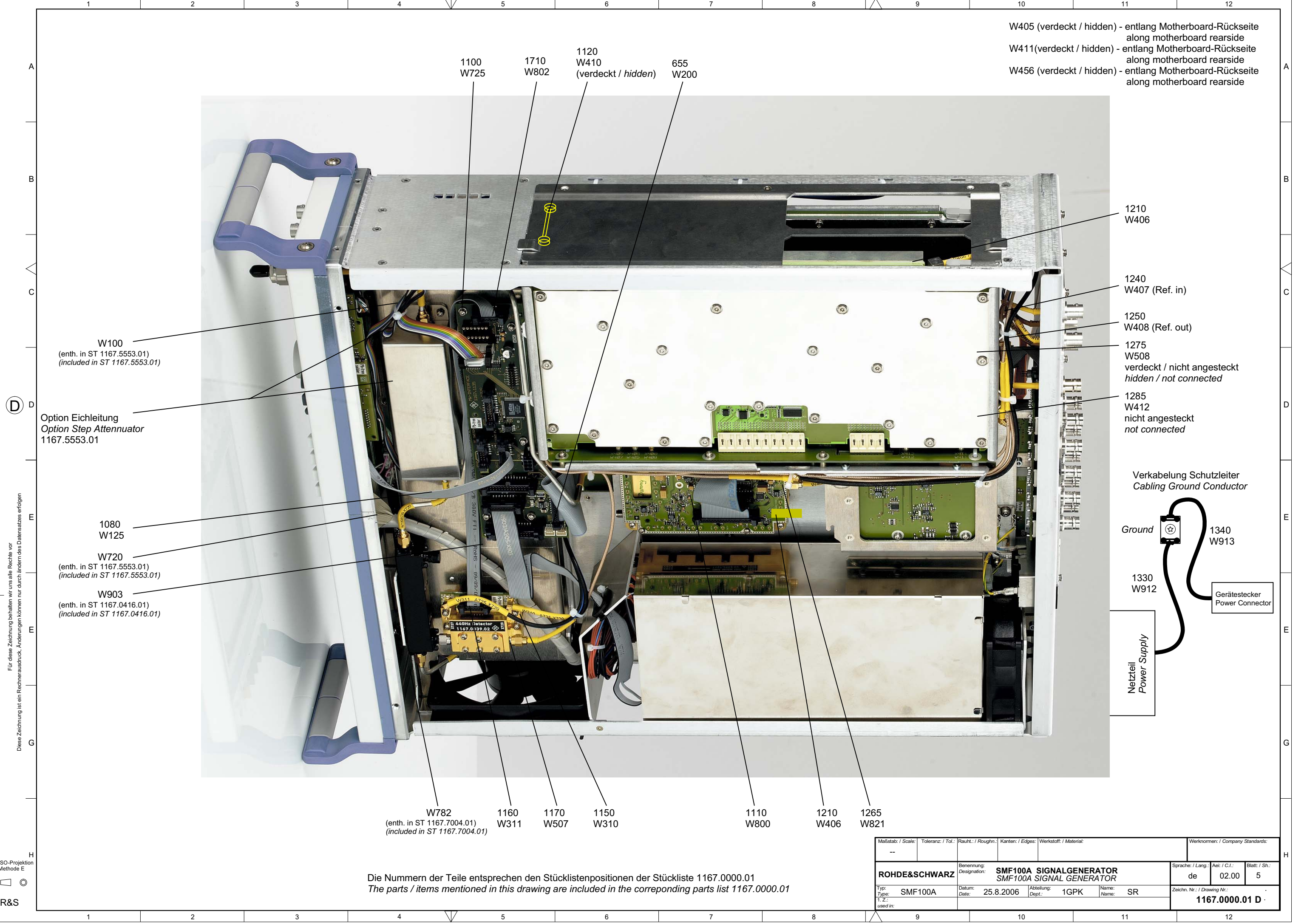
Projektions-  
methode  
Projection  
Method

Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.0000.01  
The parts / items in this drawing are included  
in the corresponding parts list 1167.0000.01

Variantenerklärung  
EXPLANATION OF MODELS  
VAR02 = Grundvariante  
MOD02 = Basic Model

| Position<br>Code | Teil<br>Bezeichnung / Designation | Werkstoff<br>Material | Sprache / Lang. / A1... / C.I. | Blatt / 26 |
|------------------|-----------------------------------|-----------------------|--------------------------------|------------|
| ROHDE&SCHWARZ    | SMF100A SIGNAL GENERATOR          |                       | de en 03.00                    | 4          |
| SMF              | SMF100A SIGNAL GENERATOR          |                       |                                |            |
| 2006-06-24       | 16PK                              | ms/sr                 | 1167.0000.01                   | D          |





W405 (verdeckt / hidden) - entlang Motherboard-Rückseite  
along motherboard rearside  
W411(verdeckt / hidden) - entlang Motherboard-Rückseite  
along motherboard rearside  
W456 (verdeckt / hidden) - entlang Motherboard-Rückseite  
along motherboard rearside

1210  
W406

1240  
W407 (Ref. in)

1250  
W408 (Ref. out)

1275  
W508  
verdeckt / nicht angesteckt  
hidden / not connected

1285  
W412  
nicht angesteckt  
not connected

Verkabelung Schutzleiter  
Cabling Ground Conductor

Ground

1340  
W913

Gerätestecker  
Power Connector

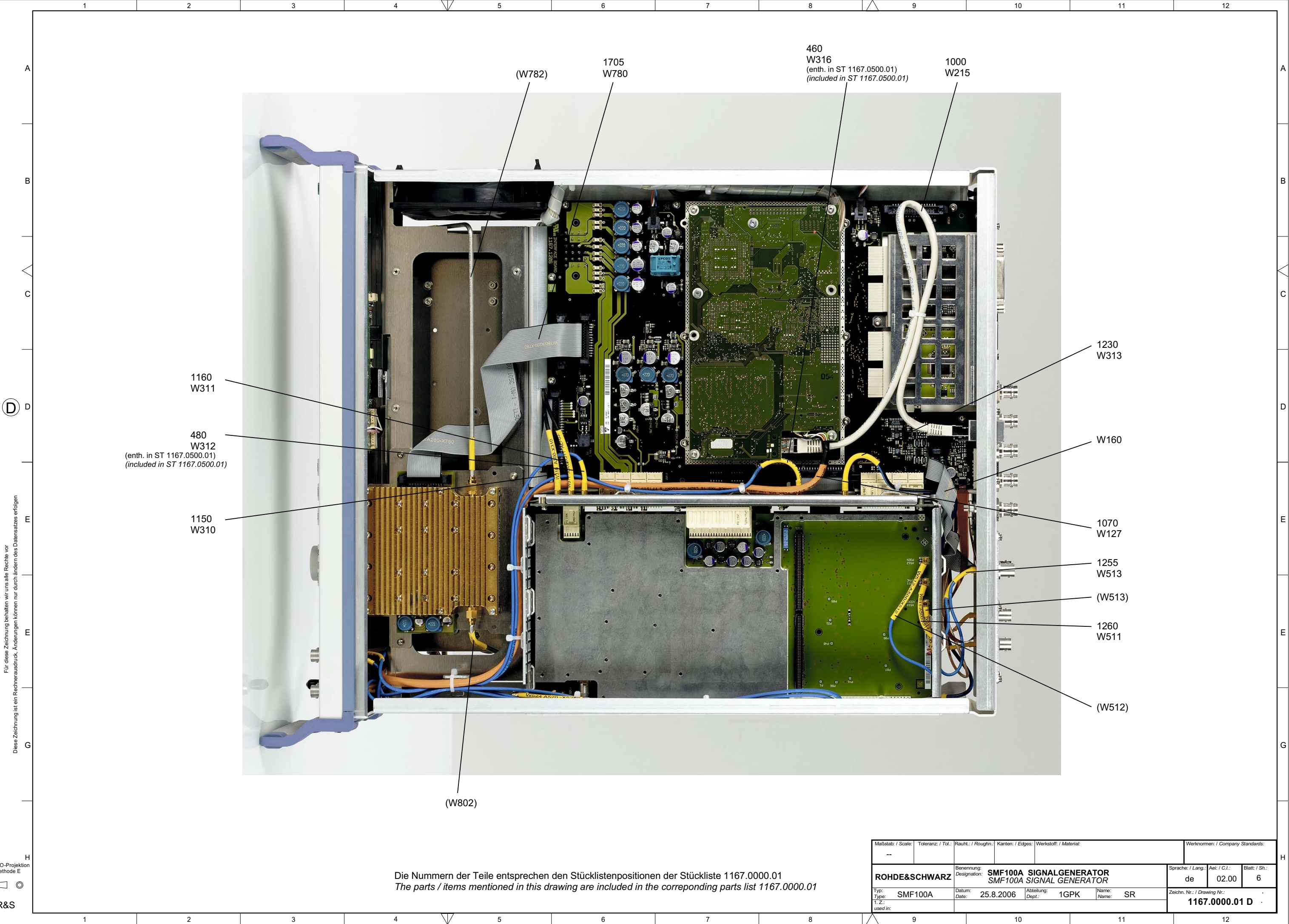
1330  
W912

Netzteil  
Power Supply

Die Nummern der Teile entsprechen den Stücklistenpositionen der Stückliste 1167.0000.01  
The parts / items mentioned in this drawing are included in the correponding parts list 1167.0000.01

|                           |                   |                          |                  |                        |                                            |              |               |
|---------------------------|-------------------|--------------------------|------------------|------------------------|--------------------------------------------|--------------|---------------|
| Maßstab: / Scale:         | Toleranz: / Tol.: | Rauht.: / Roughn.:       | Kanten: / Edges: | Werkstoff: / Material: | Werknormen: / Company Standards:           |              |               |
| --                        |                   |                          |                  |                        |                                            |              |               |
| Benennung: / Designation: |                   | SMF100A SIGNALGENERATOR  |                  |                        | Sprache: / Lang.:                          | Akt: / C.I.: | Blatt: / Sh.: |
| Type: SMF100A             |                   | Date: 25.8.2006          |                  |                        | de                                         | 02.00        | 5             |
| 1. Z.: used in:           |                   | Abteilung: / Dept.: 1GPK |                  |                        | Name: / Name: SR                           |              |               |
|                           |                   |                          |                  |                        | Zeichn. Nr.: / Drawing Nr.: 1167.0000.01 D |              |               |



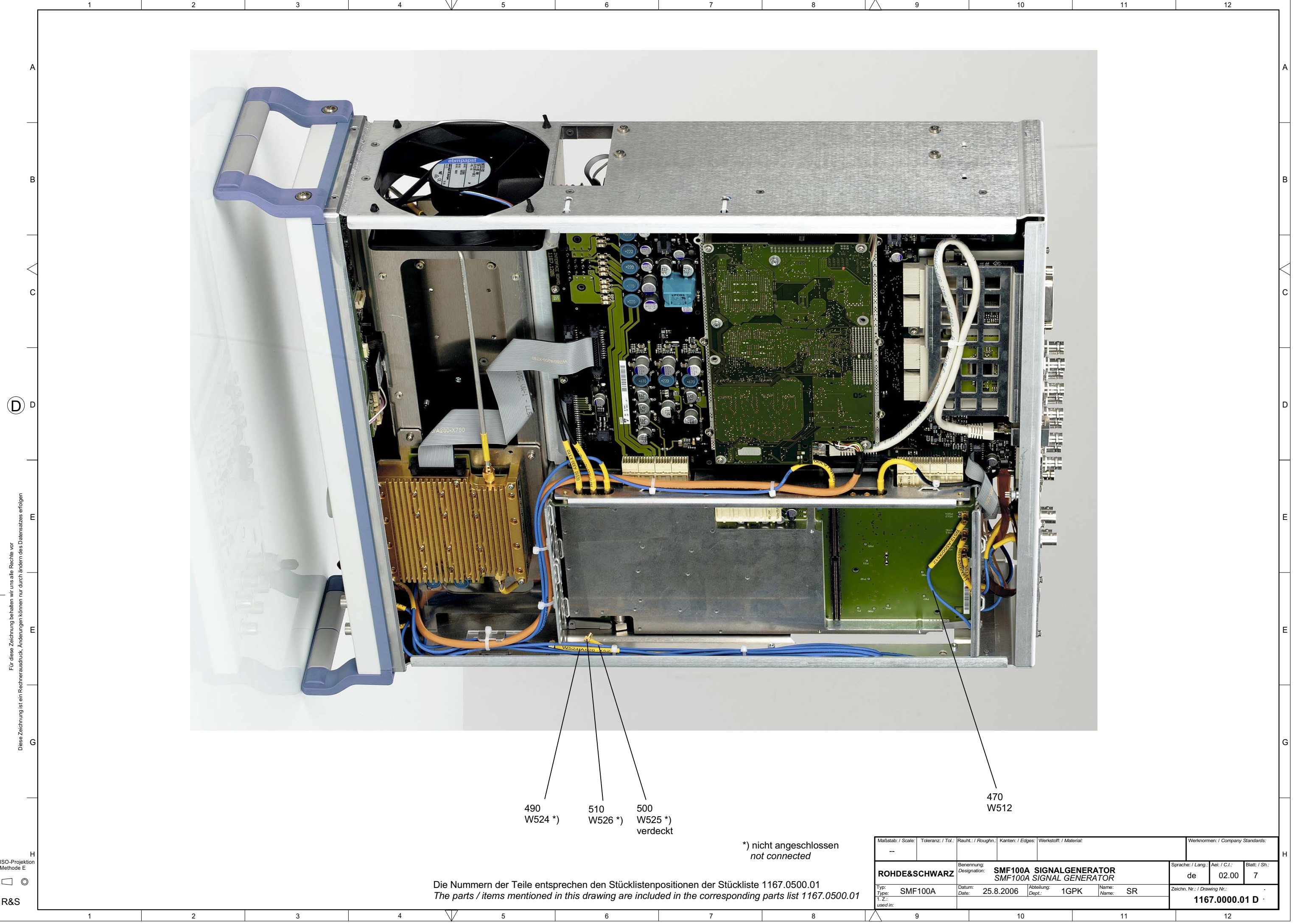


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Die Nummern der Teile entsprechen den Stücklistenpositionen der Stückliste 1167.0000.01  
The parts / items mentioned in this drawing are included in the corresponding parts list 1167.0000.01

|                                              |                        |                        |                  |                                                   |                                  |              |               |
|----------------------------------------------|------------------------|------------------------|------------------|---------------------------------------------------|----------------------------------|--------------|---------------|
| Maßstab: / Scale:                            | Toleranz: / Tol.:      | Rauht.: / Roughn.:     | Kanten: / Edges: | Werkstoff: / Material:                            | Werknormen: / Company Standards: |              |               |
| --                                           |                        |                        |                  |                                                   |                                  |              |               |
| Benennung: <b>SMF100A SIGNALGENERATOR</b>    |                        |                        |                  |                                                   | Sprache: / Lang.:                | Akt: / C.I.: | Blatt: / Sh.: |
| Designation: <b>SMF100A SIGNAL GENERATOR</b> |                        |                        |                  |                                                   | de                               | 02.00        | 6             |
| Type: <b>SMF100A</b>                         | Date: <b>25.8.2006</b> | Abteilung: <b>1GPK</b> | Name: <b>SR</b>  | Zeichn. Nr.: / Drawing Nr.: <b>1167.0000.01 D</b> |                                  |              |               |
| 1. Z.: used in:                              |                        |                        |                  |                                                   |                                  |              |               |





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ISO-Projektion  
Methode F  
R&S

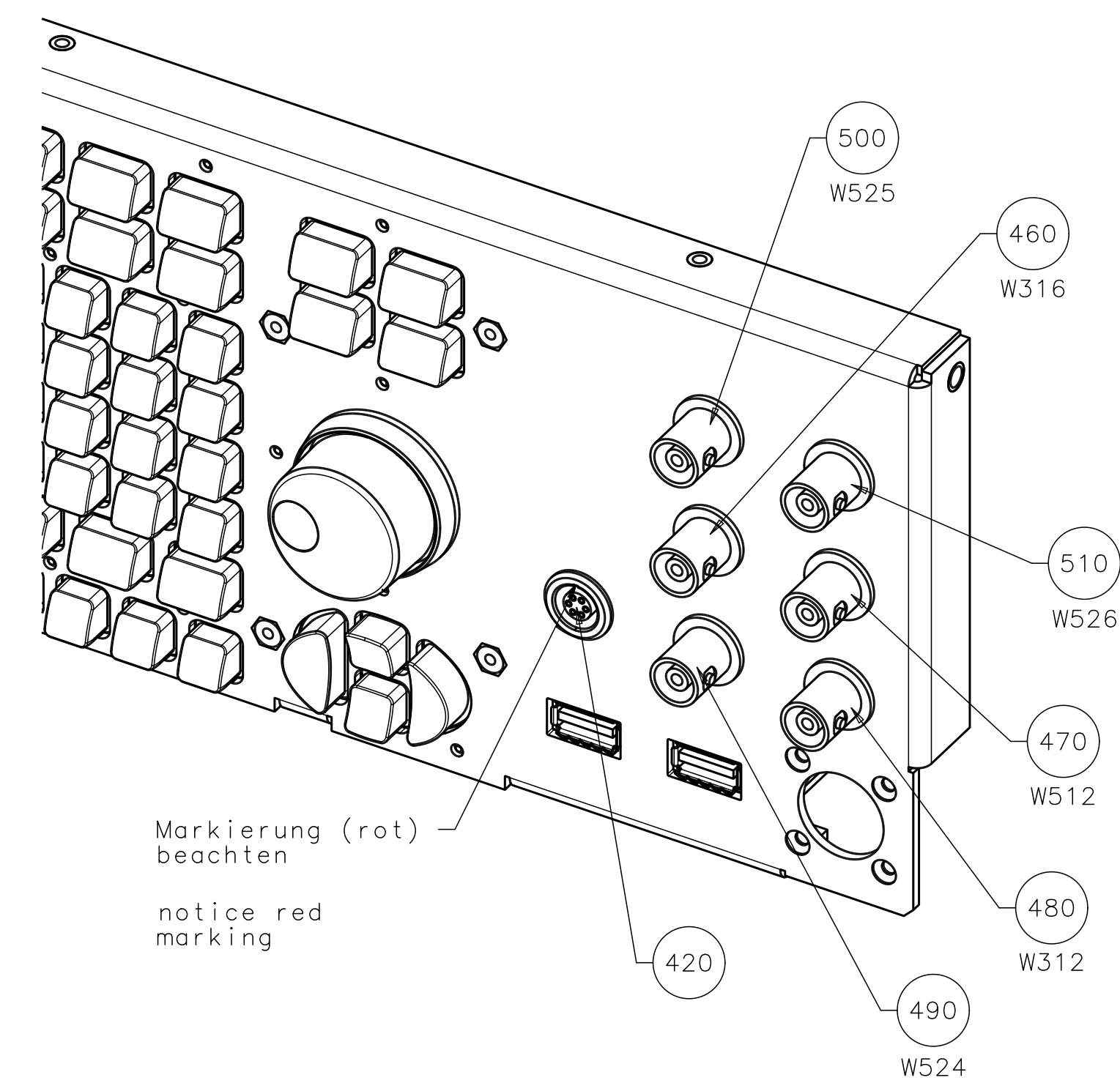
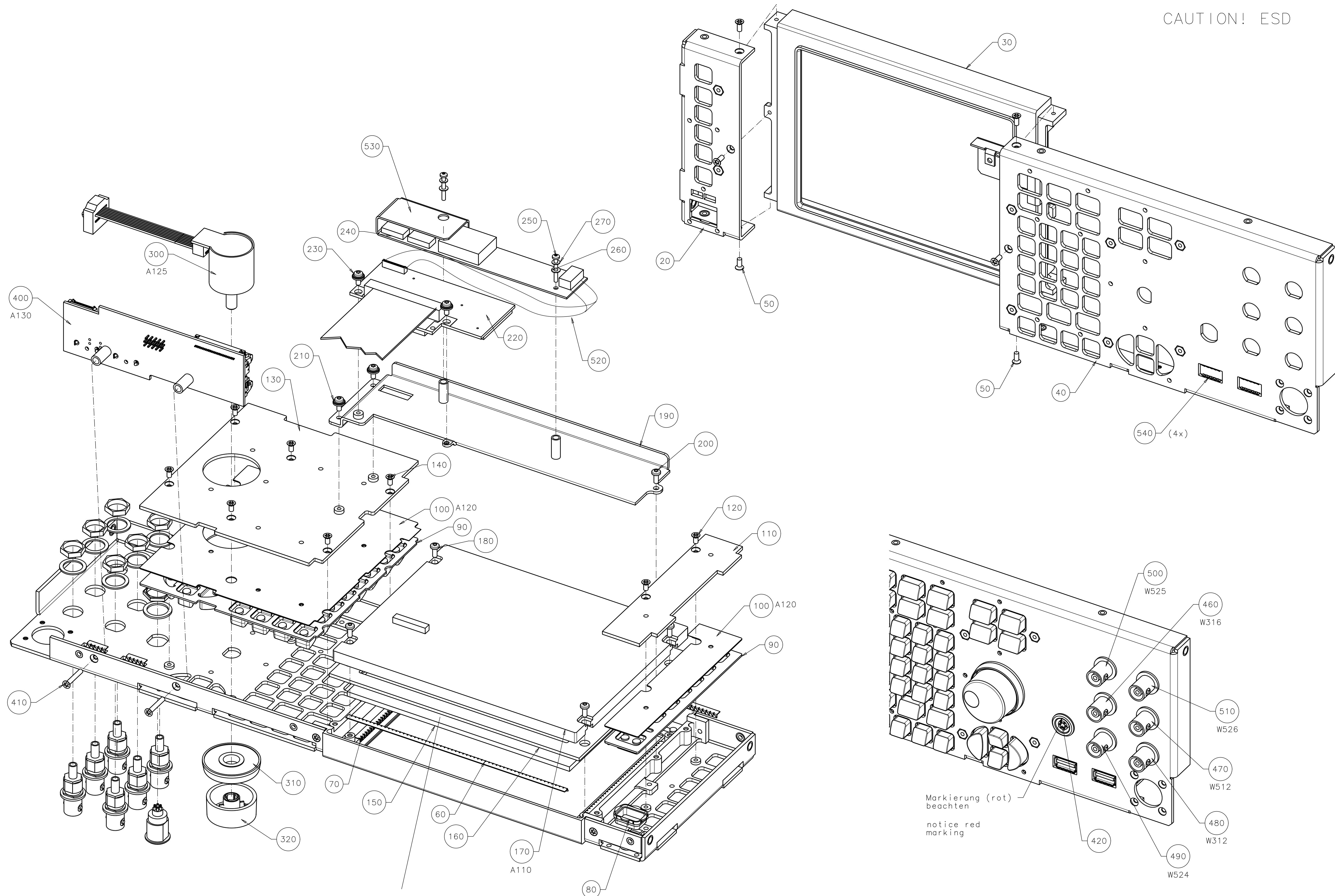
Die Nummern der Teile entsprechen den Stücklistenpositionen der Stückliste 1167.0500.01  
The parts / items mentioned in this drawing are included in the corresponding parts list 1167.0500.01

\*) nicht angeschlossen  
not connected

|                           |                   |                           |                  |                        |                                  |              |               |
|---------------------------|-------------------|---------------------------|------------------|------------------------|----------------------------------|--------------|---------------|
| Maßstab: / Scale:         | Toleranz: / Tol.: | Rauht.: / Roughn.:        | Kanten: / Edges: | Werkstoff: / Material: | Werknormen: / Company Standards: |              |               |
| --                        |                   |                           |                  |                        |                                  |              |               |
| Benennung: / Designation: |                   | Benennung: / Designation: |                  |                        | Sprache: / Lang.:                | Akt: / C.I.: | Blatt: / Sh.: |
| ROHDE&SCHWARZ             |                   | SMF100A SIGNALGENERATOR   |                  |                        | de                               | 02.00        | 7             |
| Type:                     | SMF100A           | Date:                     | 25.8.2006        | Abteilung: / Dept.:    | 1GPK                             | Name:        | SR            |
| 1. Z.:                    |                   | used in:                  |                  |                        |                                  |              |               |
|                           |                   |                           |                  |                        | Zeichn. Nr.: / Drawing Nr.:      |              |               |
|                           |                   |                           |                  |                        | 1167.0000.01 D                   |              |               |



CAUTION! ESD



Markierung (rot)  
beachten  
notice red  
marking

Der Luftraum zwischen Display (170) und Scheibe (150)  
mit Dichtung (160) staubfrei montieren

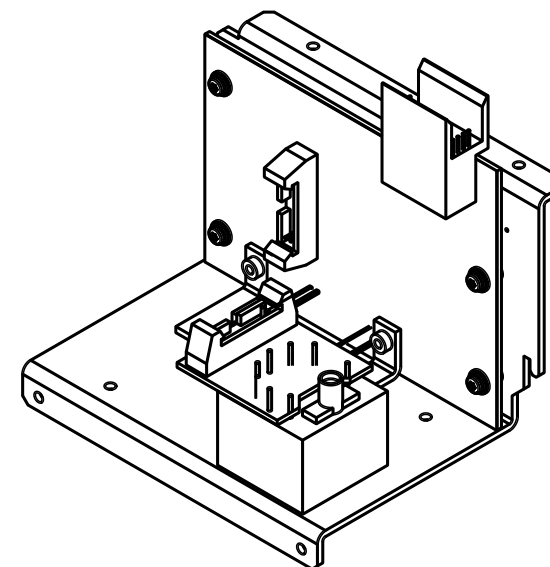
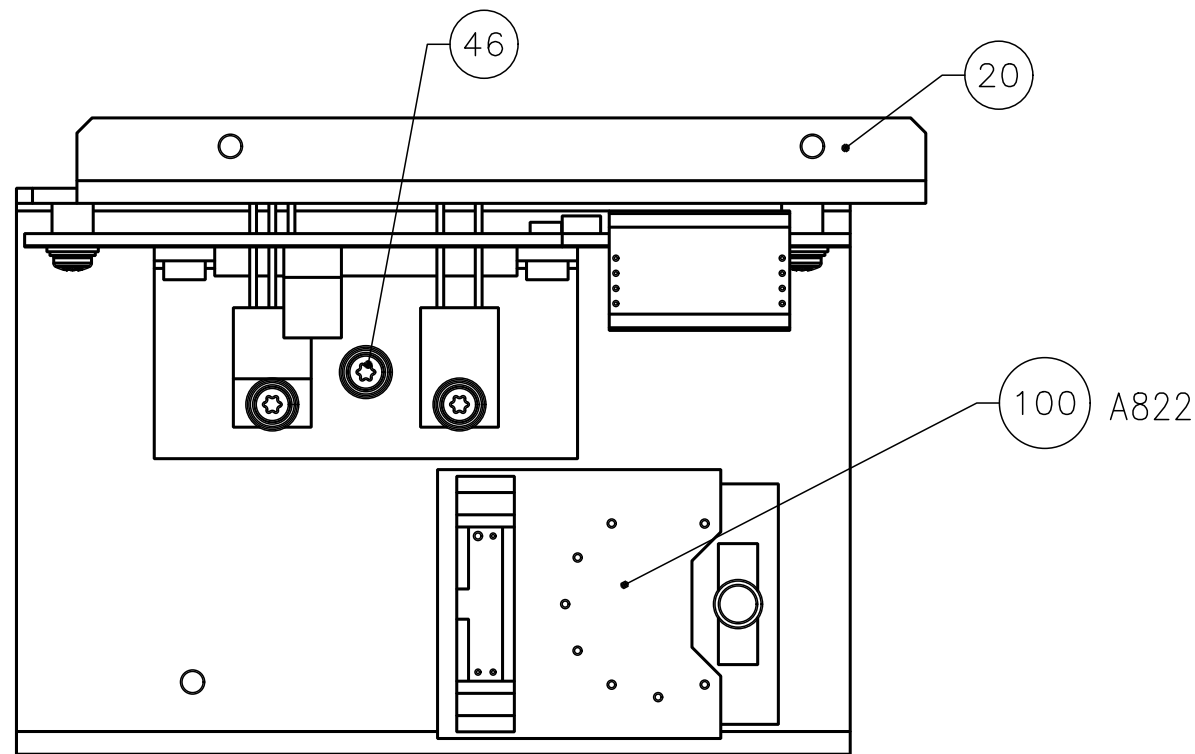
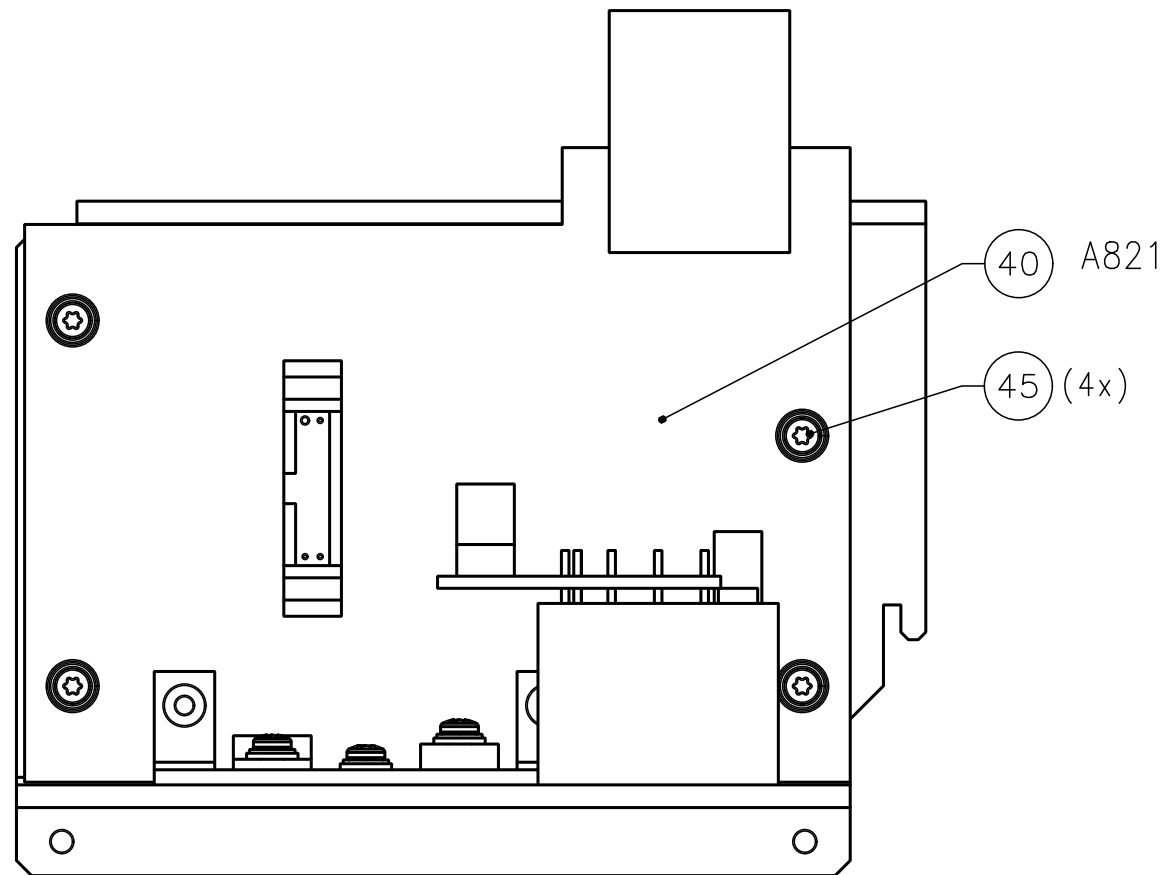
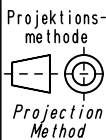
The air space between Display (170) and Filter Glass (150)  
is mounted dust-free with seal (160)

Die Nummern der Teile entsprechen der jew. Position in der  
Stueckliste 1167.0500.01 ST

The parts / items mentioned in this drawing are included  
in the corresponding parts list 1167.0500.01 ST

| Modell<br>Scale | Seitenzahl<br>Page | Bezeichnung / Designation                | Werkstoff<br>Material | Sprache / Lang.<br>Language | Blatt / Nr.<br>Sheet / No. |
|-----------------|--------------------|------------------------------------------|-----------------------|-----------------------------|----------------------------|
| ROHDE&SCHWARZ   | SMF                | FRONTEINHEIT SMF<br>FRONT PANEL UNIT SMF | 1ZKS                  | de en                       | 04.00 1                    |
| SMF             | 2006-02-14         | 2006-02-14                               | 1ZKS                  | kp                          | 1167.0500.01 D             |

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VARIANTENERKLÄRUNG  
EXPLANATION OF MODELS  
  
VAR02 = GRUNDVARIANTE  
MOD02 = BASIC MODEL

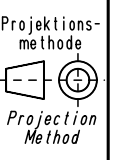
Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.1987.01

The parts / items mentioned in this drawing are included  
in the corresponding parts list 1167.1987.01

| Maßstab<br>Scale         | 1:1 (1:2)      | Toleranz<br>Tol. | Werkstoff<br>Material | Sprache / Lang. | Aei. / C.I.  | Blatt / Sh. |
|--------------------------|----------------|------------------|-----------------------|-----------------|--------------|-------------|
| Benennung / Designation  | ROHDE&SCHWARZ  | TMO UNIT         | TMO UNIT              | de en           | 02.00        | 1           |
| Datum<br>Date            | SMF100A        | 2006-08-14       | Abteilung<br>Dept.    | 1GPK            | Name<br>Name | sr          |
| Zeichn.Nr. / Drawing No. | 1167.1987.01 D |                  |                       |                 |              |             |



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Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.0416.00  
  
The parts / items mentioned in this drawing are included  
in the corresponding parts list 1167.0416.00

Kabel W904  
mit Kabelbinder  
(durch Durchbruch)  
gesichert  
  
cable W904  
fix with cable tie  
(through opening)

W904  
angeschlossen nach 1167.3938  
  
W904  
connect according to 1167.3938.00

Gummistifte (60) nach Montage kuerzen (4x)  
rubber pin shorten after mounting

Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.2031.00  
  
The parts / items mentioned in this drawing are included  
in the corresponding parts list 1167.2031.00

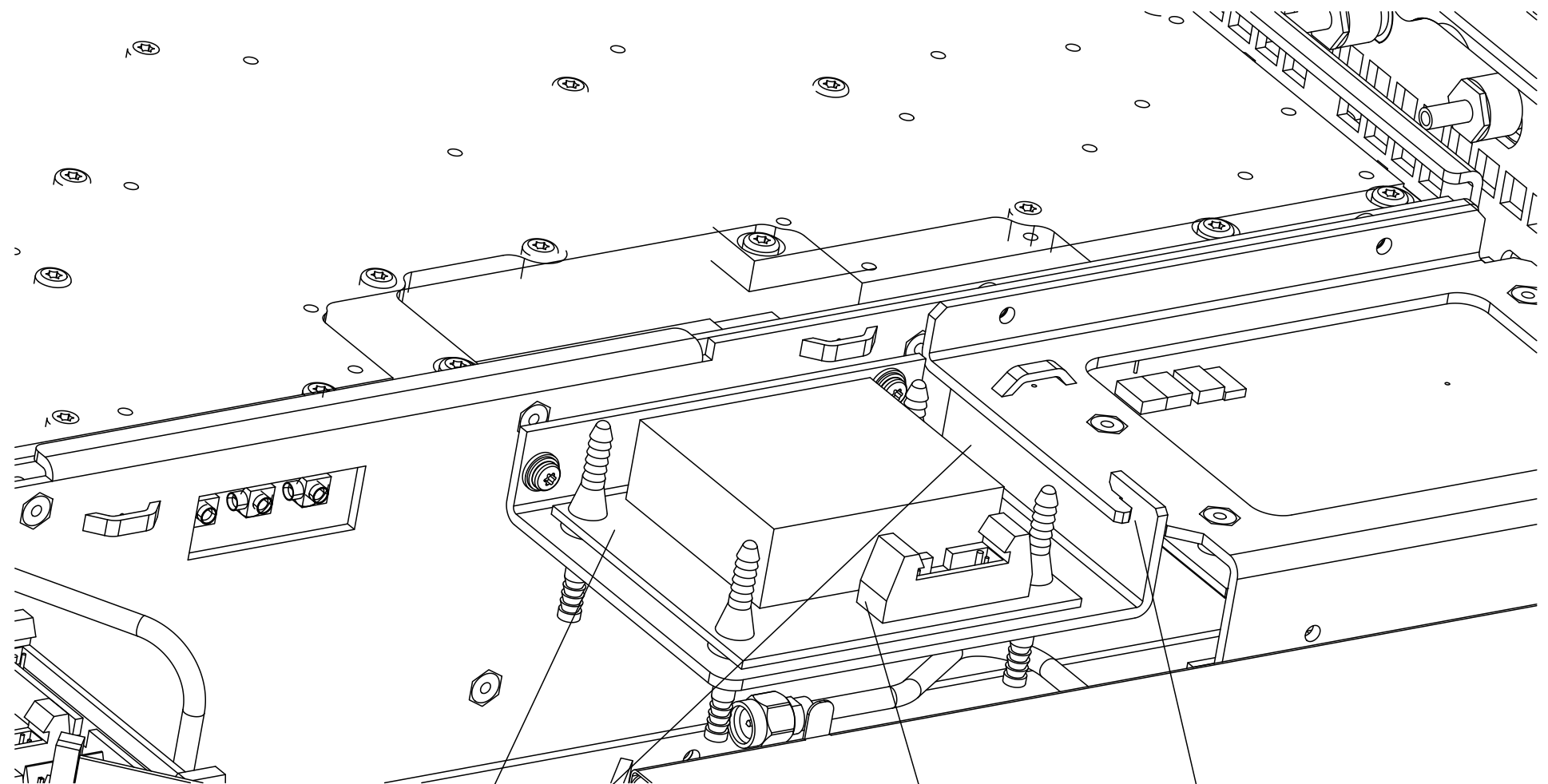
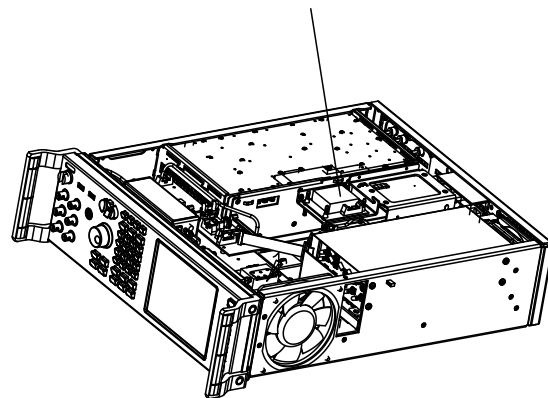
\*) Laschen nach  
dem Durchstecken  
umbiegen (4x)  
bend the panel after  
put through

| Maßstab<br>Scale                         | Toleranz<br>Tol.                                                  | Werkstoff<br>Material | Sprache / Lang.<br>de en | Blatt / Sh.<br>1 |
|------------------------------------------|-------------------------------------------------------------------|-----------------------|--------------------------|------------------|
| ROHDE&SCHWARZ                            | Benennung / Designation<br>POWER SUPPLY UNIT<br>POWER SUPPLY UNIT | Datum<br>2006-05-26   | Abteilung<br>1GPK        | Name<br>ms/sr    |
| Zeichn.Nr. / Drawing No.<br>1167.0416.01 |                                                                   |                       | D                        |                  |

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Projektions-  
methode  
Projection  
Method

Lage der OPTION SMF-B1  
Position of OPTION SMF-B1



2) 2x anschrauben mit  
M2.5x8 D6900/ISR  
2x screw on with  
M2.5x8 D6900/ISR

1) OPTION SMF-B1  
hier einhaken  
lock in here

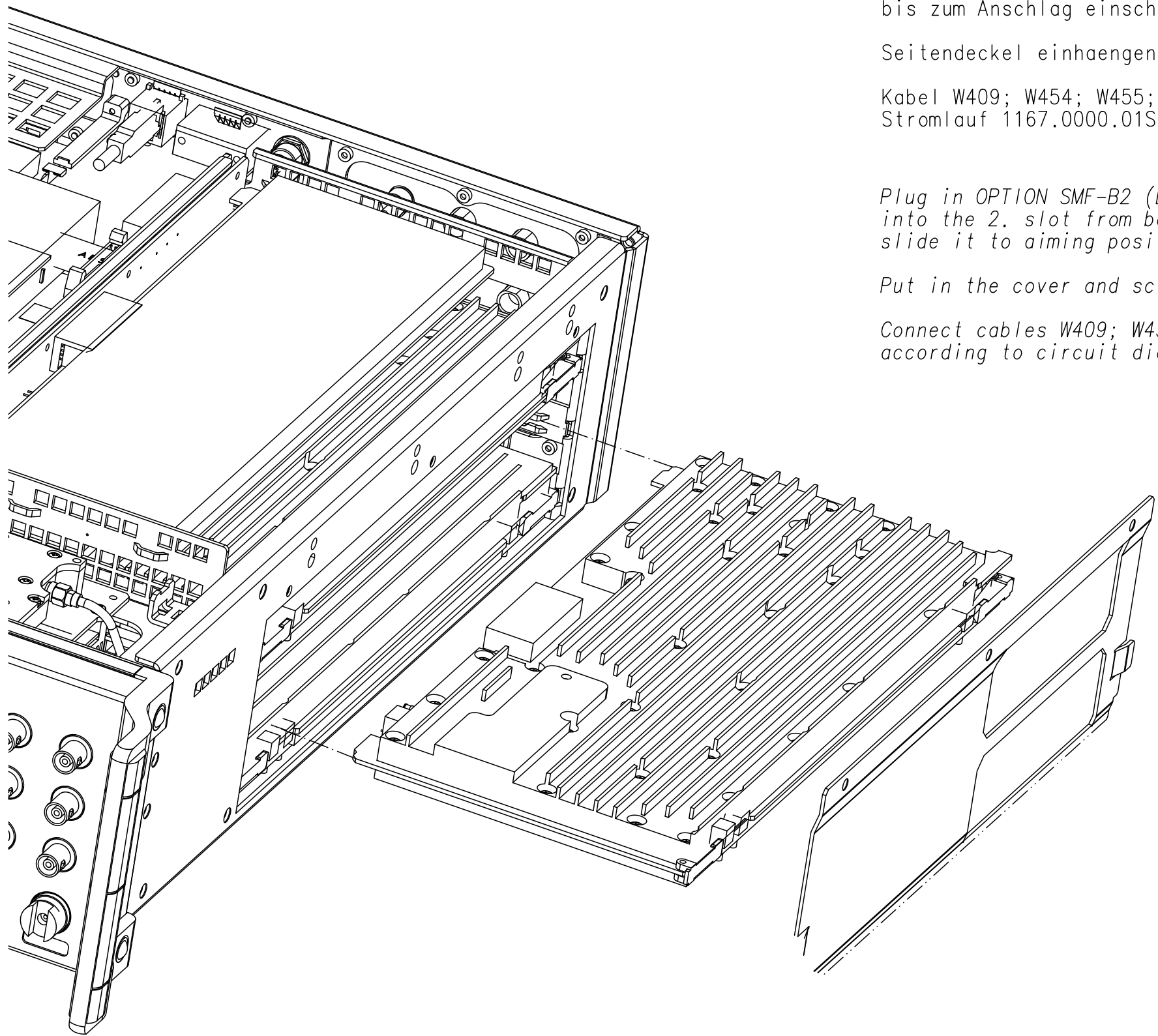
OPTION SMF-B1

Kabel W405; W575 gesteckt nach  
Stromlauf 1167.0000.01S  
Connect cable W405; W575 according to  
circuit diagram 1167.0000.01S

Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.9159.01

The parts / items mentioned in this drawing are included  
in the corresponding parts list 1167.9159.01

|                  |                             |            |                       |      |                 |    |             |                          |
|------------------|-----------------------------|------------|-----------------------|------|-----------------|----|-------------|--------------------------|
| Maßstab<br>Scale | Toleranz<br>Tol.            |            | Werkstoff<br>Material |      |                 |    |             |                          |
| ROHDE&SCHWARZ    | Benennung / Designation     |            |                       |      | Sprache / Lang. |    | Aei. / C.I. | Blatt / Sh.              |
|                  | SMF-B1 REFERENZOSZILLATOR   |            |                       |      | de en           |    | 02.00       | 1                        |
|                  | SMF-B1 REFERENCE OSCILLATOR |            |                       |      |                 |    |             |                          |
| SMF-B1           | Datum<br>Date               | 2006-08-19 | Abteilung<br>Dept.    | 1GPK | Name<br>Name    | sr |             | Zeichn.Nr. / Drawing No. |
|                  |                             |            |                       |      |                 |    |             | 1167.9159.01 D           |



OPTION SMF-B2 (DOWN CONVERTER) in den  
2. Steckplatz von unten einfuehren und  
bis zum Anschlag einschieben.

Seitendeckel einhaengen und anschrauben

Kabel W409; W454; W455; W456 nach  
Stromlauf 1167.0000.01S gesteckt

*Plug in OPTION SMF-B2 (DOWN CONVERTER)  
into the 2. slot from bottom side and  
slide it to aiming position.*

*Put in the cover and screw it on.*

*Connect cables W409; W454; W455; W456  
according to circuit diagram 1167.0000.01S*

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Projektions-  
methode  
Projection  
Method

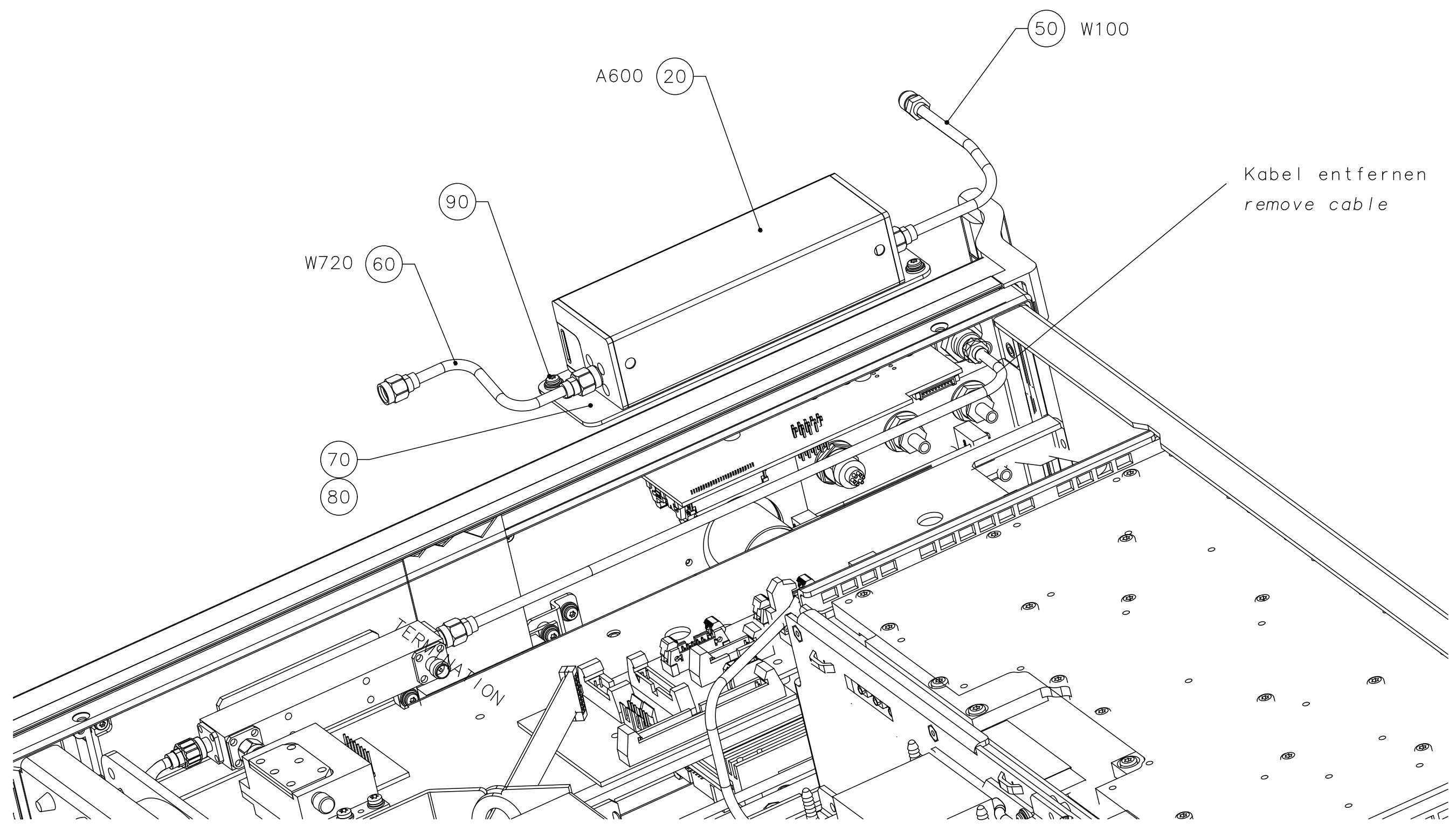
Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.4005.01

The parts / items mentioned in this drawing are included  
in the corresponding parts list 1167.4005.01

|                  |                                                     |            |                       |      |                          |    |              |             |
|------------------|-----------------------------------------------------|------------|-----------------------|------|--------------------------|----|--------------|-------------|
| Maßstab<br>Scale | Toleranz<br>Tol.                                    |            | Werkstoff<br>Material |      |                          |    |              |             |
| ROHDE&SCHWARZ    | Benennung / Designation                             |            |                       |      | Sprache / Lang.          |    | Aei. / C.I.  | Blatt / Sh. |
|                  | SMF-B2 100 KHZ BIS 1 GHZ<br>SMF-B2 100 KHZ TO 1 GHZ |            |                       |      | de en                    |    | 02.00        | 1           |
|                  |                                                     |            |                       |      | Zeichn.Nr. / Drawing No. |    |              |             |
| SMF-B2           | Datum<br>Date                                       | 2006-08-19 | Abteilung<br>Dept.    | 1GPK | Name<br>Name             | sr | 1167.4005.01 | D           |

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Projektions-  
methode  
Projection  
Method



Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.5553.01

The parts / items in this drawing are included  
in the corresponding parts list 1167.5553.01

|                  |                                                              |                       |                             |      |              |             |
|------------------|--------------------------------------------------------------|-----------------------|-----------------------------|------|--------------|-------------|
| Maßstab<br>Scale | Toleranz<br>Tol.                                             | Werkstoff<br>Material | Sprache / Lang. Aei. / C.I. |      |              | Blatt / Sh. |
| ROHDE&SCHWARZ    | Benennung / Designation                                      |                       | de                          | en   | 02.00        | 1           |
|                  | SMF-B26 EICHLEITUNG 22 GHZ<br>SMF-B26 STEP ATTENUATOR 22 GHZ |                       | Zeichn.Nr. / Drawing No.    |      |              | D           |
| SMF-B26          | Datum<br>Date                                                | 2006-09-27            | Abteilung<br>Dept.          | 1GPK | Name<br>Name | sr          |
|                  |                                                              |                       | 1167.5553.01                |      |              |             |

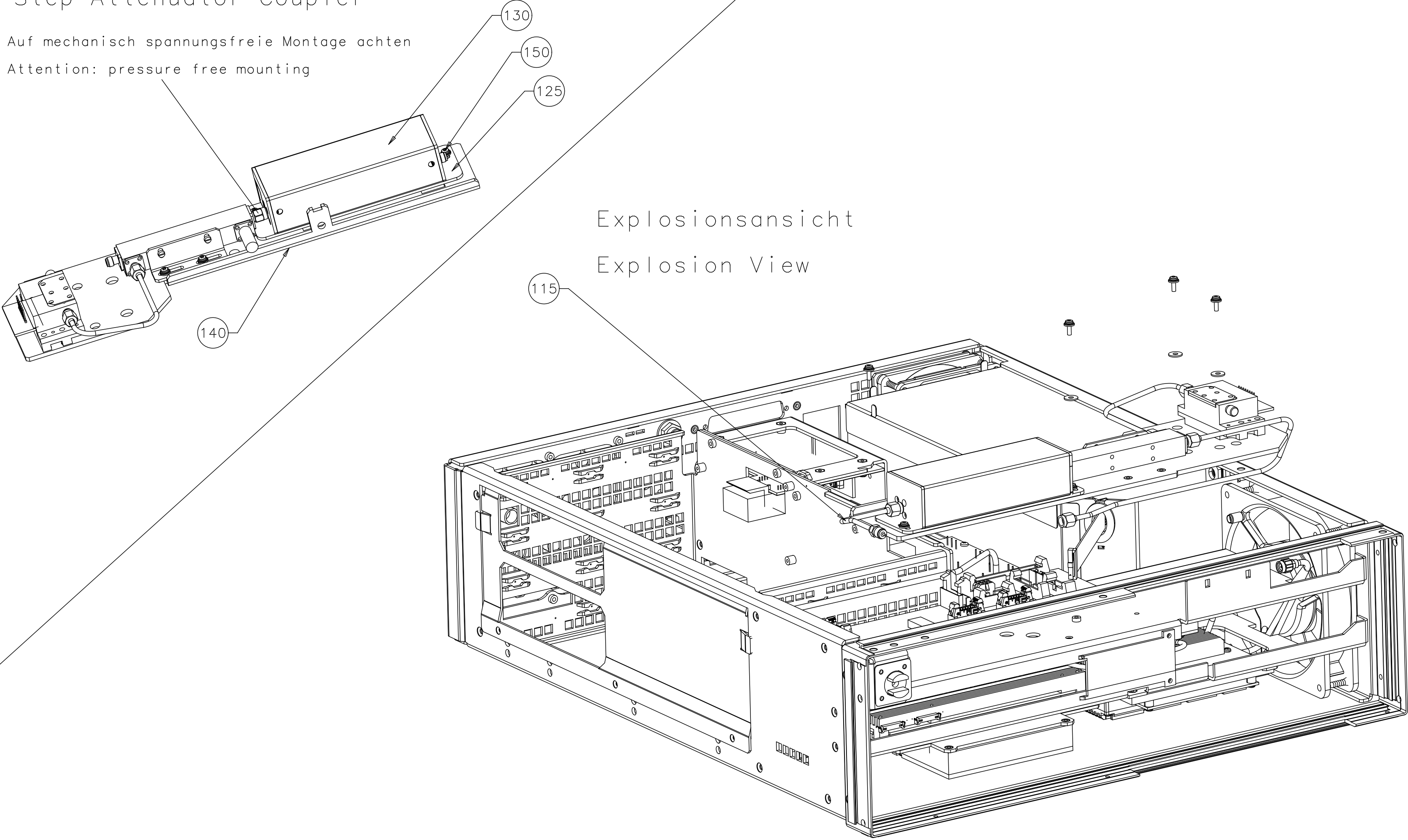


2 nd Generation RF Modules

Montage Eichleitung-Richtkoppler  
Mounting Step Attenuator-Coupler

Auf mechanisch spannungsfreie Montage achten  
Attention: pressure free mounting

Explosionsansicht  
Explosion View



Die Nummern der Teile entsprechen der jeweiligen  
Positon in der Stückliste 1167.5776.01

The parts in this drawing are included  
in the corresponding parts list 1167.5776.01

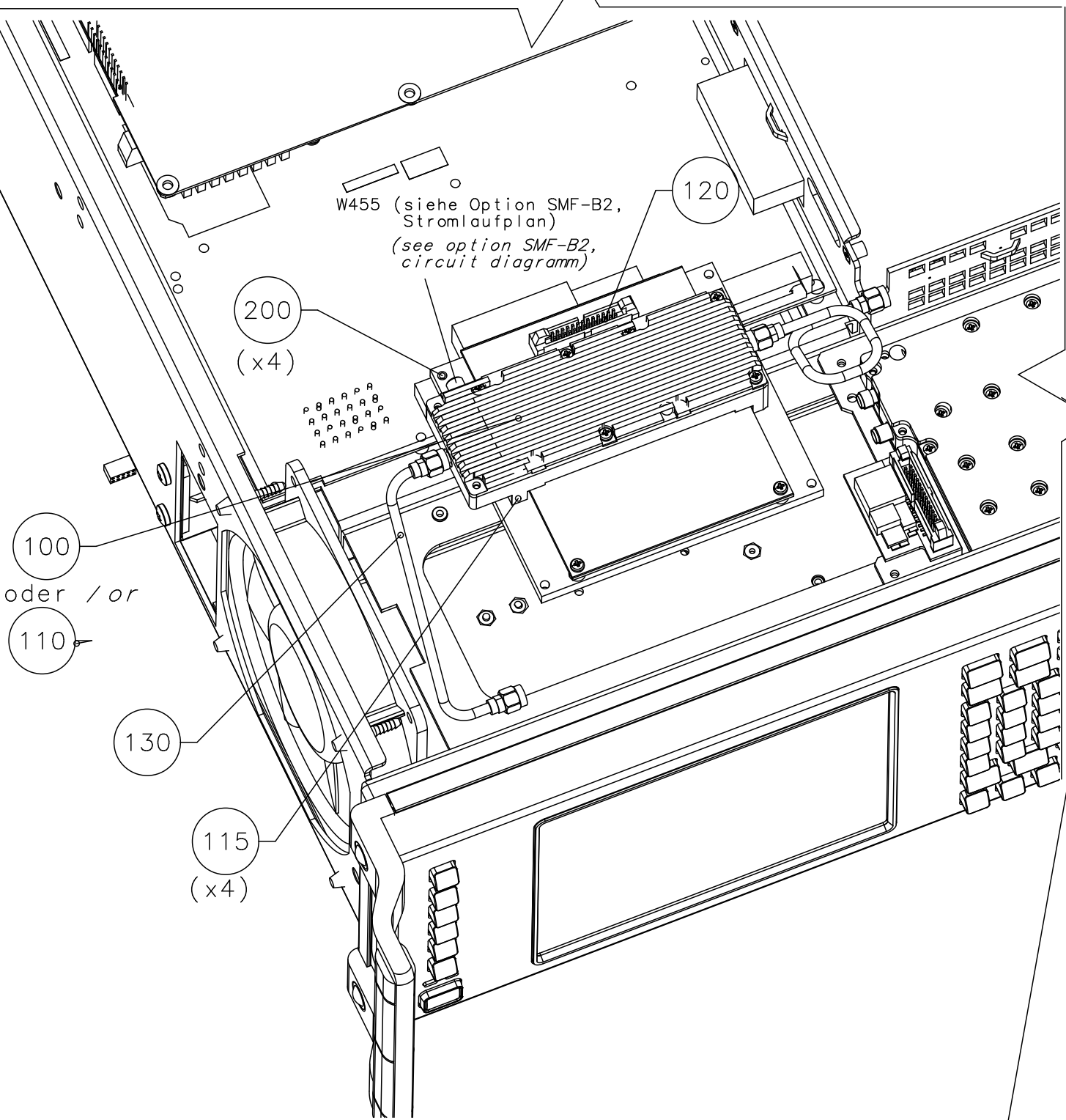
|                         |                  |                                  |                       |                             |              |              |             |
|-------------------------|------------------|----------------------------------|-----------------------|-----------------------------|--------------|--------------|-------------|
| Maßstab<br>Scale        | Toleranz<br>Tol. | ISO2768-m                        | Werkstoff<br>Material | Sprache / Lang. Ver. / C.I. |              |              | Blatt / Sh. |
| Benennung / Designation |                  | SMF-B27 EICHLERUNG 43.5GHZ       |                       | de en                       | 01.00        | 2            |             |
| SMF-B27                 |                  | SMF-B27 STEP ATTENUATOR 43.5 GHZ |                       | Zeichn.Nr. / Drawing No.    |              | 1167.5776.01 |             |
| Datum<br>Date           |                  | 2009-01-15                       | Abteilung<br>Dept.    | 16PK                        | Name<br>Name | ms           | D           |

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Projektions-  
methode  
Projection  
Method

Ausgebauter High Power Amp.

Removed High Power Amp.

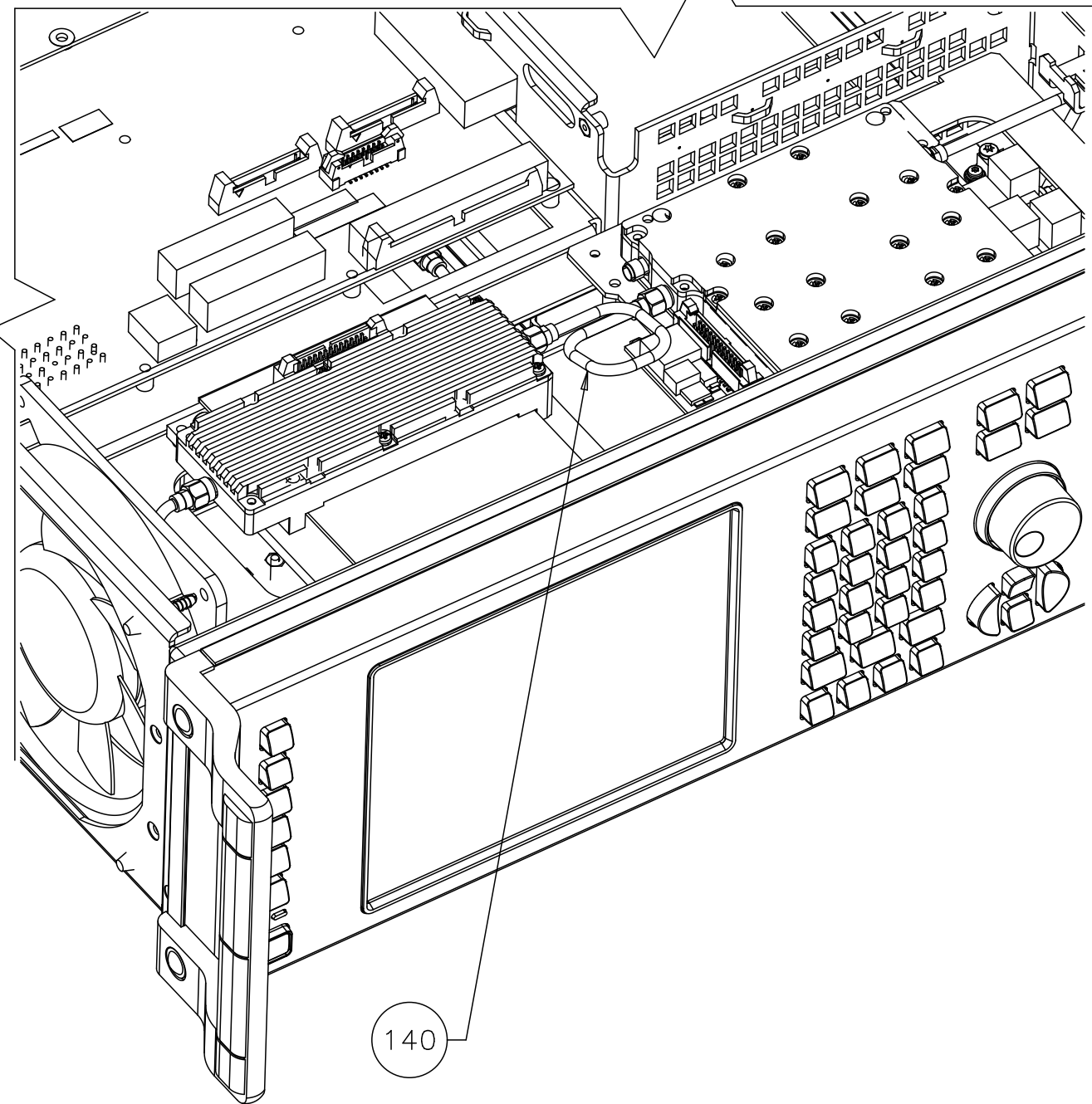


Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stückliste 1415.2304.01

The parts / items mentioned in this drawing are included  
in the corresponding parts list 1415.2304.01

Eingebauter High Power Amp.

Installed High Power Amp.

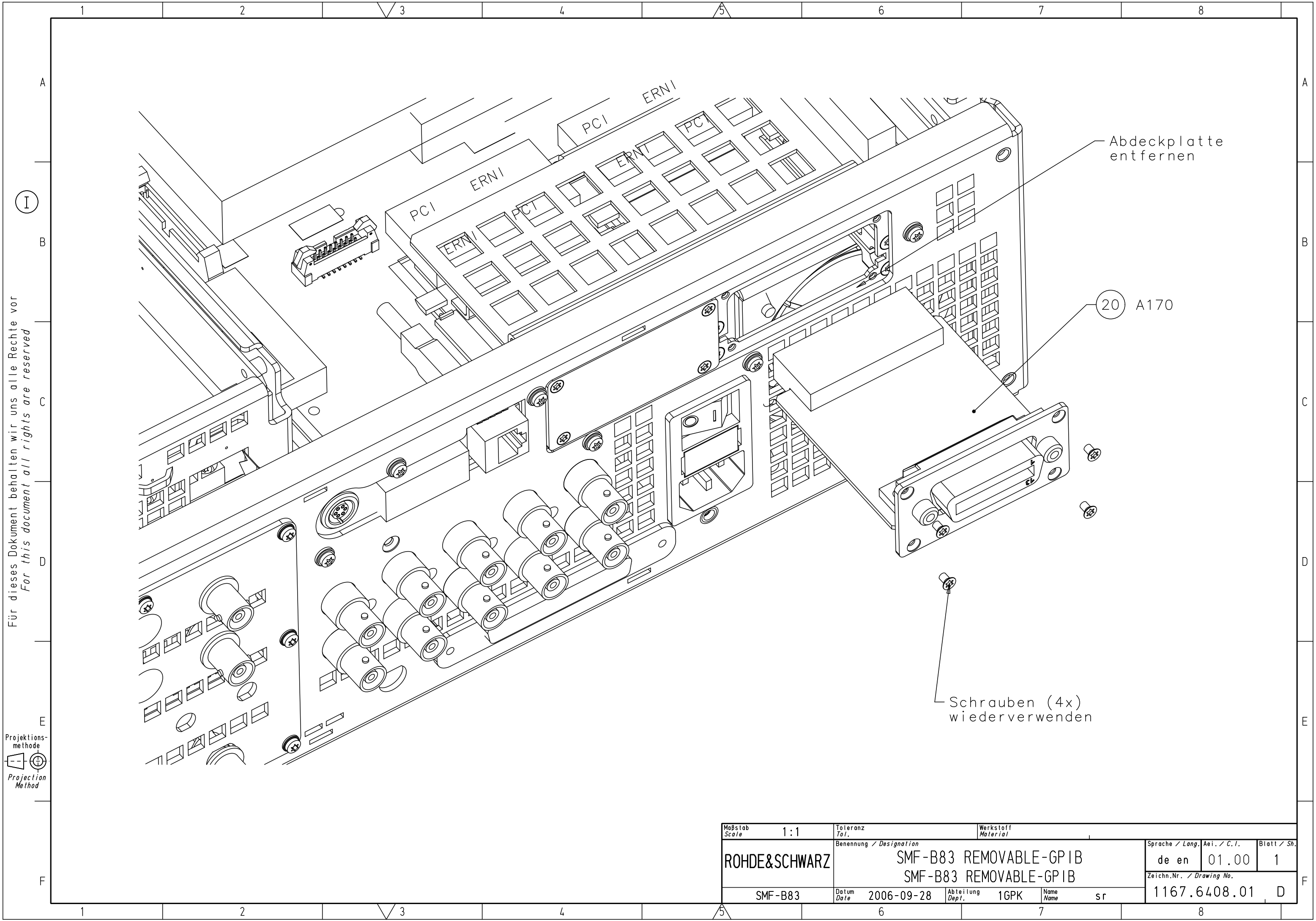


|                  |                         |                                                                |                       |                 |                          |              |
|------------------|-------------------------|----------------------------------------------------------------|-----------------------|-----------------|--------------------------|--------------|
| Maßstab<br>Scale | Toleranz<br>Tol.        | ISO2768-m                                                      | Werkstoff<br>Material | Sprache / Lang. | Aei. / C.I.              | Blatt / Sh.  |
| ROHDE&SCHWARZ    | Benennung / Designation | SMF-B32 HIGH-OUTPUT POWER (2)<br>SMF-B32 HIGH OUTPUT POWER (2) |                       | de en           | 02.00                    | 1            |
| SMF-B32          | Datum<br>Date           | 2008-08-06                                                     | Abteilung<br>Dept.    | 1GPK            | Name<br>Name             | ms           |
|                  |                         |                                                                |                       |                 | Zeichn.Nr. / Drawing No. | 1415.2304.01 |
|                  |                         |                                                                |                       |                 |                          | D            |



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Projektions-  
methode  
Projection  
Method



|                  |                         |                  |                    |      |                          |    |             |              |   |
|------------------|-------------------------|------------------|--------------------|------|--------------------------|----|-------------|--------------|---|
| Maßstab<br>Scale | 1 : 1                   | Toleranz<br>Tol. |                    |      | Werkstoff<br>Material    |    |             |              |   |
| ROHDE&SCHWARZ    | Benennung / Designation |                  |                    |      | Sprache / Lang.          |    | Aei. / C.I. | Blatt / Sh.  |   |
|                  | SMF-B83 REMOVABLE-GPIB  |                  |                    |      | de en                    |    | 01.00       | 1            |   |
|                  | SMF-B83 REMOVABLE-GPIB  |                  |                    |      | Zeichn.Nr. / Drawing No. |    |             |              |   |
| SMF-B83          | Datum<br>Date           | 2006-09-28       | Abteilung<br>Dept. | 1GPK | Name<br>Name             | sr |             | 1167.6408.01 | D |

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Projektions-  
methode  
Projection  
Method

Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.6608.01

The parts / items mentioned in this drawing are included  
in the corresponding parts list 1167.6608.01

|                         |                                                              |                    |                       |                 |             |                                          |
|-------------------------|--------------------------------------------------------------|--------------------|-----------------------|-----------------|-------------|------------------------------------------|
| Maßstab<br>Scale        | 1:1                                                          | Toleranz<br>Tol.   | Werkstoff<br>Material | Sprache / Lang. | Aei. / C.I. | Blatt / Sh.                              |
| Benennung / Designation | ROHDE&SCHWARZ SMF-B84 REMOVABLE-USB<br>SMF-B84 REMOVABLE USB |                    |                       | de en           | 01.00       | 1                                        |
| Datum<br>Date           | 2006-09-27                                                   | Abteilung<br>Dept. | 1GPK                  | Name<br>Name    | sr          | Zeichn.Nr. / Drawing No.<br>1167.6608.01 |
| SMF-B84                 |                                                              |                    |                       |                 |             | D                                        |

Abdeckplatte entfernen  
remove coverplate

20 A180

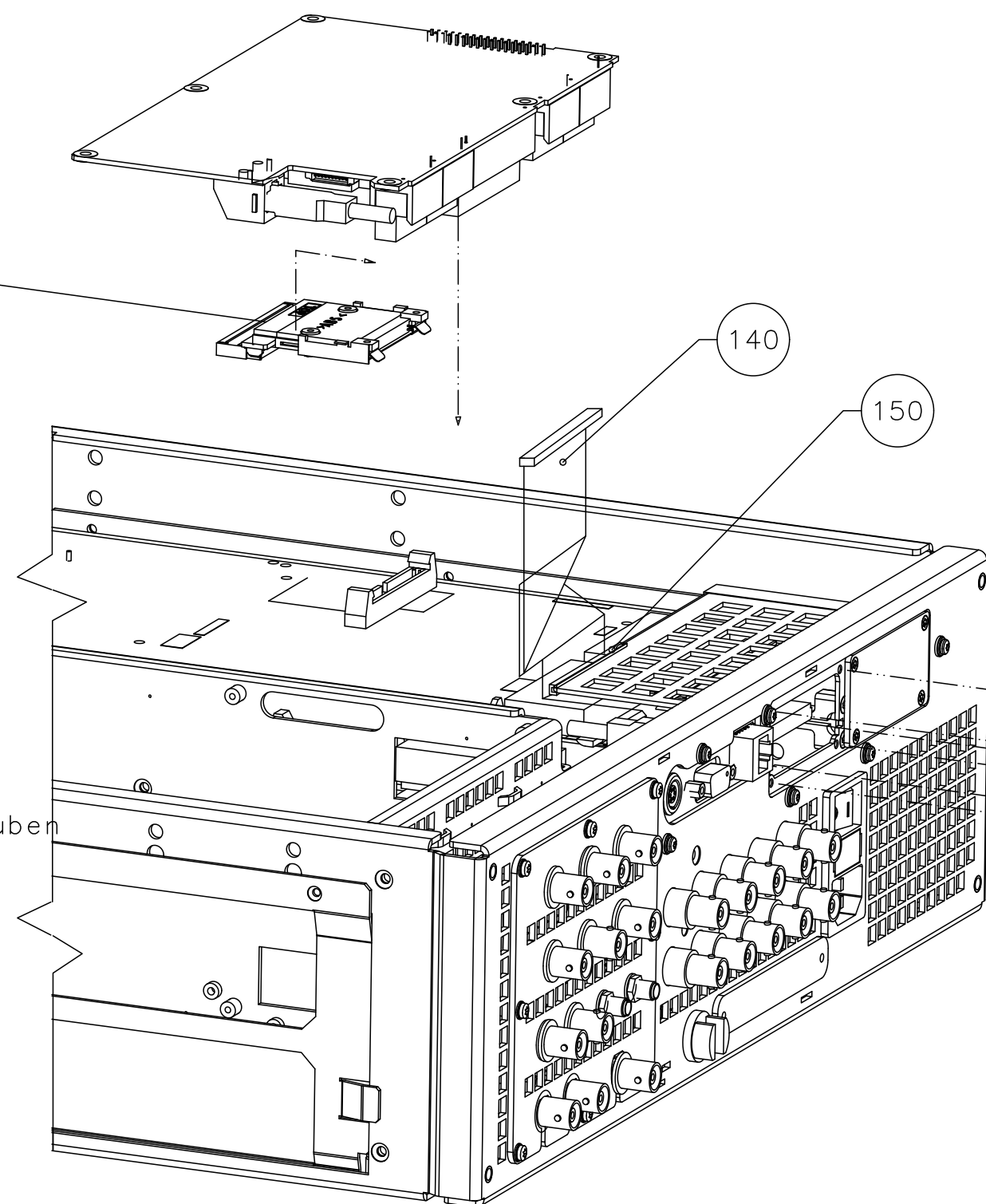
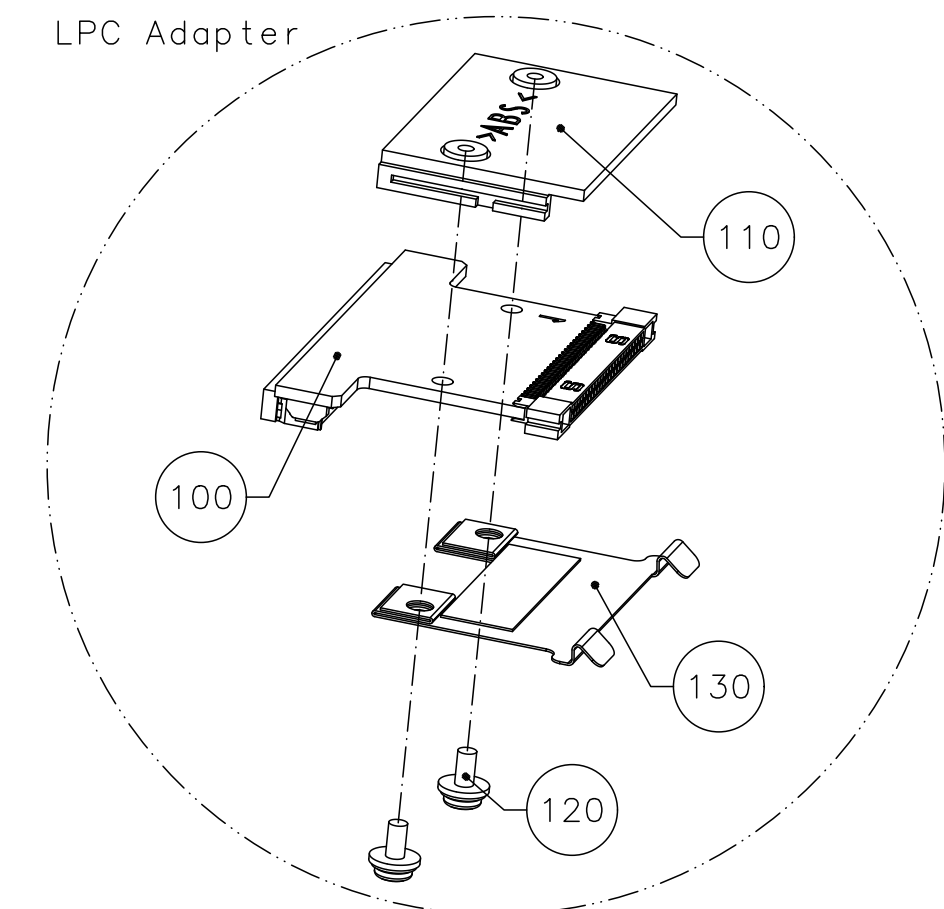
Schrauben (4x) wiederverwenden  
reuse screws (4x)

Einbau der Option SMF-B85 Removable-Flash-Card  
*Installation of the Option SMF-B85 Removeable-Flash-Card*

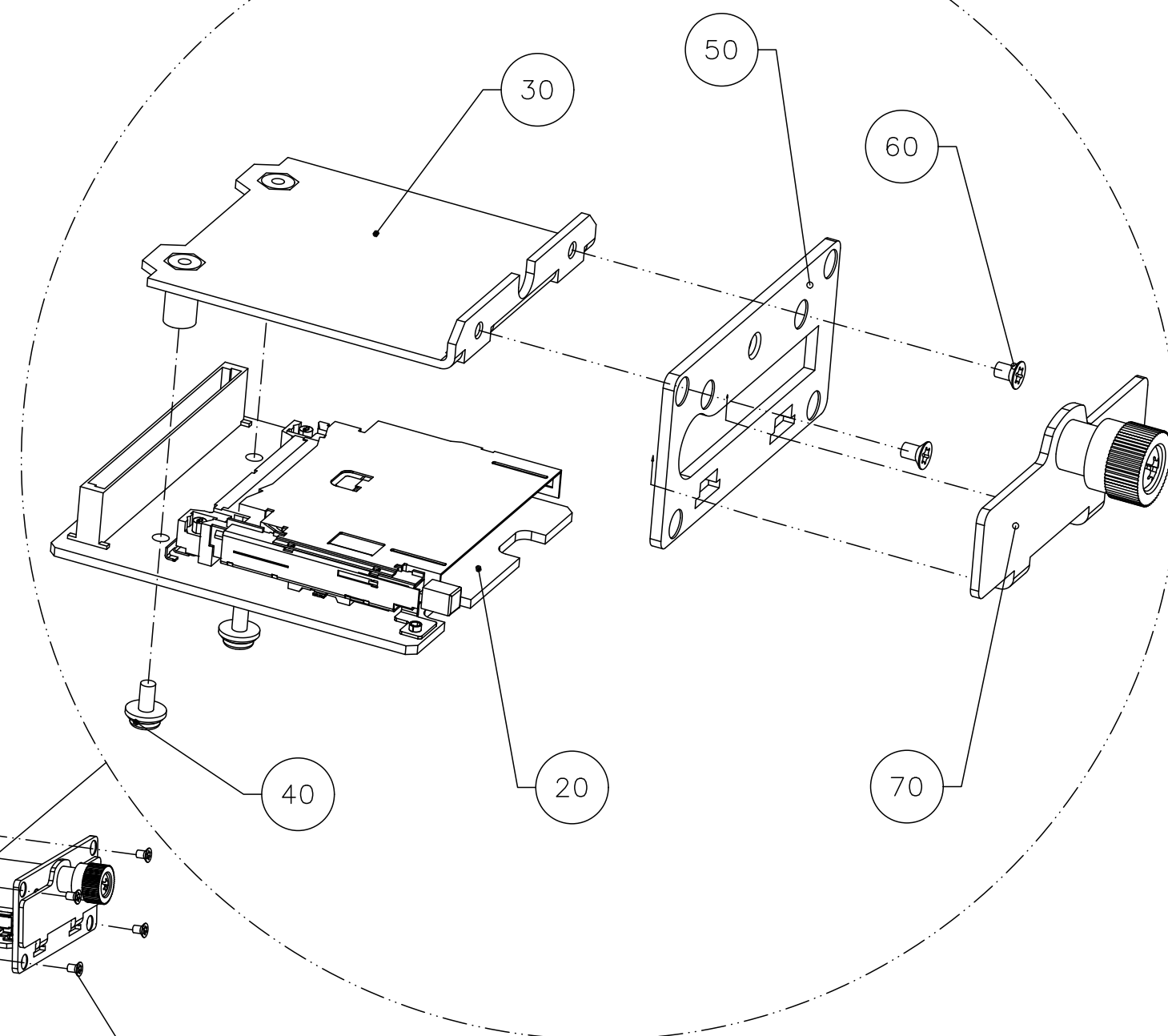
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Projektions-  
methode  
Projection  
Method

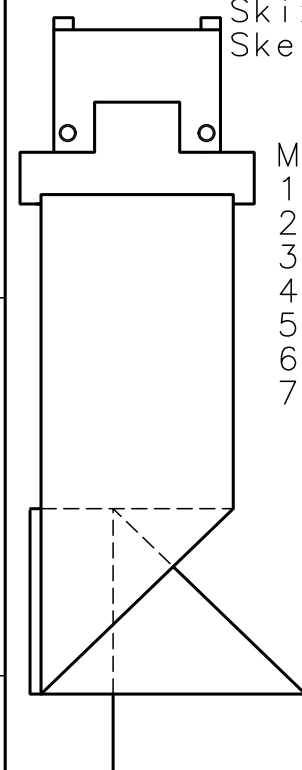
LPC Adapter



Flash Card Board



Skizze Kabel gefaltet  
Sketch Folded Cable



Montagereihenfolge:

1. Kabel durch Einschuböffnung durchfuehren
2. Kabel an Flash Card Board einstecken
3. Flasch Card Board einschieben und anschrauben
4. Kabel an LPC Adapter anstecken
5. Kabel falten (siehe Skizze)
6. LPC Adapter in LPC Rechner einstecken
7. LPC Rechner anschrauben

Mounting Order:

1. pass cable through insertion opening
2. plug cable in Flasch Card Board
3. push in Flach Card Board and screw on
4. plug cable in LPC adapter
5. fold cable (look sketch)
6. plug LPC adapter in LPC controller
7. screw on LPC controller

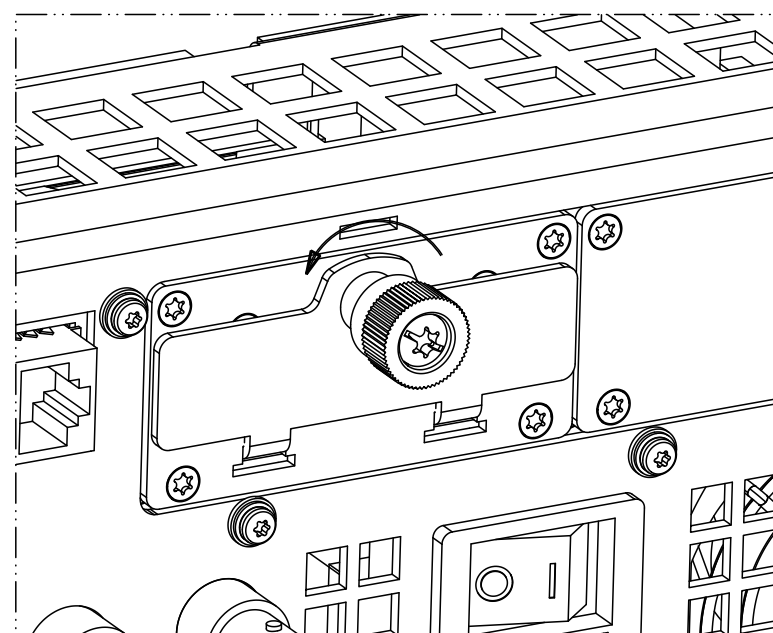
Schrauben wiederverwenden  
reuse screws

Austauschen der Compact Flash Karte  
*Change of Compact Flasch Card*

1

Raendelschraube  
nach links  
drehen und  
Klappe oeffnen

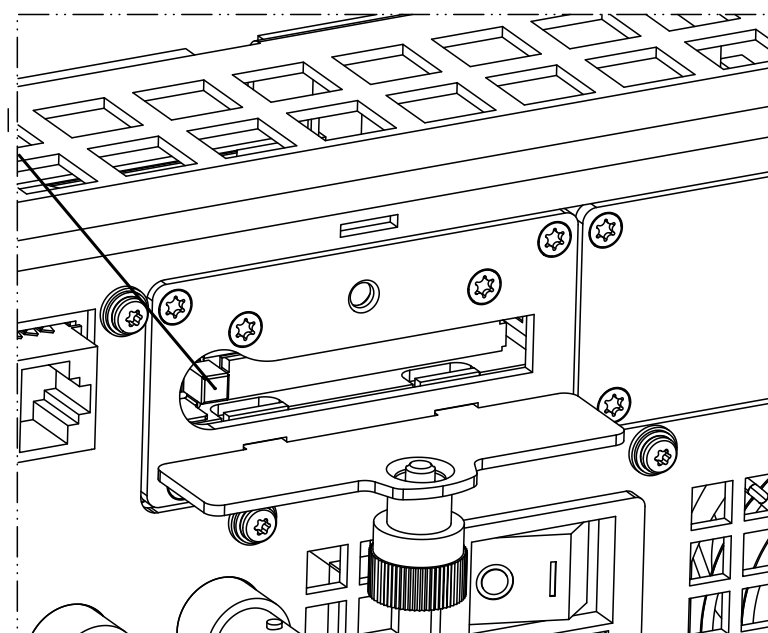
Turn captive  
screw on the  
left and open  
the lid



2

Knopf zweimal  
druecken

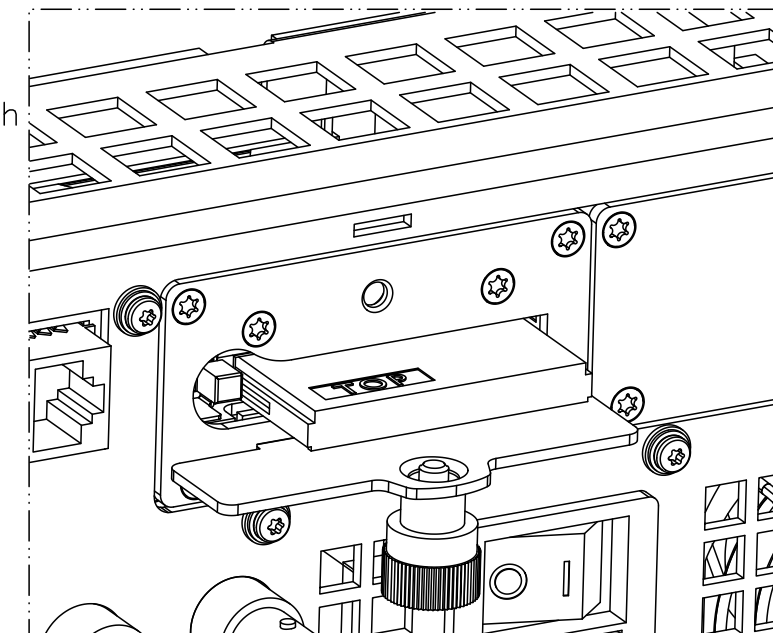
Push the  
button  
two times



3

Compact Flash  
Karte  
herausziehen

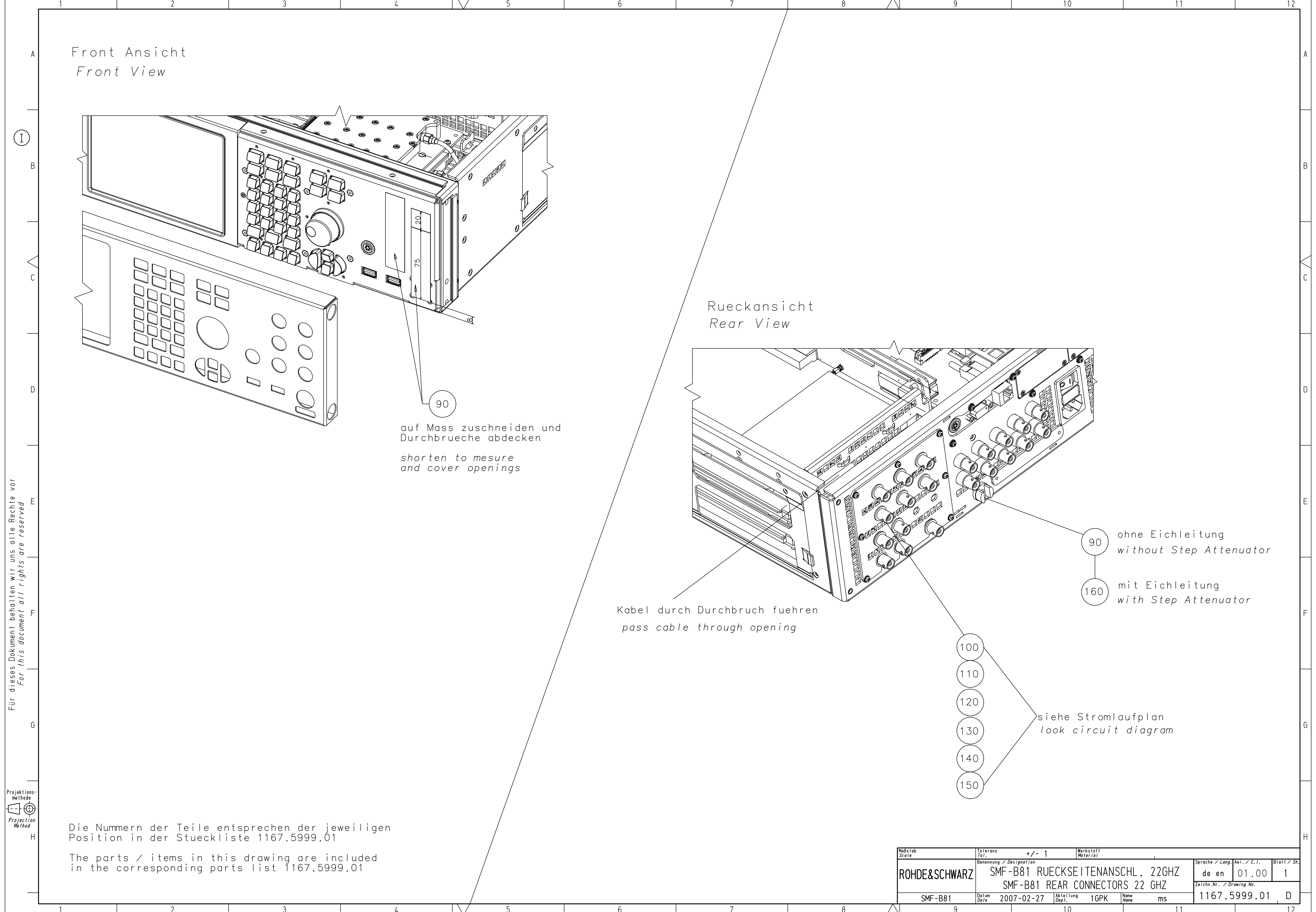
Pull out  
the Compact  
Flash Card



Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.6808.01

The parts / items in this drawing are included  
in the corresponding parts list 1167.6808.01

| Maßstab<br>Scale | Toleranz<br>Tol.        | Werkstoff<br>Material                                        | Sprache / Lang. Ael. / C.I. | Blatt / Sh.    |
|------------------|-------------------------|--------------------------------------------------------------|-----------------------------|----------------|
| ROHDE&SCHWARZ    | Benennung / Designation | SMF-B85 REMOVABLE-FLASH-CARD<br>SMF-B85 REMOVABLE FLASH CARD | de en 02.00                 | 1              |
| SMF-B85          | Datum<br>Date           | 2007-02-15                                                   | Abteilung<br>Dept.          | 1GPK           |
|                  | Name                    | ms                                                           | Zeichn.Nr. / Drawing No.    | 1167.6808.01 D |



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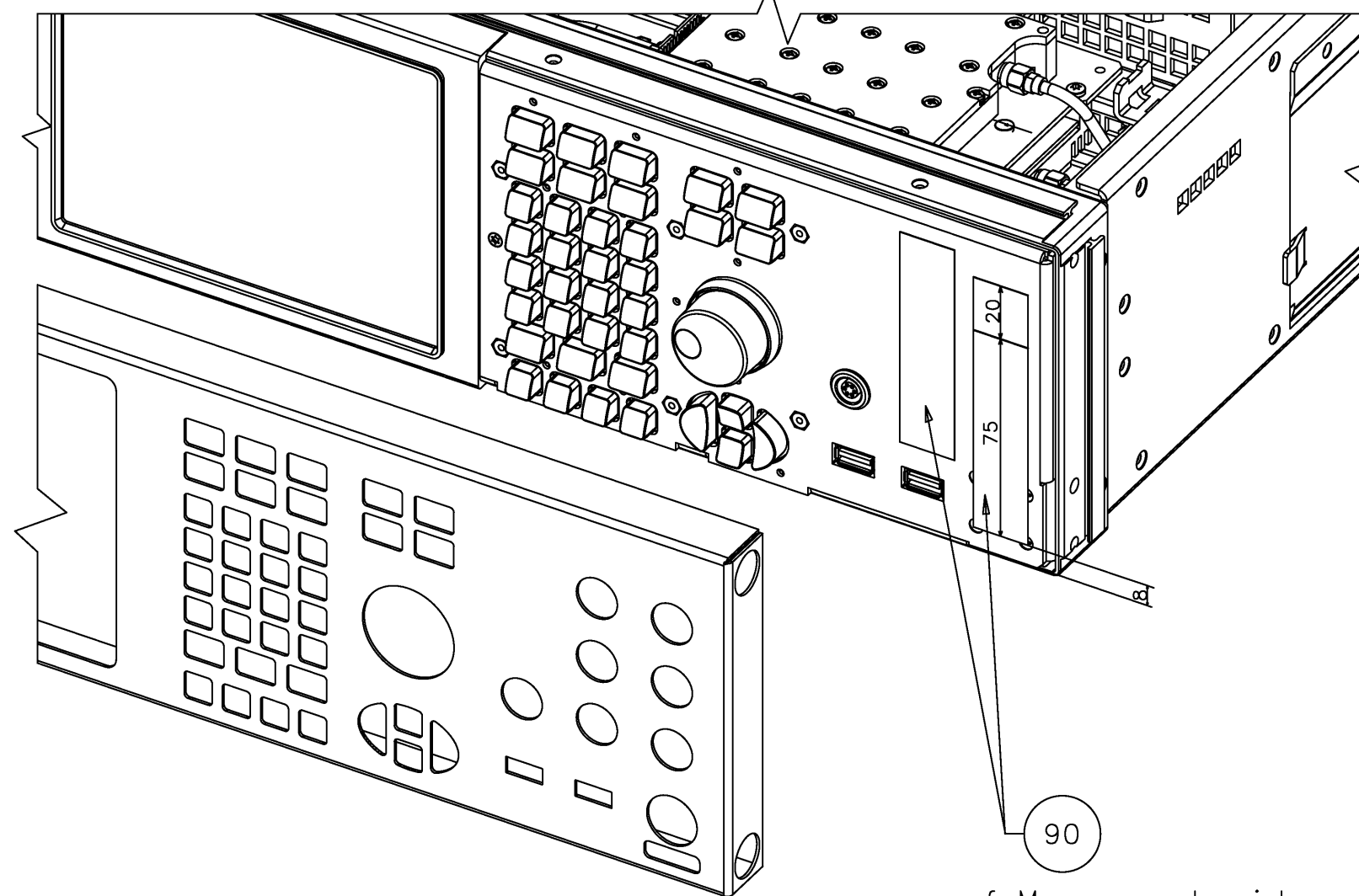
Projektions-  
methode  
Projection  
Method

Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.5999.01  
The parts / items in this drawing are included  
in the corresponding parts list 1167.5999.01

|                  |                         |                                                                    |                    |              |                          |
|------------------|-------------------------|--------------------------------------------------------------------|--------------------|--------------|--------------------------|
| Maßstab<br>Scale | Toleranz<br>Tol.        | Werkstoff<br>Material                                              | Sprache / Lang.    | Ävl. / C. I. | Blatt / Sh.              |
| ROHDE&SCHWARZ    | Benennung / Designation | SMF-B81 RUECKSEITENANSCHL. 22GHZ<br>SMF-B81 REAR CONNECTORS 22 GHZ | de en              | 01.00        | 1                        |
| SMF-B81          | Datum<br>Date           | 2007-02-27                                                         | Abteilung<br>Dept. | 1GPK         | Name<br>Name             |
|                  |                         |                                                                    |                    | ms           | Zeichn.Nr. / Drawing No. |
|                  |                         |                                                                    |                    |              | 1167.5999.01             |
|                  |                         |                                                                    |                    |              | D                        |

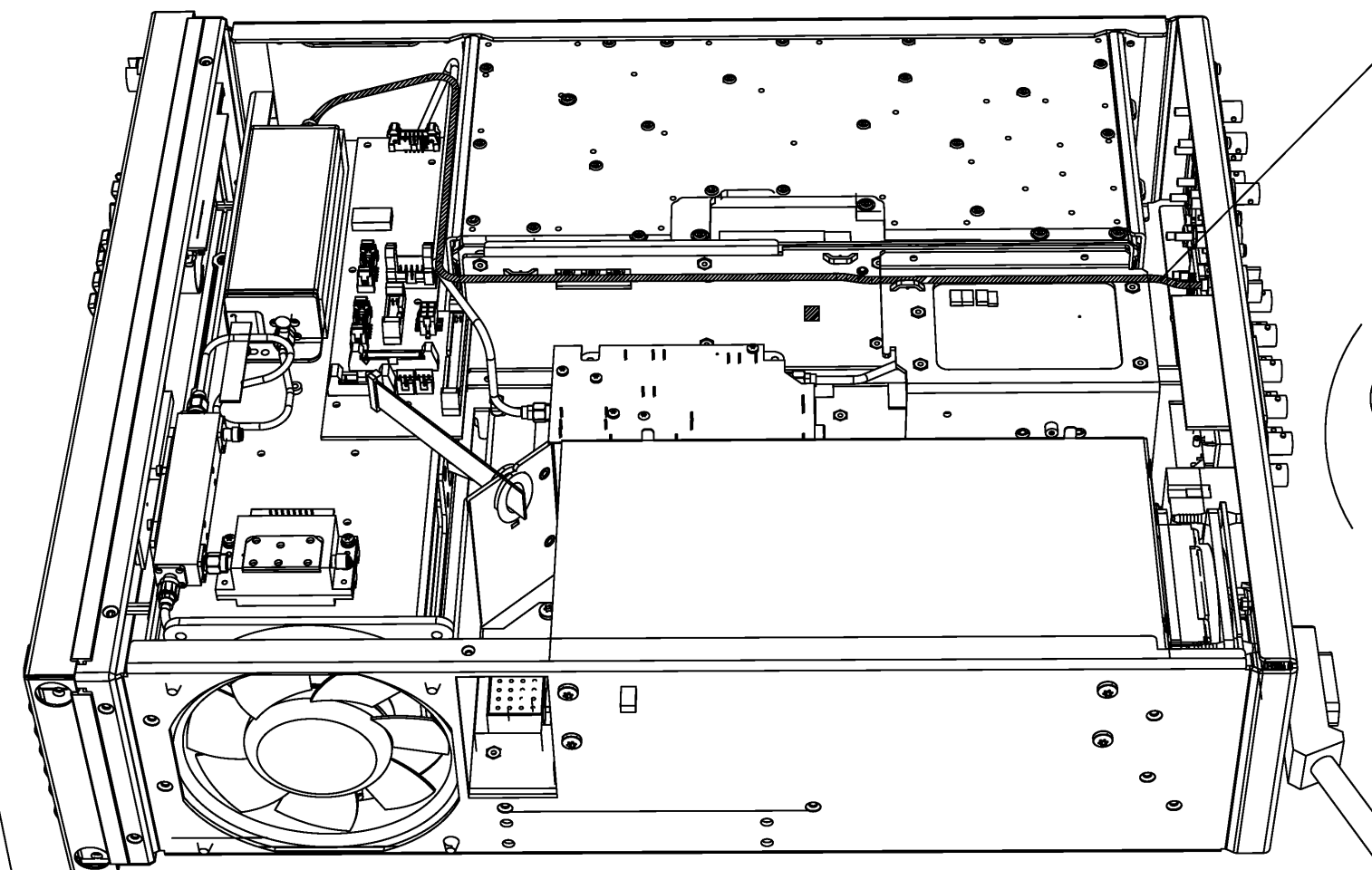


Front Ansicht  
Front View



90

auf Mass zuschneiden und  
Durchbrueche abdecken  
shorten to mesure  
and cover openings



180

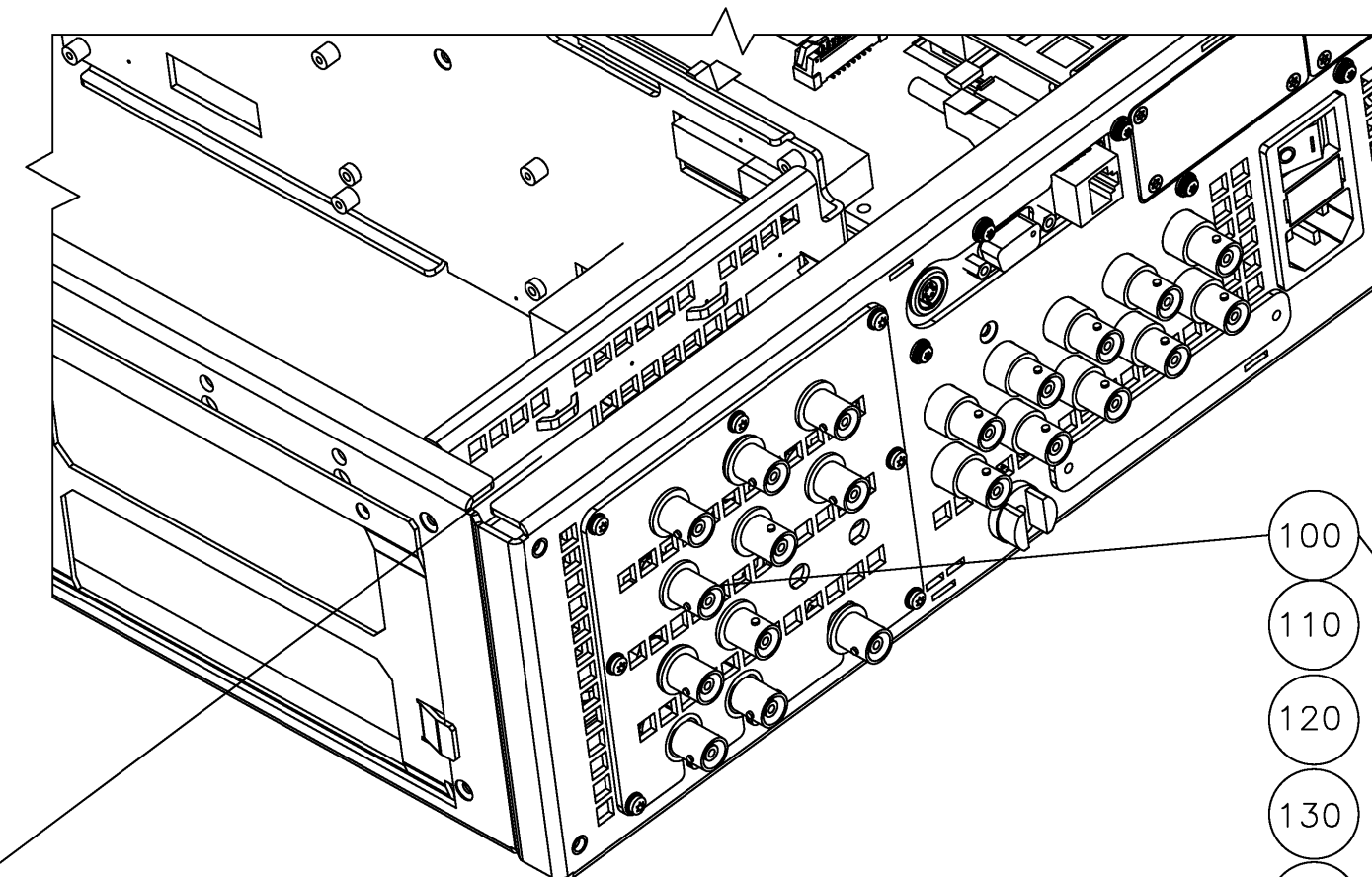
mit Eichleitung  
with Step Attenuator

siehe Stromlaufplan  
look circuit diagram

190

ohne Eichleitung  
without Step Attenuator

Rueckansicht  
Rear View



100

110

120

130

140

150

siehe Stromlaufplan  
look circuit diagram

Kabel durch Durchbruch fuehren  
pass cable through opening

Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.5999.01

The parts / items in this drawing are included  
in the corresponding parts list 1167.5999.01

|                  |                                     |                       |                               |                          |
|------------------|-------------------------------------|-----------------------|-------------------------------|--------------------------|
| Maßstab<br>Scale | Toleranz<br>Tol.                    | Werkstoff<br>Material | Sprache / Lang. / Rel. / C.I. | Blatt / Sh.              |
| ROHDE&SCHWARZ    | +/- 1                               |                       | de en                         | 01.00                    |
|                  | Benennung / Designation             |                       |                               |                          |
|                  | SMF-B82 RUECKSEITENANSCHL. 43,5 GHZ |                       |                               |                          |
|                  | SMF-B82 REAR CONNECTORS 43,5 GHZ    |                       |                               |                          |
|                  | Datum<br>Date                       | Abteilung<br>Dept.    | Name<br>Name                  | Zeichn.Nr. / Drawing No. |
|                  | SMF-B82                             | 16PK                  | ms                            | 1167.6208.01             |

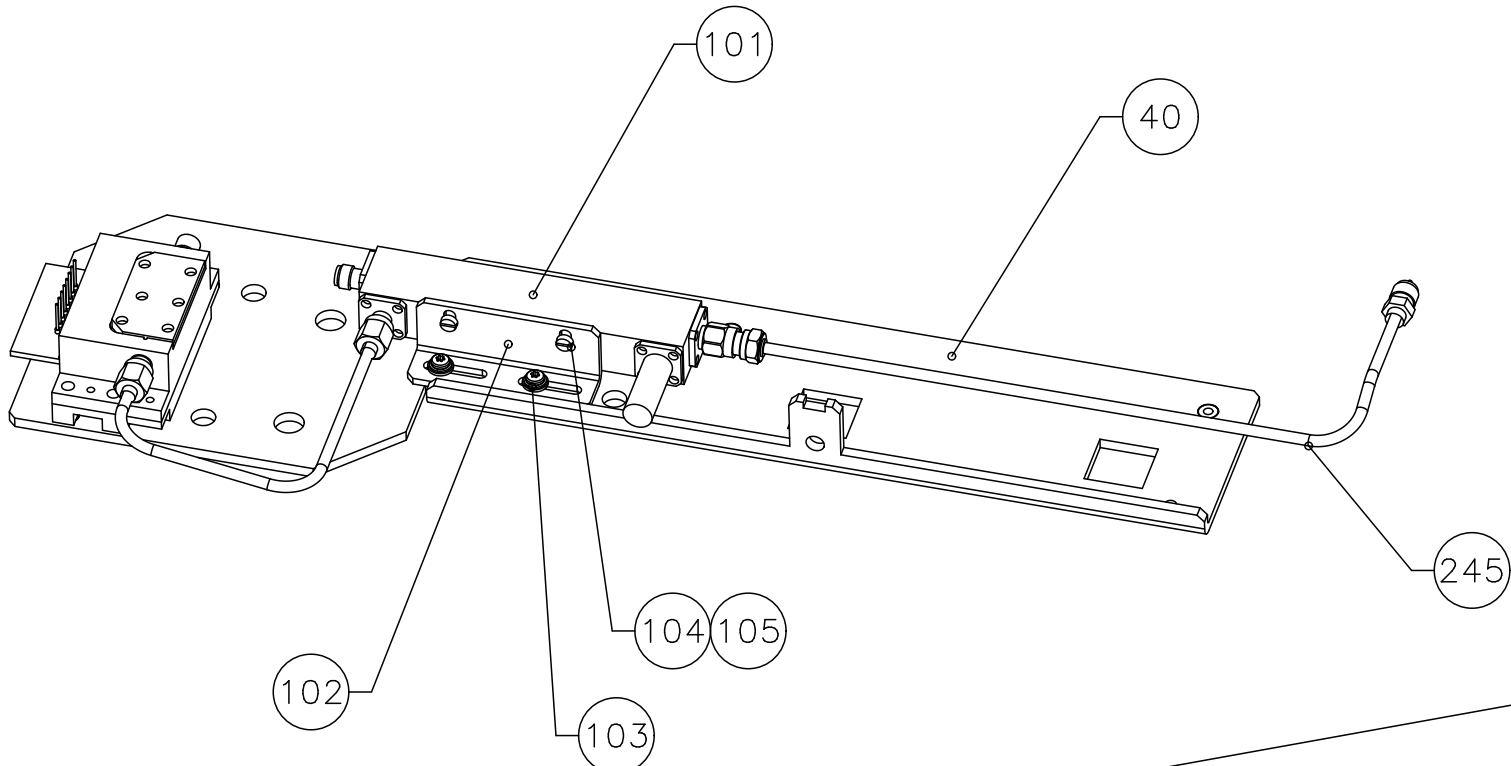
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Projektions-  
methode  
Projection  
Method

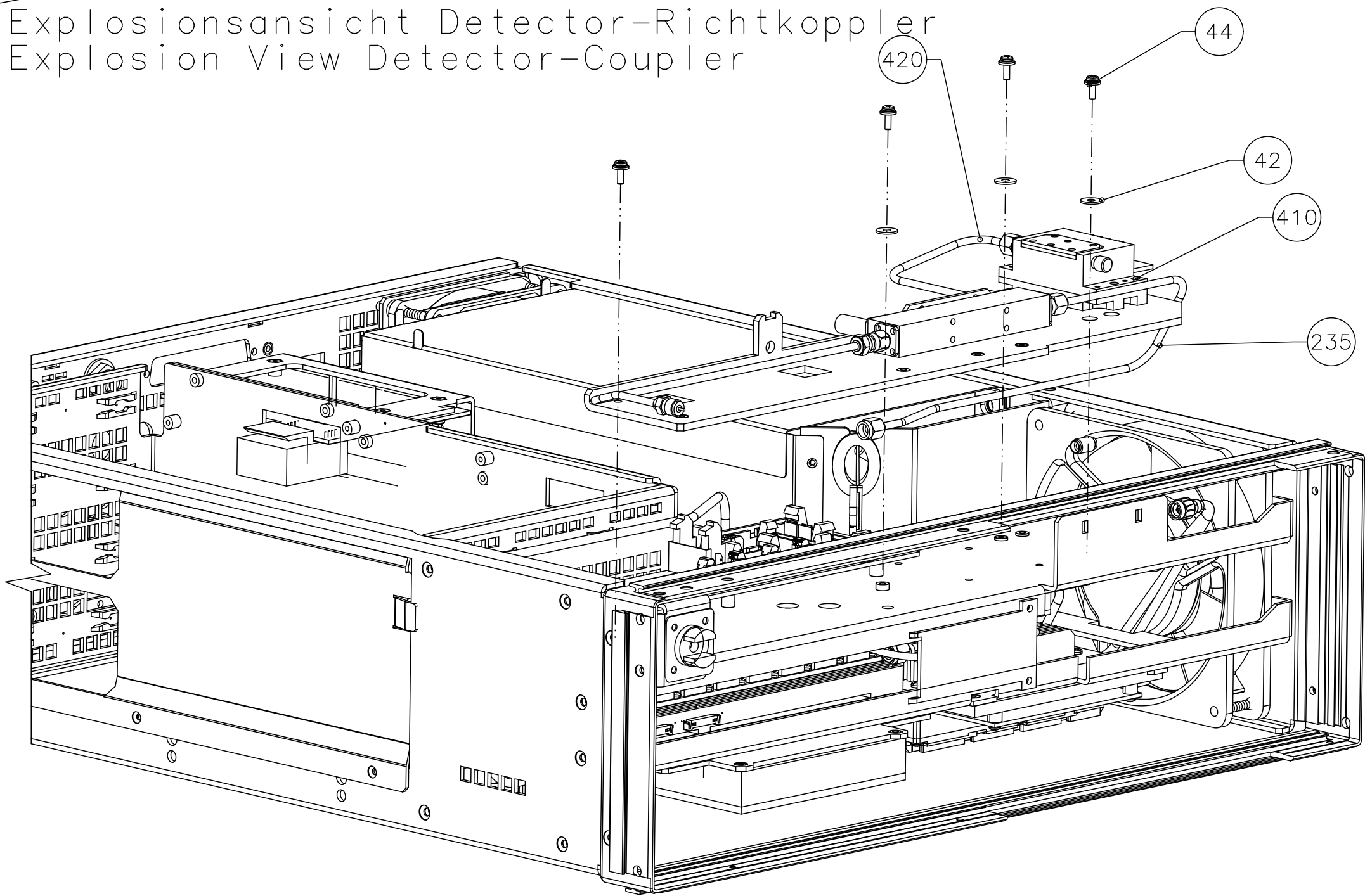


2 nd Generation RF Modules

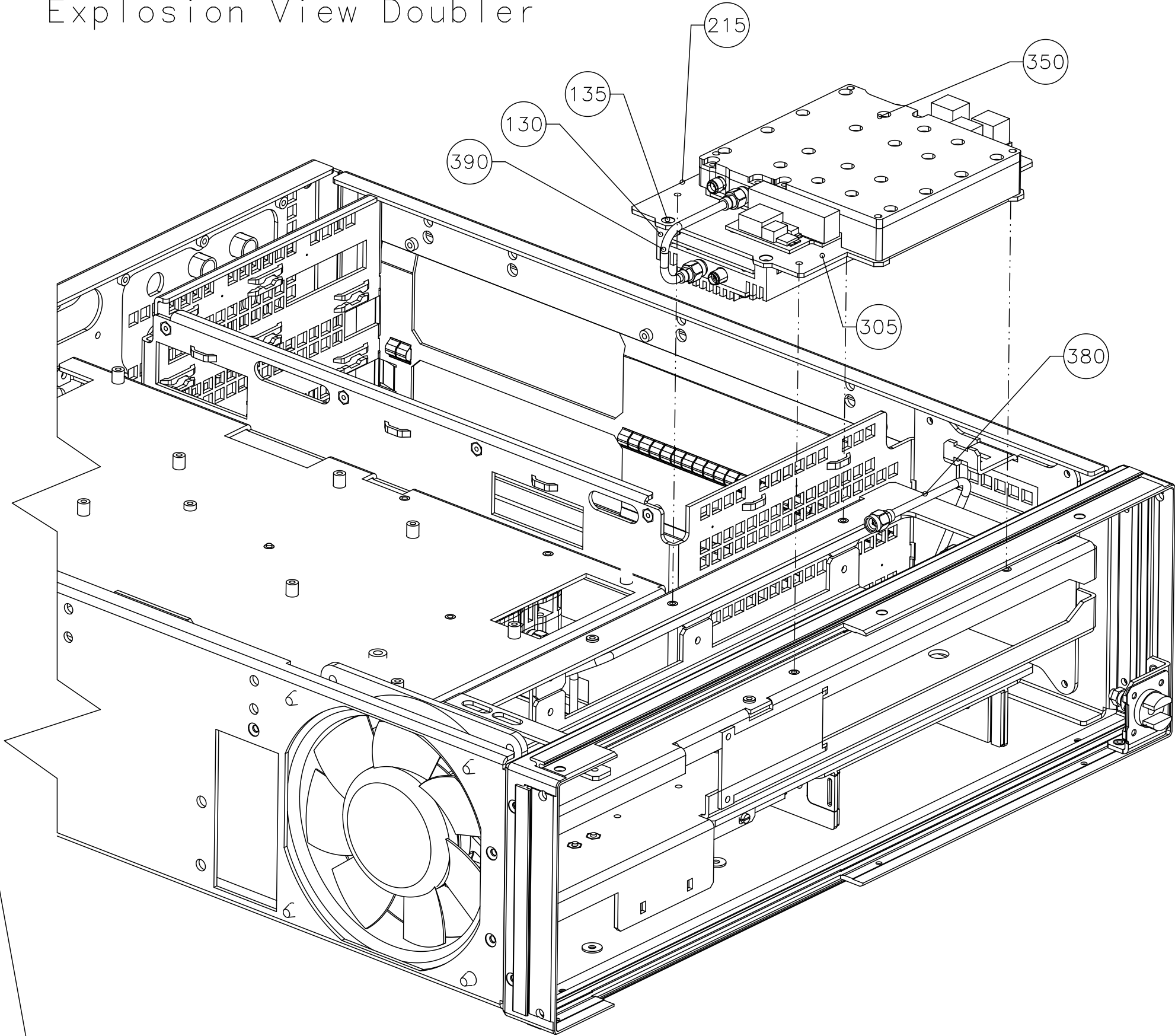
Montage Detector-Richtkoppler  
Mounting Detector-Coupler



Explosionsansicht Detector-Richtkoppler  
Explosion View Detector-Coupler



Explosionsansicht Doubler  
Explosion View Doubler



Kabel nach Stromlauf (1167.0000.01) gesteckt  
Cable connectet look at circuit diagramm (1167.0000.01)

Die Nummern der Teile entsprechen der jeweiligen  
Position in der Stueckliste 1167.7204.01

The parts / items in this drawing are included  
in the corresponding parts list 1167.7204.01

|                  |                         |                             |                       |                             |              |
|------------------|-------------------------|-----------------------------|-----------------------|-----------------------------|--------------|
| Maßstab<br>Scale | Toleranz<br>Tol.        | IS02768-m                   | Werkstoff<br>Material | Sprache / Lang. Ael. / C.I. | Blatt / Sh.  |
| ROHDE&SCHWARZ    | Benennung / Designation | SMF-B144 1 GHz BIS 43.5 GHz |                       | de en                       | 02.00        |
|                  |                         | SMF-B144 1 GHz TO 43.5 GHz  |                       |                             | 2            |
| SMF-B144         | Datum<br>Date           | 2009-01-14                  | Abteilung<br>Dept.    | 16PK                        | Name<br>Name |
|                  |                         |                             |                       | ms                          | 1167.7204.01 |
|                  |                         |                             |                       |                             | D            |

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Projektions-  
methode  
Projection  
Method

## Block Circuit Diagrams

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**Note:**

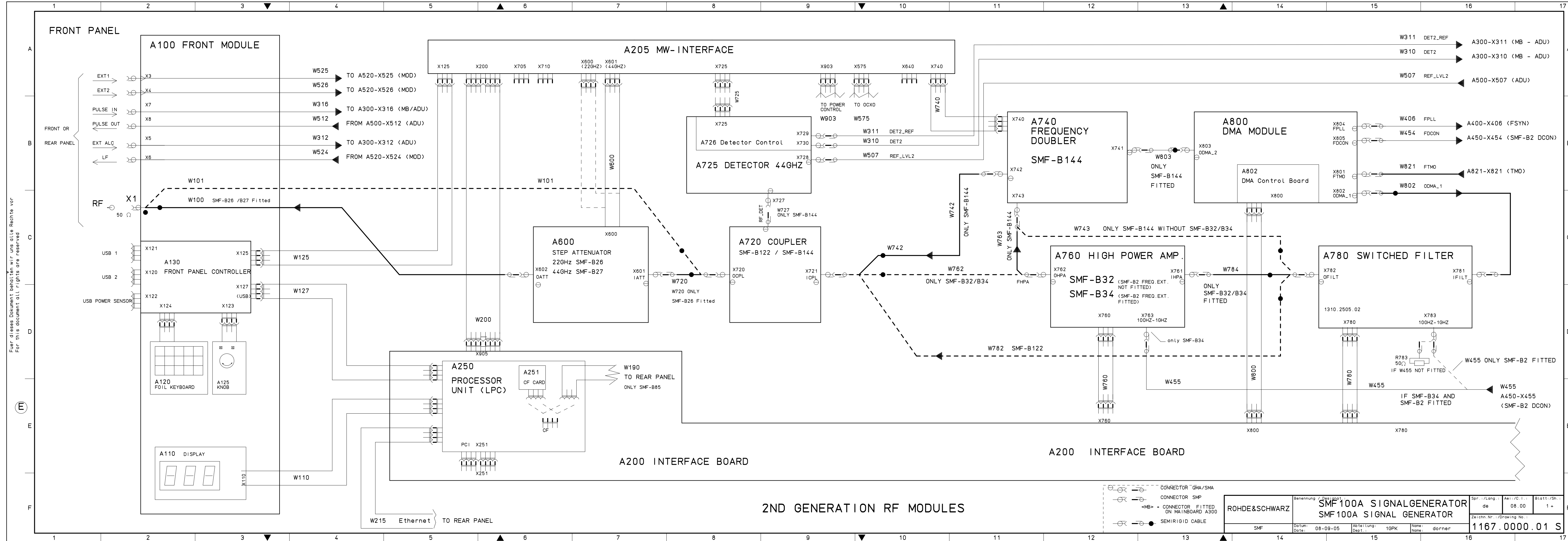


*The designation "2nd GENERATION RF MODULES" in the spare parts lists, circuit diagrams, and mechanical drawings is valid for signal generators R&S SMF100A from series 101 001.*

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FRONT PANEL

A100 FRONT MODULE

A205 MW-INTERFACE

A725 DETECTOR 44GHZ

A740  
FREQUENCY  
DOUBLER  
SMF-B144

A800  
DMA MODULE

A802  
DMA Control Board

A760  
HIGH POWER  
AMPLIFIER  
SMF-B31

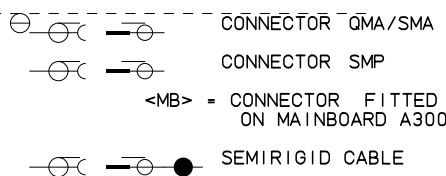
A780  
SWITCHED  
FILTER

A250  
PROCESSOR  
UNIT (LPC)

A200 INTERFACE BOARD

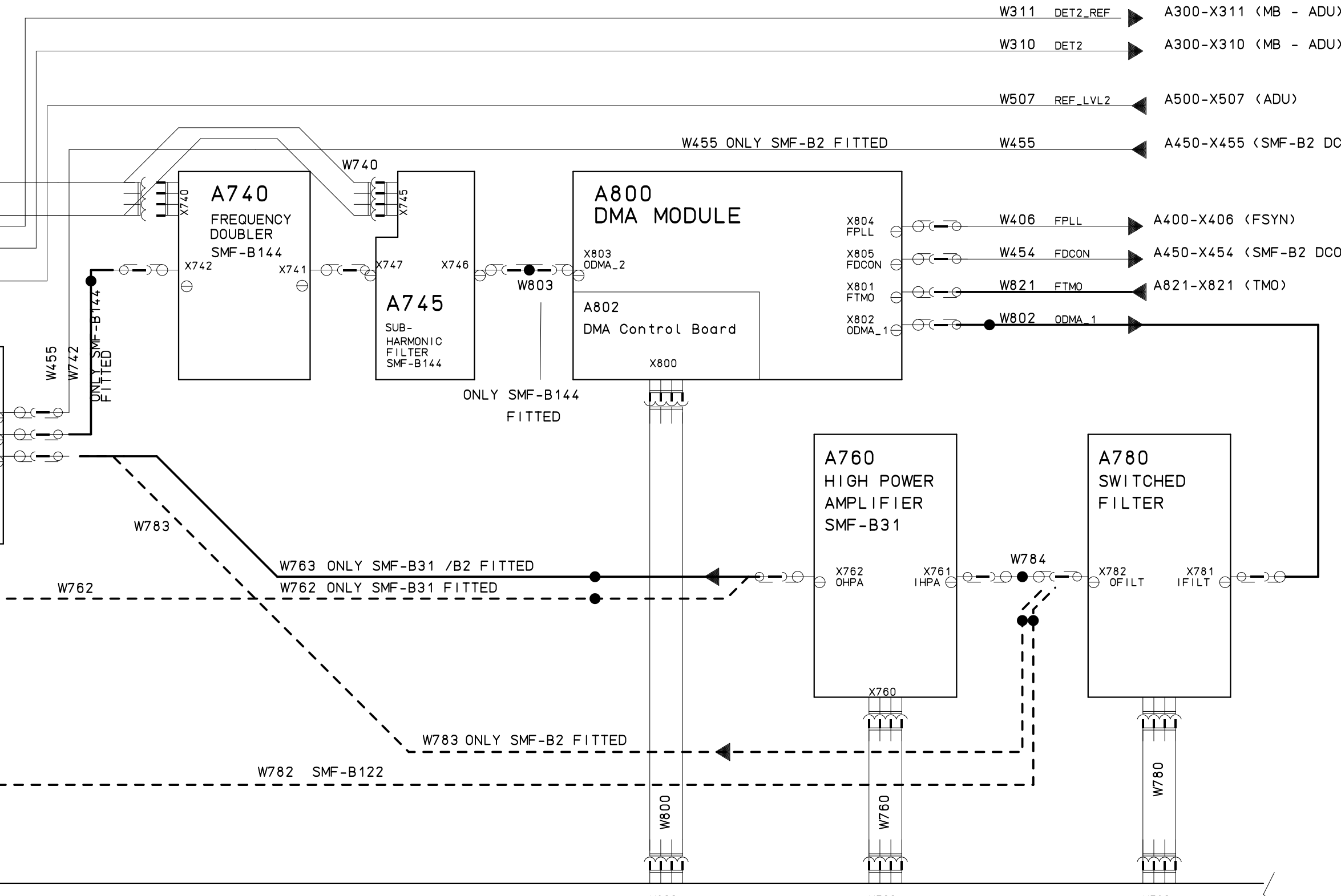
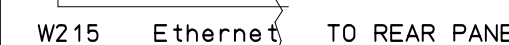
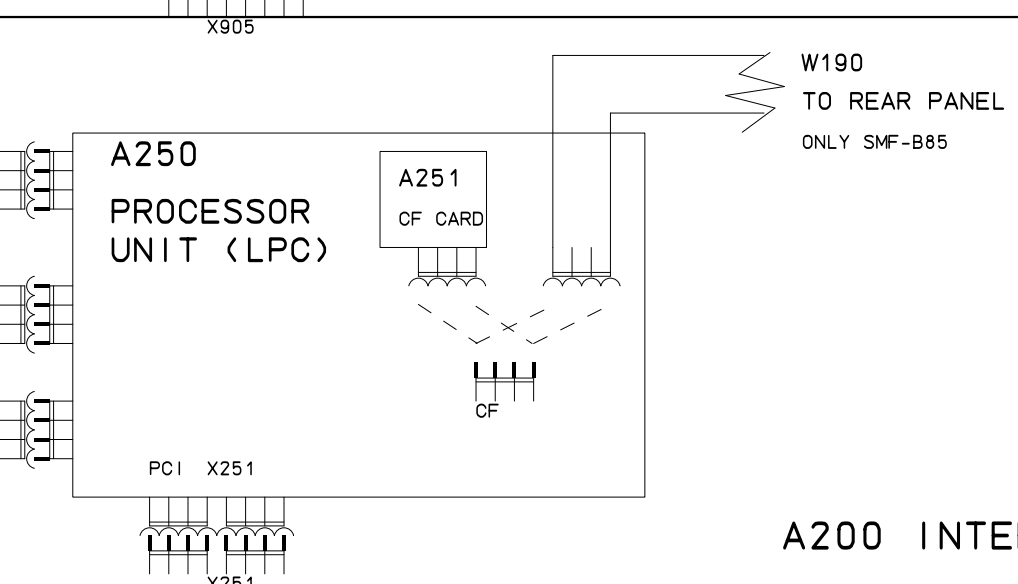
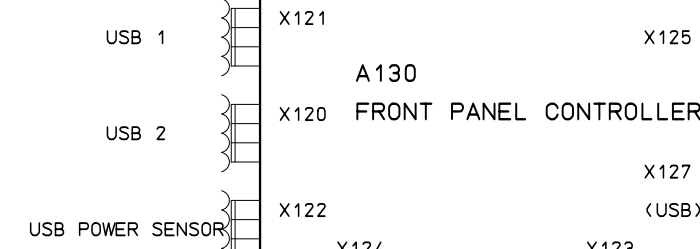
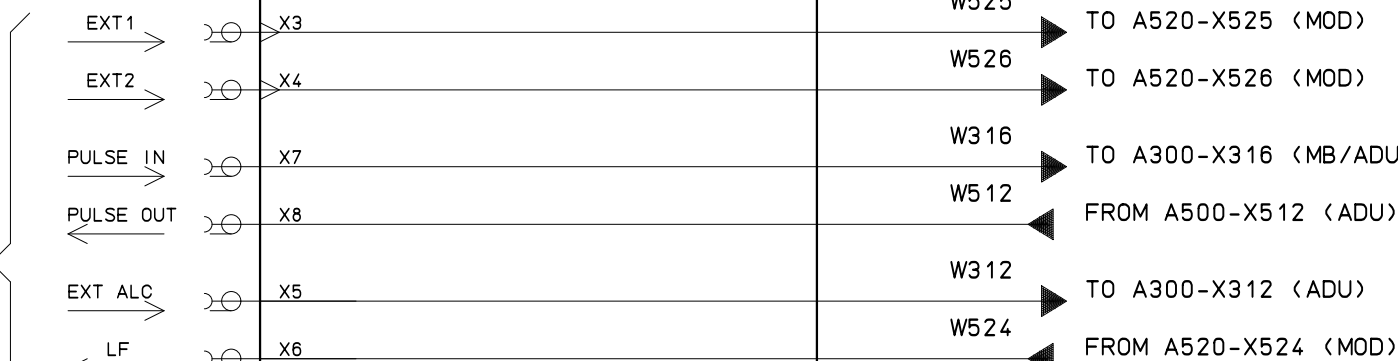
A200 INTERFACE BOARD

1st GENERATION RF MODULES



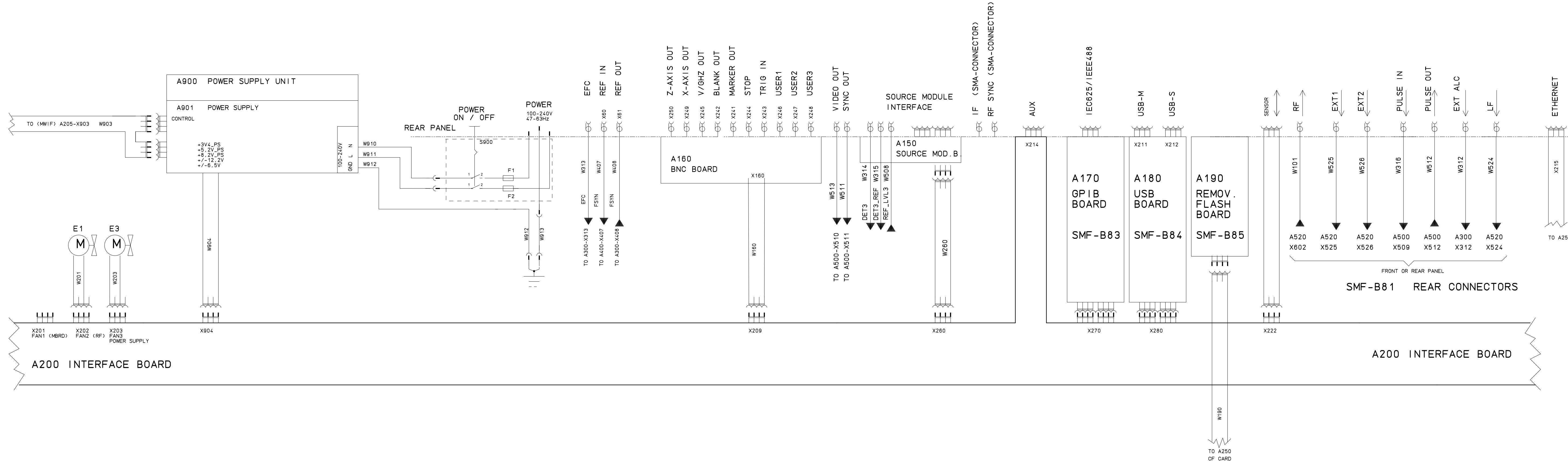
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| ROHDE&SCHWARZ | Benennung / Designat. :<br>SMF 100A SIGNALGENERATOR<br>SMF 100A SIGNAL GENERATOR |          |                      |      | Spr.:/Lang.:<br>de                          | Akt.:/C. l.:<br>08.00 | Blatt:/Sh.:<br>2 + |
|               |                                                                                  |          |                      |      | Zeichn.Nr.:/Drawing No. :<br>1167.0000.01 S |                       |                    |
| SMF           | Datum:<br>Date:                                                                  | 08-09-05 | Abteilung:<br>Dept.: | 10PK | Name:<br>Name:                              | dorner                |                    |

FRONT OR  
REAR PANEL



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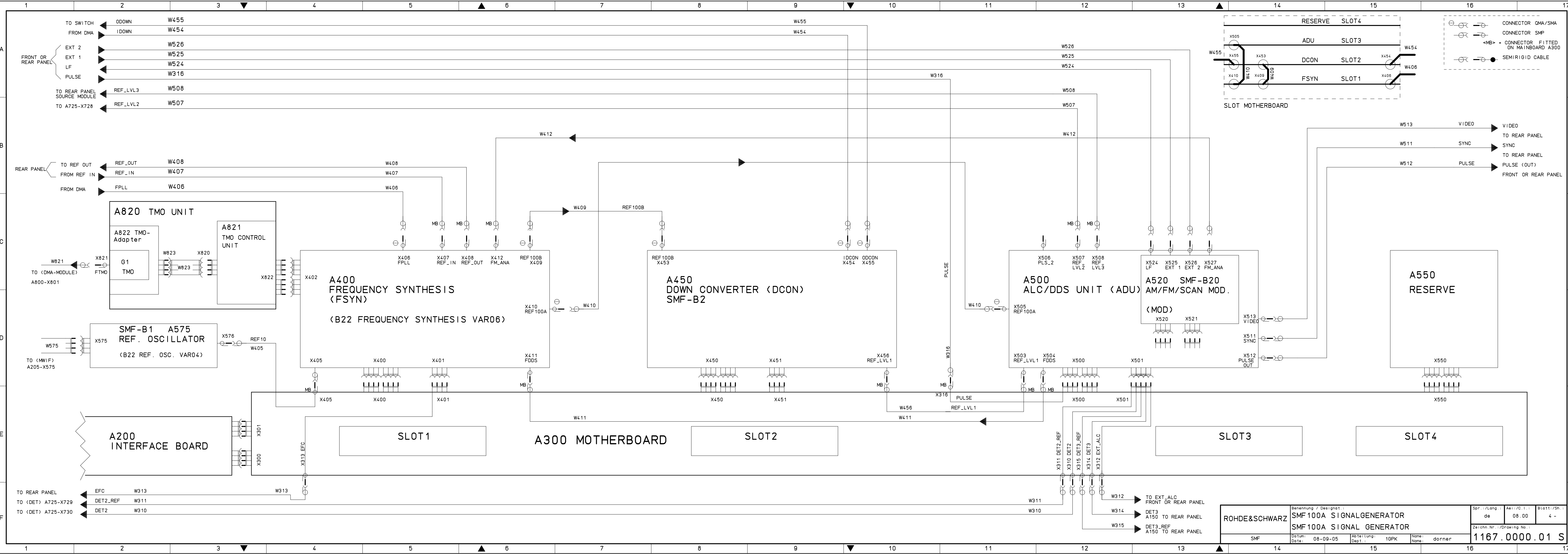
|               |                                                           |  |  |                                                |                         |                        |
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| ROHDE&SCHWARZ | Benennung / Designation: <b>SMF 100A SIGNAL GENERATOR</b> |  |  | Spr.:/Lang.: <b>de</b>                         | Äl.:/C.I.: <b>08.00</b> | Blatt:/Sh.: <b>3 +</b> |
|               | Datum: <b>08-09-05</b>                                    |  |  | Zeichn.Nr.:/Drawing No.: <b>1167.0000.01 S</b> |                         |                        |
| SMF           | Abteilung: <b>10PK</b>                                    |  |  | Name: <b>dorner</b>                            |                         |                        |



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E

F



|                 |                                                |                 |  |                                         |                   |                 |
|-----------------|------------------------------------------------|-----------------|--|-----------------------------------------|-------------------|-----------------|
| ROHDE&SCHWARZ   | Benennung / Designat.: SMF100A SIGNALGENERATOR |                 |  | Spr.:/Lang.: de                         | Arb.:/C.I.: 08.00 | Blatt:/Sh.: 4 - |
|                 | SMF100A SIGNAL GENERATOR                       |                 |  | Zeichn.Nr.:/Drawing No.: 1167.0000.01 S |                   |                 |
| Datum: 08-09-05 |                                                | Abteilung: 10PK |  | Name: dorner                            |                   |                 |