Service Manual

Signal Generator

R&S® SMA100A

1400.0000.02

ROHDE&SCHWARZ
Test and Measurement

Dear Customer,

throughout this manual, the Signal Generator R&S® SMA100A is abbreviated as R&S SMA..

Chapter Overview

Index

Index

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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.

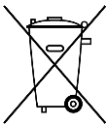
The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English. 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 Observe product documentation		ON/OFF Power
	Caution when handling heavy equipment		Standby indication
	Danger of electric shock		Direct current (DC)

Symbol	Meaning	Symbol	Meaning
	Caution ! Hot surface		Alternating current (AC)
	Protective conductor terminal 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 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 For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

Signal words and their meaning

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

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

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

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

NOTICE Indicates information considered important, but not hazard-related, e.g. messages relating to property damage.
In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

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

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

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.

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

Repair and service

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

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

Batteries and rechargeable batteries/cells

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

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

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

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

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

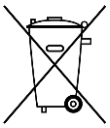
Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto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

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 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 Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser Más información en la sección "Funcionamiento", punto 7.		

Palabras de señal y su significado

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

	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.

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

Seguridad eléctrica

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

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

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

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

17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados —los llamados alérgenos (p. ej. el níquel)—. Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación/protección del medio ambiente", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
   - Aparato de clase A:
     Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
     Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos

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

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

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.

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.

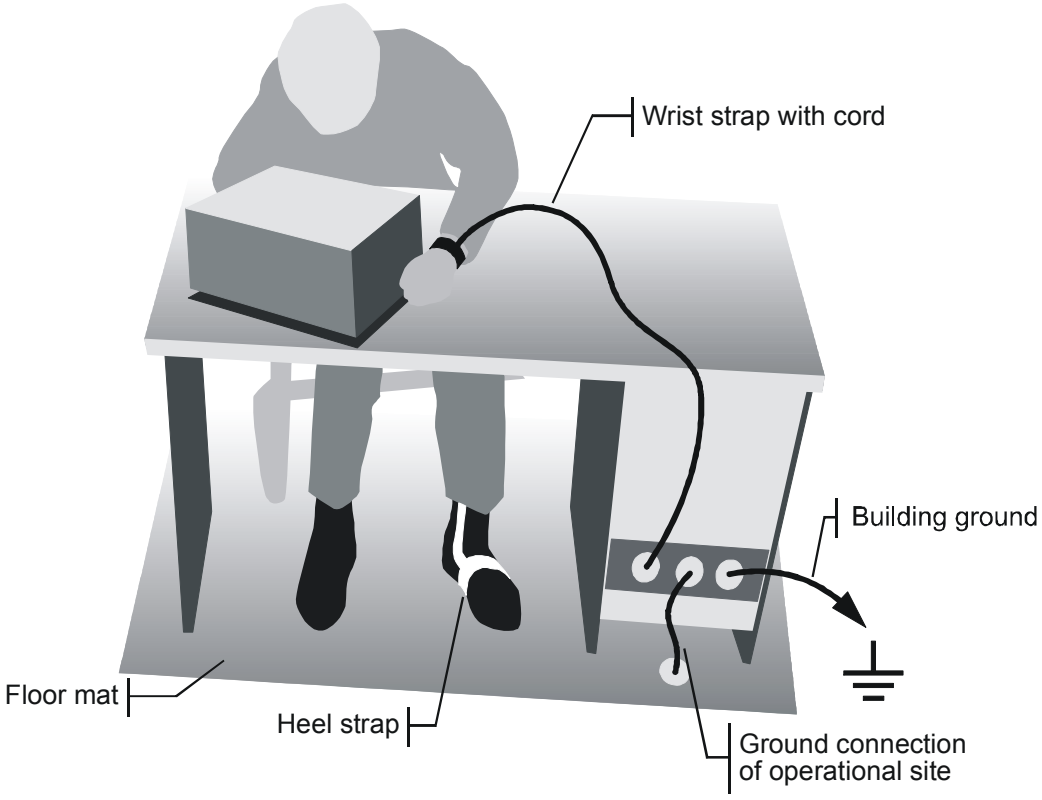
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

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:

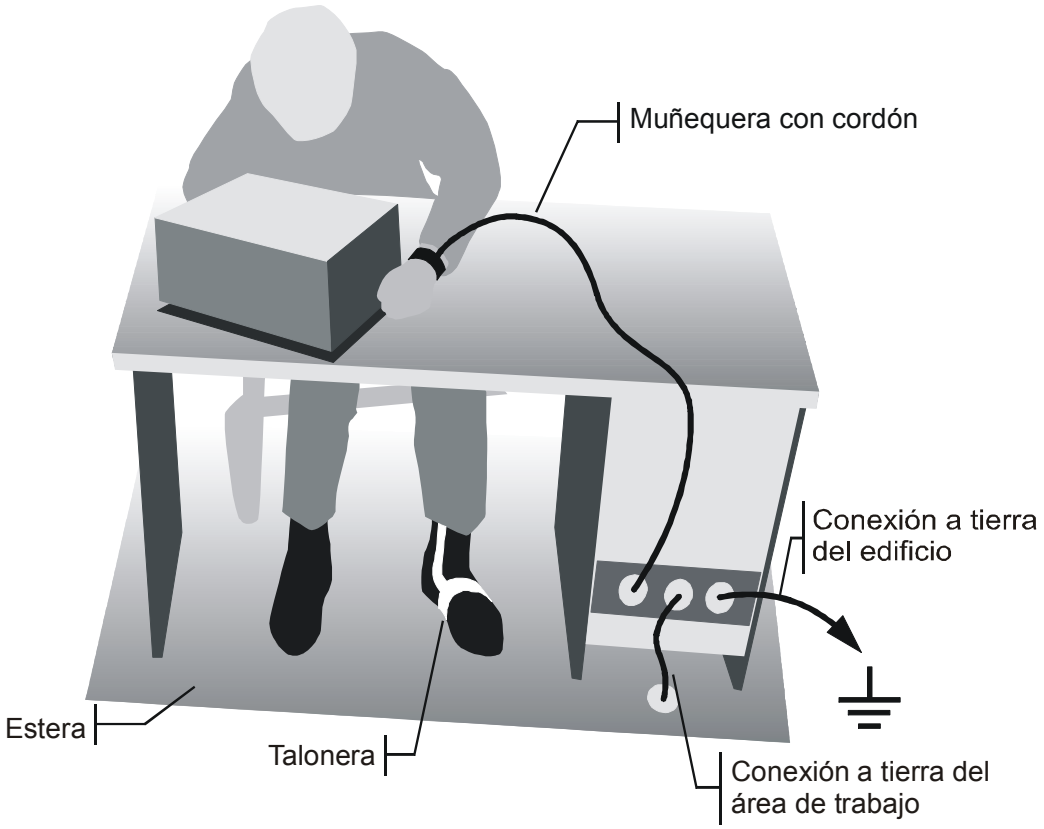
- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

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

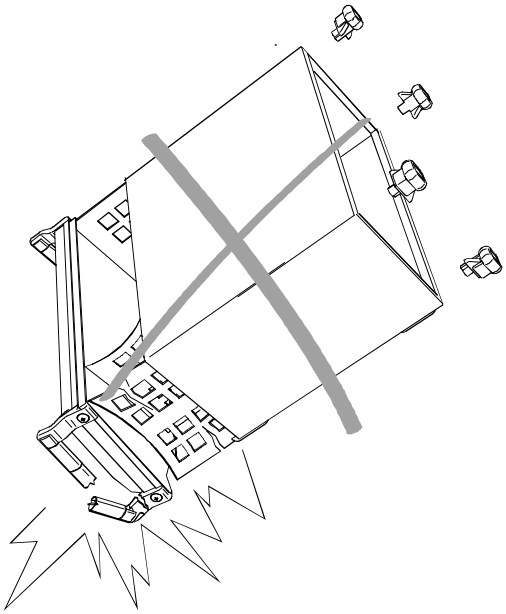
Safety Instructions for Units with Removable Cabinet

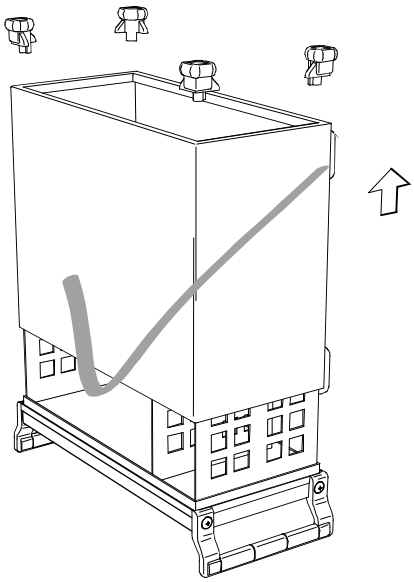
⚠ WARNING

Danger of injuries

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

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





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

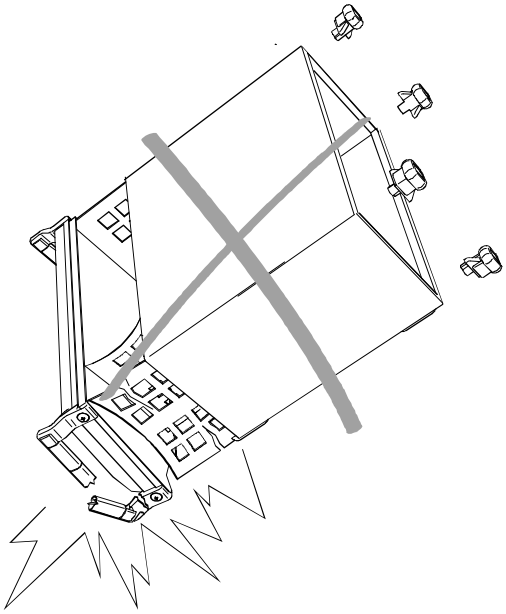
Informaciones de seguridad para aparatos con tubo de quita y pon

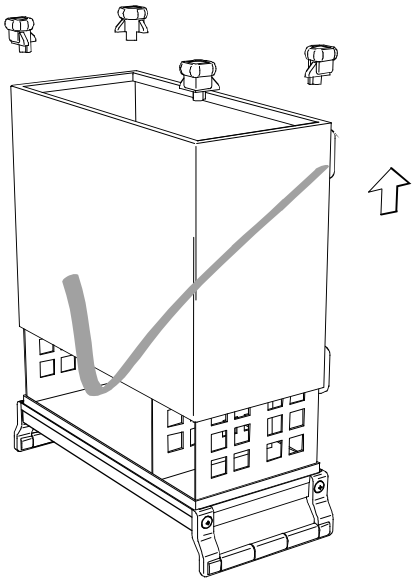
⚠ ADVERTENCIA

Peligro de heridas

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

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





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

Procedure in Case of Service and Ordering of Spare Parts

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

Please contact your local Rohde & Schwarz service center if you need service or repair work of your equipment or to order spare parts. You can find the current address of your representative on our homepage 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.

Ordering Spare Parts

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

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

Refurbished Modules

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

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

Taking Back Defective Replaced Modules

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

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

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

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

Contents - Chapter 1 "Performance Test"

1 Checking the Rated Characteristics

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

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

Measuring Equipment and Accessories

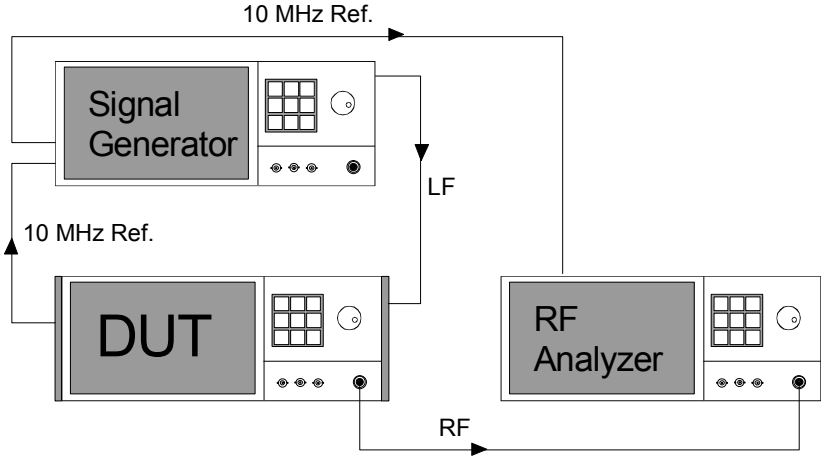
Table 1-1 Measuring equipment and accessories

Item	Type of Instrument	Required Characteristics	Suitable Instrument	R&S Order No.
1	Frequency counter (included in item 18)	1 Hz to RF_{max}, resolution 0.1 Hz (included in spectrum analyzer item 18)		
2	Reference source for SSB noise measurements	Low SSB noise, frequency range up to RF_{max}	Reference Synthesizer	1158.2878
3	Storage oscilloscope	300 M samples/s, two channels		
4	Controller	Industry standard PC/XT/AT with IEC-60625 interface and USB interface	R&S PSM17	1116.5004.70
5	Signal generator	0.1 MHz to RF_{max}	R&S SMU with options R&S SMU-B106, -B10, -B31	1141.2005.02
6	Phase noise test assembly	Mixer: 10 MHz to RF_{max}, branching filter 20 MHz, switchable attenuator to 0 and 40 dB, preamplifier with gain of approx. 30 dB, input noise < 2 nV (1 Hz), bandwidth 10 MHz, DC decoupling after the mixer for oscilloscope		
7	Oscilloscope (usually included in item 3)	Bandwidth > 100 MHz, two channels with DC coupling		
8	RF power meter	9 kHz to RF_{max}	R&S NRP with R&S NRP-Z91 R&S NRP-Z92 or R&S NRVS with R&S NRV-Z5 R&S NRV-Z51	1143.8500.02 1168.8004.02 1171.7005.02 or 1020.1809.02 0828.3818.02 0857.9004.02
9	Low-noise preamplifier	9 kHz to RF_{max}, gain > 20 dB, noise figure < 10 dB	Miteq JSTD-02K0150-8PS	
10	VSWR bridge	6.6 MHz to RF_{max} directivity > 30 dB	f < 3 GHz: R&S ZRC f > 3 GHz: Agilent 773D	1039.9492.55
11	DC voltage source	Setting range 0 to 10 V	R&S NGMD35	0117.7127.02

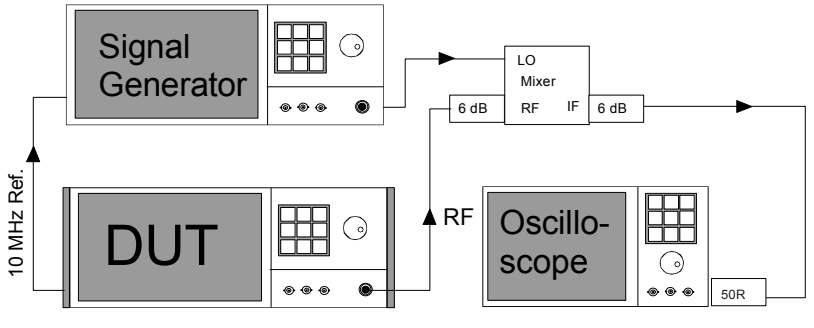
Item	Type of Instrument	Required Characteristics	Suitable Instrument	R&S Order No.
12	RF power amplifier	10 MHz to RF_{max}, power > 33 dBm	Mini Circuits ZHL-03-5WF	
13	Pulse generator	Pulse repetition frequency up to 10 MHz		
14	AC/DC voltmeter	10 Hz to 10 MHz	R&S URE3	0350.5315.03
15	Broadband FM demodulator	included in spectrum analyzer item 18		
16	RF attenuator	DC to RF_{max}, 10 dB, system N	R&S DNF	0272.4210.50
17	RF attenuator	DC to RF_{max}, 3 dB, system N	R&S DNF	0272.4010.50
18	RF analyzer & Demodulator for analog modulations & FM-demodulator	9 kHz to RF_{max} * 3	R&S FSMR26 equipped with options R&S FSU-B25 R&S FS-B223 R&S FS-B73	1166.3311.26 1044.9298.02 1157.1955.02 1169.5696.02
19	Feed-through termination	50 Ω, BNC system	R&S RAD	0289.8966.00
20	Zero Bias Schottky Detecor	50 Ω	Krytar 202S	
21	FHOP-Bus generator	Generation of clock, data and strobe for FHOP-Bus	For example the printer port of a PC with software	
22	VOR ILS Modulation Analyzer	108 MHz…335 MHz	R&S FMAV R&S EVS300 R&S FSMR/FSQ/FSU equipped with option R&S FS-K15	0856.4509.52 3544.4005.02 1302.0936.02
23	Wideband Power Sensor	1 GHz, Bandwidth 30 MHz	R&S NRP-Z81	1137.9009.02

Test Assemblies

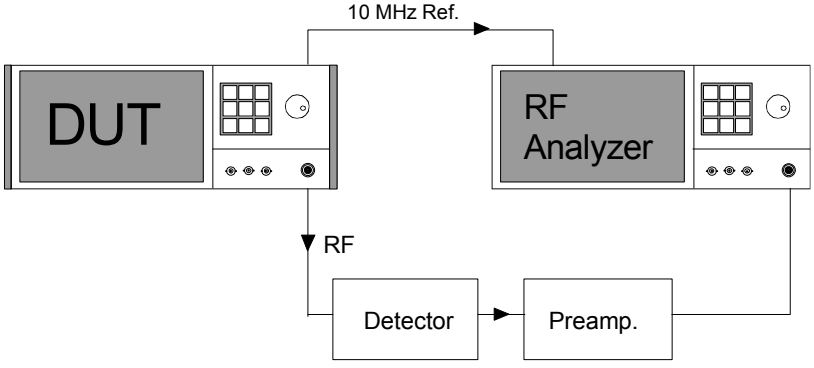
Standard Test Assembly for Analog Modulations

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

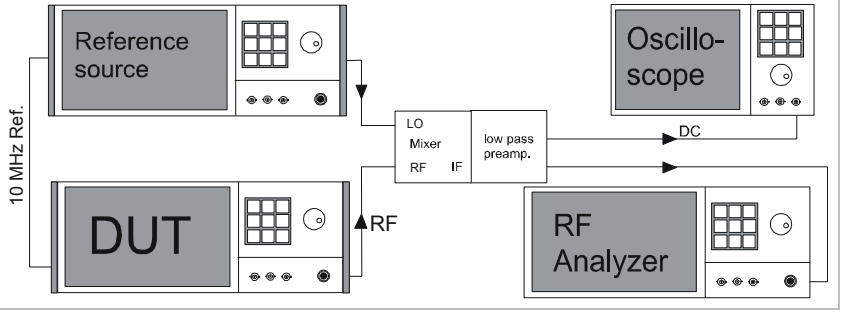
Test Assembly for Pulse Modulation

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

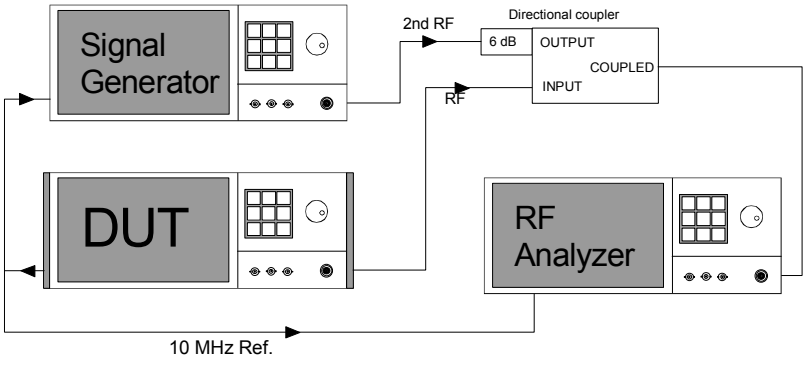
Test Assembly for Residual AM

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

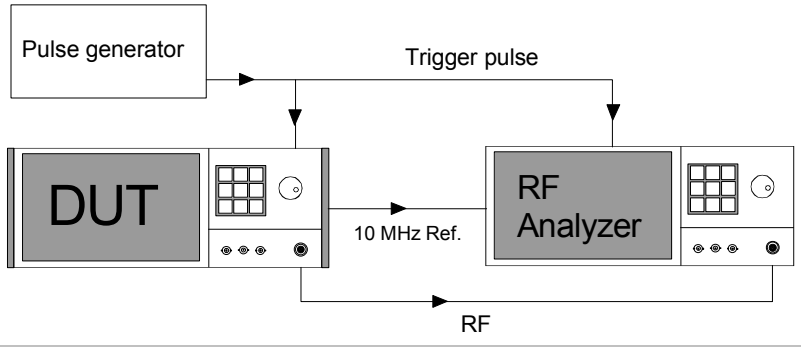
Test Assembly for SSB Phase Noise and Jitter

Test equipment	- SSB reference source (*Table 1-1* item 2), - Phase noise test assembly consisting of mixer with lowpass filter and preamplifier (*Table 1-1* item 6) - Oscilloscope (*Table 1-1* item 7) - Spectrum analyzer (*Table 1-1* item 18) - The DUT should be used as source for synchronization. If the DUT is referenced externally, the reference PLL should be set to “WIDE”.
Test setup	

Test Assembly for Output Impedance (VSWR)

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

Test Assembly for Settling Time

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

Preparation, Recommended Test Frequencies and Levels

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

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

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

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

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

Range	Frequency/ MHz	Hardware switching points	Recommended test frequencies in MHz
Mixer	0.009 to 6.6	Detector + Mixer 6.6 MHz	0.1; 6.6
Divider/128	>6.6 to 11.71875		6.7
Divider /64	>11.71875 to 23.4375	Lowpass filter 16 MHz	
Divider /32	>23.4375 to 46.875	Lowpass filter 36 MHz	
Divider /16	>46.875 to 93.75	Lowpass filter 80 MHz	
Divider /8	>93.75 to 187.5	Level Controll section 180 MHz Lowpass filter 180 MHz	179.9; 180.1
Divider /4	>187.5 to 375	Lowpass filter 285 MHz	
Divider /2	>375 to 750	Lowpass filters, 448; 716 MHz	749.9
Base octave	>750 to 1500	Lowpass filter, 1147 MHz, Oscillator limits 890, 1070, 1285 MHz	750.1, 1147.1, 1499.9
Base octave incl. R&S SMA-B22	>750 to 1500	Lowpass filter, 1147 MHz, Oscillator limits 877, 1004, 1131; 1258; 1385 MHz	750.1, 1147.1, 1499.9
Doubler	>1500 to 3000	Lowpass filter, 1840.0 MHz	1500.1, 1841.1, 2999.9
R&S SMA-B106	>3000 to 6000	Lowpass filters	3000.1, 3500, , 4500, 5000, 6000

The recommended **test levels** are at the upper and lower switching threshold of the attenuator. The electronic attenuator of the DUT is switched depending on frequency, modulation parameters and level according to an internal stored table in approximately 5 dB steps. The switching thresholds can be detected under **Attenuator fixed range** in the **Level** menu. After setting all other parameters, the threshold level can be detected by level variation. The level at which the attenuator fixed range changes is the threshold.

By measuring at the last level setting of one range and the first level setting of the next range, the internal setting range borders are used. In the following, $\mathbf{P_{min}}$ is the lowest level before switching the attenuator, and $\mathbf{P_{max}}$ the highest. For best measurement results, levels at the crossover from 0 to 5 dB attenuation are recommended.

For frequency options without attenuator (R&S SMA-B10xL), $\mathbf{P_{min}}$ and $\mathbf{P_{max}}$ are the minimum and maximum specified levels according to the datasheet.

Test Procedures

Reference Frequency

Output of Internal Reference

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

Test equipment	➢ RF power meter (*Table 1-1*, item 8) ➢ Frequency counter (*Table 1-1*, item 1)
Test setup	➢ Connect an RF power meter to the REF OUT output (on rear panel).
Measurement	➢ Measure the output level. It should be within ±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. ⇨ The frequency deviation must not exceed the sum of deviations resulting from the frequency error in the rated temperature range and from aging.

Input for External Reference

Test equipment	➢ Frequency counter (*Table 1-1*, item 1) ➢ Signal generator (*Table 1-1*, item 5)
Test setup	➢ Connect the signal generator to the REF IN input for the external reference (on rear panel). ➢ Connect a calibrated frequency counter to the RF output. ➢ Synchronize the signal generator and the reference output.
Preparations / Settings	➢ Settings on DUT: - RF on - Level: 0 dBm (suitable level for the frequency counter) - Frequency: 1 GHz - Setup ⇨ Reference Oscillator ⇨ Source: External ➢ Settings on signal generator: - RF on - Level: 0 dBm
Measurement	➢ Set the signal generator frequency to 9.99997 MHz and 10.0003 MHz. Measure the output frequency of the DUT. ➢ There must be no relative frequency error and no error message in the display of the DUT.

Signal generator frequency	9.99997 MHz	10.0003 MHz
DUT frequency	999.997 MHz	1000.03 MHz

Frequency

Frequency Settling Time

<table>
<tr><td>Test assembly</td><td>➢ See section "Test Assembly for Settling Time", page 1.5.
➢ For measuring after IEC/IEEE bus delimiter the EOI-line of the IEC/IEEE bus is used as trigger signal instead of the pulse generator.</td></tr>
<tr><td>Test method</td><td>➢ The spectrum analyzer is operated as an FM demodulator. A controller transmits the start and the stop frequency via the IEC/IEEE bus. The analyzer is triggered by the positive edge on the EOI line of the IEC/IEEE bus or the trigger pulse in list mode. At switch over from start to stop frequency, the settling procedure is displayed on the screen of the analyzer.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Synchronize the reference frequencies of the DUT and the analyzer.
➢ Make IEC/IEEE bus and RF connections.
➢ Connect trigger connector to EOI line (pin 5) of IEC/IEEE bus.
➢ Settings on DUT:
<table><tr><th>Setting</th><th></th></tr><tr><td>Output Level</td><td>0 dBm</td></tr><tr><td>Frequency</td><td>Start frequency (unmodulated)</td></tr></table>➢ Settings on spectrum analyzer:
<table><tr><th>Setting</th><th></th></tr><tr><td>Reference level</td><td>5 dBm</td></tr><tr><td>Center frequency</td><td>Stop frequency</td></tr><tr><td>FM Demodulation</td><td>On</td></tr><tr><td>Demodulation bandwidth</td><td>50 kHz</td></tr><tr><td>Deviations per division</td><td>200 Hz</td></tr><tr><td>Measurement time</td><td>5 ms (10 ms for ALC State Off)</td></tr></table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Measurement</td><td>➢ Set the spectrum analyzer to the stop frequency
➢ Set the DUT to the start frequency
➢ Send the stop frequency from the controller to the DUT
⇨ The externally triggered spectrum analyzer displays the settling curve.
⇨ The settling time is defined as the time between the trigger event and the moment from which on the frequency deviation to the stop frequency stays below the value given in the data sheet.
➢ Repeat the measurement with start and the stop frequency interchanged.
➢ Repeat the measurement with ALC OFF (S&H).</td></tr>
</table>

Measurement in List mode

- Connect pulse generator as trigger source to the INSTR TRIG connector of DUT, spectrum analyzer and oscilloscope. External triggering at 1.4 V, positive edge.
- Settings on DUT:

Setting	
List Mode	Generate a list containing the two test frequencies F1 and F2 with a level of 0dBm each
List Mode mode	External step

- Settings on spectrum analyzer:

Setting	
Demodulation bandwidth	100 kHz
Measurement time	1 ms

- Settings on pulse generator:
  - single shot
- With each pulse from the pulse generator, frequency toggles from F1 to F2 and reverse.

  ⇨ The settling curve is displayed on the screen of the externally triggered analyzer. Using the cursor, the time for reaching the specified deviation can be determined.

Recommended test frequencies

- Measure the following steps in both directions, when triggering from EOI with ALC set to AUTO. Also use these frequency steps for measuring in List Mode.

F1/MHz	F2/MHz	
6.5	700	
749	751	
1499	1501	only without B22
1499	1540	only with B22
2999.9	3000.1	
3000.1	4500	
4500	6000	

- Repeat the measurement with ALC OFF (S&H)
  pulse modulation state on
  pulse source: extern
  pulse polarity: inverse

  (with these settings, the ALC state is S&H) for:

F1/MHz	F2/MHz	
1499	**1501**	

Spectral Purity

Harmonics

Test equipment	➢ Spectrum analyzer (*Table 1-1*, item 18)
Test setup	➢ Connect the spectrum analyzer to the RF output of the DUT. ➢ Synchronize reference frequencies of analyzer and DUT.
Preparations / Settings	➢ Settings on spectrum analyzer

Setting	
Reference level	DUT level + 3 dB
Level range	100 dB, 10 dB/Division
Span	0 Hz
Resolution bandwidth	300 Hz
Detector	Sample detector

Note: *These values are typical values that depend on the analyzer used. The necessary measurement resolution must be verified prior to the measurement.*

Measurement	➢ Measure the level of the fundamental signal. ➢ Find Signals at twice and three times of the carrier frequency and measure the levels. ⇨ The harmonic spacing is the measured level referred to the fundamental (dBc = referred to the carrier).
Recommended test frequencies and levels	➢ Test frequencies according to *Table 1-2* ➢ Test levels: specified levels of data sheet

Subharmonics

Test equipment and setup	Same as for Harmonics
Test setup	Same as for Harmonics
Measurement	➢ Measure the level of the fundamental signal. ➢ For test frequencies ≤ 3 GHz find signals at 0.5 * test frequency and 1.5 * test frequency and measure the levels. ➢ For test frequencies > 3 GHz find signals at 0.25 * test frequency and measure the level. ⇨ The subharmonic spacing is the measured level referred to the fundamental (dBc = referred to the carrier).
Recommended test frequencies and levels	1501 MHz, 1550 MHz to Fmax in 50 MHz steps level: P_{min}

Nonharmonics

Test equipment	Same as for harmonics
Test setup	Same as for harmonics
Preparations / Settings	➢ Synchronize the reference frequencies of the DUT and the analyzer. ➢ Settings on DUT: **Setting** | Output level | 0 dBm Modulation | Off ➢ Settings on spectrum analyzer: **Setting** | Reference level | 3 dBm Span | 50 Hz
Measurement	➢ First the level is measured at the test frequency as reference, then a signal is searched for at the analyzer frequency. ⇨ The nonharmonic spacing is the measured level referred to the reference level (dBc = referred to the carrier).
	Note: *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.* ***Alternative:*** *Check with a second source (not R&S SMA or R&S SMU, or equipped with different options).*

Recommended settings and sampling frequencies:

Test frequencies for nonharmonics of the synthesis without option R&S SMU-B22

DUT frequency in MHz	Analyzer search frequency in MHz
984.001	987.557
1007.6443	1007.6515
1027.155	1027.20444
1144.005	1144.055
1253.0	1265.2
1401.26	1401.3074
1499.02379	1499.03469
1696.853	1696.8639
1849.5328	1849.5438
2696.296	2696.3058
3019.5	3020.375
4367.2	4368.00
4887.2	4888.00
4471.2	4472.00

Additional test frequencies for nonharmonics of the synthesis without option R&S SMU-B22 for SSYN 1141.4220

DUT frequency in MHz	Analyzer search frequency in MHz
839.2	912.8
1218.82595	1228.22595
1455.99935	1465.79935
2080.01	2090.01

Test frequencies for nonharmonics of output mixer without option R&S SMU-B22

DUT frequency in MHz	Analyzer search frequency in MHz
6.5	130.00 at P_{min}
6.5	1040.00 at P_{min}
6.5	136.5
6.5	78
6.5	84.5
6.5	91
6.5	97.5
6.5	104

Test frequencies for nonharmonics of the synthesis with option R&S SMU-B22

DUT frequency in MHz	Analyzer search frequency in MHz
1000.08	1000.0
1050.08	1050.0
1100.08	1100.0
1150.08	1150.0
1200.08	1200.0
1250.08	1250.0
1300.08	1300.0
1350.08	1350.0
1400.08	1400.0
1450.08	1450.0
1499.92	1500.0
1500.506680	1500.76002
1500.506680	1502.02672
1500.506680	1517.426687
1746.74317	1746.93402
1800.2893045	1800.7234345
1828.65883132	1828,81149132
1875.38113408	1875.47165408
1924.53660942	1924.75680942
2043.92934349	2044.11700349
2110.663972	2111.026712
2163.630319	2163.796569
2210.14856183	2210.25761183
2356.0	2356.54075
2684.95121340	2684.6154234
2898.0	2898.909
2985.158823	2985.300303
3000.001	3000.029
3012.5	3013.54166
3162.41688	3163.93688
3162.41688	3179.33688
3229.1894	3228.17615
4711.0	4711.54
5800	5800.909

Test frequencies for nonharmonics of output mixer with option R&S SMU-B22

Setting on DUT Frequency in MHz	Analyzer search frequency in MHz
6.5	150.00 at P_{min}
6.5	1200.00 at P_{min}
6.5	156.5
6.5	98
6.5	91.5
6.5	85

Non-systematic nonharmonics

Test equipment	➢ Spectrum analyzer (*Table 1-1*, item 18)
Test setup	➢ Connect the spectrum analyzer to the RF output of the DUT. ➢ Synchronize reference frequencies of analyzer and DUT.
Preparations / Settings	➢ Settings on DUT: **Setting** | Output level | 10 dBm Modulation | Off ➢ Settings on spectrum analyzer: **Setting** | Reference level | 10 dBm Filter type | FFT Detector | Max Peak Averaging | On (e.g. 10 averages) ➢ Recommended settings for span and resolution bandwidth:
Measurement	➢ Measurement range: 3 kHz to 20 MHz offset from carrier ➢ During the scan, you should use an overlap of at least 1% for the measurement partitions.
Recommended test frequencies	➢ without option B22 in MHz: 5, 93.8125, 1493, 2080.01, 3001, 4000, 6000 ➢ with option B22 in MHz: 5, 93.8125, 1493, 2000, 2080.01, 2700, 3001, 4000, 6000

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

	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 af the analyzer, use a second generator with a different synthesis architecture.*

Wideband Noise

Test equipment

- Spectrum analyzer (*Table 1-1*, item 18)

Test setup

- Connect the spectrum analyzer to the RF output of the DUT.
- Synchronize reference frequencies of analyzer and DUT.

Preparations / Settings

- Settings on DUT:

Setting	
Output level	P_{upper} + 0.1 dB P_{upper} is determined by evaluating the DUT's answer to OUTP:AFIX:RANGE:UPPER?
Modulation	Off

- Settings on spectrum analyzer:

Setting	
Reference level	DUT output level + 1 dB
Span	110 kHz
Measurement function	Channel Power
Channel bandwidth	10 kHz
Detector	RMS
Measurement time	1 s

Measurement

- Determine the channel power with the center frequency of the analyzer set to the test frequency and note it down as P_{ref}.
- Increase the center frequency by the offset (e.g. 10 MHz).
- Reduce the spectrum analyzer's attenuation without overdriving the input mixer.
- Lower the reference level of the analyzer without overdriving the input mixer (e.g. by 30 dB), read the new channel power P_{noise} and note it down.
- Switch off DUT (RF Off) and read the channel power P_{res} and note it down.

Evaluation	➢ If the power P_{res} is lower than P_{noise} by more than 0.41 dB and less than 10 dB, the inherent noise power of the analyzer can be subtracted. To this effect, convert the two power values into mW according to the formula P[mW] = $10^{(P[dBm]/10)}$, then subtract P_{res} from P_{noise}. Reconvert the corrected power into dBm according to the formula PdBm = 10*log10(P[mW]). ➢ If the power P_{res} is less than 0.41 dB below the power P_{noise}, the analyzer resolution is not sufficient for a precise measurement. The true result is in such case certainly more than 10 dB below the measured value. If P_{res} is more than 10 dB below P_{noise}, P_{noise} need not be corrected since the noise component of the analyzer is negligible (<0.41 dB). ➢ Convert the power P_{noise} to 1 Hz bandwidth according to the formula P(1Hz) = P(channel bandwidth) - (10*log10(channel bandwidth)). ⇨ The difference between the (possibly corrected) power P_{noise} in dBm and the power P_{ref} in dBm is the broadband noise floor in dBc.
Recommended test frequencies	➢ See *Table 1-2*.

SSB Phase Noise and Jitter

Test assembly	➢ See section "*Test Assembly for SSB Phase Noise and Jitter*", page *1.4*.
Test method	The two generators are set to the test frequency and synchronized with a phase offset of 90° (phase quadrature). Mixing to 0 Hz suppresses the RF carrier, 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	➢ Set the levels of the two generators in accordance with the specifications of the mixer used. ➢ 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. ➢ 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 **Delta Phase** in the **Frequency/Phase** menu. Observe the output voltage of the mixer on the oscilloscope and vary the phase until the voltage becomes zero. ➢ Read the noise voltage, normalized to a bandwidth of 1 Hz (noise level) from the analyzer.
Evaluation	➢ 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. 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&S SMU as reference source instead of item 2. ⇨ The corrected S/N ratio is the wanted measured value. ***Example:*** *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.* *The final result is then -139 dBc.*
	⇨ The jitter is calculated from the phase noise spectrum. A spectrum with sufficient fine resolution is to be recorded in the required frequency range f_a to f_b. The rms jitter results to $$\Delta T_{rms} = \frac{1}{2\pi f_0} \cdot \sqrt{2 \cdot \int_{f_a}^{f_b} 10^{\frac{L(f_m)}{10}} \cdot df_m}$$ with f_0 as center frequency.

Residual FM

Measurement of Residual FM by Demodulation

<table>
<tr><td>Test assembly</td><td>➢ See section "1.3", page 1.4.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Synchronize reference frequencies of analyzer and DUT.
➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>Frequency</td><td>1 GHz</td></tr>
<tr><td>Modulation</td><td>Off</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Reference level</td><td>1 dBm</td></tr>
<tr><td>Center frequency</td><td>1 GHz</td></tr>
<tr><td>Demodulation</td><td>FM</td></tr>
<tr><td>Measurement time</td><td>100 ms</td></tr>
<tr><td>Demodulation bandwidth</td><td>200 kHz</td></tr>
<tr><td>AF filters</td><td>
<table>
<tr><th>Low pass filter</th><th>High pass filter</th></tr>
<tr><td>300 Hz</td><td>3 kHz</td></tr>
<tr><td>20 Hz</td><td>23 kHz</td></tr>
</table>
</td></tr>
</table>
</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Measurement</td><td>➢ The FM demodulator of the spectrum analyzer is used to FM-demodulate the CW signal of the DUT.
➢ The displayed RMS value is the sum of the residual FM of the DUT and the spectrum analyzer in the corresponding AF filter ranges. As they are not correlated the displayed result is worse than the residual FM of the DUT alone. Therefore, if the displayed sum is within tolerance according to the data sheet, the DUT’s residual FM is also within tolerance.</td></tr>
<tr><td>Evaluation</td><td>➢ The displayed RMS value is the sum of the residual FM of the DUT and the spectrum analyzer in the corresponding AF filter ranges. As they are not correlated the displayed result is worse than the residual FM of the DUT alone. Therefore, if the displayed sum is within tolerance according to the data sheet, the DUT’s residual FM is also within tolerance.</td></tr>
</table>

Measurement of Residual FM by Evaluation of SSB Phase Noise

Test assembly	➢ See section "*Test Assembly for SSB Phase Noise*", page *1.4*.
Preparations / Settings	➢ See section "*SSB Phase Noise and Jitter*", page *1.18*.
Measurement	➢ The Residual FM is calculated from the phase noise measurement data. The measurement setup and procedure is identical to the phase noise measurement.
Evaluation	➢ The Residual FM is defined as $\sigma = \sqrt{2 \cdot \int_{f\,\min}^{f\,\max} L_\Phi(f) \cdot f^2 df}$ with $L_\Phi(f)$ being the single side band phase noise. ➢ Set Analyzer Start and Stop Frequency to $F_{start} = 300Hz$ and $F_{stop} = 3kHz$. ➢ Read Trace Data $T(\mu)$ with $\mu \in [1, N]$ and $N = 625$ from spectrum analyzer and calculate the summed residual FM of the DUT and the Reference Signal Generator $\sigma = \sqrt{2\sum_{\mu=1}^{N} \frac{10^{(T(\mu)-P_{ref}-46dB)/10}}{RBW} \cdot \frac{F_{stop}-F_{start}}{N} \left(F_{start} + (\mu-1) \cdot \frac{F_{stop}-F_{start}}{N-1} \right)^2}$ with P_{ref} being the reference level from the SSB Phase Noise. ➢ Measurement with 40 dB reduced level with 20 kHz detuned frequency. ➢ The sum of the residual FM of the DUT and the Reference Signal Generator should be well below the guaranteed value of the DUT, so no correction of the measurement result is necessary. ➢ Repeat measurement with a test bandwidth of 20 Hz to 23 kHz in two sweeps. First sweep from 20 Hz to 1kHz with a RBW of 3 Hz and then sweep from 1 kHz to 23 kHz with a RBW of 100 Hz. Calculate the Residual FM for both measurements with the formula given above. The Residual FM from 20 Hz-23 kHz is: $\sigma_{20Hz-23kHz} = \sqrt{\sigma^2_{20Hz-1kHz} + \sigma^2_{1kHz-23kHz}}$

Residual AM

Measurement of Residual AM by Demodulation

Measurement of Residual AM using a Detector Diode

<table>
<tr><td>Test assembly</td><td>➢ See section "Test Assembly for Residual AM", page 1.4.</td></tr>
<tr><td>Test method</td><td>➢ The signal is AM-demodulated with a zero Bias Schottky Detector.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Output level</td><td>According to mixer specifications</td></tr>
<tr><td>Frequency</td><td>1 GHz</td></tr>
<tr><td>Modulation</td><td>AM internal</td></tr>
<tr><td>Depth</td><td>1 %</td></tr>
<tr><td>LF frequency</td><td>10 kHz</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Start frequency</td><td>9.9 kHz</td></tr>
<tr><td>Stop frequency</td><td>10.1 kHz</td></tr>
<tr><td>Filter type</td><td>FFT</td></tr>
<tr><td>Resolution bandwidth</td><td>100 Hz</td></tr>
<tr><td>Detector</td><td>Max Peak</td></tr>
<tr><td>Coupling</td><td>DC</td></tr>
</table>
➢ An external preamplifier with > 30 dB Gain and a DC-blocking Capacitor is necessary (f_{-3dB} < 10Hz)</td></tr>
</table>

Measurement

- Calibrate the setup:
  Measure power level P_{ref} [dBm] at f = 10 kHz.
- Switch off AM.
- Settings on spectrum analyzer:

Setting	
Start frequency	20 Hz
Stop frequency	1 kHz
Resolution bandwidth	3 Hz
Detector	Sample detector

- Read Trace $T(\mu)$ with $\mu \in [1, N]$ and $N = 625$ from spectrum analyzer. Calculate the summed power:

$$P = \sum_{\mu=1}^{N} \frac{10^{T(\mu)/10}}{RBW} \cdot \frac{F_{stop} - F_{start}}{N}$$

- Repeat Measurement with following settings on spectrum analyzer:

Setting	
Start frequency	1 kHz
Stop frequency	23 kHz
Resolution bandwidth	100 Hz

Evaluation

- Calculate the residual AM:

$$AM_{residual} = \frac{1}{\sqrt{2}} \cdot \sqrt{\frac{P_{20Hz-1kHz} + P_{1kHz-23kHz}}{10^{P_{ref}/10}}} [\%]$$

Test frequencies

1 GHz

Level Data

Level Uncertainty

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

Test method for levels in measurement range of power meter

Test setup

➢ Connect power meter to RF output socket.

Preparations / Settings

➢ Settings on DUT

Setting	
Output level	➢ Without option B103L or B106L

Level mode	Test level
ALC ON AUTO	15 dBm
ALC ON NORMAL	9 dBm
ALC OFF (S&H)	5.01 dBm

➢ With option B103L or B106L

Level mode	Test level
ALC ON AUTO	17 dBm
ALC OFF (S&H)	12 dBm

➢ For ALC OFF (S&H) apply the following settings to the DUT

Setting	
Pulse modulation	On
Pulse source	Extern
Pulse polarity	Inverse

Measurement

➢ Measure the level at output frequencies of 100 kHz to RF_{max}.

⇨ The level error is the deviation of the measured level from the set value.

Recommended test frequencies for the level frequency response measurement	➢ ALC ON, Auto: 1 MHz, 5 MHz, 7.000001 MHz, 10 MHz, 23.4375 MHz, 25 MHz, every 10 MHz up to 95 MHz, 112.5 MHz, every 25 MHz up to maximum frequency ➢ ALC ON, Normal: 200 kHz, 25 MHz, 100 MHz, 1100 MHz, 2200 MHz, 3200 MHz, 6000 MHz ➢ ALC OFF (S&H): 200 kHz, 25 MHz, 100 MHz, 1100 MHz, 2200 MHz, 3200 MHz, 6000 MHz

Test method for low levels (only for Option R&S SMA-B103 and B106)

Test setup	➢ Connect the spectrum analyzer to the RF output of the DUT with **hermetically sealed RF measurement cables**.
Test method	➢ 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). ➢ 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 (P_{max} –40) dBm, no error occurs due to alternating internal impedance of the DUT.
Preparations / Settings	➢ Synchronize reference frequencies of analyzer and DUT. ➢ Settings on spectrum analyzer:

Setting	
Reference level	Sufficient for maximum signal level measured. Only changed when signal level is approx. 50 dB below full scale (depends on spectrum analyzer's linearity).
Span	0 Hz
Sweep time	➢ -70 dBm: 500 ms ➢ -70 dBm … -100 dBm: 2 s ➢ < - 110 dBm: 5 s
Marker readout	RMS summary

Measurement	➢ Levels are measured beginning with high levels (within level range of power meter) and ending with the lowest levels specified. ➢ For levels within range of the power meter, 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. ➢ When signal level is approx. 50 dB below reference level) corrections values have to be taken before and after switching the spectrum analyzer's reference level. These corrections values have to be applied for measurements of lower levels. ➢ In order to obtain enough spacing to the noise limit of the analyzer, a low-noise preamplifier (*Table 1-1*, item 9) is looped between the DUT and the analyzer for low levels **(Caution: hermetically sealed RF cables!)**. Correction values have to be taken and applied when the preamplifier is added. The sweep time is to be increased with lower levels to maintain measurement accuracy.
Recommended test frequencies	➢ 1 MHz, 512.5 MHz, 1087.5 MHz, 2187.5 MHz, 3187.5 MHz, 4012.5 MHz, 5012.5 MHz, 5987.5 MHz
Recommended test levels	➢ 18 dBm to -120 dBm in steps of 5 dB

Output Impedance

<table>
<tr><td>Test assembly</td><td>

See section "Test Assembly for Output Impedance (VSWR)", page 1.5.
If option R&S SMA-B106 or R&S SMA-B106L is installed, the VSWR measurement above 3 GHz must be performed with a high frequency VSWR bridge.

</td></tr>
<tr><td>Test method</td><td>

Since the VSWR of a source must be measured, a purely passive measurement using the VSWR bridge is only possible with levels where the VSWR is determined by the output impedance of the attenuator only. This applies to attenuations of more than 20 dB.
With higher levels, the effect of level control must be taken into account. For this purpose, an auxiliary generator is used which transmits a wave with a slightly offset carrier frequency (difference frequency within the control bandwidth of the level control) into the DUT, on which the outgoing wave of the DUT is superimposed. In the case of an ideal source impedance, only the outgoing wave of the DUT flows back into the bridge, in the case of a deviating source impedance, the two components are superimposed on one another, which, due to the frequency offset, results in a beat, from the amplitude ratio of which the VSWR can be derived.

</td></tr>
<tr><td>Preparations / Settings</td><td>

Settings on DUT:

<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>See recommended test levels</td></tr>
<tr><td>Modulation</td><td>Off</td></tr>
</table>

Settings on spectrum analyzer:

<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>Reference level</td><td>2 dBm</td></tr>
<tr><td>Span</td><td>0 Hz</td></tr>
<tr><td>Resolution bandwidth</td><td>10 kHz</td></tr>
<tr><td>Video bandwidth</td><td>10 kHz</td></tr>
<tr><td>Level scaling</td><td>Linear</td></tr>
<tr><td>Sweep time</td><td>30 ms</td></tr>
</table>

Settings on second signal generator:

<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>Test frequency – 100 Hz</td></tr>
<tr><td>Output level</td><td>Minimum level</td></tr>
</table>
</td></tr>
</table>

Measurement with high levels	➢ With the settings given above vary the reference level to bring the line displayed on the screen of the spectrum analyzer approximately into the center of the screen and read and note down the level as reference level. ➢ Unscrew the VSWR bridge from the DUT and increase the level at the second signal generator until the reference level is measured again at the analyzer. ➢ Screw the bridge or directional coupler onto the DUT again. ⇨ A sinusoid trace representing the VSWR of the DUT is now displayed on the spectrum analyzer. The VSWR is to be calculated from the maximum and minimum voltage $VSWR = V_{max}/V_{min}$
Recommended test frequencies	➢ 6.61 MHz ➢ 50 MHz to maximum frequency in steps of 50 MHz
Recommended test levels	➢ 6 dBm, 15 dBm

Settling Time

Test assembly

- Connect the spectrum analyzer (*Table 1-1*, item 18) to the RF connector of the DUT.

Test method

- The spectrum analyzer is operated as a fast level meter with a span of 0 Hz. A controller transfers the start and the stop level via the IEC bus. The analyzer is triggered by the positive edge on the EOI line of the IEC bus. When the controller switches over from start to stop level, the settling procedure is displayed on the screen of the analyzer.

Preparations / Settings

- Synchronize reference frequencies of analyzer and DUT.
- Make IEC/IEEE bus and RF connections. Apply trigger connection to EOI line (pin 5) of the IEC/IEEE bus.
- Settings on DUT:

Setting	
Frequency	See recommended test frequencies
Output level	Start level
Modulation	Off

- Settings on spectrum analyzer:

Setting	
Center frequency	Test frequency
Reference level	Stop level + 3 dB
Level range	10 dB
Span	0 Hz
Resolution bandwidth	200 kHz
Video bandwidth	2 MHz
Sweep Time	10 ms
Trigger source	Extern (positive edge at 1.4 V)

- For ALC OFF (S&H) apply the following settings to the DUT

Setting	
Pulse modulation	On
Pulse source	Extern

Measurement

- First send the start and then the stop level from controller.

  ⇨ The level settling is displayed on the screen of the externally triggered analyzer. The time difference between the trigger event and the time to reach the specified deviation to the final level is defined as the settling time.

- Perform measurements in the level modes: ALC ON, ALC OFF (S&H), HIGH POWER.
- Perform measurements in List Mode.

Recommended test frequencies

- 6 MHz, 3000 MHz, 6000 MHz
- Additional test frequencies for List Mode: 180 MHz, 3001 MHz, 3850 MHz

Recommended level steps

Start level in dBm	Stop level in dBm	Remarks	Options
-130	maximum specified level	with attenuator mode "auto" and "normal"	B103 B106
-8	maximum specified level		B103L B106L

Internal Modulation Generator / Multifunction Generator (option R&S SMA-K24)

The standard Modulation generator includes a sine generator up to 1 MHz.

Test equipment

- Spectrum analyzer (*Table 1-1*, item 18)
- AC/DC voltmeter (*Table 1-1*, item 14)

Test setup

- 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.

Preparations / Settings

- Synchronize reference frequencies of analyzer and DUT.
- Settings on DUT for measurement of distortion:

Setting	
LF output state	On
LF output voltage	1 V
Source (R&S SMA-K24)	LFGen 1; LFGen2

- Settings on DUT for measurement of level:

Setting	
LF output state	On
LF frequency	1 kHz

- Settings on spectrum analyzer for measurement of distortion:

Setting	
Start frequency	Test frequency / 2
Stop frequency	Test frequency * 5
Reference Level	10 dBm
Attenuator	20 dB
Measurement functionality	Harmonic distortion

Measurement distortion

- Use marker to read the power of the fundamental and the harmonic spectral lines (up to 5th order) or use automized measurement functionality for harmonic distortion.

  ⇨ The distortion is calculated from the summed power of the spectral lines of the harmonics related to the fundamental.

Recommended test frequencies for distortion

100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz

Measurement of level

- Measure the output level with the AC/DC voltmeter at the recommended test levels.

Recommended test levels

3 mV, 10 mV, 30 mV, 100 mV, 300 mV, 1500 mV, 4000 mV

Frequency response

Test equipment	➢ AC voltmeter (*Table 1-1*, item 14)
Test setup	➢ Connect the AC voltmeter to the LF socket of the DUT.
Preparations / Settings	➢ Settings on DUT:
Measurement	➢ Measure the level with the voltmeter. ⇨ The frequency response is the difference between the highest and the lowest level.
Recommended test frequencies	➢ 10 Hz to 1 MHz (10 MHz with R&S SMA-K24) with logarithmic spacing (4 steps per decade)

Setting	
LF output state	On
LF output voltage	1 V
Source (R&S SMA-K24)	LFGen 1; LFGen2

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

Amplitude Modulation

AM Setting Uncertainty

<table>
<tr><td>Test assembly</td><td>➢ See section "Standard Test Assembly for Analog Modulations", page 1.3.</td></tr>
<tr><td>Preparations / Settings
for measurement of accuracy vs. modulation depth</td><td>➢ Settings on DUT:<table><tr><th>Setting</th><th></th></tr><tr><td>Frequency</td><td>150 MHz</td></tr><tr><td>Output level</td><td>0 dBm</td></tr><tr><td>Amplitude Modulation</td><td>On</td></tr><tr><td>Source</td><td>Internal</td></tr><tr><td>LF frequency</td><td>1 kHz</td></tr></table>➢ Settings on spectrum analyzer:<table><tr><th>Setting</th><th></th></tr><tr><td>Reference level</td><td>6 dBm</td></tr><tr><td>Center frequency</td><td>150 MHz</td></tr><tr><td>AM Demodulation</td><td>On</td></tr><tr><td>Demodulation bandwidth</td><td>50 kHz</td></tr><tr><td>Deviation per division</td><td>20 %</td></tr><tr><td>Measurement time</td><td>100 ms</td></tr></table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Measurement of accuracy vs. modulation depth</td><td>➢ Set the AM depth to the recommended test modulation depths and read the ±peak/2 value from the spectrum analyzer.
➢ Repeat measurement with following settings for the DUT:<table><tr><th>Setting</th><th></th></tr><tr><td>LF output</td><td>On</td></tr><tr><td>LF frequency</td><td>1 kHz</td></tr><tr><td>LF level</td><td>1 V</td></tr><tr><td>Source</td><td>External</td></tr></table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Recommended modulation depths</td><td>➢ 10 %, 20 %, 30 %, 40 %, 50 %, 60 %, 70 %, 80 %</td></tr>
</table>

Preparations / Settings

for measurement of accuracy vs. RF frequency

➢ Settings on DUT:

Setting	
Frequency	See recommended test frequencies
Output level	0 dBm
Amplitude Modulation	On
Source	Internal
LF frequency	1 kHz
AM depth	80 %

➢ Settings on spectrum analyzer:

Setting	
Reference level	6 dBm
Center frequency	Test frequency
AM Demodulation	On
Demodulation bandwidth	50 kHz
Deviation per division	20 %
Measurement time	100 ms

Measurement of accuracy vs. RF frequency

➢ Set the the DUT and the spectrum analyzer to the recommended test frequencies and read the ±peak/2 value from the spectrum analyzer.

➢ Repeat measurement with following settings for the DUT:

Setting	
LF output	On
LF frequency	1 kHz
LF level	1 V
Source	External
Source (R&S SMA-K24)	LFGen 1; LFGen2

Recommended test frequencies

➢ See *Table 1-2*

AM Distortion

<table>
<tr><td>Test assembly</td><td>➢ See section "Standard Test Assembly for Analog Modulations", page 1.3.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>2 dBm</td></tr>
<tr><td>Amplitude Modulation</td><td>On</td></tr>
<tr><td>Source</td><td>Internal</td></tr>
<tr><td>LF frequency</td><td>1 kHz</td></tr>
<tr><td>AM depth</td><td>30 %</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Reference level</td><td>20 dBm</td></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>AM Demodulation</td><td>On</td></tr>
<tr><td>Display</td><td>AF spectrum</td></tr>
<tr><td>AF stop frequency</td><td>50 kHz</td></tr>
<tr><td>Demodulation bandwidth</td><td>70 kHz</td></tr>
<tr><td>Measurement time</td><td>160 ms</td></tr>
</table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Measurement</td><td>➢ Measure THD for the recommended test frequencies. To convert to percent calculate THDpct = 100 * 10 ^(THDdB/20).
➢ Repeat the measurement with 80% AM depth.</td></tr>
<tr><td>Recommended test frequencies</td><td>➢ See Table 1-2</td></tr>
</table>

AM Frequency Response

<table>
<tr><td>Test assembly</td><td>See section "Standard Test Assembly for Analog Modulations", page 1.3.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>Amplitude Modulation</td><td>On</td></tr>
<tr><td>AM depth</td><td>60 %</td></tr>
<tr><td>Source</td><td>External DC</td></tr>
<tr><td>LF output state</td><td>On</td></tr>
<tr><td>LF output voltage</td><td>1 V</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Reference level</td><td>8 dBm</td></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>AM Demodulation</td><td>On</td></tr>
<tr><td>Demodulation bandwidth</td><td>≥ 7 * LF frequency</td></tr>
<tr><td>Measurement time</td><td>≥ 16 / LF frequency</td></tr>
</table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Measurement</td><td>➢ Vary the generator frequency to determine the modulation frequency response. Measure the modulation depth as described above under ‘Uncertainties’.
⇨ The modulation frequency response is the difference between the greatest and the smallest modulation depth.
➢ Repeat the measurement at RF = 1 GHz with the internal modulation generator with the setting Source Internal.</td></tr>
<tr><td>Recommended test frequencies</td><td>➢ Extern DC: 1 MHz, 180 MHz, 3000 MHz, 6000 MHz
➢ Intern: 1 GHz</td></tr>
<tr><td>Recommended LF frequencies</td><td>➢ 20 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz</td></tr>
</table>

Synchronous PhiM with AM

<table>
<tr><td>Test assembly</td><td>➢ See section "Standard Test Assembly for Analog Modulations", page 1.3.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>2 dBm</td></tr>
<tr><td>Amplitude Modulation</td><td>On</td></tr>
<tr><td>AM depth</td><td>30 %</td></tr>
<tr><td>Source</td><td>Internal</td></tr>
<tr><td>LF frequency</td><td>1 kHz</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Reference level</td><td>8 dBm</td></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>PM Demodulation</td><td>On</td></tr>
<tr><td>Demodulation bandwidth</td><td>12.5 kHz</td></tr>
<tr><td>Demodulation detector</td><td>Peak</td></tr>
<tr><td>Measurement time</td><td>10 ms</td></tr>
</table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Measurement</td><td>➢ Measure the phase modulation for the recommended test frequencies.</td></tr>
<tr><td>Recommended test frequencies</td><td>➢ See Table 1-2</td></tr>
</table>

Frequency Modulation (Option R&S SMA-B20/B22)

Test Methods

Test assembly	See section "*Standard Test Assembly for Analog Modulations*", page *1.3*.
Test Method "Spectrum Measurement"	➢ The FM/PhiM deviation is determined by a spectrum measurement. All relevant spectral components of the modulation spectrum are measured and modulation index m is computed via Bessel functions. 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 m. Since the ratio of the spectral lines is used, the result is corrrect, when a sufficient number of lines is used. Missing lines at the spectrum borders do not deteriorate the result. ➢ 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. ➢ First measure the carrier amplitude as zero order of Bessel function, then determine the n orders up to int(m + 1) by measuring the spectral lines CF + (n * fmod) and CF - (n * fmod). Calculate the average of the amplitude of both lines for each order. Now the measured modulation index m can be calculated by numerical search for the error minimum. ⇨ The PhiM deviation equals the modulation index m, FM deviation is calculated as m * fmod. ➢ Settings on spectrum analyzer:

Setting	
Reference level	Test level
Center frequency	Test frequency
Span	LF frequency / 4 (max. 80 kHz)
Resolution bandwidth	LF frequency / 20 (max. 20 kHz)

Test Method "FFT Demodulation (Option FS-K7)"

- The FM deviation and distortion are determined by digital signal processing in the spectrum analyzer.
- 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.
- Settings on spectrum analyzer:

Setting	
Reference level	Test level
Center frequency	Test frequency
Demodulation (FM/PM)	On
Demodulation bandwidth (FM)	2 * (deviation + LF frequency)
Demodulation bandwidth (PM)	2 * LF frequency * (1 + deviation)
Measurement time	3 / LF frequency

- Settings on spectrum analyzer for measurement of distortion:

Setting	
Demodulation bandwidth (FM)	2 * (deviation + 3.5 * LF frequency)
Demodulation bandwidth (PM)	7 * LF frequency * (1 + deviation)
Measurement time	16 / LF frequency

FM Setting Uncertainty

<table>
<tr><td>Test Method</td><td>➢ Spectrum Measurement (see chapter "Test Methods")</td></tr>
<tr><td>Measurement</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>Frequency Modulation</td><td>On</td></tr>
<tr><td>FM Mode</td><td>Normal</td></tr>
<tr><td>FM deviation</td><td>100 kHz</td></tr>
<tr><td>Source</td><td>Internal / LFGen 1</td></tr>
<tr><td>LF frequency</td><td>10 kHz</td></tr>
</table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Measurement</td><td>➢ Measure the FM uncertainty according to the described test method.
➢ Repeat the measurement with changing settings to:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Source</td><td>External AC</td></tr>
<tr><td>External impedance</td><td>50 Ohm</td></tr>
</table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Recommended test frequencies</td><td>➢ FM source Internal: 46.8 MHz, 3000 MHz, 6000 MHz.
➢ FM source External AC: 70.687 MHz</td></tr>
<tr><td>Recommended test deviations</td><td>➢ FM source Internal, RF frequency 3000 MHz: 1 kHz, 40 kHz
➢ FM source External AC, RF frequency 70.687 MHz: 20 kHz, 312.5 kHz</td></tr>
</table>

FM Distortion

<table>
<tr><td>Test Method</td><td>➢ FFT Demodulation (see chapter "Test Methods")</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>Frequency Modulation</td><td>On</td></tr>
<tr><td>FM Mode</td><td>Normal</td></tr>
<tr><td>FM deviation</td><td>1 MHz</td></tr>
<tr><td>Source</td><td>Internal</td></tr>
<tr><td>LF frequency</td><td>10 kHz</td></tr>
</table>
➢ Settings on spectrum analyzer for measurement of distortion:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Demodulation bandwidth</td><td>10 MHz</td></tr>
<tr><td>Display</td><td>AF spectrum</td></tr>
<tr><td>AF stop frequency</td><td>50 kHz</td></tr>
<tr><td>Measurement time</td><td>2.5 ms</td></tr>
</table></td></tr>
<tr><td>Measurement</td><td>➢ Read THD from the display. To convert to percent calculate THDpct = 100 * 10 ^(THDdB/20)</td></tr>
<tr><td>Recommended settings</td><td>➢ CF sweep
Recommended test frequencies: as with FM Setting uncertainty</td></tr>
</table>

FM Frequency Response

Test Method	➢ FFT Demodulation ➢ Spectrum measurement (See chapter "*Test Methods*")
Preparations / Settings	➢ Settings on DUT:

Setting	
Frequency	See recommended test frequencies
Output level	0 dBm
Frequency Modulation	On
FM Mode	Normal
FM deviation	According to data sheet
Source	External
External impedance	50 Ohm

Measurement	➢ LF source: for frequencies up to 300 kHz the internal LF generator of the signal generator is used. For frequencies above 300 kHz the the second signal generator is used. It is recommended to use an AC voltmeter (Item 14) to control the correct input voltage. - LF generator level: 2 Vemf (equivalent to 1 V peak at 50 Ohm) - Second generator level: 10 dBm (equivalent to 1 V peak voltage). ➢ Settings on spectrum analyzer: up to fmod = 300 kHz FFT demodulation is used. For higher modulation freuquencies the spectrum measurement is used. ➢ Vary the signal generator frequency and measure the modulation depth. ⇨ The modulation frequency response is the difference between the greatest and the smallest modulation depth. ➢ Repeat the measurement with the internal modulation generator with the setting **Source Internal.**
Recommended test frequencies and deviations	➢ Recommended test frequencies and settings:

RF frequency [MHz]	Source	Deviation	Modulation frequency
46.8	Intern	5 MHz	1 kHz, 10 kHz …1 MHz
375.5	Extern DC	5 MHz	1 kHz, 10 kHz …10 MHz
502	Extern AC	5 MHz	1 kHz, 10 kHz …10 MHz
502	Extern AC	100 kHz	10 Hz, 10 kHz …10 MHz
565	Extern AC	5 MHz	1 kHz, 10 kHz …10 MHz
595	Extern AC	5 MHz	1 kHz, 10 kHz …10 MHz
660	Extern AC	5 MHz	1 kHz, 10 kHz …10 MHz
693	Extern AC	5 MHz	1 kHz, 10 kHz …10 MHz
3100	Extern AC	5 MHz	1 kHz, 10 kHz …10 MHz
4100	Extern AC	5 MHz	1 kHz, 10 kHz …10 MHz
5400	Extern AC	5 MHz	1 kHz, 10 kHz …10 MHz

➢ For variation of modulation frequency in the given range use a logarithmic spacing with 4 steps per decade.

Synchronous AM with FM

<table>
<tr><td>Test assembly</td><td>➢ See section "Standard Test Assembly for Analog Modulations", page 1.3.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>Frequency Modulation</td><td>On</td></tr>
<tr><td>FM Mode</td><td>Normal</td></tr>
<tr><td>FM deviation</td><td>40 kHz</td></tr>
<tr><td>Source</td><td>Internal</td></tr>
<tr><td>LF frequency</td><td>1 kHz</td></tr>
</table>
➢ Settings on spectrum analyzer (measurement via AF spectrum):
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>Reference level</td><td>Test level + 6 dB</td></tr>
<tr><td>AM demodulation</td><td>On</td></tr>
<tr><td>Demodulation bandwidth</td><td>100 kHz</td></tr>
<tr><td>Display</td><td>AF spectrum</td></tr>
<tr><td>AF start frequency</td><td>0 Hz</td></tr>
<tr><td>AF stop frequency</td><td>5 kHz</td></tr>
<tr><td>AF resolution bandwidth</td><td>30 Hz</td></tr>
<tr><td>IF bandwidth</td><td>10 MHz</td></tr>
<tr><td>Averaging</td><td>On</td></tr>
<tr><td>Measurement time</td><td>3 ms</td></tr>
</table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>➢ Measurement</td><td>➢ Read the AM depth at 1 kHz modulation frequency from the demodulated AF spectrum.</td></tr>
<tr><td>Recommended settings</td><td>➢ See Table 1-2</td></tr>
</table>

Carrier Frequency Offset with FM

<table>
<tr><td>Test assembly</td><td>➢ See section "Standard Test Assembly for Analog Modulations", page 1.3.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>1 GHz</td></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>Frequency Modulation</td><td>On</td></tr>
<tr><td>FM Mode</td><td>Normal</td></tr>
<tr><td>FM deviation</td><td>1 MHz</td></tr>
<tr><td>LF frequency</td><td>1 MHz</td></tr>
</table>
➢ Settings on spectrum analyzer (measurement via AF spectrum):
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Center frequency</td><td>1 GHz</td></tr>
<tr><td>Reference level</td><td>3 dBm</td></tr>
<tr><td>Span</td><td>1 MHz</td></tr>
<tr><td>Marker function</td><td>Signal count</td></tr>
<tr><td>Counter resolution</td><td>10 Hz</td></tr>
</table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>➢ Measurement</td><td>➢ Execute a single sweep. Using MKR→ / PEAK, read counted marker frequency.
⇨ The offset is the difference between marker frequency and set carrier frequency.
➢ Repeat measurement with FM source external, impedance 50 Ohmcoupling AC and DC (4 measurements).</td></tr>
</table>

Phase Modulation (Option R&S SMA-B20/B22)

PhiM Setting Uncertainty

Test Method	➢ Spectrum Measurement (see chapter "*Test Methods*").
Preparations / Settings	➢ Settings on DUT:
Measurement	➢ Measure the PhiM uncertainty according to the described test method.
Recommended test scenarios	➢ Recommended test scenarios:

Setting	
Frequency	See recommended test scenarios
Output level	0 dBm
Phase modulation	On
PhiM Mode	High Deviation
Deviation	See recommended test scenarios
Source	See recommended test scenarios
LF frequency	10 kHz

RF frequency [MHz]	**Source**	**Deviation**	**PhiM mode**
46.8	Intern	10 rad	High Deviation
3000	Intern	10 rad	High Deviation
6000	Intern	10 rad	High Deviation
500	Intern	0.001 rad	High Bandwidth
500	Intern	0.01 rad	High Bandwidth
500	Intern	0.1 rad	High Bandwidth
500	Intern	0.5 rad	High Bandwidth
500	Intern	1.0 rad	High Deviation
500	Intern	2.5 rad	High Deviation
500	Intern	5.0 rad	High Deviation
70.687	Extern AC	0.625 rad	High Deviation

➢ For Extern AC measurement feed in a 10 kHz external modulation signal at FM/PM EXT connector.

PhiM Distortion

<table>
<tr><td>Test Method</td><td>➢ FFT Demodulation (see chapter "Test Methods")</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>Phase Modulation</td><td>On</td></tr>
<tr><td>PhiM Mode</td><td>High Deviation</td></tr>
<tr><td>Deviation</td><td>1 rad</td></tr>
<tr><td>Source</td><td>Internal</td></tr>
<tr><td>LF frequency</td><td>10 kHz</td></tr>
</table>
➢ Settings on spectrum analyzer for measurement of distortion:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>Reference level</td><td>0 dBm</td></tr>
<tr><td>Display</td><td>AF spectrum</td></tr>
<tr><td>AF stop frequency</td><td>50 kHz</td></tr>
<tr><td>Measurement time</td><td>2.5 ms</td></tr>
</table></td></tr>
<tr><td>Measurement</td><td>➢ Read THD from the Display. To convert to percent calculate THDpct = 100 * 10 ^(THDdB/20).</td></tr>
<tr><td>Recommended settings</td><td>➢ See Table 1-2</td></tr>
</table>

PhiM Frequency Response

Test method

➢ Spectrum measurement (see chapter "*Test Methods*").

Preparations / Settings

➢ Settings on DUT:

Setting	
Frequency	See recommended test frequencies
Output level	0 dBm
Phase Modulation	On
PhiM Mode	High Bandwidth
Deviation	According to data sheet
Source	External AC
External impedance	50 Ohm

➢ Settings on spectrum analyzer:

Setting	
Demodulation bandwidth	10 MHz
Display	AF spectrum
AF stop frequency	50 kHz
Measurement time	2.5 ms

Measurement

➢ LF source: for frequencies up to 300 kHz the internal LF generator of the signal generator is used. For frequencies above 300 kHz the the second signal generator is used. It is recommended to use an AC voltmeter (Item 14) to
control the correct input voltage.
- LF generator level: 2 Vemf (equivalent to 1 V peak at 50 Ohm)
- Second generator level: 10 dBm (equivalent to 1 V peak voltage).

➢ Vary the signal generator frequency and measure the modulation depth.

⇨ The modulation frequency response is the difference between the greatest and the smallest modulation depth.

Recommended settings

➢ Recommended test frequencies and settings:

RF frequency [MHz]	PhiM Mode	Deviation [rad]	Modulation frequency
79.9	High Deviation	0.3125	10 kHz …1 MHz
187.4	High Bandwidth	0.125	10 kHz …10 MHz
500	Low Noise	0.125	10 kHz …100 kHz

➢ For variation of modulation frequency in the given range use a logarithmic spacing with 4 steps per decade.

Pulse Modulation

ON/OFF Ratio

<table>
<tr><td>Test equipment</td><td>➢ Spectrum analyzer (Table 1-1, item 18)
➢ Pulse generator (Table 1-1, item 13)</td></tr>
<tr><td>Test setup</td><td>➢ Connect the spectrum analyzer to the RF output socket of the DUT.
➢ Connect the pulse generator to the PULSE EXT socket on the rear of the DUT.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Output Level</td><td>0 dBm</td></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Pulse Modulation</td><td>On</td></tr>
<tr><td>Source</td><td>External</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Reference level</td><td>2 dBm</td></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>Span</td><td>0 Hz</td></tr>
<tr><td>Resolution bandwidth</td><td>3 kHz</td></tr>
<tr><td>Sweep time</td><td>1 s</td></tr>
<tr><td>Measurement function</td><td>Time domain power</td></tr>
</table></td></tr>
<tr><td>Measurement</td><td>➢ Determine the output level of the DUT at the test frequency with a "high" and a "low" signal applied.
⇨ The difference between the output level with a "high" signal applied and that with a "low" signal applied is the ON/OFF ratio.</td></tr>
<tr><td>Recommended test frequencies</td><td>➢ 5 MHz, 150 MHz, 400 MHz, 1000 MHz, 2200 MHz, 3000 MHz.3001 MHz, 4000 MHz, 5000 MHz, 6000 MHz</td></tr>
</table>

Dynamic Characteristics

<table>
<tr><td>Test assembly</td><td>➢ Test Assembly for Pulse Modulation (see page 1.3).</td></tr>
<tr><td>Test method</td><td>➢ The RF signal is down converted to 0 Hz in phase. Thus the IF output reproduces the RF amplitude vs. time.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Output Level</td><td>0 dBm</td></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Pulse Modulation</td><td>On</td></tr>
<tr><td>Source</td><td>External</td></tr>
</table>
➢ Settings on pulse generator:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Output Level</td><td>TTL</td></tr>
<tr><td>Frequency</td><td>Adjustment: static high
Measurement: 10 MHz (square wave)</td></tr>
</table>
➢ Settings on oscilloscope:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Timebase</td><td>20 ns / Division</td></tr>
<tr><td>Trigger source</td><td>Adjustment: free running
Measurement: edge of input signal</td></tr>
</table></td></tr>
<tr><td>Measurement</td><td>➢ Adjustment: At each test frequency vary the DUT’s phase using menue RF Mod / Frequency/Phase / Phase Settings to obtain maximal dc output at the mixers IF port. The voltage at maximum corresponds to 100 % of RF amplitude. Measurement: Evaluate the pulse-modulated RF signal on the oscilloscope.
⇨ Rise time = time between 10% and 90% of RF amplitude
Fall time = time between 90% and 10% of RF amplitude</td></tr>
<tr><td>Recommended test frequencies</td><td>400 MHz, 1 GHz, 2.2 GHz, 3 GHz, 3.001 GHz. 4 GHz, 5 GHz, 6 GHz</td></tr>
</table>

Video Crosstalk

<table>
<tr><td>Test equipment</td><td>➢ Spectrum analyzer (Table 1-1, item 18)
➢ Pulse generator (Table 1-1, item 13)</td></tr>
<tr><td>Test setup</td><td>➢ Connect the spectrum analyzer to the RF output socket of the DUT.
➢ Connect the pulse generator to the PULSE EXT socket on the rear of the DUT.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Output Level</td><td>0 dBm</td></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Pulse Modulation</td><td>On</td></tr>
<tr><td>Source</td><td>External</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Reference level</td><td>2 dBm</td></tr>
<tr><td>Center frequency</td><td>100 kHz</td></tr>
<tr><td>Span</td><td>10 kHz</td></tr>
</table>
➢ Settings on pulse generator:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Output Level</td><td>TTL</td></tr>
</table></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Measurement</td><td>➢ Evaluate the signal on the analyzer.
⇨ The Video Crosstalk is the amplitude of the spectral line found at 100 kHz related to the RF carrier level</td></tr>
<tr><td>Recommended test frequencies</td><td>➢ 1 GHz, 6 GHz</td></tr>
</table>

VOR Modulation (option R&S SMA-K25)

Test equipment	➢ VOR modulation analyzer (*Table 1-1*, item 22).
Test setup	➢ Connect the modulation analyzer to the RF socket of the DUT. ➢ Synchronize reference frequencies of modulation analyzer and DUT.
Preparations / Settings	➢ Settings on DUT:
Measurement	➢ Measure the depth of VAR (30 Hz), subcarrier (9.96 kHz) and COM/ID (1020 Hz) tone ➢ Measure the FM deviation of subcarrier (9.96 kHz) ➢ Measure the VOR Phase (Bearing Angle). ➢ Set the bearing angle of DUT to 270° and measure the VOR Phase (Bearing Angle).

Setting	
Output Level	0 dBm
Frequency	113 MHz
VOR Modulation	On
COM/ID State	On

ILS Modulation (option R&S SMA-K25)

Test equipment	➢ ILS modulation analyzer (*Table 1-1*, item 22).
Test setup	➢ Connect the modulation analyzer to the RF socket of the DUT. ➢ Synchronize reference frequencies of modulation analyzer and DUT.
Preparations / Settings	➢ Settings on DUT:
Measurement	➢ Measure the depth of 90 Hz and 150 Hz tone and calculate the SDM (sum of depth = depth(90 Hz) + depth(150 Hz)) ➢ Measure the depth of COM/ID tone (only for ILS-LOC Mode) ➢ Set SDM to default, vary DDM to ±0.4 (for ILS LOC) and ±0.8 (for ILS GS) and measure DDM ➢ Set DDM to 0. ➢ Measure ILS Phase. ➢ Set Up/Down Phase to 30° and measure ILS Phase

Setting	
Output Level	0 dBm
Frequency	113 MHz
ILS Modulation	On (LOC / GS) (Set To Default)
COM/ID State	On

Marker Beacon Modulation (option R&S SMA-K25)

<table>
<tr><td>Test equipment</td><td>➢ Spectrum analyzer (Table 1-1, item 18).</td></tr>
<tr><td>Test setup</td><td>➢ Connect the spectrum analyzer to the RF socket of the DUT.
➢ Synchronize reference frequencies of RF analyzer and DUT.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Output Level</td><td>0 dBm</td></tr>
<tr><td>Frequency</td><td>75 MHz</td></tr>
<tr><td>MKR-BCN Modulation</td><td>On (Set to Default)</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Center frequency</td><td>75 MHz</td></tr>
<tr><td>Reference level</td><td>6 dBm</td></tr>
<tr><td>AM demodulation</td><td>On</td></tr>
</table></td></tr>
<tr><td>Measurement</td><td>➢ Vary marker frequency and measure the depth of marker tones.</td></tr>
<tr><td>Recommended test frequencies</td><td>➢ Marker frequencies: 400 Hz, 1300 Hz, 3000 Hz</td></tr>
</table>

DME Modulation (option R&S SMA-K26)

ON/OFF Ratio

<table>
<tr><td>Test equipment</td><td>➢ Spectrum analyzer (Table 1-1, item 18).</td></tr>
<tr><td>Test setup</td><td>➢ Connect the spectrum analyzer to the RF output socket of the DUT.
➢ Synchronize reference frequencies of RF analyzer and DUT.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>DME State</td><td>On (Off for reference values)</td></tr>
<tr><td>Mode</td><td>DME REPLY</td></tr>
<tr><td>Channel suffix</td><td>CH X</td></tr>
<tr><td>Pulse squitter</td><td>Off</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>Reference level</td><td>0 dBm</td></tr>
<tr><td>Span</td><td>0 Hz</td></tr>
<tr><td>Resolution bandwidth</td><td>100 Hz</td></tr>
<tr><td>Video bandwidth</td><td>300 Hz</td></tr>
<tr><td>Sweep time</td><td>800 ms (200 ms for reference values)</td></tr>
</table></td></tr>
<tr><td>Measurement</td><td>➢ Determine the output level of the DUT with DME modulation state off
➢ Determine the output level of the DUT with DME modulation state on
⇨ The difference between the output level with modulation on and modulation off is the ON/OFF ratio.</td></tr>
<tr><td>Recommended test frequencies</td><td>960 MHz, 1 GHz, 1.22 GHz</td></tr>
</table>

Level Uncertainty

<table>
<tr><td>Test equipment</td><td>➢ Power meter (Table 1-1, item 8)
➢ Spectrum analyzer (Table 1-1, item 18)</td></tr>
<tr><td>Test setup</td><td>➢ Connect the power sensor to the RF output socket of the DUT for the measurement of reference values.
➢ Connect the spectrum analyzer to the RF output socket of the DUT for the measurement of DME level uncertainty.
➢ Connect the PULS SYNC output of the DUT with trigger input of the analyzer.</td></tr>
<tr><td>Test method</td><td>➢ To determine the level uncertainty of the DME signal, the pulse top level is measured and compared to a CW signal at the spectrum analyzer. To eliminate the level uncertainty of the spectrum analyzer, the CW signal is also measured with a power meter.</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>0 dBm</td></tr>
<tr><td>DME State</td><td>On (Off for reference values)</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>Reference level</td><td>3 dBm</td></tr>
<tr><td>Span</td><td>0 Hz</td></tr>
<tr><td>Resolution bandwidth</td><td>10 MHz</td></tr>
<tr><td>Video bandwidth</td><td>10 MHz</td></tr>
<tr><td>Sweep time</td><td>10 µs</td></tr>
<tr><td>Trigger</td><td>Extern</td></tr>
<tr><td>Trigger offset</td><td>-1 µs</td></tr>
</table></td></tr>
<tr><td>Measurement</td><td>➢ Connect power meter to the RF socket an measure the output level. Calculate the level uncertainty of the CW signal.
➢ Connect the spectrum analyzer to the RF socket an measure the output level again. Calculate the difference between the measurement with power meter and spectrum analyzer und use this value as a correction factor for the level measurement with the spectrum analyzer.
➢ Measure the pulse top level of both pulses.
➢ Calculate the level uncertainty for each pulse and determine the level difference between the two pulses.</td></tr>
<tr><td>Recommended test frequencies</td><td>960 MHz, 1 GHz, 1.22 GHz</td></tr>
</table>

Dynamic Characteristics

<table>
<tr><td>Test equipment</td><td>➢ Spectrum analyzer (Table 1-1, item 18)</td></tr>
<tr><td>Test setup</td><td>➢ Connect the spectrum analyzer to the RF output socket of the DUT.
➢ Connect the PULS VIDEO output of the DUT with trigger input of the analyzer
➢ Execute internal adjustment “Adjust DME Pulse Slope” in advance</td></tr>
<tr><td>Preparations / Settings</td><td>➢ Settings on DUT:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Frequency</td><td>See recommended test frequencies</td></tr>
<tr><td>Output level</td><td>10 dBm</td></tr>
<tr><td>DME State</td><td>On</td></tr>
</table>
➢ Settings on spectrum analyzer:
<table>
<tr><th>Setting</th><th></th></tr>
<tr><td>Center frequency</td><td>Test frequency</td></tr>
<tr><td>Reference level</td><td>13 dBm</td></tr>
<tr><td>Span</td><td>0 Hz</td></tr>
<tr><td>Resolution bandwidth</td><td>10 MHz</td></tr>
<tr><td>Video bandwidth</td><td>10 MHz</td></tr>
<tr><td>Sweep time</td><td>10 µs (20 µs for pulse spacing)</td></tr>
<tr><td>Trigger</td><td>Extern</td></tr>
<tr><td>Trigger offset</td><td>-2 µs (10 µs for analysis of second pulse)</td></tr>
</table></td></tr>
<tr><td>Measurement</td><td>➢ Evaluate the modulated RF signal at the spectrum analyzer
• Rise time = time between 10% and 90% of rising edge
• Fall time = time between 90% and 10% of falling edge
• Pulse width = time between 50% of rising edge and 50% of falling edge of first pulse
• Pulse spacing = time between 50% of rising edge of first pulse und 50% of rising edge of second pulse
➢ Setting at Analyzer
SWEEPTIME 45µs
➢ Evaluate the pulse spacing for Channel Suffix Y. Change the sweep time of the spectrum analyzer to 45 µs.</td></tr>
<tr><td>Recommended test frequencies</td><td>960 MHz, 1 GHz, 1.22 GHz</td></tr>
</table>

Clock Synthesis (Option R&S SMA-B29)

For Test equipment and methods see corresponding chapters of main synthesis. It is recommended to terminate the unused output of the Clock Synethesis with a 50 Ω termination during measurements.

Frequency settling time

Recommended test frequencies

F1/MHz	F2/MHz
5	1500
950	1500
1500	950
1214	950
950	1214

Output Voltage, Frequency Response

Test equipment and method	➢ Connect a power meter (item 8 on *Table 1-1*) to the output CLKSYN resp. CLKSYN_N. Connect a 50Ω termination to the unused output CLKSYN_N resp. CLKSYN. At test frequencies read power level.
Recommended test frequencies	➢ 100 kHz … 1.5 GHz in logarithmic spacings of 4 steps per decade.

Spectral Purity

Nonharmonics

Recommended settings and sampling frequencies:

Setting on DUT Frequency in MHz	offset frequency of spur in kHz
750.01	±10 ±20 ±40
800.01	±10 ±20 ±40
850.01	±10 ±20 ±40
900.01	±10 ±20 ±40
950.01	±10 ±20 ±40
1000.01	±10 ±20 ±40
1050.01	±10 ±20 ±40
1150.01	±10 ±20 ±40
1200.01	±10 ±20 ±40
1250.01	±10 ±20 ±40
1300.01	±10 ±20 ±40
1350.01	±10 ±20 ±40
1450.01	±10 ±20 ±40
1500.01	±10 ±20 ±40

Non-systematic nonharmonics

Preparations / Settings

- Recommended settings for span and resolution bandwith:

Offset in kHz	**Span in kHz**	**RBW in Hz**	**Partitions**
10…103	93	10	1
103…303	100	20	2
303…603	100	50	3
603…1103	500	200	1
1103…2103	1000	1000	1
2103…20000	1000	1000	6

Measurement

- Measurement range: 10 kHz to 20 MHz offset from carrier
- During the scan, you should use an overlap of at least 1% for the measurement partitions.

Recommended test frequencies

- 275.1 MHz, 766.1 MHz, 1333.1 MHz

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 af the analyzer, use a second generator with a different synthesis architecture.*

Wideband Noise

Recommended test frequencies	From 20 MHz to 1.5 GHz in logarithmic spacings of 4 pro decade.

SSB Phase Noise and Jitter

Recommended test frequencies	Refer to data sheet

Contents - Chapter 2 "Adjustments"

2 Adjustments

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

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

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.

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 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 SMA to maintain level accuracy.

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 be adjusted with a external frequency counter.

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

Test equipment	- External frequency counter
Test setup	➢ Connect a calibrated external frequency counter to the RF output
Adjustment	➢ Setting on DUT: **PRESET** **RF On** **Frequency**: 1 GHz **Level:** 0 dBm Setup Menu Protection Protection Level 2 = 147946 ENTER **RF Menu**: **Ref Oscillator** ➢ Setting on spectrum analyzer (external frequency counter): **MKR** SIGNAL COUNT **MKR / NEXT CNT RESOL** 0.1 Hz ➢ Adjust the OCXO Calibration Value for a external frequency counter reading of 1 GHz, within 0.1 Hz resolution. ➢ Press **Write value to Eeprom** to store the DAC value.

Note*: The internal reference can be influenced by up to approx.* $\pm 10^{-6}$ ($\pm 5 \cdot 10^{-7}$ *with option R&S SMA-B22) in 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.*

Adjustment of internal Reference Oscillator

Due to aging effects of the internal 1040 MHz reference oscillator, it might be necessary to adjust the oscillators tuning voltage. The tuning voltage can be checked with the internal diagnostic tool in the Setup/Test Point menu. For adjustment it is necessary to dismount the case of the instrument (*see chapter 2 "dismounting the case*") in order to get access to the trim capacitor C1 located on the synthesizer module SSYN. The module SSYN is the upper module of the RF section and the trim capacitor C1 is placed below the via hole marked in figure 2-1 below.

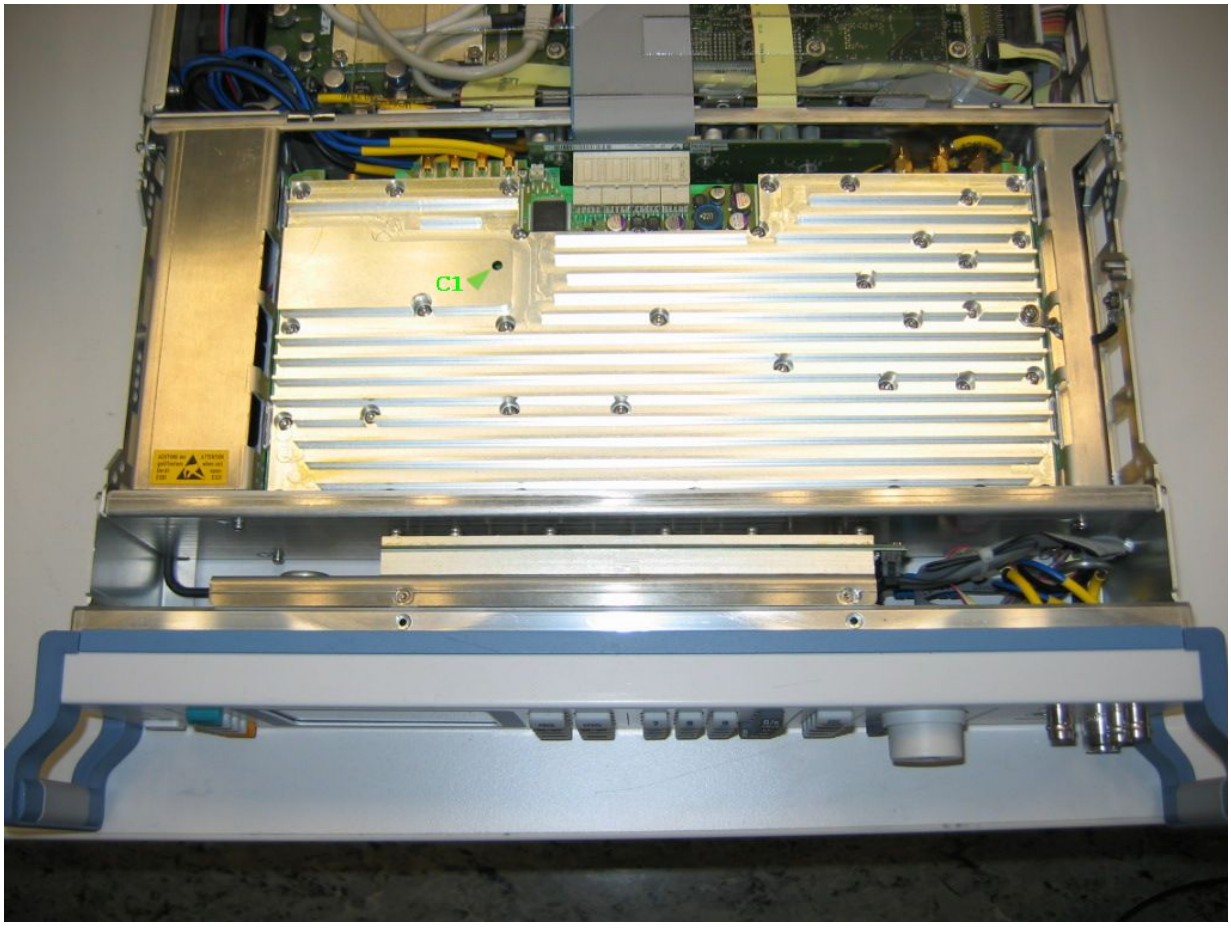


Fig. 2-1 Location of synthesizer module SSYN and trim capacitor C1

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

Test equipment	- Ceramic screwdriver 0.9 x 0.3 mm - External reference frequency 5 MHz or 13 MHz The external reference source is only necessary for instruments equipped with option SMA-B22 and SSYN module 1141.4220, since for these instruments the 1040 MHz reference oscillator is switched off if the generator is running with internal or external 10 MHz reference frequency.
Test setup	Only for instruments equipped with option SMA-B22 and SSYN module1141.4220 ➢ Connect external reference source to REF IN connector at rear panel. ➢ Feed in 5 MHz or 13 MHz external reference frequency with a level of +5 dBm ± 5 dB. ➢ Setting on DUT **Setup / Reference Oscillator** **Source** External **External Reference Frequency** 5 MHz or 13 MHz The following setting enables the measurement of the oscillators tuning voltage using the internal diagnostic tool. ➢ Setting on DUT: **Setup / Test Point** **State** On **Select Test Point** DIAG_SSYN_REF_LOOP
Adjustment	➢ Check the test point for a voltage within the range 6 V to 13 V ➢ If the test point shows less than 6 V or more than 13 V, adjust the voltage to 9 V ± 0.5 V with trim capacitor C1.

Adjustments after Module Replacement

Changed module	Required adjustment/correction	Calibration necessary (refer to chapter "Checking the rated characteristics")
CPU Board	See below, "*Procedures after Replacing the Lithium Battery*"	None
Compact Flash Memory	Setup/Internal Adjustments/Adjust All	None
Standard Synthesis SSYN	Adjustment of internal Reference Frequency (not when option R&S SMA-B22 is installed) Setup/Internal Adjustments/Adjust Synthesis	Reference Frequency, Frequency, Spectral Purity, Internal Modulation Generator, AM Modulation, Pulse Modulation, Multifunction Generator (optional), FM/PM Modulation (optional), Clock Synthesis (optional)
Synthesis Extension SYNEX	Adjustment of internal Reference Frequency Setup/Internal Adjustments/Adjust Synthesis	Reference Frequency, Frequency, Spectral Purity, Internal Modulation Generator, FM/PM Modulation, AM Modulation, Pulse Modulation, Multifunction Generator (optional), Clock Synthesis (optional)
Output Stage CWOP3/CWOP6	External Level Correction (power meter spectrum analyzer and special measuring software required)	Spectral Purity, Level Data, AM Modulation, Pulse Modulation
Attenuator SATT3C/SATT6C	External Level Correction (power meter spectrum analyzer and special measuring software required)	Level Data, Spectral Purity
Interface Board IFB	Setup/Internal Adjustments/Adjust LFGen/ModGen	Internal Modulation Generator, Multifunction Generator (optional), FM/PM Modulation, AM Modulation, Pulse Modulation, Spectral Purity Hardware Signals
Clock Synthesis CLKSYN	Setup/Internal Adjustments/Adjust Clock Synthesis	Clock Synthesis, Internal Modulation Generator, Multifunction Generator (optional), FM/PM Modulation, AM Modulation, Pulse Modulation, Spectral Purity
AC/DC Power Supply A400	Setup/Internal Adjustments/Adjust All	Reference Frequency, Frequency, Spectral Purity, Level Data
Motherboard MBRD	Feed in the serial number of R&S SMA to motherboard EEPROM enable all required software options with option key External Level Correction (power meter spectrum analyzer and special measuring software required) ***Notice:***  *The motherboard contains an EEPROM with all the specific data such as serial number and correction data of the instrument. After replacement, the data and correction tables have to be restored. This can only be done in the factory. Without this data, the instrument will not operate correctly.*	Level Data, Spectral purity, AM Modulation, FM/PM Modulation

Procedures after Replacing the Lithium Battery

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

3. Wait about 10 seconds and aftwerwards press “F1”.
4. The operating system (LINUX) and the R&S SMA firmware will start.
5. Set correct date and time at R&S SMA setup menu.

Procedures after Replacing the Controller LPC A320

Required equipment
External USB CD or DVD ROM Drive

Required software:
BIOS_SMAxxxx.iso (order number 1400.3651.00)
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 SMA:

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_SMAxxxx.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 SMA.
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 Ramdrive. 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 SMA.
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.

Contents – Chapter 3 "Repair"

3 Repair

Instrument Design and Function Description

A detailed schematic of the signal generator's design is presented in the block diagrams (see chapter 5). The following functional description of the instrument refers to the block diagram.

RF Section

Standard Synthesis (SSYN) Module

The standard synthesis (SSYN) module generates a frequency in the range from 105.6 MHz to 3000 MHz with an internal resolution of approx. 2 μHz. The actual frequency synthesis generates the frequency band 750 MHz to 1500 MHz. All other output frequencies are generated by frequency doubling or division.

The module contains the 10 MHz reference oscillator as well as a fixed frequency oscillator at 1040 MHz that is synchronized to the reference oscillator. The 1040 MHz signal is used to generate the lower frequency band down to 9 kHz (by down-conversion) on the CWOP3/6 module.

Additional reference signals for other modules (IF board, CLKSYN, SYNEX) are derived by dividing the 1040 MHz signal.

The individual functional blocks are described below.

Reference Loop

The reference loop block contains a low-noise 1040 MHz ceramic resonator oscillator. The oscillator is locked to a stable reference frequency in a phase locked loop using a frequency divider in the feedback path. The loop bandwidth can be switched. The reference frequency may be either the 10 MHz OCXO located on the board (internal reference mode) or an externally applied reference frequency (EXTREF_IN) of 5 MHz, 10 MHz or 13 MHz (external reference mode).

The 1040 MHz reference signal is distributed to the individual parts of the synthesizer via several power splitters and buffer amplifiers. It is also fed as a level-controlled signal to the CWOP3/6 module for down-conversion (REF 1040).

A variable frequency (REFVAR) is derived from the CRO 1040 MHz via a programmable divider. This frequency is used as a reference signal for either the IF board or the clock synthesis (CLKSYN) module.

Fractional-N Loop

The fractional-N loop block provides fine resolution for the entire synthesizer. It contains a PLL in which a tuneable oscillator in the range from 652.689 MHz to 676 MHz is synchronized to a reference frequency (43.51 MHz to 45.06 MHz) obtained via fractional-N division. The feedback path contains a frequency divider.

Fractional division is performed by using the SYNCON4 and RFDIV ASICs. The advantage of fractional-N division in the reference path of the PLL is that with the high input frequency of 1040 MHz high division factors can be used, which is beneficial with respect to spurious performance.

To ensure fast settling, the loop bandwidtch is dynamically switched during the settling process. However, it is also possible to set the control bandwidth statically wide. The VCO is preset via a D/A converter. A programmable divider at the output of the fractional-N loop block divides the oscillator output spectrum

down to a frequency range of 56.7 MHz to 117.55 MHz. This improves phase noise and spurious suppression by the corresponding divider factor. The output frequency is used by the main loop block as a reference frequency.

Step Frequency Unit

The step frequency unit handles coarse resolution for frequency synthesis. Within a specified frequency grid, it creates discrete frequency signals that are derived from the 1040 MHz reference signal in the range from 693.33 MHz to 1500 MHz.

This is done by using a programmable divider (RFDIV) to divide the 1040 MHz signal into three frequencies of 104 MHz to 115.55 MHz (division factors of 9, 9.5 and 10). These frequencies are multiplied by factors of 6 to 14 using a comb generator. The required frequency is then selected by means of a tuneable bandpass filter.

The level of the output signal of the Step Frequency Unit is adjusted by means of a level preset and is used by the main loop block as an RF signal for down-conversion in a PLL.

Main Loop

The main loop submodule generates the frequency spectrum from 750 MHz to 1500 MHz. It consists of four tuneable oscillators that each cover a segment of the entire spectrum. The feedback path of the PLL contains a mixer that down-converts the VCO signal and the output signal of the Step Frequency Unit to the reference frequency of 56.7 MHz to 117.55 MHz. An analog frequency phase detector (mixer) compares the down-converted frequency with the output signal of the fractional-N loop block. To ensure proper settling, a digital PD (RFDIV) is connected in parallel during frequency switchover.

The frequency algorithm prevents mixing products from crossing the reference frequency (it would not be possible to suppress the resulting spurious near the carrier).

The control bandwidth of the main loop block is approx. 200 kHz. To ensure that the loop always locks on the correct mixing sideband, pretuning of the VCOs is provided.

The output signal of the main loop block is directly forwarded to the frequency doubler block. The input signal to the frequency doubler module covers the frequency range from 750 MHz to 1500 MHz.

If SYNEX (R&S SMA-B20 or R&S SMA-B22) is fitted, the frequency range for the main loop is shifted by about 20 MHz.

Output Unit

Frequency Doubler Module

By using frequency doubling, the frequency doubler block expands the frequency range of the synthesizer up to 3000 MHz. Tunable highpass and lowpass filters connected in series ensure sufficient suppression of subharmonic spurious.

Divider Unit

The divider unit divides the spectrum of the base octave from 750 MHz to 1500 MHz to the frequency range from 105.6 MHz to 750 MHz by using a programmable 2^N divider. Filtering of harmonic spurious caused by frequency division is not provided. Frequencies above 750 MHz are routed via a bypass. The frequency spectrum at the output of the divider unit ranges from 105.6 MHz to 3000 MHz. Output amplifiers with level preset ensure a constant output level at the module output. If DMF pulses are generated, the output divider is also used as a fast amplitude modulator.

Synthesis Extension (SYNEX) Module

The synthesis extension (SYNEX) module adds frequency and phase modulation capability (option R&S SMA-B20). This module works only in combination with the standard synthesis module.

The source of the modulation signal is chosen by a modulation switch. FM/PhiM is generated by A/D conversion of the modulation signal and feeding it to a digital synthesis device (DDS modulator). The output of the DDS modulator is fed as reference signal into a phase locked loop (PLL), the FM loop. At high modulation rates, the VCOs of this PLL are modulated directly by D/A conversion and a level setting device to adjust the level to the sensitivity of the VCOs. The input signal of the standard synthesis is fed to the FM loop to convert the VCO frequency down to the reference frequency from the DDS modulator.

The option R&S SMA-B22 provides two high-precision quartz oscillators. Several signal are derived from these references by multiplying, dividing and filtering.

The individual functional blocks are described below.

Modulation Switch

This block consists of an input switch matrix, an aliasing filter and an A/D converter to feed modulation signals to the DDS modulator from internal or external sources.

DDS Modulator

This block consists mainly of the DDS modulator implemented in an FPGA. The 14 bit output of this FPGA is D/A-converted and filtered. The frequency range is about 17 MHz to 19 MHz.

Analog FM

This module provides the modulation signal to directly modulate the FM loop VCOs. The fine-scaled signal from the DDS is D/A-converted, filtered and coarse-scaled by a level setting device.

FM Loop

The FM loop contains six VCOs, providing 750 MHz to 1500 MHz output frequency. By mixing the VCO output with a step frequency signal obtained from the SSYN module, the frequency is converted down to the DDS output frequency. A phase detector, switchable loop filter and pretune facility complete this loop. A divider in the IF branch makes it possible to handle high FM.

Low Phase Noise Option

The option R&S SMA-B22 provides two high precision quartz reference oscillators operating at 10 MHz and 100 MHz. The 100 MHz oscillator is synchronized to the 10 MHz oscillator or, with the signal generator's reference set to external, to a 10 MHz signal from the SSYN module (see also section "RF Reference Frequency" in the R&S SMA100A operating manual).

The 100 MHz signal is fed to the standard synthesis module, where it is used as an input signal to the step frequency unit.

To generate a clean 1200 MHz LO signal for the output module, the 100 MHz signal is multiplied by four, filtered, tripled and filtered again.

In addition, a 100 MHz clock signal for the IF board module (or for the CLKSYN module if fitted) is provided.

Output Unit 3 GHz CWOP3

The Output Unit 3 GHz CWOP3 generates output frequencies in the range 9 kHz through 3000 MHz from input frequencies between 105.6 MHz and 3000 MHz. Depending on the output frequency, the signal from the synthesizer modules SSYN and SYNEX follows different routes: the standard frequency band of 180 MHz through 3000 MHz is taken direct from the input signal, while frequencies between 6.6 MHz and 180 MHz (divider frequency band) are produced by a programmable frequency divider that divides by 4 and 16. The lowest frequency band of 9 kHz to 6.6 MHz (mixer frequency band) is obtained by a mixer whose local oscillator (LO) signal comes from the SSYN (1040 MHz) or SYNEX (1200 MHz). The latter is divided down to 130 MHz or 150 MHz by a programmable frequency divider before it is used in the mixer for frequency conversion.

In both the standard frequency band of 180 MHz through 3000 MHz and the divider frequency band between 6.6 MHz and 180 MHz there are switchable harmonics filters. The paths for the standard frequency band and the divider frequency band are recombined following the harmonics filters. The signal path subsequently exhibits a switchable amplifier (SWAMP) that allows an increase in gain of approx. 8 dB and is activated for high output levels. The mixer for generating the lowest frequency band of 9 kHz through 6.6 MHz is directly ahead of the output stage. The output stage subsequently boosts the signal to the required output level. A measuring point (directional coupler) on the output of the CWOP3 derives the actual value for automatic level control (ALC).

The pulse modulator is formed by high-speed RF switches at the output of the switchable amplifier (SWAMP) and at the mixer input. A third pulse modulator switch is configured between them and activated to produce a sufficient drop in level of more than 80 dB at high frequencies.

The individual functional blocks are described below. Special module statuses, as in AM and FM modulation for example, are not explicitly mentioned. The stated frequency and level figures for checking the Output Unit CWOP3 are consequently only for settings made straight from the PRESET status. You may only set CW mode and without any modulation.

Input signal switching

Following the OPU_RF_IN (X262) input connector on an Output Unit CWOP6 it is first of all possible to switch the SSYN/SYNEX signal between the Output Unit 3 GHz (CWOP3) and the Output Unit 6 GHz (CWOP6). In the event of errors in the 3 GHz and 6 GHz frequency bands, *refer to the description of the Output Unit CWOP6*. This first switch is not fitted in an Output Unit CWOP3.
The OPU_RF_IN (X262) input connector is followed by switchover between the direct path for output frequencies from 180 MHz through 3000 MHz (standard frequency band) and the divider frequency band for 6.6 MHz through 180 MHz. The lowest frequency band (mixer frequency band of 9 kHz through 6.6 MHz) is produced by a mixer at the end of the signal path.

Divider frequency band 6.6 MHz to 180 MHz

The SSYN/SYNEX input signal is switched to a programmable frequency divider for output frequencies between 6.6 MHz and 180 MHz. For input frequencies lower than 500 MHz this divider requires a rectangular signal, so in this case you possibly may not be able to feed the CWOP3 with a sinusoidal output signal from another signal generator.

For output frequencies between 6.6 MHz and 46.875 MHz the input signal is divided by 16, and by 4 for output frequencies between 46.875 MHz and 180 MHz:

Output frequency	Division factor	Input frequency
6.600 000 01 to 46.875 MHz	16	105.600 000 16 to 750 MHz
46.875 000 01 to 180 MHz	4	187.500 000 04 to 720 MHz

A voltage-variable amplifier (VVA) on the output of the frequency divider ensures level setting by means of the control voltage of the ALC. The VVA is followed by the harmonics filters for the divider frequency band with the following cutoff frequencies:

Band	Cutoff frequency
6.6+ to 180 MHz	6.600 000 01 to 16 MHz
	16.000 000 01 to 36 MHz
	36.000 000 01 to 80 MHz
	80.000 000 01 to 180 MHz

Standard frequency band 180 MHz to 3000 MHz

In the standard frequency band the input signal is only amplified and subsequently filtered for harmonics. The input amplifier is followed by a PIN diode level control for level setting by means of the control voltage of the ALC. A further amplifier isolates these PIN diodes from the subsequent lowpass filters for rejection of harmonics. The harmonics filters in the standard frequency band are scaled as follows:

Band	Cutoff frequency
180+ to 3000 MHz	180.000 000 01 to 285 MHz
	285.000 000 01 to 448 MHz
	448.000 000 01 to 716 MHz
	716.000 000 01 to 1147 MHz
	1147.000 000 01 to 1840 MHz
	1840.000 000 01 to 3000 MHz

Switchable amplifier (SWAMP)

To increase the overrange output level of the R&S SMA, this amplifier is looped in on the R&S SMA output with approx. 8 dB gain if the level is above 13 dBm or 11 dBm. The switch on the output is at the same time the first switch of the pulse modulator.

Pulse modulator

The pulse modulator is located between the switchable amplifier (SWAMP) and the mixer. Three high-speed GaAs RF switches with high isolation suppress the RF signal by more than 80 dB when the appropriate control signal appears on the pulse input. The isolation of two GaAs RF switches is sufficient at low frequencies, so the center switch is only used at high frequencies.

To drive the pulse modulator there is a special pulse input that must be connected to TTL-compatible input signals. But it is also possible to switch to the AM modulation inputs (internal or external). These inputs are to be operated with a 1 V signal that is balanced to ground. The polarity can be set by a logic circuit.

Mixer with LO divider to generate 9 kHz through 6.6 MHz

A mixer is used to generate frequencies from 9 kHz through 6.6 MHz. Its LO signal comes from the SSYN or SYNEX, and is scaled down by a programmable divider. The division factor is set to 8, so 1040 MHz (SSYN) or 1200 MHz (SSYN plus SYNEX) produce an internal LO frequency on the mixer of 130 MHz or 150 MHz respectively.

Mode	LO frequency on X263	Division factor	LO frequency on mixer
CW without SYNEX	1040 MHz	8	130 MHz
CW with SYNEX	1200 MHz	8	150 MHz

In this operating status the input signal of the CWOP3 on X263 is switched to the above divider path (division factor 4) because a signal between 130.009 MHz and 136.6 MHz or 150.009 MHz and 156.6 MHz must appear before the mixer for an output frequency range of 9 kHz through 6.6 MHz. The synthesizer modules consequently produce the following frequency bands on OPU_RF_IN (X262):

Mode	RF frequency on mixer U1	Division factor	Input frequency on X262
CW without SYNEX	130.009 to 136.6 MHz	4	520.036 to 546.4 MHz
CW with SYNEX	150.009 to 156.6 MHz	4	600.036 to 626.4 MHz

Level control (ALC) is performed in the mixer frequency band with a measuring point ahead of the mixer. Refer to the description of the detector.

Output amplifier 3 GHz with directional coupler

The pulse modulator is followed by the output stage with a 2 W heterostructure FET. The measuring point for level control is a directional coupler that couples out a small portion of the signal for the detector.

Detector

The detector is temperature-compensated and linearized, level linearity being set by means of a D/A converter through a bias voltage.

A separate detector in the mixer frequency band stabilizes the level at the mixer input. The path from the mixer to the output connector of the CWOP3 is consequently temperature-compensated.

Output signal switching

In the Output Unit 3 GHz (CWOP3) the output amplifier and directional coupler are connected direct to the output connector OPU_RF_OUT (X264). In the Output Unit 6 GHz (CWOP6) there is an additional GaAs switch that, like the input switch, allows selection between the 9 kHz through 3000 MHz and 3000 MHz through 6000 MHz frequency bands.

Level control (ALC)

The detector following the directional coupler and ahead of the mixer produces the actual level value for level control. The nominal value for control comes from a multiplying D/A converter whose reference voltage is a DC signal in the case of CW. An integrator forms the control voltage for the level control in the standard frequency band (PIN control) and in the divider frequency band (VVA) from the difference between actual value and nominal value.

With AM, the modulating LF signal is added across the internal or external modulation input to the nominal value of the level control. Switching the loop bandwidth produces a flat modulation frequency response. This setting is stored in the EEPROM of the module.

With the ALC off, the D/A converter produces the control voltage for the level controls.

Output Unit 6 GHz CWOP6

The CWOP6 module contains all of the blocks of the CWPO3 module indicated above and additional blocks to generate the frequency range from above 3 GHz to 6 GHz.
Input and output signal switching is described in the CWOP3 section.

The output signal of a VCO with a frequency range of 3 GHz to 6 GHz is divided by 4 and downconverted to a frequency in the range of 17 MHz to 28 MHz by mixing it with a signal from the SSYN module with a range of approximately 750 MHz to 1500 MHz.
A phase detector compares this signal with the output signal of the SYNEX module. A feedback controller adjusts the VCO frequency.

The undivided output signal of the VCO is fed to a wideband PIN modulator via a preset control element and a buffer stage. A second buffer stage and a second preset control element provide clean decoupling of the AM control from the pulse modulator and the output stage.

The pulse modulator consists of six shunt PIN diodes that can be rapidly switched between the conducting and blocking states by a fast drive circuit. The RF signal is suppressed by approximately 90 dB when the diodes are conducting.

Finally, a driver and an output stage bring the signal to the desired output level, and a directional coupler extracts part of the signal for the level control circuit. The level control circuit is located in the OP3.

The individual blocks are described in detail below. All diagnostic voltages mentioned in the descriptions apply to the preset configuration. Any settings that deviate from that configuration are stated explicitly.

PLL and frequency modulation

The 3 GHz to 6 GHz frequency range cannot be covered by a single VCO. The VCO module thus contains three separate VCOs, each of which has an upper subband and a lower subband.

The exact switching boundaries of the individual VCOs and subbands are determined in the R&S SMA by an internal calibration routine. Assignment of the frequencies in the table below to specific VCOs and subbands is ensured as follows:

Frequency	VCO	Subband
3000 MHz + 0.01 Hz	1	0
3500 MHz	1	1
3900 MHz	2	0
4500 MHz	2	1
5000 MHz	3	0
6000 MHz	3	1

The VCO module has two outputs. One output (RF_OUT, approx. +7 dBm) provides the output signal, while the other one (RF_PLL, approx. +3 dBm) provides the signal for the PLL.

The PLL signal from the VCO is fed to the programmable divider 2NDIV via two buffer amplifiers. The divider operates here with at a fixed 1:4 division ratio. An additional buffer amplifier feeds the signal to the RF input of mixer U1000.

The RF signal from the SSYN module is routed from connector X262 to the LO input of the mixer via a changeover switch and a buffer amplifier.

The intermediate frequency signal is fed to the CLK input of the phase comparator IC PD_DIV2 via a two-stage bipolar amplifier. Depending on the operating mode (CW or FM) and the FM deviation, the CLK signal is further divided by a factor of 1, 2 or 8.

The DDS signal of the SYNEX module is routed from connector X267 via a configurable divider to the reference input FREF of phase comparator PD_DIV2. In this case the divider ratio is set to 1:1.

If no SYNEX is present, connector X267 is connected to the 104 MHz reference clock from the SSYN module. In this case the divider is operated with a division ratio of 1:4 to provide the phase comparator with a fixed frequency of 26 MHz. At the same time, the reference signal at connector X265 is passed through unchanged for use by other modules.

The differential output signal of the phase comparator is fed via a summing amplifier (N1004) to a feedback controller (N1005) with switchable gain.

As the feedback controller cannot cover the entire 2 V to 22 V tuning voltage range of the VCO module, and in order to reduce the settling time when the frequency is changed, a pretune current is injected into the summing junction of an inverting amplifier (N1007).
This current is set by pretune controller D1016/D1017 using switchable resistors.

For wideband frequency modulation, an analog modulation signal is also injected into this summing junction.

Inverting amplifier N1007 is operated with switchable gain to compensate for the differences in the transfer characteristics of the VCOs and their subbands. The selected gain is calculated by an internal calibration routine.
The pretune settings are also calculated by an internal routine for each frequency in 10 MHz increments.
Transistors V1014 and V1015 boost the output current that can be provided by the N1007 to enable fast frequency changes and rapid frequency modulation.

The VCO tuning voltage is then routed to the input of the VCO module via a switchable filter, which is selected according to the operating mode (CW or FM). A speedup circuit with two MOSFETS provides rapid discharging of the filter capacitors.

Amplitude modulation

The output signal RF_Out of the VCO module is fed via a highpass filter and a PIN control element to a first buffer stage, which raises the level to approximately 10 dBm.
A coupler (–14 dB) taps off a small part of the RF signal and feeds it to a detector and a diagnostic point (D_6G_RFAMOD).
The amplitude modulator consists of five ultralow-capacitance PIN diodes connected in series, and it has a dynamic range of around 60 dB.

The modulator is driven via a linearization network. The drive signal from the ALC controller is disabled if the configured output frequency is less than or equal to 3 GHz.

The output signal from the modulator is raised once again to a level of approximately 15dBm by another buffer and PIN control element.

Pulse modulation

The pulse modulator consists of six shunt diodes connected in parallel. Highly attenuated highpass filters before and after the diodes suppress the drive signal.

A drive circuit built around V1045, V1046 and D1034 conditions the drive signal so the PIN diodes can be switched rapidly from the blocking state to the conducting state.
The drive signal is routed via the CWOP3 module. Refer to the description of that module for more details.

In the conducting state, a current of approximately 20 mA flows through each diode, with RF signal attenuation greater than 90 dB.

In the blocking state, a voltage of approximately –5 V is present across each diode. A diagnostic point (D_6G_PULS) allows the actual voltage across the diodes to be read out.

A coupler (–14 dB) is placed at the output of the pulse modulator, making the RF level available for diagnostic purposes (D_6G_RFPA).

6 GHz output amplifier

The output amplifier for the 3 GHz to 6 GHz range consists of a driver stage and an output stage. The driver raises the RF level to approximately 22 dBm, and the output stage can deliver up to 30 dBm.

The driver stage consists of a Filtronic FPD2250DFN depletion-mode AlGaAs/InGaAs pHEMT transistor, which runs at an operating point of approximately 4.8 V/165 mA. The gate and drain voltages can be read out via diagnostic points (D_6G_UGDRV and D_6G_UDDRV).

A Filtronic FPD1000AS AlGaAs/InGaAs pHEMT transistor is used for the output stage. It runs at an operating point of 8.2 V/270 mA. Here again the gate and drain voltages can be read via diagnostic points (D_6G_UGPA and D_6G_UDPA).

The operating point of the output stage can be reduced when it is not being used (f_out <= 3 GHz). Individual voltage regulators for the driver and output stages ensure stable operating conditions. The stabilized voltages of 6 V and 10 V, respectively, can be checked via diagnostic points (D_6G_6VPA and D_6G_10VPA).

Harmonics filter

A switchable harmonics filter reduces harmonic distortion at frequencies below 3.85 GHz. It has no effect at higher frequencies.

Directional coupler and detector

A stripline directional coupler (L1135–L1142) couples out part of the RF power to the detector. The coupling loss is approximately 9 dB.
The output voltage of the detector diode is fed to the linearisation circuit via a FET switch. The circuit is identical to the CWOP3 circuit from this point on.

Electronic Attenuator 3/6 GHz SATT3/6C

The SATT3C and SATT6C modules are is a adjustable RF attenuator pad with integrated overvoltage protection. The module has an RF input and RF output. The insertion loss of the module fully can be electronically set from approx. 5 dB to 130 dB in steps of 5 dB. The switches used are CMOS switches. In the model 1400.3400.03and 1400.3400.06, a relay path can be used to bypass the attenuator pad in order to decrease insertion loss. This bypass is referred to as the high-power path. The overvoltage protection is at the module output. If RF powers exceeding 30 dBm are fed in on the rear panel, a relay separates the RF output from the adjustable attenuator pads. In this state, the module triggers a software interrupt and the firmware generates an error message. Switching off the instrument also interrupts this connection and changes the signal generator's RF output changes to high impedance, which protects the module.

Clock Synthesizer (CLKSYN)

The clock synthesis (CLKSYN, R&S SMA-B29) module is a synthesizer that delivers a differential clock signal on the rear side of the R&S SMA, covering a frequency range from 100 kHz to 1.5 GHz.

The frequency synthesis is based on a reference input from either the standard synthesis (SSYN) or the synthesis extension (SYNEX, R&S SMA-B22) module with a frequency of 104 MHz or 100 MHz, respectively. This signal is converted by a fractional-N phase locked loop (PLL), generating VCO frequencies of 1.5 GHz to 3.0 GHz with fine frequency resolution. The PLL output is fed to a divider chain that divides to the wanted output frequency. The reference input signal is available as an output signal to be connected to the IF board of the R&S SMA.

A detailed description of the functional blocks is given below.

Reference Input and Output

The reference input signal of 104 MHz (100 MHz with option R&S SMA-B22) is buffered and distributed to the reference output and the reference divider.

Reference Divider

A frequency divider produces the reference frequency for the PLL with division factors of 3 and 4.

Fractional-N PLL

The fractional-N PLL contains three voltage-controlled oscillators (VCOs) that cover the PLL frequency range of 1.5 GHz to 3.0 GHz. The VCO signal is split to the PLL output and to the PLL feedback path. In the feedback path a frequency divider (RFDIV), controlled by the fractional-N controller SYNCON4, converts the VCO frequency down. A phase frequency detector (RFDIV) is used to compare the down-converted signal to the reference of the PLL. To adjust for changes in the VCOs' sensitivity and for changing division factors, the gain of the PLL can be switched in the loop filter. To obtain the values for the VCO sensitivity, an internal adjustment has to be performed.

Divider Chain

The output of the fractional-N PLL is fed to a prescaler (2NDIV) and to a integer frequency divider (RFDIV). The outputs of the divider are connected via switches to the output of the module, yielding a differential square wave signals with 50 % duty cycle.

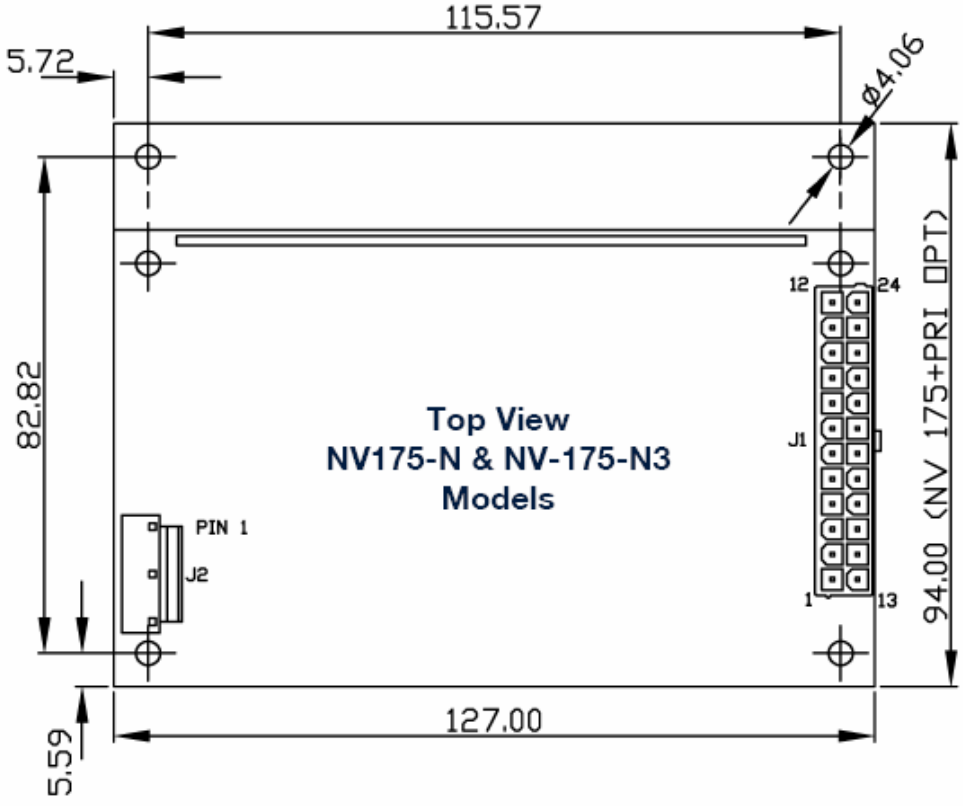
Power Supply Module

The power supply module provides all currents necessary for the operation of the signal generator. It can be switched on and off by means of the power switch on the rear panel. After switch-on, the instrument is either ready for operation (STANDBY) or in operating mode, depending on the position of the standby switch on the instrument front panel.

The power supply works over a wide input voltage range from 100 V to 240 V (±10 %) and AC supply frequencies form 50 Hz to 400 Hz (-5 %/+10 %). The power factor correction meets EN 61000-3-2.

On the secondary side, the power supply generates four DC voltages (+3.3 V, +5.2 V, +12.2 V, -12 V) and one standby voltage (+13.5 V).

The pinning of the input and output connectors is shown in the following figure.



Note: *The Power Supply R&S SMA-B46 is 130.00 mm in length*

Fig. 3-1 Power supply

J2	
Pin	Function
1	Neutral
2	Not connected
3	Live
4	Not connected
5	Earth

J1			
Pin	Function	Pin	Function
12	13.5 V Standby	24	GND (Standby)
11	PWRGD_N	23	POWER_ON_N
10	5.2 V	22	
9	5.2 V	21	5.2 V
8	5.2 V	20	5.2 V
7	+ Sense 5.2 V	19	- Sense 5.2 V
6	GND	18	GND
5	GND	17	GND
4	3.3 V	16	GND
3	3.3 V	15	3.3 V
2	+ Sense 3.3 V	14	- Sense 3.3 V
1	+12 V	13	-12 V

The control signal POWER_ON_N controlled by the front panel controller (depending on the operating key STBY on the front of the instrument frame) switches the power supply from standby mode to operating mode. In standby operation, it only supplies a 13.5 V standby voltage, that is stabilized to +12 V on the motherboard for the crystal oscillator and converted to 5 V on the interface board to supply the front panel controller and the STBY LED on the front panel.

The control line PWRGD_N indicates if the 5.2 V are within the tolerance limits of typ. +/-10% (low level).

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

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

A further fuse is fitted inside the power supply as a means of fire protection.

Note: *This fuse is not accessible to the user from outside and will not blow unless there is a serious fault of the power supply. Servicing is required; change the module!*

Motherboard

The motherboard of the signal generator involves the following components and modules:

- Fuses
  Each supply voltage is fused with several fuses on the motherboard.(see *Table 3-1*)
- EEPROM
  The following data is stored here: Serial number of the instrument, calibration data (which must be taken into account for all modules throughout the entire instrument).
- Supplementary regulator for the 12 V standby voltage: The standby voltage from the power supply is passed through a linear regulator to minimize interference in the quartz reference oscillator.
- Switching regulator for 6.5 V supply voltage: This supply voltage is generated by means of a switching regulator on the motherboard.
- Temperature monitoring: A temperature sensor mounted on the motherboard monitors the temperature. If a defined temperature is exceeded, the power supply is switched off.
- Fan: A Fan for cooling the RF modules is connected to the motherboard.

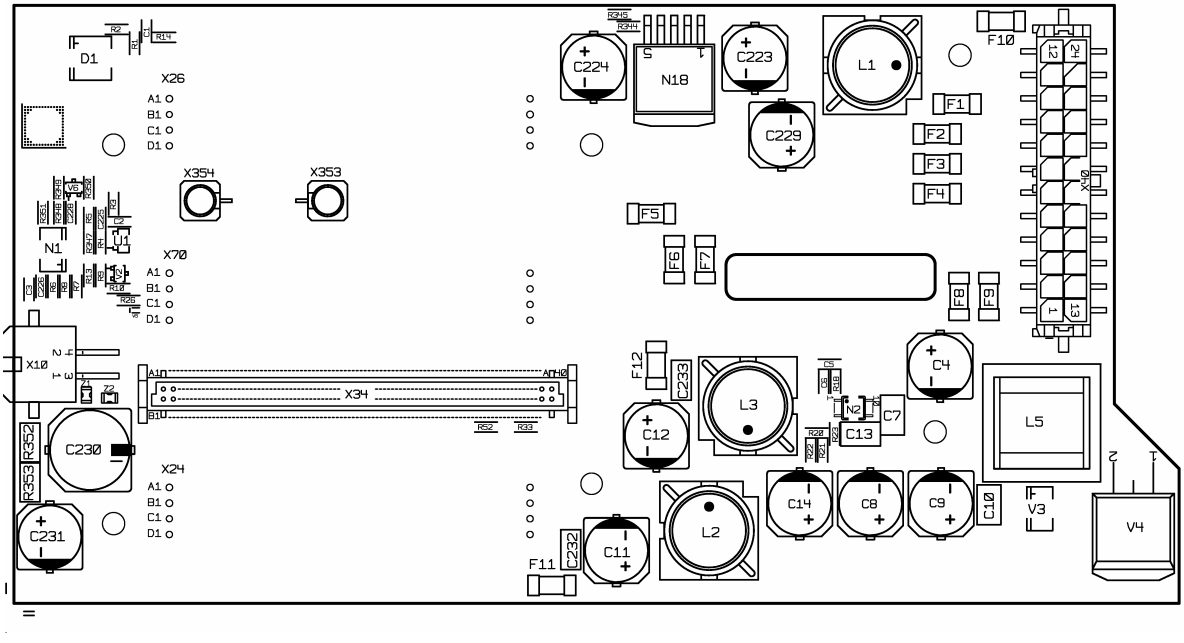


Fig. 3-2 Motherboard

Table 3-1 Fuses at motherboard

Fuse	supply voltage
F1	-12 V
F2	+12 V
F3	+3.3 V
F4	+3.3 V (only IF-Board)
F5	+5.2 V

Fuse	supply voltage
F6 + F7	+5.2 V (only IF Board)
F8 + F9	+5.2 V (only 6.5 V DC-DC converter at MBRD)
F10	+13.5 V Standby
F11	+6.5 V (only SSYN)
F12	+6.5 V

Interface Board IFB

The interface board (IFB) is the central interface between the CPU module and the other modules. The CPU is connected to the IFB, and communication runs via the PCI bus.

An FPGA (SMA_COM) performs data processing for the serial bus, which sends setting data to the modules. Since the SMA_COM also contains the PCI interface for the CPU, it is booted by an EPROM when the unit is switched on. Other FPGAs are configured by the CPU after the operating system has been loaded. A JTAG interface built into the SMA_COM is used for this purpose; a pulse generator and diverse I/O ports are also implemented on the SMA_COM.

A diagnostic ADC is used for measuring the voltages that occur in the unit as well as for calibration. The control signals and the read-in data are generated by the SMA_COM.

Another FPGA (SMA_MOD) contains the following LF generators:

- Two LF generators for sine signals up to 1 MHz or 10 MHz
- A multifunctional generator that generates sine, square or trapezoidal signals.
- A noise generator with adjustable noise bandwidth

All generators can be optionally routed via level dividers and amplifiers to the output of the unit.

Voltage converters generate not only the supply voltages for the FPGAs but also the +28 V needed by the other modules.

The unit is controlled by means of an IEC/IEEE bus interface and a USB controller.

A temperature monitor does not issue the POWER_ON control signal for the power supply unless the ambient temperature is in the permissible range.

The SATT3/6 attenuator, the CLKSYN module and the front panel controller (FPCTRL) are connected to the IFB.

The DVI is a 1:1 connection that runs from the processor to the X343 connector and from there to the display.

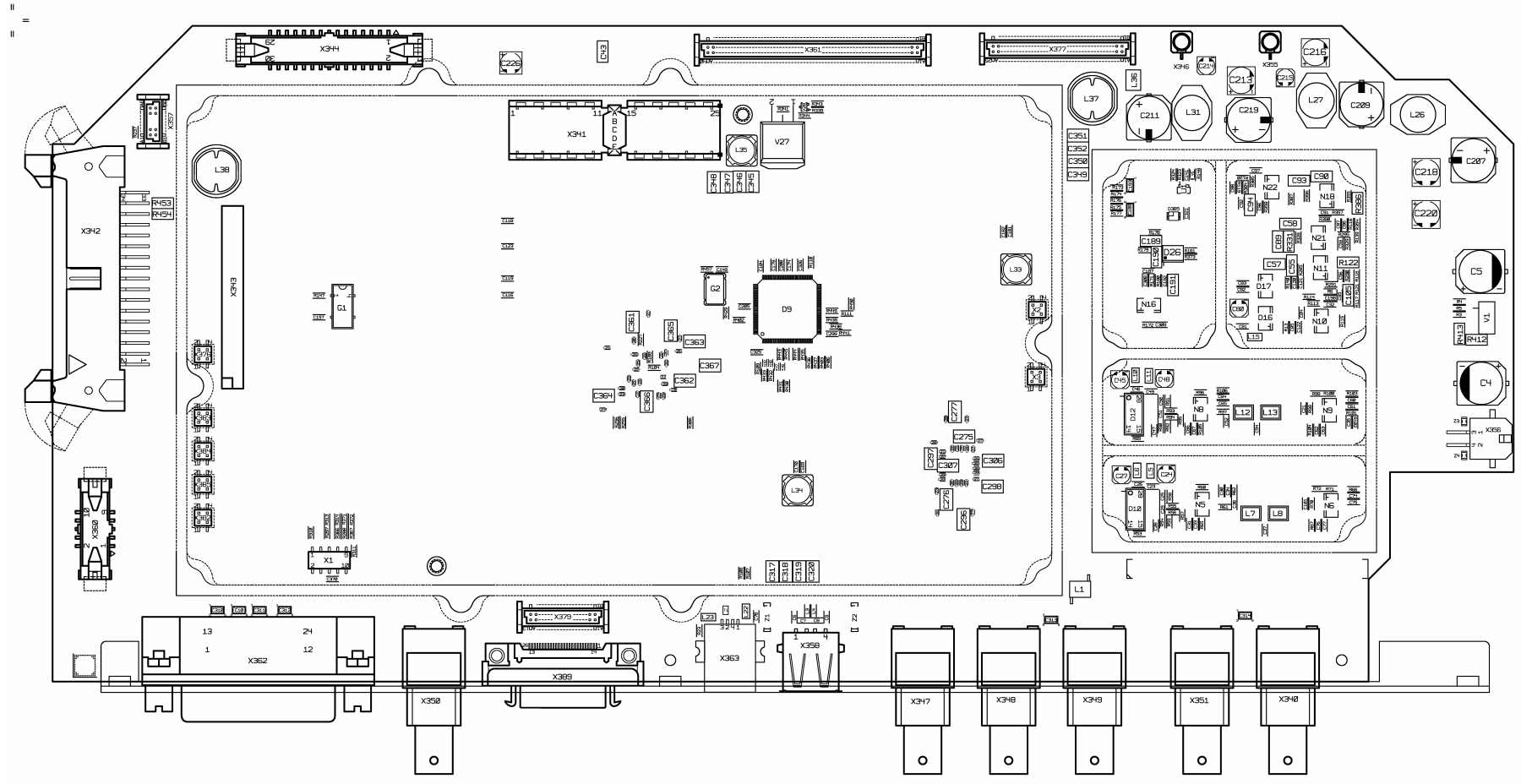


Fig. 3-3 Interface Board

CPU Board

The CPU board (LPC6/1L+) is connected directly on the interface board and contains all necessary PC components such as processor, memory chips, I/O devices (PCI, USB, DVI, Ethernet, CompactFlash controller and EEPROM) and a lithium battery.

Keyboard Controller Board

The keyboard controller board is mounted in the front module of the signal generator. This board contains a micro controller (front panel controller) which controls the keyboard and the rotary knob and transfers the data via USB to the CPU board.

Furthermore, the micro controller is used to control the power supply shutdown.
The USB port of the front panel is mounted on the front panel controller and connected via filters and cable with the CPU board.

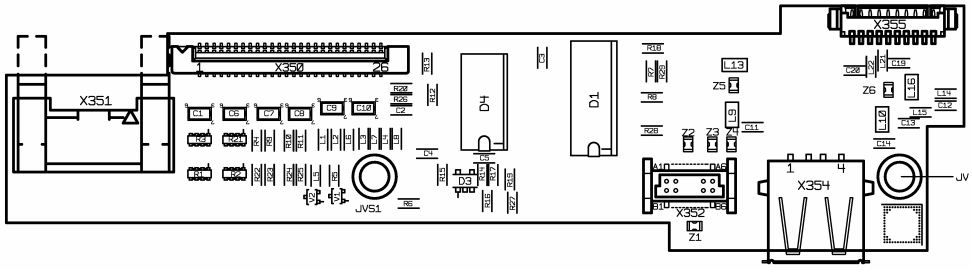


Fig. 3-4 Keyboard Controller Board

Display Adapter Board

The display adapter board is mounted to the front module of the signal generator.

This board contains a DVI receiver and a FPGA which converts the DVI signal of the CPU board to a ¼ VGA RGB signal for the TFT display.

Furthermore, LEDs are included with the display for the background illumination.

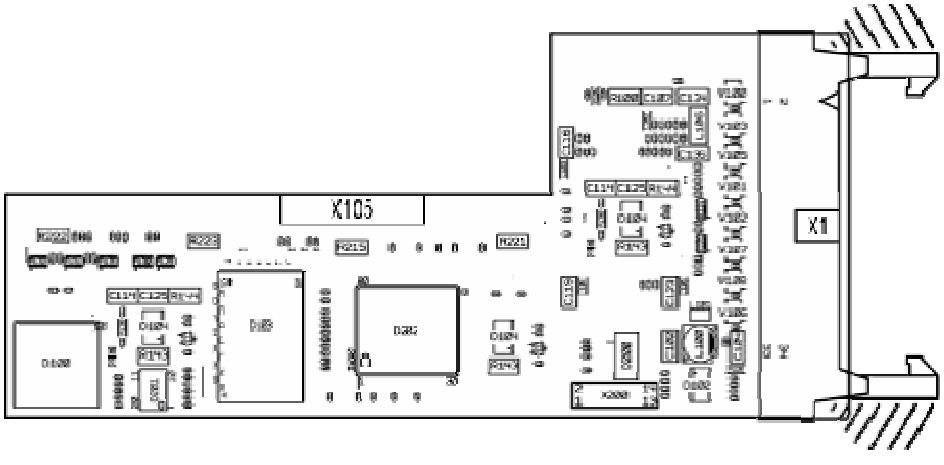


Fig. 3-5 Display Adapter Board

Troubleshooting

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

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

Warning:

Make sure that the instrument is disconnected from the AC supply before inserting or removing boards!

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

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

- Internal 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 URE	0350.5315.02
2	Spectrum analyzer	Frequency range 0 to 7 GHz	R&S FSP	1164.4391.07
3	Adapting cable	1 m long SMP-to-SMA connection	-	1129.8259.00
4	Oscilloscope	100 MHz	TDS 220	

Switch-On Problems

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

Action	Possible error causes and further steps
Check power-on switch on the rear. Check fuses on the rear. ⇓	Power switch OFF: Switch on power supply.
Check yellow LED (standby). ⇓	LED remains unlit: ➢ Measure standby voltage at power supply J2 pin 12 (see *Fig. 3-1*). Rated value: 13.5 V ± 3% ➢ Measure standby voltage at X361.A27 (IF board see *Fig. 3-6*): Rated value: +12 V ± 0.5 V No voltage: Check power cable from power supply to motherboard. Subsequently remove SSYN, SYNEX, IF board. ➢ Repeat measurement of voltage at X361.A27 (IF board see *Fig. 3-6*) Rated value: +12.0 V ± 0.5 V Correct voltage: The removed module caused short circuit and has to be replaced. No voltage: check +12 V standby voltage regulator on motherboard (N18 Pin 4 see *Fig. 3-2*). no/faulty voltage: change motherboard ➢ Measure voltage at X357.A2 (IF board see *Fig. 3-7*): Rated value: +5 V ± 0.5 V Voltage OK: Check cabling from IF board to front panel controller Remove keyboard controller board or complete front panel No voltage: Remove IF board

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

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

To analyze switch-on and switch-off problems that occur with the R&S SMA, 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) on the keyboard controller board. The TRISTATE outputs RS_PS_ON_M from the CPU board (LPC6/1L+) and the keyboard controller board are interconnected on the interface board (interface board X341 B9 see *Fig. 3-6* and X357 A6 see *Fig. 3-7*). This signal is subsequently routed via an overtemperature cutout on the IFB and becomes the POWER_ON_IF_N signal (IFB X361 B12 see *Fig. 3-6*). This signal is likewise routed via an overtemperature cutout on the MBRD and becomes the POWER_ON_N signal (power supply J1 pin 23 see *Fig. 3-1*). If the level is low, this signal switches on the power supply.

As soon as the ON/OFF button on the front panel is pressed, the output of the FPC (signal RS_PS_ON_M at IFB X357.A6 see *Fig. 3-7*) switches from HIGH (HIGH Z) to LOW. If the temperatures of the two sensors are within the permitted limits, the power supply's POWER_ON_N signal (power supply J1 pin 23 see *Fig. 3-1*) is set (low active). The power supply then starts up its output voltages. When the +5 V output passes the 4.75 V threshold, the PWRGD_N signal from the power supply (J1 pin 11 see *Fig. 3-1*) is set. If all the required voltages on the IF board are within the acceptable range, the SMA_COM FPGA is booted. The CPU is now started up by the RS_PWRGD_NT signal (IFB X341.A23 see *Fig. 3-6*) from the SMA_COM FPGA, which is set after successful loading.

Within four seconds after switch-on, the CPU board must set the RS_PS_ON_M signal (IFB X341.B9 see *Fig. 3-6*) to LOW , 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. The cause may be a defective or overheated power supply, motherboard or interface board.

Switch-off

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

The CPU's RS_ATX_ON_D (IFB X341.A21 see *Fig. 3-6*) signal 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 on the RS_ATX_ON_D signal, 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 RS_PS_ON_M signal (IFB X341.B9 see *Fig. 3-6*) is switched to tristate (HIGH Z), generating together with the RS_PS_ON_M (HIGH Z) output of the FPC (IFB X357.A6 see *Fig. 3-7*) a high level of the POWER_ON_N signal (power supply J1 pin 23 see *Fig. 3-1*), which in turn switches 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 RS_PS_ON_M 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 RS_ATX_ON_D circuit 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. There is a circuit for this purpose on the IF board.

The instrument can also be switched off by means of the temperature monitoring circuits on the IFB or MBRD. If one of these sensors detects an overtemperature on these modules (e.g. in the event that a fan fails), the power supply's POWER_ON_N circuit is set directly to HIGH, and the power supply is thus switched off. This sets the RS_PS_ON_M signals of the CPU and the keyboard controller (FPC) to HIGH Z state, preventing the power supply from starting up again after the temperature sensors have cooled down. The instrument can only be restarted by pressing the ON/OFF button or the power switch.

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

Description of error	Possible error causes and further steps
CPU does not boot correctly	➢ Check signal on IFB X341 A23 (see *Fig. 3-6*) while the signal generator is on Rated voltage = 2.5 V ± 0.2 V Faulty signal: Change IF board Correct signal: ➢ Check DVI signals on IF board X342 (see *Fig. 3-7*) Pins 23 to 26: 3.3 V ± 0.1 V Pins 29 to 34: 5.0 V ± 0.2 V Pin 15: DVI clock signal 25.2 MHz U_{PP} = 0.7 V ± 0.1 V Faulty signal: Change CPU
Cables are loose	➢ Check cabling between IF board, display adapter board and display inverter
Display adapter board defective TFT display defective	➢ Replace display adapter board ➢ Replace TFT display

- **Error: Fan does not work**

Description of error	Possible error causes and further steps
Front fan in RF slot does not work	➢ Disconnect fan and check voltage on motherboard X10 pin 1 (see *Fig. 3-2*): Rated voltage: 11.5 V ± 0.5 V Correct voltage: Replace fan Faulty voltage: Check +12 V at power supply (J1 pin 1): Rated voltage: +12 V ± 0.4 V Correct voltage: Replace motherboard Faulty voltage: See chapter “Switch-On Problems”
Front fan in RF slot does not work	➢ Disconnect fan and check voltage on IF board X356 (see *Fig. 3-3*) pin 1: Rated voltage: 11.5 V ± 0.5 V Correct voltage: Replace fan Faulty voltage: Check +12V at power supply (J1 pin 1 see *Fig. 3-1*): Rated voltage: +12 V ± 0.4 V Correct voltage: Replace motherboard Faulty voltage: See chapter “Switch-On Problems”

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
➢ Start signal generator	 R&S logo does not disappear The operating system (LINUX) can't be started • Connection of CompactFlash™ card became looser → Make sure the CompactFlash™ card or the CompactFlash adapter (option R&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. • CMOS failure of BIOS (after battery change) → Connect a USB keyboard and press F1 to resume → If the signal generator starts up correctly now, you have to update date and time in the R&S SMA setup menu.

Keyboard and Rotary Knob Test

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

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

Troubleshooting with Internal Test Points

A diagnostic A/D converter on the IF 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:

- IF board
- SSYN
- CWOP3/6
- SATT3C (optional)
- SYNEX (optional)
- CLKSYN (optional)

Normal action	Error, possible causes and corrective action
Internal diagnosis switched on with: SETUP - **Test Points...** Select the desired test point under **Select Test Point**. To operate, set **State** ON	
The measured voltage is displayed under Voltage. "99.9999V" means that the test point does not exist. This value is also returned for queries concerning the IEC/IEEE bus if a non-existent test point is queried.	➢ For troubleshooting refer to the following chapters. ➢ Compare the displayed values with the values specified in the respective sections concerning troubleshooting on the module. Major deviations from the named values indicate a defect: Change the module.
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. It is advisable to begin by checking the test points on the IF board, since the diagnostic converter is located on this module.	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 IF board. If values are still out of tolerance, replace the IF board. ***Note:*** *Temperatures are not always output directly in °C. The measured value often has to be multiplied by 100.*

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 synthesis module (SSYN), the IF board, the 3 GHz output unit (CWOP3) and, if installed, the synthesis extension (SYNEX), 6 GHz output unit (CWOP6) and clock synthesizer (CLKSYN) options.

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

Normal action	Error, possible causes and corrective action
Internal adjustments called: SETUP - **Internal Adjustments…**	***Note:*** *When **Adjust All** 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.*
Adjust Synthesis Internal adjustment of synthesis modules SSYN, SYNEX (optional) and CWOP6 (optional) is executed.	Abort during adjustment: See section *"Troubleshooting − Standard Synthesis (SSYN) Module"*. *See "Troubleshooting − Synthesis Extension (SYNEX) Module".* See section *"Troubleshooting - Module Output Unit 6 GHz CWOP6"*.
Adjust LFGen/ModGen Internal adjustment of internal modulation generator at interface board is executed.	*See "Troubleshooting – Interface Board (IFB) Module".*
Adjust Clock Synthesis (optional) Internal adjustment of clock synthesizer (CLKSYN) module is executed.	*See "Troubleshooting − Clock Synthesis Module".*
Adjust Level CWOP3 Internal adjustment of CWOP3 mixer output level.	*See "Troubleshooting - Output Unit 3 GHz CWOP3".*

Faulty RF Output Signal

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

Normal action	Error, possible causes and corrective action
RF output is switched on; **RF RF ON** menu	**No RF signal or a signal with insufficient level is output at the RF output.** Run internal adjustments (see *"Troubleshooting with Internal Adjustments"*). Following successful internal adjustment, check the following modules in sequence. Change any defective modules. ➢ Check attenuator (see *"Troubleshooting – SATT3C & SATT6C Modules"*). ➢ Check CWOP3 (see *"Troubleshooting - Output Unit 3 GHz CWOP3"*). ➢ Check SSYN (see *"Troubleshooting − Standard Synthesis (SSYN) Module"*). 6 GHz path ➢ Check 6 GHz attenuator. ➢ Check CWOP6 (see *"Troubleshooting - Module Output Unit 6 GHz CWOP6"*). ➢ Check SSYN (see *"Troubleshooting − Standard Synthesis (SSYN) Module"*). **The frequency at the RF output is not correct.** ➢ Run internal adjustments (see *"Troubleshooting with Internal Adjustments"*). ➢ Following successful internal adjustment, check SSYN (see *"Troubleshooting − Standard Synthesis (SSYN) Module"*).

Faulty LFGen/ModGen Output Signal
Faulty Pulse Generator Output Signal

The signals for LF-Generator and pulse generator are generated at a FPGA at the interface board (IFB). For a proper work of the FPGA a correct reference clock is needed at the interface board. (X365 see *Fig. 3-3*).

Error	Actions
Faulty LFGen/ModGen Output Signal	➢ Run internal adjustment: Adjust LFGen/ModGen. ➢ If internal adjustment fails see *"Troubleshooting – Interface Board (IFB) Module"*. ➢ If internal adjustment fails see *"Troubleshooting – Interface Board (IFB) Module"*.
Faulty Pulse Generator Output Signal	➢ See *"Troubleshooting – Interface Board (IFB) Module"*.

Faulty AM

The amplitude modulation AM is generated at the CWOP3/6 module using a level control loop (ALC). The internal modulation generator is implemented at the interface board (IFB) module .

Error	Actions
Internal AM is faulty	➢ Run internal adjustment: Adjust LFGen/ModGen. ➢ Activate internal AM with 1 kHz modulation frequency and check for correct input signal at IF board X361.A21 (see *Fig. 3-6*) (1 kHz, 1 V_{peak}). If input signal is not correct, troubleshoot IF board first. ➢ If input signal is correct, change CWOP3/6 module.
External AM is faulty	➢ Activate external AM and feed in a modulation signal (1 kHz, 1 V_{peak}) at AM EXT BNC connector of the signal generator. Check for correct input signal at CWOP3/6 X261.D10 (see *Fig. 3-8*) (1 kHz, 1 V_{peak}). If input signal is not correct, check coax cable from BNC connector to motherboard. ➢ If input signal is correct, change CWOP3/6 module.

Faulty FM/PM

The FM/PM modulation is generated at the synthesis extension (SYNEX) module.
The internal modulation generator is implemented at the interface board (IFB) module.

Error	Corrective action
Internal FM is faulty	➢ Run internal adjustment: Adjust LFGen/ModGen. ➢ Activate internal FM with 1 kHz modulation frequency and check for correct input signal at IF board X361.A16 (see *Fig. 3-6*) (1 kHz, 1 V_{peak}). If input signal is not correct, troubleshoot IF board first. ➢ If input signal is correct, change SYNEX module.
External FM is faulty	➢ Run internal Adjustment: Adjust LFGen/ModGen. ➢ Check coax cable from BNC-connector to motherboard. ➢ If modulation is still faulty, change SYNEX module.

Faulty Pulse Modulation

The signal for internal pulse modulation is generated at the pulse generator FPGA at the interface board (IFB). The external pulse modulation signal is also feed into the pulse generator FPGA.
The output signal of this FPGA is feed to the pulse modulator at the output unit CWOP3/6.

Error	Corrective action
Internal pulse modulation is faulty.	➢ Activate internal pulse modulation with 1 ms pulse period and 500 µs pulse width and check for correct input signal at CWOP3 2361.C9 (see *Fig. 3-8*) (square 1 kHz, 3.3 V_{peak}). If input signal is not correct, troubleshoot IF board first. ➢ IF input signal is correct, change CWOP3/6 module.
Error	**Corrective action**
External pulse modulation is faulty.	➢ Activate external pulse modulation and feed in a modulation signal (square 1 kHz, 3.3 V_{peak}) at PULSE EXT BNC connector of the signal generator. Check for correct input signal at CWOP3/6 X261.C9 (see *Fig. 3-8*) (square 1 kHz 3.3 V_{peak}). If input signal is not correct, troubleshoot IF board first. ➢ IF input signal is correct, change CWOP3/6 module.

Faulty Output Signal at CLKSYN_OUT and/or CLKSYN_OUT_N

Error	Actions
Faulty signal or none at all at CLKSYN_OUT and/or CLKSYN_OUT_N	**No output signal or a signal with insufficient level is output at CLKSYN_OUT and/or CLKSYN_OUT_N** ➢ Change the module. **The signals at CLKSYN_OUT and CLKSYN_OUT_N do not have the entered frequency** ➢ Run internal adjustment “Adjust Clock Synthesis” (see *“Troubleshooting with Internal Adjustments”*). ➢ If the adjustment is successful but the error persists, check the module that is fed to REF_IN (X284).

Troubleshooting – Interface Board (IFB) Module

Supply Voltages

Before Troubleshooting on the IFB, measure the supply voltages on its connector (X361, see *Fig. 3-6*) 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 motherboard and power supply (see *"Power Supply Module"* and *"Motherboard"*).

Supply Voltage	Pin at X361 row A	Pin at X361 row B
+28 V	A39	
+3.3 V	A35 … A37	B35 … B37
+5.2 V	A30 … A33	B29 … B33
+6.5 V	A28 + A29	
+12 V Standby	A27	
+12 V	A25 … A26	B26
-12 V	A24	B24

Check Reference Clock

Error	Error correction
no output signal at LFGEN out	➢ Check the reference clock on X346 (see *Fig. 3-3*). If the reference clock is okay, then change the module
not output signal at PULSGEN out	➢ Check the reference clock on X346 (see *Fig. 3-3*). If the reference clock is okay, then change the module

Internal Adjustment "Adjust LFGen/ModGen"

Errors in the internal LF generators are indicated by internal calibration.

Error message	Error correction
"LFGEN adjustment failed"	LfGen calibration fails (missing reference clock, convergence problems; values outside definition range). ➢ Check the reference clock on X346 (ses *Fig. 3-3*). If the reference clock is okay, then change the module

Other possible error messages:

"At least one parameter of the following source paths can't be calibrated correctly (no convergence): [FM;AM;LF]"	➢ Offset or gain calibration does not converge (the path causing the problems is displayed). Module must be changed.
"wrong calibration data for this device"	➢ Calibration files were not generated with the device. ➢ Run the calibration again. If the error message persists, the module must be changed.
"at least one saved configuration value is invalid"	➢ Calibration values outside definition range. ➢ Run the calibration again. If the error message persists, the module must be changed.
"can't store calibration data"	➢ Configuration files cannot be written. Module must be changed.

Error Messages of the Pulse Generator (PGEN)

Error message	Error correction
"settings for PulseGen are wrong"	➢ Settings for PulseGen are incorrect.
"settings for PulseGen are wrong" setting conflict: PulseWidth + PulseDelay > PulsePeriod!	➢ Single pulse cannot be correctly set. Check the time settings.
"settings for PulseGen are wrong" setting conflict: DoublePulseWidth + DoublePulseDelay > PulsePeriod! or PulseWidth > DoublePulseDelay!	➢ Double pulse cannot be correctly set. Check the time settings.

Input and Output Signals

Connector, system	Signal name	Frequency	Level	Signal flow
X346, SMA	CLK_IN	100 MHz (with option B22) or 104 MHz (without option B22)	TTL	Input reference frequency from SSYN, SYNEX or CLKSYN (depends on installed options B20, B22 or B29)
X355, SMP	LF_OUT	0.1 Hz to 10 MHz	1 mVs to 4 Vs	To LF connector
X348, BNC	PULSE_VIDEO	1/85 s to 10 MHz	TTL	To PULSE VIDEO connector
X349, BNC	PULSE_SYN	Pulse width: 20 ns to 5.1 us	TTL	To PULSE SYNC connector
X347, BNC	PULSE_EXT	….. 10 MHz	TTL	Trigger input from PULSE EXT

IFB - Connections

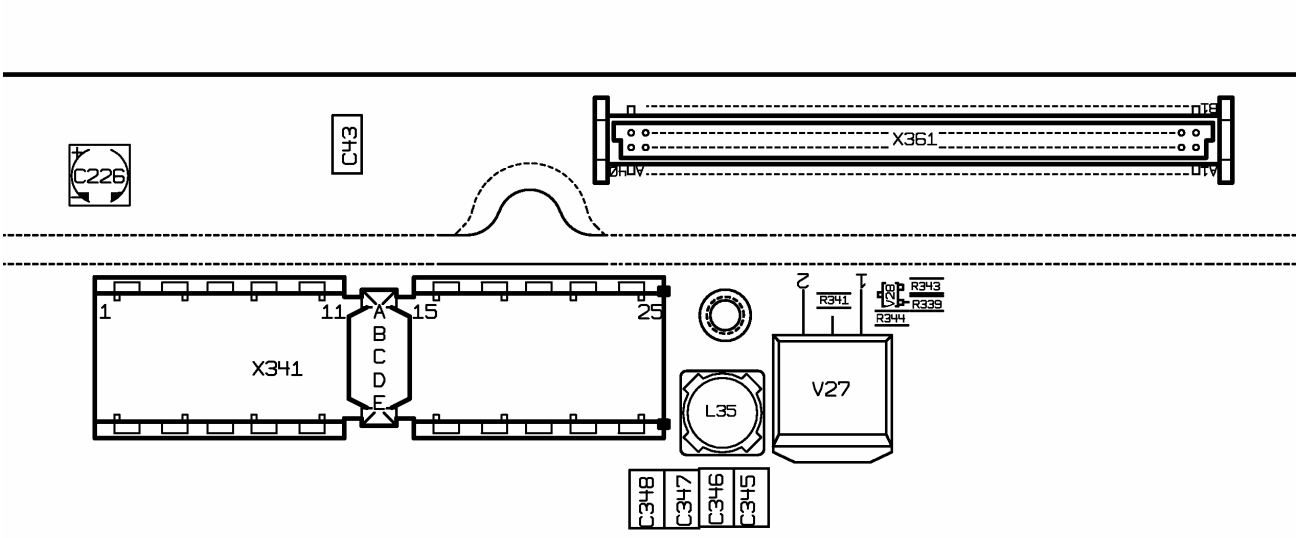


Fig. 3-6 Connection X341 to CPU Board and X361 to Motherboard

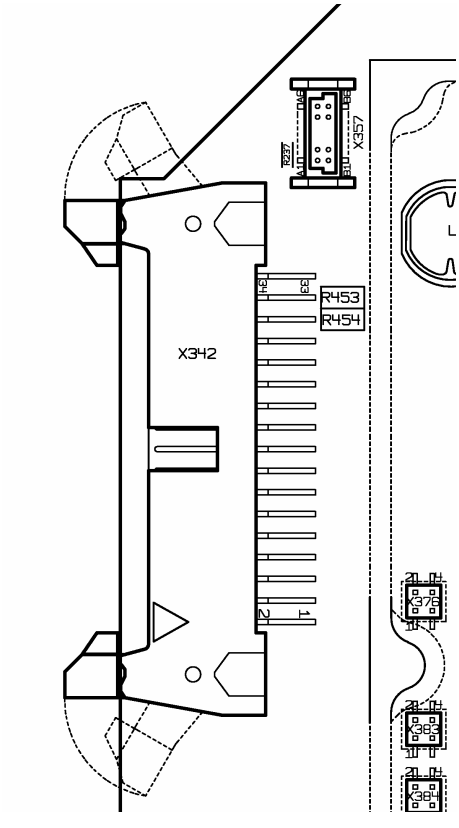


Fig. 3-7 Connection X342 to Display Adapter Board and X357 to Keyboard Controller Board

Troubleshooting − Standard Synthesis (SSYN) Module

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

Internal Adjustment "Adjust Synthesis"

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

Normal action	Error and error cause
Adjust Synthesis The SFU (step frequency unit), MLP (main loop), FRA (fractional-N -synthesis) and OPU (output unit) are now calibrated in sequence. If SYNEX is fitted, the corresponding adjustments are also executed.	**Abort during adjustment of SSYN:** See *"Error during internal adjustment"* section. **Abort during adjustment of SYNEX:** See *"Troubleshooting − Synthesis Extension (SYNEX) Module"* section.

Error during internal adjustment

Error	Error correction
Internal adjustment "Adjust Synthesis" aborts at SSYN-OPU Adjustment.	➢ Terminate socket X244 with 50 Ω and perform internal module adjustment (SETUP **- Internal Adjustment Adjust Synthesis).** Internal adjustment is now performed successfully: This indicates that termination at X244 is insufficient (defective cable or output module CWOP3/6). Adjustment aborts again: ➢ Change module.

Input and Output Signals

Connector, system	Signal name	Setting on signal generator	Frequency	Level	Signal flow
X242, SMA	SYNEX_IN	750 MHz to 1500 MHz	731 MHz to 1495.5 MHz	5 ± 3 dBm	to SYNEX (if fitted)
X243, SMA	SYNEX_OUT	750 MHz to 1500 MHz	750 MHz to 1500 MHz	5 ± 3 dBm	from SYNEX (if fitted)
X244, SMA	SYNRF	6.6 MHz to 3000 MHz 0.1 MHz to 6.6 MHz	105.6 MHz to 3000 MHz 1040.1 MHz to 1046.6 MHz, 1200.1 MHz to 1206.6 MHz with SYNEX fitted	13 ± 3 dBm	to CWOP3/6
X245, SMP	EXTREF_OUT	Ext. ref. freq. 5/10/13 MHz	5/10/13 MHz	>6 dBm	to Rear Panel or to SSYN
X246, SMP	EXTREF_IN	Ext. ref. freq. 5/10/13 MHz	5/10/13 MHz	-6 dBm to 19 dBm	from rear Panel or from SSYN
X247, SMP	REF100	B22 fitted	100 MHz	10 ± 2 dBm	from SYNEX
X248, SMP	REFVAR	SYNEX not fitted SYNEX not fitted and R&S SMA-B29 fitted	104 MHz 104 MHz	13 ± 3 dBm 13 ± 3 dBm	to IF board to CLKSYN
		R&S SMA-B20 fitted	104 MHz	13 ± 3 dBm	to SYNEX
		SSYN 1141.4220.02 R&S SMA-B22 fitted *SYNEX 1142.0270.02* ref. int ref. ext. 10 MHz ref. ext. 5; 13 MHz	 10 MHz 10 MHz 10 MHz	 10 dBm ± 3 dB 5 dBm ± 3 dB 3 V, TTL	 from SYNEX to SYNEX to SYNEX
		SSYN 1141.4220.02 R&S SMA-B22 fitted *SYNEX 1142.0070.02* ref. int ref. ext. 10 MHz ref. ext. 5; 13 MHz	 10 MHz 10 MHz 40 MHz	 3 V, TTL 3 V, TTL 3 V, TTL	 from SYNEX to SYNEX to SYNEX
X249, SMA	REF1040	<6.6 MHz	1040 MHz	10 ± 2 dBm	to CWOP3

Error Messages Concerning the SSYN Module

Error message	Error correction
"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. ➢ Check adjustment of 1040 MHz reference oscillator (*see chapter 2 "Adjustment of Internal Reference Oscillator"*) ➢ If the input signal, frequency settings and reference oscillator adjustment are correct and the error message is still displayed, change the module.
"Synthesis Reference Frequency ALC-loop unlocked"	➢ Input level of external reference signal is too low. Check cabling for external reference signal.
"Synthesis Reference 1040 MHz ALC-loop unlocked"	This error message indicates that the level control for the 1040 MHz reference signal at X249 is unlocked. ➢ Terminate X249 with 50 Ω. Set RF to 100 MHz and to 1000 MHz. If the message disappears, the cable connection or CWOP3/6 module is defective. If the message is still displayed, change the module.
"Synthesis fractional-loop PLL unlocked" "Synthesis main-loop PLL unlocked"	➢ Change the module.
"Synthesis SFU attenuator DAC on limit" "Synthesis OPU attenuator DAC on limit" "Synthesis MLP adjustment failed" "Synthesis FRA adjustment failed" "Synthesis SFU adjustment failed" "Synthesis OPU adjustment failed"	These errors may occur when the internal adjustment "Adjust Synthesis" is executed. ➢ See *"Error during internal adjustment"*.
"Synthesis adjustment data invalid" "Synthesis new adjustment data invalid" "Synthesis cannot initialize adjustment data" "Synthesis cannot store adjustment data" "Synthesis cannot read EEPROM data"	➢ Try to execute Internal Adjustment "Adjust Synthesis" anew. ➢ If error messages continue, change module. If there are problems with other modules too, data transfer may be faulty. Try to change the IF board.

Frequency Error < 2*10^{-6}, Reference Oscillator Adjustment

Error	Error correction
Internal reference frequency: Frequency error < 2*10^{-6}	➢ 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 adjusted with a external frequency counter (*see chapter 2 "Adjustment of internal reference frequency*). ***Note**: The internal reference can be impaired by up to approx. ±10^{-6} under the menu **Setup** - **Reference Oscillator** - **Adjustment**. This setting does not affect the factory adjustment and can be reset at any time by means of deactivation.*

Troubleshooting − Synthesis Extension (SYNEX) Module

Internal Adjustment "Adjust Synthesis"

For a comprehensive test of the module, run the internal adjustment.

Error	Actions
Internal adjustment "Adjust Synthesis" aborts during SSYN adjustments.	➢ Troubleshoot SSYN module first.
Internal adjustment ”Adjust Synthesis” aborts during SYNEX Adjustments.	➢ Check for error messages concerning SYNEX (see *"Error Messages Concerning the SYNEX Module"*).

Input and Output Signals

Connector, system	Signal name	Setting on signal generator	Frequency	Level	Signal flow
X702, SMA	SYNEX_OUT	750 MHz to 1500 MHz	750 MHz to 1500 MHz	5 ± 3 dBm	to SSYN
X703, SMA	SYNEX_IN	750 MHz to 1500 MHz	731 MHz to 1495.5 MHz	5 ± 3 dBm	from SSYN
X704, SMP	REFVAR	R&S SMA-B20 fitted	104 MHz	3 V TTL	from SSYN
		SYNEX 1142.0270.02 R&S SMA-B22 fitted *SSYN 1141.4220.02* ref. int ref. ext. 10 MHz ref. ext. 5; 13 MHz	 10 MHz 10 MHz 10 MHz	 10 dBm ± 3 dB 5 dBm ± 3 dB 3 V, TTL	 to SSYN from SSYN from SSYN
		SYNEX 1142.0270.02 R&S SMA-B22 fitted *SSYN 1141.4208.02* ref. int ref. ext.	 10 MHz 10 MHz	 3 V, TTL 3 V, TTL	 to SSYN from SSYN
X705, SMP	REF100		100 MHz	10 ± 2 dBm	to SSYN
X706, SMP	REF_DACB	R&S SMA-B20 R&S SMA-B22 R&S SMA-B20 & R&S SMA-B29 fitted R&S SMA-B22 & R&S SMA-B29 fitted	104 MHz 100 MHz 104 MHz 100 MHz	13 ± 3 dBm 13 ± 3 dBm 13 ± 3 dBm 13 ± 3 dBm	to IF board to IF board to CLKSYN to CLKSYN
X708, SMA	REF1200	<6.6 MHz	1200 MHz	10 ± 2 dBm	to CWOP3

Error Messages Concerning the SYNEX Module

Error message	Error correction
"Synthesis-extension: 100-MHz-loop unlocked" or "Synthesis-extension: Synchronisation error on 10-MHz-reference PLL"	➢ Check for correct external reference frequency setting and corresponding input signal. ➢ Check correct input signals from SSYN at X704. ➢ If input signals are correct and error message is still displayed, change the module.
"Synthesis-extension: fm-loop PLL unlocked"	➢ Check for correct input signals from SSYN ➢ If input signals are correct and error message is still displayed, change the module.
"Synthesis-extension: modulation input level out of range"	➢ If this message does not disappear after the input signal is reduced or removed, change the module.
"Synthesis-extension: fm-offset adjustment failed"	➢ Try to execute Internal Adjustment "Adjust FM" anew. ➢ If error messages continue, change the module.
"Synthesis-extension: msw-ad adjustment failed"	➢ Check for proper functioning of LFGEN on IF board
"Synthesis-extension: kvco adjustment failed"	➢ Check for correct input signals and cabling from SSYN. ➢ Activate internal FM with 1kHz modulation frequency and check for correct input signal to X361.A16 (1kHz, 1 V_{peak}). If input signal is not correct, troubleshoot IF-Board first. ➢ If input signals are correct and error message is still displayed, change the module.
"Synthesis-extension: adjustment data invalid" "Synthesis-extension: new adjustment data invalid" "Synthesis-extension: cannot initialize adjustment data" "Synthesis-extension: cannot initialize adjustment pattern"	➢ Try to execute Internal Adjustment "Adjust Synthesis" anew. ➢ If error message continues although the adjustment was successfully completed, data transfer may be faulty. Try to change the IF board.
"Synthesis-extension: cannot read EEPROM data" "Synthesis-extension: cannot store adjustment data"	➢ This indicates problems concerning the data transfer from and to the EEPROM of the module. If changing the module does not help, change the IF board module.

Frequency Error < 2*10^{-6}, Reference Oscillator Adjustment

Error	Error correction
Internal reference frequency: Frequency error < 2*10^{-6}	➢ 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 be adjusted with a external frequency counter (*see chapter 2 "Adjustment of internal reference frequency*). ***Note**: The internal reference can be tuned by up to approx. ±5·10^{-7} (with option R&S SMA-B22) in the menu **Setup - Reference Oscillator - Adjustment**. This setting does not affect the factory adjustment and can be reset at any time by means of deactivation.*

Troubleshooting - Output Unit 3 GHz CWOP3

The tests listed below ensure that a supposed fault on the Output Unit 3 GHz CWOP3 is not caused by a defective or incorrectly connected cable, incorrect adjustment or another module.

Before further troubleshooting on the Output Unit 3 GHz CWOP3 ensure that internal adjustments **(SETUP - Internal Adjustment Adjust Synthesis)** work correctly.

Before a Go/NoGo decision on the CWOP3, measure the supply voltages on its connector (X261, see photo) 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 motherboard and power supply (see *"Power Supply Module"* and *"Motherboard"*).

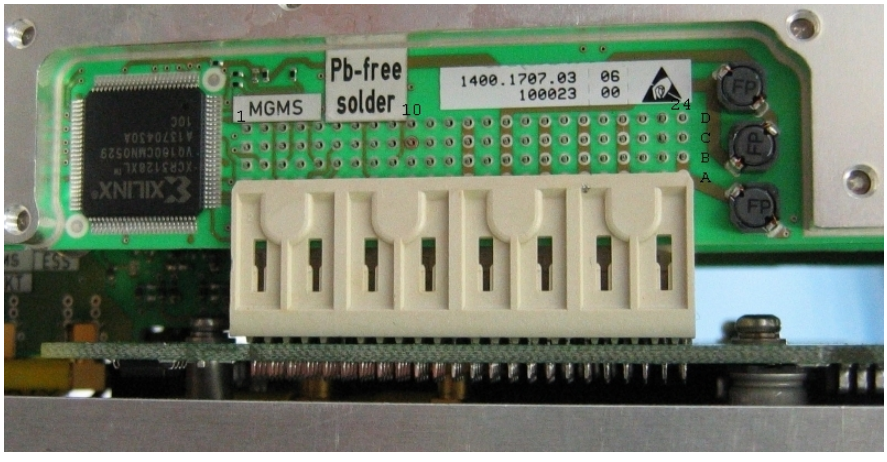


Fig. 3-8 Connection X261 at CWOP

Pin	Voltage
X261.A…D13	-12 V ± 0.5 V
X261.A…D15	+12 V ± 0.5 V
X261.A…D19	+6.5 V ± 0.2 V
X261.A…D21	+5.2 V ± 0.2 V
X261.A…D23	+3.3 V ± 0.2 V
X261.A…B24	+28 V ± 1.0 V

Input and Output Signals

Connector, system	Signal name	Setting on signal generator	Frequency	Level	Signal flow
X262, SMA	OPU_RF_IN	9 kHz to 3000 MHz	105.6 MHz to 3000 MHz	+13 ± 2 dBm	From SSYN/SYNEX
X263, SMA	OPU_LO_IN	9 kHz to 6.6 MHz	1040 MHz / 1200* MHz	+10 ± 2 dBm	From SSYN/SYNEX
X264, SMA	OPU_RF_OUT	9 kHz to 3000 MHz	9 kHz to 3000 MHz	-20 to +29 dBm	To attenuator

* only with option -B22

Error Messages of the Output Unit 3 GHz CWOP3

Error message	Error correction
"Missing detune eeprom data"	➢ If this message appears, the EEPROM of the CWOP3 cannot be read. If the message does not disappear after restarting the R&S SMA, the instrument must be newly level-calibrated externally. If the error continues to appear, replace the CWOP3.
"Missing gain eeprom data"	➢ If this message appears, the EEPROM of the CWOP3 cannot be read. If the message does not disappear after restarting the R&S SMA, the EEPROM must be newly programmed with the gain data. If the error continues to appear, replace the CWOP3.
"CWOP ALC unlocked"	➢ If this message appears, the level control (ALC) cannot set the output level. Check whether the error appears in the entire frequency range or only in certain bands. Check at the following frequencies: 5 MHz, 100 MHz, 1000 MHz. ➢ If the error only appears at 5 MHz but not at 100 MHz and 1000 MHz, check the level and frequency of the signal at the OPU_LO_IN (X263) input. If the level and frequency are OK, the CWOP3 is defective and must be replaced. Otherwise test the SSYN and SYNEX modules. ➢ If the error appears at all three frequencies, check the level and frequency of the signal at the OPU_RF_IN (X262) input. If the level and frequency are OK, the CWOP3 is defective and must be replaced. Otherwise test the SSYN and SYNEX modules. ➢ If the error only appears in certain frequency bands, the CWOP3 is defective and must be replaced. ➢ Before removing the CWOP3, you can also try new external level calibration. If this does not work, the CWOP3 is definitely defective.
"CWOP3 mixer adjustment failed"	➢ If this message appears, the mixer output level for the downconverter can not be adjusted correctly. ➢ Check cabling and level for LO signal (X263) and RF IN signal (X262). ➢ If the cabling and signal levels are O.K. replace the CWOP module.

Warnings	Warning correction
"Pep value greater than defined limit"	➢ The peak envelope power (PEP) is higher than the set upper limit. ➢ Reduce the output level.
"Pep value less than defined lower bound (fix range)"	➢ The peak envelope power (PEP) is lower than the permissible lower limit in the "fix range" mode of the attenuator. ➢ Increase the output level, set the attenuator mode to "Auto", or reset the "fix range" by briefly switching the attenuator mode to "'Auto" and then switching back to "Fixed".
"Pep value greater than defined upper bound (fix range)"	➢ The peak envelope power (PEP) is higher than the permissible upper limit in the "fix range" mode of the attenuator. ➢ Reduce the output level, set the attenuator mode to "Auto", or reset the "fix range" by briefly switching the attenuator mode to "'Auto" and then switching back to "Fixed".
"Pep value greater than allowed in normal attenuator mode"	➢ The peak envelope power (PEP) is higher than the permissible upper limit in normal attenuator mode. ➢ Reduce the output level or set the attenuator mode to "Auto" to allow high power.
"Settings conflict, pep value vs. AM depth"	➢ The peak envelope power (PEP) is higher than the permissible upper limit because of the set AM modulation depth. ➢ Reduce the output level or increase the level limit (e.g. by switching the attenuator mode to "Auto" if "Normal" or "Fixed" mode was set). Reducing the AM modulation depth will also eliminate the warning.
"Settings conflict, pep value greater than allowed level vs. frequency"	➢ The full output level range cannot be utilized at low frequencies – except in "High Power" mode – because internal components may be overloaded. So you can only set max. +11 dBm CW level below 600 kHz and max. +8 dBm CW level below 50 kHz. ➢ Possible remedy: Switch the attenuator mode from "Auto" to "High Power".

Troubleshooting - Module Output Unit 6 GHz CWOP6

The tests listed below ensure that a supposed error in the 6 GHz Output Unit Module CWOP6 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 3GHz. If errors occur at frequencies less than or equal to 3GHz, follow the troubleshooting steps described under Troubleshooting – Module Output Unit 3 GHz CWOP3.

Before proceeding with additional troubleshooting on the CWOP6 module, ensure that the internal adjustments (SETUP **– Internal Adjustment Adjust Synthesis**) can be completed without any errors.

Error messages concerning the CWOP6 module

Error message	Error correction
"CWOP6 PLL unlocked"	➢ This message appears if the PLL is unable to lock. The internal adjustment routines terminate with an error message (see below). ➢ If the message "CWOP ALC unlocked" appears at frequencies below 3 GHz, check the signal level at X252. If the signal level is OK, replace the CWOP6 module. ➢ If no error message appears at frequencies below 3 GHz, check the cabling between X267 and SYNEX and check the signal level. If no fault is found, replace the CWOP6 module.
"CWOP6 Pretune adjustment failed"	➢ This message usually appears in connection with the "CWOP6 PLL unlocked" message. ➢ Check whether the message "CWOP6 PLL unlocked" appears at all frequencies above 3 GHz or only in certain frequency ranges (100 MHz intervals). ➢ If the message "CWOP6 PLL unlocked" appears at all frequencies above 3 GHz, proceed as described for that message. ➢ If the message "CWOP6 PLL unlocked" appears only at certain frequencies, the CWOP6 module must be replaced. To further localize the fault, note the frequency range in which the message "PLL unlocked" appears. ➢ If the message "CWOP6 PLL unlocked" does not appear at all, the CWOP6 module must be replaced.

"CWOP6 KVCO adjustment failed"	➢ If this message appears, the FM deviation cannot be calibrated correctly. ➢ Check the cabling. In particular, check the connection between X266 and SYNEX X8. ➢ If the cabling is correct, check the signal level at X266. For that purpose, configure the R&S SMA as follows: Preset Frequency: **4 GHz** Frequency modulation: **ON** FM internal deviation: **80 MHz** A sinusoidal signal with a frequency of 1 kHz and a peak-to-peak amplitude greater than 2 V must be present. ➢ If no signal can be measured, check the SYNEX module. ➢ If the signal is present, replace the CWOP6 module.

Troubleshooting – SATT3C & SATT6C Modules

Error	Error correction
No RF output level	➢ If the CWOP output section supplies an output signal, either the RF cabling or the SATT3C or SATT6C attenuator is defective.
Output level is wrong by more than 1 dB with some, **but not all**, attenuator settings	➢ SATT3C or SATT6C attenuator is defective.
Output level is wrong by a similar amount with all attenuator settings	➢ Check the output level of CWOP. If this is okay, the SATT3C or SATT6C attenuator is defective. Measure the insertion loss of the attenuator in the 0 dB position (set a level of +9 dBm on the R&S SMA for this purpose). It must match the values specified in *Table 3-2* ±1 dB.
Overvoltage protection does not trigger	➢ Switch on RF -> Apply a DC voltage of >12 V or an RF power of >2 W to X303 (= RF N connector) -> The overvoltage protection must trigger. If it doesn't, the SATT3C or SATT6C attenuator is defective.

Table 3-2 Nominal insertion loss of SATT3C and SATT6C attenuators in the 0 dB position

Frequency	10 MHz	1 GHz	2 GHz	3 GHz	4 GHz	5 GHz	6 GHz
Insertion loss	-5 dB	-5.5 dB	-6 dB	-6.5 dB	-8 dB	-10 dB	-10.5 dB

Input and Output Signals

Connector, system	Signal name	Frequency	Level	Signal flow
X301		Logic signals <20 MHz	TTL	Control interface and power supply from IF board
X302, SMA	RF_IN	9 kHz to 3/6 GHz	<29 dBm	Input from CWOP output section
X303, SMA	RF_OUT	9 kHz to 3/6 GHz	<29 dBm	RF output to N output connector of the R&S SMA

Troubleshooting − Clock Synthesis Module

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

Internal Adjustment "Adjust Synthesis"

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

Error	Actions
Internal adjustment "Adjust Clock Synthesis" aborts during execution.	➢ Check the input signal to CLKSYN REF_IN (X284). If the signal is incorrect, try to repair feeding module. ➢ If the input signal and cabling are correct and the adjustment keeps aborting, change the module.

Input and Output Signals

Connector, System	Signal name	Setting on Generator	Frequency	Level	Signal flow
X284, SMP	REF_IN		104 MHz (100 MHz with R&S SMA-B22)	3.3V TTL	From SSYN (with R&S SMA-B22 from SYNEX)
X285, SMP	REF_OUT		104 MHz (100 MHz with R&S SMA-B22)	Approx. 5V TTL	To IF board
X282, SMA	CLKSYN_OUT	Clock Synthesis On	100 kHz – 1.5 GHz	0.5 V peak-peak into 50 Ω	To rear panel
X283, SMA	CLKSYN_OUT_N	Clock Synthesis On	100 kHz – 1.5 GHz	0.5 V peak-peak into 50 Ω	To rear panel

Error Messages Concerning CLKSYN Module

Error message	Actions
"ClkSyn: frequency is out of range" "ClkSyn: vco adjustment failed"	➢ Check the input signal to CLKSYN REF_IN (X284). ➢ If the input signal is correct and error message is still displayed, change the module.
"ClkSyn: adjustment data invalid" "ClkSyn: cannot store adjustment data" "ClkSyn: cannot initialize adjustment pattern"	➢ Try to execute internal adjustment "Adjust Clock Synthesis" anew. ➢ If error message persists despite succesful completion of the adjustment,, data transfer may be disturbed. Try to change the data cable or, if this does not help, try to change the IF board.

Module Replacement

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

Notice:

Module replacement only by authorized Rohde & Schwarz Service.

Overview of the Modules

Table 3-3 Overview - module replacement

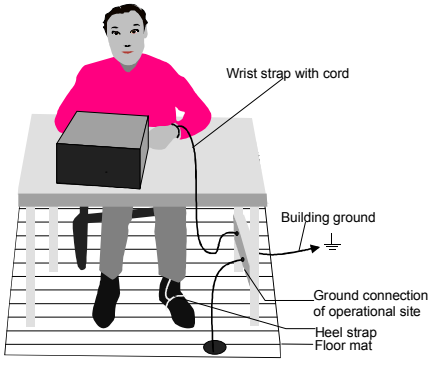
Module	Adjustment (see chapter 2, "Adjustments")	See page
Controller LPC A320	X	3.57
CompactFlash™ Card A321	X	3.59
Lithium battery	X	3.57
4.3" TFT (Display) A370 Display Unit (3586.5545.02)		3.50
Rotary Pulse Generator A450		3.51
Push Button Board Set (1400.0717.00) or Flex. Switch Board (1400.0723.00) A355		3.51
Converter DC/AC A380		3.50
Display Control Board A360		3.50
Front Panel (1400.0700.00 3 GHz, 1400.0681.00 6 GHz)		3.49
Standard Synthesis A240	X	3.53
Synthesis Extension A700	X	3.53
CW Output Module 3 GHz A260	X	3.53
CW Output Module 6 GHz A260	X	3.53
Interface Board A340	X	3.56
Keyboard Controller Board A350		3.51
Clock Synthesis R&S SMA-B29 A280	X	3.61
CompactFlash rear A321, A322, A323 CompactFlash™ card R&S SMA-B80		3.59
AC/DC Power Supply A400	X	3.55
Fan Units E1, E2		3.60
Front unit		3.49
Motherboard A100	X	3.54
Elec. Attenuator 3 GHz A300	X	3.52
Elec. Attenuator 6 GHz A300	X	3.52

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

Safety Instruction, Dismounting the Case

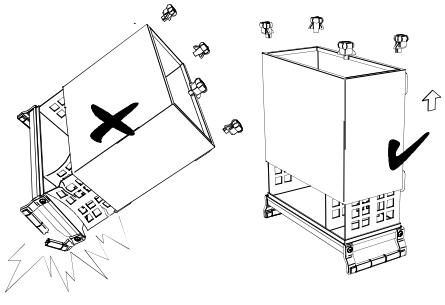
Warning:

- *Please note the safety instructions at the beginning of this manual.*
- *Disconnect the instrument from the mains before opening the case.*
- *Protect the replacement site against electrostatic discharge to avoid damage to electronic components of the modules.*



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.*



- *Put the instrument on the front handles before loosening the rear feet and pulling off the case to avoid damage to the instrument.*
- *When mounting the case, take care not to damage or pull off cables.*

The tube is to be dismounted for all the following procedures and retrofitted to finish. This will not be mentioned again.

Replacing Fuses

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

The spare fuses come in a small plastic bag included in the Quick Start Guide binder.

➢ Switch off the instrument.

➢ Disconnect the power supply cord.

➢ To replace a fuse, use a small screwdriver to open the fuse holder at the power inlet.

Replacing the Front Panel and the Front Unit

Removing the Front Panel

(See chapter 5, spare parts list 1400.0052.01, parts list and drawing 1400.0000.01 and 1400.0100.01).

- Switch off the instrument and pull the mains plug.
- Unscrew the four screws (1096.4896.00) of the front handles (1096.1468.00) on both sides and take off the front handles.
- Pull off the front panel (1400.0700.00 3 GHz or 1400.0681.00 6 GHz) towards the front.

Removing the Front Unit

(See chapter 5, spare parts list 1400.0052.01, parts list and drawing 1400.0000.01 and 1400.0100.01).

Before removing the front unit, you must undo the following cable connections. To remove cables W353 and W354, the RF module has to be dismounted. Please refer to the section *"Removing an RF Module"*.

- Pull off the RF cables W303, W353, W354 and W355.
- Pull off the flex. cables W350 and W361.
- Unscrew four countersunk screws (1148.3288.00) in the front frame each at the top and at the bottom.
- Completely remove the front unit with keyboard and TFT display toward the front (front unit 1400.0617.03).

Notice:
The connecting cables are still connected.

- Pull off the connecting cables to the display control board and the keyboard controller board.

Mounting the Front Panel

- Place the front unit with the keys pointing upward so that the cables can be connected.
- Reconnect the cables to the RF-frame and the interface board (see 1400.0000.01S).
- Push the front panel onto the signal generator and fasten it in place using four countersunk screws (1148.3288.00) in the front frame.
- Mount the new front panel and reassemble the instrument in the reverse order.

Notice:
Make sure to route the cables properly.

- Mount the two front handles on the instrument.

Removing the TFT Display

- Unscrew four screws (1148.2600.00) and pull off the display (A370).
- Disconnect cable from the display (A370).

Removing the Display Controller Board

- Unscrew three screws (1148.3307.00) and pull off the display controller board (A360).
- Disconnect cable from the Interface Board and DC/AC converter (A380).

Installing the New TFT Display and/or Display Controller Board

- To insert the new TFT display and/or display controller board , proceed in the reverse order. Connect all cables in the correct position and tighten all screws (drawings 1141.0617.01 and 1400.0000.01S).

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

- Reinstall the front module (see above).
- Functional test is necessary.

Replacing the Pushbutton Board Set (1400.0717.00), Flex. Switch Board (A355), Rotary Pulse Generator (A450) and Keyboard Controller Board (A350)

(See chapter 5, spare parts list 1400.0052.01, parts list and drawing 1400.0617.01).

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

- Remove the front panel (see above).

Removing the Modules

- Place the front unit onto a clean surface with the keys pointing upwards.
- Pull off the knob (0852.1086.00) of the rotary pulse generator. The rotary pulse generator can be replaced after undoing the hexagon nut.
- Remove cable to the keyboard controller board.
- Unscrew the two screws (1148.3307.00) and remove the keyboard controller board.
- Remove cable between the keyboard controller board and the switch board, which is mounted on the LCD holding plate.

  The pushbutton board set (1400.0717.00), the flex. switch board (A355), as well as the keyboard controller board can now be replaced.

Installing the Modules

- To insert the new modules, proceed in the reverse order. Connect all cables in the correct position and tighten all screws (drawings 1141.0617.01 and 1400.0000.01S).
- Functional test is necessary.
- Remount the front panel (see above).

Replacing the Elec. Attenuators A300

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1400.0000.01 and 1400.0100.01).

The attenuator is located behind the front unit.

Removing the Elec. Attenuator

- Remove tube by opening the two rear wall feet 1096.2487.00.
- Place the instrument onto its left side and unscrew the RF cables at the input and the output of the RF attenuator.
- Remove the panel for the attenuator (1400.0781.00) from the chassis by undoing the three countersunk screws (3 x 1148.2752.00) and lift out the module together with the panel. Exchange the spare attenuator by undoing the four screws and four washers (4x 0041.1682.00, 4x 0082.4670.00) from the inside of the panel for the attenuator.
- Unplug the flexible ribbon connection (W301) from the attenuator. Now the attenuator can be removed.

Installing the New RF Attenuator

- Proceed in the reverse order as described under *"Removing the Elec. Attenuator"*. Torque (60 Ncm).

Circuit diagram 1400.0000.01S shows the mounting instructions for the removed cable connections.

- Screw the four screws with washers fastening the attenuator to the panel.
- Screw the three countersunk screws fastening the attenuator panel to the chassis.
- After replacement, perform the internal and external adjustments as described in chapter 2, *"Adjustments and Calibration"*).

Replacing RF Modules A240, A260, A1280, A700 and the Motherboard A100

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1400.0000.01 and 1400.0100.01).

Table 3-4 Replacing RF modules – overview and specific requirements of the individual boards

RF module		**Remarks**
Standard Synthesis	A240	
CW Output Module 3 GHz (R&S SMA-B103)	A260	
CW Output Module 6 GHz (R&S SMA-B106)	A260	
Synthesis Extension (R&S SMA-B20/-B22)	A700	*If the synthesis extension module is not mounted, the airguide panel (1400.0498.00) is necessary!*

Removing an RF Module

- Switch off the instrument and pull the mains plug.
- Remove tube by undoing the two rear wall feet 1096.2487.00.
- Undo the six screws (0041.1660.00), unplug the RF cables W302 (R&S SMA-B103) or W305 (R&S SMA-103L) from the output module (A260), unplug the power supply cable W402 at the motherboard. Then lift the frame with the RF boards.
- Turn the RF module around and fasten it with the two screws at the instrument frame, while the motherboard is on the bottom.
- Unscrew the four screws (0041.1660.00) of the cover (1400.0252.00) for RF modules.
- Now you can change the boards, but do not forget to unplug the cables between the boards and the instrument. (See plan 1400.0000.01 sheets 3, 4 and 1400.0000.01S).
- Place the instrument on its side and remove all RF cables leading to and from the board at the bottom of the instrument.
- Pull out the board toward the top of the instrument.

Note: *The boards can be disconnected from the motherboard connector by carefully pressing them up from the bottom.*

Installing a New RF Module

- Plug the new board into the RF frame and reconnect the RF cables.
- If the synthesis extension module (1400.0498.00) is not mounted, insert the airguide panel into the middle slot.
- After replacing RF modules, perform the internal and external adjustments as described in chapter 2, *"Adjustments and Calibration"*).

Removing the Motherboard

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1400.0000.01 and 1400.0100.01).

- First take out the frame with the RF boards; see chapter *"Removing an RF Module"*.
- Remove all cable fasteners of the rear panel connections.
- To take off the motherboard, you have to undo six screws (0041.1653.00), disconnect the flex cables (W353, W354) from the RF boards,, and disconnect all connections to the power supply (W402), to the fan E2 (X10) and to interface board W341.
- Remove all boards.

Notice:

The motherboard contains an EEPROM with all the specific data such as serial number and correction data of the instrument. After replacement, the data and correction tables have to be restored. This can only be done in the factory. Without this data, the instrument will not operate correctly.

Replacing the Motherboard A100

- To insert the new motherboard, proceed in the reverse order. Connect all cables (also flex. cable W341) in the correct position and tighten all screws (drawings 1400.0100.01 and 1400.1000.01S).
- Reinstall the RF frame (see above).
- Functional test is necessary.
- After replacing the motherboard, perform adjustments as described in chapter 2, *"Adjustments and Calibration"*.

Replacing the Power Supply A400

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1400.0000.01 and 1400.0100.01; if Power Supply R&S SMA-B46 is installed, see also parts list 1405.1305.01).

Removing the Power Supply

- Switch off the instrument and pull the mains plug.
- Remove tube by undoing the two rear wall feet 1096.2487.00.
- Unplug primary power cable W401, and sec. power cable W402, at the sides of the power supply.
- Unscrew only the two screws of the power supply from the rear panel. Here you will see two holes for the screwdriver. Three rotations are enough, the screws are extra long for easy installation.
- Now push the power supply toward the fan.
- Remove the power supply.

Installing a New Power Supply

- The power supply plate must be remounted from the old power supply to the new one.
- Install the new power supply in the reverse order. Insert the two screws and washers but do not screw them tight. They are long enough for easy assembly. Mount the power supply plate and chassis plate in direct contact, with no washers between!
- To avoid mistakes, be careful when connecting the DC lines.
- Reinstall instrument tube.

Replacing the Interface Board A340

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1400.0000.01 and 1400.0100.01).

- Switch off the instrument and pull the mains plug.
- Remove tube by undoing the two rear wall feet 1096.2487.00.
- The interface board is located above the power supply at the rear of the instrument.
- Remove the three screws (0041.1653) from the side of the rear panel and the other four screws (0041.1653.00) near the cross wall.
- Disconnect the cables (W341) to the RF frame and to fan E1.
- The cables W355, W350, W301, W285, W346, W281, W351 and W361 are described in the electrical circuit 1400.0000.01S.
- Exchange the module for the spare interface board by carefully swinging it out.
- Exchanging the controller LPC is described in the following page.

Removing the Interface Board

- To insert the new interface board, proceed in the reverse order. Connect all cables in the correct position and tighten all screws (drawing 1400.0100.01).
- Reinstall the tube.
- Perform internal adjustments as described in chapter 2, *"Adjustments"*.

Note: *Be careful when installing the interface board in order not to cause damage to any components. Make sure to connect the cables according to their labelling.*

Replacing the Controller LPC A320, Lithium Battery 0858.2049 and the CompactFlash™ Card A321 on the Controller

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1400.0000.01 and 1400.0100.01).

Removing the Controller LPC

- Switch off the instrument and pull the mains plug.
- Remove tube by undoing the two rear wall feet 1096.2487.00.
- The LPC is fitted on top of the interface board A340 and fastened with six screws (2084.8000.00). Be careful when disconnecting the PCB from the interface board.
- Disconnect cable W12 (to keyboard controller) and W11 LAN cable to rear panel.
- Carefully pull the CF-card or CF-card adapter (option R&S-B80) out of the defective controller LPC and plug it into the new LPC

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

Removing the Lithium Battery

- The lithium battery is accommodated on the controller LPC board.

Caution:

- *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 1400.0052.01).*
- *Lithium batteries are hazardous waste and must be disposed of in special containers.*

- Carefully lift and pull out the battery.

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

Warning:
Do not short-circuit the battery!

- 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.

Removing the CompactFlash™ Card

- 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"*.

Installing the Controller LPC

- Install the new controller LPC in the reverse order.
- Carefully plug the new controller (A320) to the interface board (A340) and fasten it in place using the six screws.
- Carefully plug the cable connectors to the controller LPC, taking care not to reverse the polarities.
- Connect cable W12 to the keyboard controller board, and connect W11 (LAN cable) to rear panel).
- See chapter 2, *"Procedures after Replacing the Front Module Controller"* .

Replacing the Removable CompactFlash™ Card Slot R&S SMA-B80, CompactFlash Rear (A321), A322, A323, R&S SMA-B80

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1405.2001.01 and 1400.0100.01S).

- The CompactFlash™ card (A321) is fitted in the adapter in the rear panel.
- Open the black cover with "CF MEMORY SLOT" screw (1405.2053.00), then carefully pull the card out of the adapter.
- Unscrew the adapter to rear (A323) with the four screws (1148.3288.00).
- Disconnect the cable (W322) between A323 and A322, carefully disconnect the adapter to LPC (A322) from the LPC (A320). Replacement of LPC is described above.
- The adapter to rear (A323) is mounted on the angle of rear panel (1405.2282.00) with 2 screws (0041.1653.00).

Note:

Option R&S SMA-Z10, CompactFlash™ card, provides the current firmware and the operating system for the instrument.

Removing the CompactFlash Rear

- Mount in reverse order.
- The adapter to LPC (A322) is fitted into the LPC.
- Connect the ribbon cable (W322) to the adapter LPC (A322). Carefully observing the pinning, mount the other adapter to the rear panel.
- Plug the card into the slot, and close the slot by screwing on the cover.
- Reinstall tube and rear wall feet.
- Perform internal adjustments as described in chapter 2, *"Adjustments"*.

Replacing the Fans E1 and E2

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1400.0000.01 and 1400.0100.01). The fans are fitted at the left side of the frame.

Removing the Fans E1 and E2

- Switch off the instrument and pull the mains plug.
- Remove tube by opening the two rear wall feet 1096.2487.00.
- Disconnect the fan cable at the motherboard connector E2 and/or at the interface board connector E1.
- Replace fan E2: First undo the six screws (0041.1660.00) and then lift the frame with the RF boards.
- Unplug the RF cables W302 (R&S SMA-B103) or W305 (R&S SMA-103L).
- Turn the RF unit around and fasten it with the two screws at the instrument frame, with the motherboard at the bottom.
- Unscrew the four screws (0041.1660.00 M2.5x10) of the cover (1400.0252.00) for RF-modules.
- Now you can change the fan E2, but do not forget to unplug the cables between the board and the instrument.
- Remove the fans E1 and/or E2 by rotating them out of the hole.

Notice:
The arrow on the fan must be pointing toward the outside of the instrument!

Installing the New Fans

- Mount the new fans.
- Connect the fan cables at the motherboard and/or the interface board.

Note: *Please note the direction of the airflow printed on the fan. The fan must blow the warm air out of the instrument.*
Make sure to route the cable so that it cannot get into the fan.

- Reinstall tube and the rear wall feet.

Replacing the Clock Synthesis Module R&S SMA-B29 A280

(See chapter 5, spare parts list 1400.0052.01, parts list and drawings 1400.2503.01 and 1400.0000.01S).

- The clock synthesis module (CLK SYN) is mounted on the rear panel.

Removing the Clock Synthesis Module

- Switch off the instrument and pull the mains plug.
- Remove tube by undoing the two rear wall feet 1096.2487.00.
- Undo the module with the four screws (0041.1653.00) — two screws on the instrument rear panel and two on the side of the instrument – from the chassis.
- Disconnect cables W282, W283, W285 and W706.
- Disconnect cable W281.
- Undo the three screws (2084.7991.00) between the "panel for Clock Syn" and the clock synthesis board.

Installing the New Clock Synthesis Module

- Proceed in the reverse order as described under *"Removing the Clock Synthesis Module"*.
- Mount the "panel for Tact Syn" onto the new module.
- Reinstall tube and rear wall feet.

Contents - Chapter 4 "Software Update/Installing Options"

4 Software Update / Installing Options

This chapter contains information on firmware update, Linux operating system update and installing options to the R&S SMA. 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 SMA_..... 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 SMA Firmware

Your R&S SMA 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 SMA homepage http://www.sma100a.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 "SMA_" 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: SMA_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.

Installing the firmware

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

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.

   Attention:
   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.

7. When the new/updated firmware is up and running, execute internal adjustments after a warmup time of approx. 10 minutes.

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

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

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

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 SMA.
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 programm informs about the installation progress.
5. Wait until the installationf 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 warmup time of approx. 10 minutes.

   - Press the SETUP key on the instrument front panel, select **Internal Adjustments** and execute **Adjust All**.
     This process updates internal instrument adjustments and 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 SMA options is provided in the data sheet and on the internet http://www.sma100a.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.

Warning:

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

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.

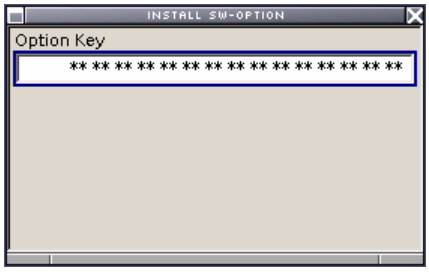
The SETUP **Installed Options** menu provides information on the already installed options.

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

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



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

Contents - Chapter 5 "Documents"

5 Documents

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

Spare Parts

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

Notice:

When replacing a module please note the safety instructions and the repair instructions given in chapter 3 and at the beginning of this service manual.

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

Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 006.7013	BS1363: 1967' complying with IEC 83: 1975 standard B2	Great Britain
DS 006.7020	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 006.7036	Type 498/13 complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 006.7107	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365 DS 0099.1456	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight	Europe (except Switzerland)

ROHDE&SCHWARZ

Spare Part List

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
3	0	S		PB BEMERKUNG NOTE Die Montage der Optionen SMA-B29 und SMA-B80 ist in der jew. zugeh. Optionszeichnung dargestellt. The mounting instruction of the options SMA-B20 and SMA-B29 in SMA100A has show on the respective option drawings		0999.9610.00		B	O
5	0	S		ZS ERSATZTEILLISTE VORHANDEN SPARE PARTS LIST AVAILABLE Sachnr. / Part No. 1400.0052.01		0999.9684.00		M	O
20	1	S		ZM Rahmen vormont. Equipment frame	Z	1400.0100.02		M	G
24	1	S	Z1	FN GERAETESTECKER MODUL M. FILTER 4A POWER ENTRY MODUL WITH FILTER 4A		1401.4800.00		B	T
25	1	S		FN SCHUBLADE EXTRA SAFE FUSE DRAWER EXTRA SAFE		1160.2994.00		B	O
26	2	S	F1, F2	SS SCHMELZSICH. T2.5H IEC60127-2 TIME LAG FUSE		0020.7575.00		B	B
40	1	S	A400	NJ SCHALTNETZTEIL AC 90-264V AC/DC POWER SUPPLY		1400.1307.00	X	B	O
50	1	S		ZN HALTEPL. F. NETZTEIL PANEL FOR POWERSUPPLY	Z	1400.0230.00		M	O
70	4	S		VS 6900/ISR-M3.0X8-A2 COMBINATION SCREWS	Z	2084.7991.00		B	O
80	1	S		ZN LUFTABSCHOTTWINKEL AIRSTOPPANEL	Z	1400.0352.00		M	O
85	1	S		DZ DURCHF.TUELLE10X17X6.8 GROMMET 10X17X6.8		0099.1433.00		B	O
110	1	S	W401	DX VERSORGUNGSKABEL PRIM. PRIMARY POWER CABLE	Z	1400.1994.00		M	O
112	1	S	W404	DX SCHUTZLEITERKABEL PROTECTIONCABLE	Z	1400.2003.00		M	O
114	1	S		DZ KABELHALTER 9.2X10.6 CABLE-HOLDER		1130.0941.00		B	O
116	1	S		MZ NETZABDECKUNG COVER FOR POWER INPUT		1400.0469.00		M	
120	1	S	W402	DX SEKUNDAER VERSORGUNG SECUNDARY POWER CABLE	Z	1400.1988.00		M	O
240	1	S	A100	ED MOTHERBOARD SMA MOTHER BOARD SMA	Z	1400.0417.02	X	M	O
250	6	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
260	1	S	W341	DY IF FLACHBANDKABEL IF CABLE	Z	1400.2332.00		M	O
300	.5	S		MZ LUFTFUEHRUNG (SYNEX) AIRGUIDE PANEL (SYNEX)	Z	1400.0498.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
490	1	S	A340	ED INTERFACE BOARD INTERFACE BOARD	Z	1400.0530.02	X	M	
500	1	S	A320	NR LPC6/1L+ CONTROLLER LPC6/1L+	Z	1091.3127.00	X	B	V
505	1	S	A321	NM COMPACTFLASH 256MB TOSHIBA 256MB COMPACT FLASH CARD		2095.8788.00	X	B	A
507	1	S		OS SCHILD FUER CF MEMORY CARD LABEL FOR CF MEMORY CARD Nur mit Einbau von OPT. SMA-B80 in den SMA100A Only with mounting of opt. SMA-B80 in SMA100A		1400.3622.00		M	
510	7	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
515	6	S		VS 7985/ISR-M2.5X25-A4-PA 7985/ISR-M2.5X25-A4-PA		2084.8000.00		B	T
520	1	S	X11	FT EINBAUADAPTER 8P.GER 2XRJ45 COUPLER JACK STRAIGHT		1093.9122.00		B	V
530	1	S	W12	DF KABEL 4X2 U.SCHIRM 630 CABLE 4X2 W. SHIELD 630MM		1145.5115.00		B	O
532	1	S		LF FERRITRING MIT NYLONHALTER SPLIT FERRITE WITH NYLON CLAMP		1400.3551.00		B	O
534	1	S		VS HVC/ISR-M3.0X20-A2 COMBINATION SCREWS		1090.5184.00		B	B
536	1	S		VS ISO7093-3.2-A4 PLAIN WASHER ISO7093-3.2-A4		0031.5185.00		B	O
540	1	S	W11	DG PATCHKABEL CAT6. 0.5M PATCHCABLE CAT.6. 0.5M		0041.9283.00		B	T
550	1	S	W410	DX MASSEBRUECKE GROUND CABLE	Z	1400.1971.00		M	
554	1	S		VS ISO7093-3.2-A4 PLAIN WASHER ISO7093-3.2-A4		0031.5185.00		B	O
556	1	S		VS DIN7985-M3X22.5X5.5-A4 SCREW		0564.4060.00		B	V
560	1	S		VS 7985/ISR-M4X8-A4-PA 7985/ISR-M4X8-A4-PA		1148.2652.00		B	T
561	1	S		VS DIN125-A4.3-A4 WASHER DIN125-A4.3-A4		0082.4686.00		B	V
562	1	S		VS DIN934-M4-A4 NUT		0016.4400.00		B	O
580	1	S		MZ ABDECKUNG F KABELTUNNE PANEL FOR CABLETUNNEL		1400.0298.00		M	O
600	1	S		ZM FRONTEINHEIT SMA FRONT PANEL UNIT SMA	Z	1400.0617.03		M	
605	4	S		VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
650	6	S		MP ABDECKK. RD11.1/9.9 COVER		0009.9217.00		B	O
660	1	S		MP ABDECKKAPPE RD15.9 COVER RD 15.9		0009.9200.00		B	O
670	1	S		MZ ABDECKUNG FUER RUECKWA	Z	1400.0081.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				COVER FOR REARPANEL					
680	3	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
690	3	S		VS DIN934-M2.5-A4 NUT		0088.0230.00		B	O
700	1	S		MZ KABELABDECKPLATTE PANEL FOR KABEL	Z	1400.3045.00		M	
720	2	S		OS EGB-SCHILD 14X30 (12X28) WARNING LABEL FOR ESDS		0061.1520.00		M	O
750	1	S		ZM TUBUS, VORMONT. TUBE, MOUNTED	Z	1400.0481.00		M	
780	2	S		KR BW2-FRONTGRIFF 2E FRONT HANDLE		1096.1468.00		B	O
790	4	S		VS SCHR. M4X14-ISR-PA SCREW M4X14-ISR-PA		1096.4896.00		B	O
800	4	S		KR BW2-RUECKWANDFUSS REAR WALL FOOT		1096.2487.00		B	O
810	1	S		OS BW2-SCHILD F RUECKWAND BW2 LABEL F. REAR PANEL FOOT		1096.2435.00		M	O
890	1	S	JHS1	HS BIOS LPCx SMA BIOS LPCx SMA	Z	1400.3651.00		M	
900	1	S	JHS2	HS SMA FIRMWARE SMA FIRMWARE	Z	1400.3668.00		M	
910	1	S	JHS3	HS FONT MICROSOFT ARIAL WGL FONT MICROSOFT ARIAL WGL Lizenz der Schriftart Microsoft Arial		3584.9795.00		B	O

el.Kennz *Part*	Benennung / Hinweise *Designation*	Sachnummer *Stock No.*	Hersteller *Manufacturer*	Bestellbezeichnung *Designation*	enthalten in *contained in*
	ACHTUNG EGB /ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL				
A100	ED MOTHERBOARD SMA MOTHER BOARD SMA	1400.0417.02			1400.0000.01
A320	NR LPC6/1L+ CONTROLLER LPC6/1L+	1091.3127.00	E_E_P_D_	LL61P21B	1400.0000.01
A321	NM COMPACTFLASH 256MB TOSHIBA 256MB COMPACT FLASH CARD	2095.8788.00			1400.0000.01
A340	ED INTERFACE BOARD INTERFACE BOARD	1400.0530.02			1400.0000.01
A350	EE TAST.CONTR.BOARD KEYBOARD CONTROLLER	1400.0930.02			1400.0617.01
A355	SF SCHALTFOLIE 38T SMA FLEX. SWITCHBOARD	1400.0723.00	SCHURTER	R&S-ZEICHNUNG 1400.0723.00 AEZ 03	1400.0617.01
A360	NR DWE DVI-ADAPTER-WIDE-QVGA EDT DWE DVI-ADAPTER-WIDE-QVGA EDT VAR 03	1400.0875.00			1400.0617.01
A370	ND TFT 4.3 WQVGA DRGB LED TFT ET0430G0DM6 VAR 03	3586.5545.00	EMERGING	ET0430G0DM6	1400.0617.01
A400	NJ SCHALTNETZTEIL AC 90-264V AC/DC POWER SUPPLY	1400.1307.00	LAMBDA	NV175 K10013	1400.0000.01
A450	EM DREHIMP.4 (MIT TASTE) ROTARY PULS-GENERATOR	0852.2799.00	EBE	R&SNR:0852.2799.00/ EBENR:2107553-REV 6	1400.0617.01
E1, E2	DX LUEFTEREINHEIT FAN UNIT VAR 02	1400.0346.00			1400.0100.01
F1, F2	SS SCHMELZSICH. T2.5H IEC60127-2 TIME LAG FUSE	0020.7575.00	LITTELFUSE	2150 2,5	1400.0000.01
W11	DG PATCHKABEL CAT6. 0.5M PATCHCABLE CAT.6. 0.5M	0041.9283.00	ELSPEC	PATCHKABEL (S.TEXT)	1400.0000.01
W12	DF KABEL 4X2 U.SCHIRM 630 CABLE 4X2 W. SHIELD 630MM	1145.5115.00	LACON	R&S-ZCHNG.1145.5115.00 AEZ.02.00	1400.0000.01
W115	DF FLEX-STRIP.40P R=0.5 FLEX-STRIP.40P R=0.5 VAR 03	5353.1887.00	HUNG_FU_EL	FFC-P0.5-C5-40-040-B-6-5	1400.0617.01
W341	DY IF FLACHBANDKABEL IF CABLE	1400.2332.00			1400.0000.01
W350	DY USB SENSOR KABEL USB SENSOR CABLE	1400.2055.00			1400.0617.01
W351	DY FLACHBAND STBY/TRIG	1400.2032.00			1400.0617.01

el.Kennz *Part*	Benennung / Hinweise *Designation*	Sachnummer *Stock No.*	Hersteller *Manufacturer*	Bestellbezeichnung *Designation*	enthalten in *contained in*
	CABLE STBY/TRIG				
W353	DV HF KABEL AM EXT OUT RF CABLE AM EXT OUT	1400.2278.00			1400.0617.01
W354	DV HF KABEL FM/PM EXT IN RF CABLE FM/PM EXT IN	1400.2261.00			1400.0617.01
W355	DV HF KABEL LF OUT RF CABLE LF OUT	1400.2284.00			1400.0617.01
W361	DY FLACHB.DVI DISPLAYCON. CABLE DVI	1400.2378.00			1400.0617.01
W401	DX VERSORGUNGSKABEL PRIM. PRIMARY POWER CABLE	1400.1994.00			1400.0000.01
W402	DX SEKUNDAER VERSORGUNG SECUNDARY POWER CABLE	1400.1988.00			1400.0000.01
W404	DX SCHUTZLEITERKABEL PROTECTIONCABLE	1400.2003.00			1400.0000.01
W410	DX MASSEBRUECKE GROUND CABLE	1400.1971.00			1400.0000.01
X11	FT EINBAUADAPTER 8P.GER 2XRJ45 COUPLER JACK STRAIGHT	1093.9122.00	YAMA	TS3101S-881	1400.0000.01
X101	FV FLACHSTECKER GR 6.3 CONNECTOR	0543.6705.00	TYEA	141878-2	1400.0100.01
Z1	FN GERAETESTECKER MODUL M. FILTER 4A POWER ENTRY MODUL WITH FILTER 4A	1401.4800.00	SCHURTER	KMF1.1141.11	1400.0000.01

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
5	0	S		PB BEMERKUNG NOTE Diese Ersatzteilliste gilt fur SMA100A SMA100AF3/6 SMA-B103 SMA-B103L SMA-B106 SMA-B106L SMA-B20 SMA-B22 SMA-B29 SMA-B46 SMA-B80 SMA-B81 SMA-B89		0999.9610.00		B	O
7	0	S		PB BEMERKUNG NOTE ********** !!! MODULE REPLACEMENT ONLY BY AUTORIZED R&S SERVICES !!! **********		0999.9610.00		B	O
10	1	S		ED MOTHERBOARD SMA MOTHER BOARD SMA	Z	1400.0417.02	X	M	O
18	0	S		ED INTERFACE BOARD INTERFACE BOARD wird ersetzt durch 1400.0530.02	Z	1400.0517.02		M	
20	1	S		ED INTERFACE BOARD INTERFACE BOARD	Z	1400.0530.02	X	M	
30	1	S		EE TAST.CONTR.BOARD KEYBOARD CONTROLLER	Z	1400.0917.02	X	M	O
40	1	S		EE SMA-CW-OPU SMA-CW-OPU enth. in / incl in SMA-B103, -B103L,	Z	1400.1707.03	X	M	
50	1	S		EE SMA-CW-OPU SMA-CW-OPU enth. in / incl in SMA-B106, -B106L	Z	1400.1707.06	X	M	
58	0	S		EE STANDARD SYNTHESE STANDARD SYNTHESE wird ersetzt durch 1141.4220.02	Z	1141.4208.02		M	
60	1	S		EE STANDARD SYNTHESE STANDARD SYNTHESE enth. in / incl in SMA-B103, -B103L, -B106, -B106L	Z	1141.4220.02	X	M	
63	0	S		EE STANDARD SYNTHESE STANDARD SYNTHESE wird ersetzt durch 1141.4220.06	Z	1141.4208.06		M	
65	1	S		EE STANDARD SYNTHESE STANDARD SYNTHESE enth. in / incl in SMA-B103MX, -B106MX	Z	1141.4220.06	X	M	
70	1	S		ED STEP ATTENUATOR CMOS STEP ATTENUATOR CMOS enth. in / incl in SMA-B103, nur bis ca. 08.2006	Z	1400.3400.03	X	M	
75	1	S		ED STEP ATTENUATOR CMOS STEP ATTENUATOR CMOS enth. in / incl in SMA-B106	Z	1400.3400.06	X	M	
80	1	S		DW KABEL RF OPU-ATT W302 RF-CABLE W302 enth. in / incl in SMA-B103, -B106	Z	1400.1859.00	X	M	O
85	1	S		DW HF-KABEL W305 (OH ATT)	Z	1400.1888.00	X	M	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				RF-CABLE W305 enth. in / incl in SMA-B103L, -B106L					
90	1	S		DW KABEL ATT-RF OUT W303 RF-CABLE W303 enth. in / incl in SMA-B103, -B103L, -B106, -B106L	Z	1400.1842.00	X	M	O
95	1	S		DW HF-KABEL RUECKW W81 RF-CABLE REAR W81 enth. in / incl in SMA-B81+ SMA-B89	Z	1405.2460.00	X	M	O
100	1	S		DY IF FLACHBANDKABEL IF CABLE	Z	1400.2332.00	X	M	O
110	1	S		MZ ABDECKUNG F KABELTUNNE PANEL FOR CABLETUNNEL		1400.0298.00	X	M	O
120	1	S		KB FRONTHAUBE SMA(BEDR.) FRONT COVER SMA enth. in / incl in SMA-B103, -B103L	Z	1400.0700.00	X	M	O
130	1	S		KB FRONTHAUBE SMA(BEDR.) FRONT COVER SMA enth. in / incl in SMA-B106, -B106L	Z	1400.0681.00	X	M	
148	0	S		EE SYNTHESE ERWEITERUNG SYNTHESIS EXTENSION wird ersetzt durch 1142.0270.06	Z	1142.0070.06		M	O
150	1	S		EE SYNTHESE ERWEITERUNG SYNTHESIS EXTENSION enth. in / incl in SMA-B20	Z	1142.0270.06	X	M	
158	0	S		EE SYNTHESE ERWEITERUNG SYNTHESIS EXTENSION wird ersetzt durch 1142.0270.02	Z	1142.0070.02		M	
160	1	S		EE SYNTHESE ERWEITERUNG SYNTHESIS EXTENSION enth. in / incl in SMA-B22	Z	1142.0270.02	X	M	
170	1	S		EE CF ADAPTER AN LPC CF ADAPTER TO LPC enth. in / incl in SMA-B80	Z	1405.2101.02	X	M	O
180	1	S		EE CF ADAPTER AN RUECKW CF ADAPTER TO REAR enth. in / incl in SMA-B80	Z	1405.2201.02	X	M	O
185	0	S		ED CLOCKSYNTHESE CLOCK SYNTHESE wird ersetzt durch 1400.2749.02	Z	1400.2703.02	X	M	
190	1	S		ED CLOCKSYNTHESE CLOCK SYNTHESE enth. in / incl in SMA-B29	Z	1400.2749.02	X	M	O
205	1	S		GR DISPLAYCONTROLLER DISPLAYCONTROLLER	Z	1400.0852.00	X	B	V
210	1	S		GJ SCHALTNETZTEIL AC 90-264V AC/DC POWER SUPPLY		1400.1307.00	X	B	T
215	1	S		GJ SCHALTNETZTEIL AC 90-264V AC/DC POWER SUPPLY enth. in / incl in SMA100AF3/6 und SMA-B46		1400.1113.00		B	V
220	1	S		GR LPC6/1L+ CONTROLLER LPC6/1L+	Z	1091.3127.00	X	B	V
230	1	S		SF SCHALTMATTENSATZ SMA PUSH-BUTTON BOARD SET	Z	1400.0717.00	X	B	V
240	1	S		SF SCHALTFOLIE 38T SMA	Z	1400.0723.00	X	B	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				FLEX. SWITCHBOARD					
250	1	S		BP TFT 3.8 QVGA DRGB CCFL TFT DISPLAY		1400.0730.00	X	B	V
400	1	S		EV 60X60X25 11.4L/S 12V TEMP FAN 60X60X25		1400.0475.00	X	B	B
410	1	S		EV LUEFTERMANS. 60X60X3 T=1.5-2.5 FRILL FOR FAN 60X60X25		1400.3345.00	X	B	T
420	1	S		GP COMPACTFLASH 256MB TOSHIBA 256MB COMPACT FLASH CARD		2095.8788.00	X	B	V
430	1	S		ED FRONT- UND RUECKANSCHLUSSBOARD FRONT AND REAR CONNECTORBOARD enth. in / incl in SMA-B89	Z	1405.3120.02	X	M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL VAR03=MIT 80MM LUEFTER MOD03=WITH 80MM FANS					
10	1	S		KB RUECKWAND BEDR U-FRAME VAR 02	Z	1400.0123.00		M	G
12	1	S		KB RUECKWAND BEDR U-FRAME VAR 03	Z	1400.1520.00		M	
20	1	S		MZ FRONTRAHMEN 2E 1/1 FRAME 2E 1/1	Z	1400.0217.00		M	
21	2	S		VS 965/ISR-M2.5X8-A4-PA 965/ISR-M2.5X8-A4-PA		1148.3294.00		B	T
22	2	S		VS ISO7093-2.7-A4 PLAIN WASHER		0031.5179.00		B	O
23	2	S		VS DIN934-M2.5-A4 NUT		0088.0230.00		B	O
25	2	M		EK HF-DICHT O-PROF 2.0 SI SEALING		0396.1035.00		B	T
30	1	S		ZN HALTEPLATTE IN FRONTRA PANEL IN FRONTFRAME	Z	1400.0369.00		M	O
40	1	S		ZN QUERWAND PANEL	Z	1400.0198.00		M	O
50	1	S		ZN ZWISCHENBLECH PANEL VAR 02	Z	1400.0200.00		M	G
52	1	S		ZN ZWISCHENBLECH F. 80ER LUEFTER PANEL VAR 03	Z	1400.1542.00		M	
54	.115	M		WT KTSCH.PROF PVC-W 1-2 SW EDGE PROTECTIVE STRIP VAR 02		0298.1477.00		B	O
55	.095	M		WT KTSCH.PROF PVC-W 1-2 SW EDGE PROTECTIVE STRIP VAR 03		0298.1477.00		B	O
56	.14	M		WT KTSCH.PROF PVC-W 1-2 SW EDGE PROTECTIVE STRIP		0298.1477.00		B	O
57	.025	M		WT KTSCH.PROF PVC-W 1-2 SW EDGE PROTECTIVE STRIP		0298.1477.00		B	O
60	1	S		ZN KABELTUNNEL TUNNEL FOR CABLE	Z	1400.0281.00		M	O
80	1	S		ZN MB-HALTE- + QUERWAND PANEL FOR MB	Z	1400.0300.00		M	O
90	1	S		ZN LP-FUEHRUNG RECHTS PANEL RIGHT SIDE	Z	1400.0323.00		M	O
100	1	S		ZN LP-FUEHRUNG LINKS PANEL LEFT SIDE VAR 02	Z	1400.0330.00		M	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
102	1	S		ZN LP-FUEHRUNG + LUE.HALTERG F. 80ER L PANEL LEFT SIDE VAR 03	Z	1400.1559.00		M	
110	1	S		ZN FIXIERHAUBE F HF-GS COVER FOR HF-GS	Z	1400.0252.00		M	O
120	4	S		VS 6900/ISR-M2.5X10-A2 COMBINATION SCREWS		0041.1660.00		B	T
130	2	S		DZ DURCHF.TUELLE10X17X6.8 GROMMET 10X17X6.8		0099.1433.00		B	O
132	1	S		DZ DURCHF.TUELLE14X24X7 GROMMET 14X24X7		0099.1440.00		B	O
150	26	S		VN BLINDNIET 3.2X5.8 ST BLIND RIVET 3.2X5.8 ST		1096.4821.00		B	O
160	2	S	E1, E2	DX LUEFTEREINHEIT FAN UNIT VAR 02	Z	1400.0346.00		M	O
175	2	S	E1, E2	DX LUEFTEREINHEIT MIT 80ER LUEFTER FAN UNIT WITH 80MM FAN VAR 03	Z	1400.1571.00		M	
180	1	S		ZN LUEFTERHALTERUNG PANEL VAR 02	Z	1400.0269.00		M	G
182	1	S		ZN LUEFTERHALTERUNG FUER 80ER PANEL FOR FAN 80MM VAR 03	Z	1400.1565.00		M	
190	2	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
200	6	S		VS 6900/ISR-M2.5X10-A2 COMBINATION SCREWS		0041.1660.00		B	T
210	2	S		VS DIN6797-A2.7-A2 TOOTHED LOCK WASHERS		0016.2814.00		B	O
240	1	S	X101	FV FLACHSTECKER GR 6.3 CONNECTOR		0543.6705.00		B	O
250	1	S		VS DIN6797-A4.3-A2 TOOTHED LOCK WASHERS		0016.2837.00		B	O
260	1	S		VS 7985/ISR-M4X6-A4-PA 7985/ISR-M4X6-A4-PA		1148.2646.00		B	T
270	1	S		VS DIN128-A4-A2 SPRING LOCK WASHER DIN 128-A4-A2		0005.2501.00		B	O

ROHDE&SCHWARZ

SMA

Benennung/*Designation*
Rahmen vormont.
Equipment frame

Datum/*Date* 2010-07-06 | Abt./*Dept.* 1GPK | Name/*Name* Hi

Sprach./Lang de en | Ä.I. / *C.I* 10.00 | Blatt/Sheet 2 of 2

Dokument Nr. / Document No.
1400.0100.01 *ST*

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL VAR03=MIT 4.3" DISPLAY MOD03=WITH 4.3" DISPLAY					
20	1	S	JMZ1	MZ MONTAGEWANNE SMA MOUNTING TROUGH SMA VAR 02	Z	1400.0646.00		M	O
25	1	S	JMZ1	MZ MONTAGEWANNE SMA 4.3ZOLL DISPLAY MOUNTING TROUGH SMA 4.3INCH DISPLAY VAR 03	Z	1400.0630.00		M	
30	1	S	JOP1	OP FRONTSCHEIBE SMA FRONT PANE VAR 02		1400.0769.00		B	B
35	1	S	JOP1	OP FRONTSCHEIBE 4.3ZOLL DISPLAY FRONT PANE 4.3INCH DISPLAY VAR 03		1400.3845.00		B	B
60	1	S	JMZ2	MZ LCD-HALTEBLECH LCD-HOLDING PLATE VAR 02	Z	1400.0669.00		M	O
65	1	S	JMZ2	MZ HALTEBLECH SCHALTM. UND DISPLAY 4.3 HOLDING PLATE FLEX SWITCHB. +DISPLAY VAR 03	Z	1400.0652.00		M	
66	2	S		MZ FEDERSTREIFEN 2 VAR 03		6079.4935.00		M	
70	1	S	A355	SF SCHALTFOLIE 38T SMA FLEX. SWITCHBOARD	Z	1400.0723.00		B	B
80	1	S	A370	ND TFT 3.8 QVGA DRGB CCFL TFT DISPLAY VAR 02		1400.0730.00		B	A
85	1	S	A370	ND TFT 4.3 WQVGA DRGB LED TFT ET0430G0DM6 VAR 03		3586.5545.00		B	O
86	3	S		MZ FEDER SPRING VAR 03	Z	1201.3847.00		M	
87	1	S		MZ FEDERSTREIFEN 66MM SPRING 66MM VAR 03	Z	1155.6666.00		M	
88	.03	M		EK FEDER D-FORM SEALING SPRING VAR 03		2007.7632.00		B	O
90	1	S	JMZ3	MZ STAUBABDICHTUNG POWDER SEAL VAR 02	Z	1400.0746.00		M	O
95	1	S	JMZ3	ZN STAUBABDICHTUNG 4.3ZOLL DISPLAY POWDER SEAL 4.3INCH DISPLAY VAR 03	Z	1400.3839.00		M	
100	4	S	JVS1	VS 7985/ISR-M2X8-A4-PA 7985/ISR-M2X8-A4-PA VAR 02		1148.2600.00		B	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
			JVS2 JVS3 JVS4						
110	1	S	A380	NJ CXA-L0605-VJL DC-AC DC TO AC INVERTER UNIT VAR 02		0048.6996.00		B	V
115	1	S	W380	DF WANDLERKAB.L=350 10POL CABLE 350MM 10PIN VAR 02		1091.2643.00		B	V
120	2	S	JVS5 JVS6	VS 7985/ISR-M2X4-A4-PA 7985/ISR-M2X4-A4-PA VAR 02		1148.2698.00		B	O
130	1	S	JMM1	MM SCHUTZKRAGEN 9.6X13.9 SHROUD		0852.1234.00		B	O
140	1	S	JSF1	SF SCHALTMATTENSATZ SMA PUSH-BUTTON BOARD SET	Z	1400.0717.00		B	V
150	1	S	JMZ4	MZ ABSCHIRMWINKEL F. FP SHIELDING PANEL VAR 02	Z	1400.0752.00		M	
155	1	S	JMP1	MP KLEBEFOLIE 30X20 SW COVER VAR 02		1093.9051.00		B	O
160	7	S	JVS7 JVS8 JVS9 JVS10 JVS11 JVS12 JVS13 JVS14 JVS15 JVS16 JVS17	VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS		1148.3059.00		B	T
161	4	S	JHS15 JVS14 JVS16 JVS17	VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS VAR 02		1148.3059.00		B	T
170	1	S	JMZ4	ZN HAUBE DISPLAY4.3 ZOLL COVER DISPLAY4.3 INCH VAR 03	Z	1400.3822.00		M	
172	4	S	JVS14 JVS15 JVS16 JVS17	VS HVC/ISR-M2.5X16-A2 COMBINATION SCREWS VAR 03		0048.8218.00		B	B
180	1	S	A360	NR DISPLAYCONTROLLER DISPLAYCONTROLLER VAR 02	Z	1400.0852.00		B	A
185	1	S	A360	NR DWE DVI-ADAPTER-WIDE-QVGA EDT DWE DVI-ADAPTER-WIDE-QVGA EDT VAR 03		1400.0875.00		B	B
186	1	S	W115	DF FLEX-STRIP.40P R=0.5 FLEX-STRIP.40P R=0.5 VAR 03		5353.1887.00		B	B
190	3	S	JVS18	VS 6900/ISR-M2.5X6-A2		1148.3059.00		B	T

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				COMBINATION SCREWS					
			JVS19 JVS20						
220	1	S	A350	EE TAST.CONTR.BOARD KEYBOARD CONTROLLER	Z	1400.0930.02		M	
230	2	S	JVS21	VS 965/ISR-M2.5X12-A4-PA 965/ISR-M2.5X12-A4-PA		1148.3307.00		B	T
			JVS22						
235	1	S	JVS23	VS 965/ISR-M2X5-A4-PA 965/ISR-M2X5-A4-PA		1148.3265.00		B	O
			JVS24						
270	1	S	A450	EM DREHIMP.4 (MIT TASTE) ROTARY PULS-GENERATOR		0852.2799.00		B	I
280	1	S	JMP2	MP KRAGEN M. MUTTER COLLER WITH NUT	Z	0852.2699.00		B	O
290	1	S	JOK1	OK DREH.RD28 ACHS-RD6 KNOB		0852.1086.00		B	V
330	1	S	W361	DY FLACHB.DVI DISPLAYCON. CABLE DVI	Z	1400.2378.00		M	O
340	1	S	JDZ1	DZ KABELBI.RD50BR2.4L200 CABLETIE		0099.2181.00		B	O
350	1	S	W350	DY USB SENSOR KABEL USB SENSOR CABLE	Z	1400.2055.00		M	O
360	1	S	W351	DY FLACHBAND STBY/TRIG CABLE STBY/TRIG	Z	1400.2032.00		M	O
370	1	S	W353	DV HF KABEL AM EXT OUT RF CABLE AM EXT OUT	Z	1400.2278.00		M	O
380	1	S	W354	DV HF KABEL FM/PM EXT IN RF CABLE FM/PM EXT IN	Z	1400.2261.00		M	
390	1	S	W355	DV HF KABEL LF OUT RF CABLE LF OUT	Z	1400.2284.00		M	O
450	1	S	JOS1	OS SCHILD 12.5MM BLITZPFEIL SIGN 12.5 LIGHTNING ARROW VAR 02		4024.5843.00		B	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
3	0	S		PB BEMERKUNG NOTE Die Montage ist in den Zeichnungen 1400.0000.01 D dargestellt / For mounting instruction see drawings 1400.0000.01 D		0999.9610.00		B	O
20	1	S	A700	EE SYNTHESE ERWEITERUNG SYNTHESIS EXTENSION	Z	1142.0270.06		M	
30	1	S	W242	DW HF KABEL SYNEX IN W242 RF CABLE SYNEX IN W242	Z	1400.2084.00		M	O
40	1	S	W243	DW HF KABEL SYNEX OUT W243 RF CABLE SYNEX OUT W243	Z	1400.2090.00		M	O
70	1	S	W248	DV HF KABEL REFVAR W248 RF CABLE REFVAR W248	Z	1400.2326.00		M	O
90	1	S	W709	DY FLACH FM DATA /AUX I/O W709 CABLE W709	Z	1400.2384.00		M	
1270	1	S	W346	DV HF KABEL CLK IN RF CABLE CLK IN Wird im SMA100A nur mit SMA-B106x benötigt	Z	1400.2290.00		M	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
3	0	S		PB BEMERKUNG NOTE Die Montage ist in den Zeichnungen 1400.0000.01 Ddargestellt / For mounting instruction see drawings 1400.0000.01 D		0999.9610.00		B	O
20	1	S	A700	EE SYNTHESE ERWEITERUNG SYNTHESIS EXTENSION	Z	1142.0270.02		M	
30	1	S	W242	DW HF KABEL SYNEX IN W242 RF CABLE SYNEX IN W242	Z	1400.2084.00		M	O
40	1	S	W243	DW HF KABEL SYNEX OUT W243 RF CABLE SYNEX OUT W243	Z	1400.2090.00		M	O
50	1	S	W708	DW HF KABEL RF1200 W708 RF CABLE RF1200 W708	Z	1400.2132.00		M	O
60	1	S	W247	DV HF KABEL REF100 W247 RF CABLE REF100	Z	1400.2310.00		M	O
70	1	S	W248	DV HF KABEL REFVAR W248 RF CABLE REFVAR W248	Z	1400.2326.00		M	O
80	1	S	W709	DY FLACH FM DATA /AUX I/O W709 CABLE W709	Z	1400.2384.00		M	
1279	1	S	W346	DV HF KABEL CLK IN RF CABLE CLK IN Wird im SMA100A nur mit SMA-B106x benötigt	Z	1400.2290.00		M	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
20	1	S	A280	ED CLOCKSYNTHESE CLOCK SYNTHESE	Z	1400.2749.02		M	O
30	1	S	W281	DY FLACHBANDKABEL CLKSYN W281 IF CABLE CLKSYN W281	Z	1400.2349.00		M	O
40	1	S		ZN HALTEBLECH F TAKTSYN PANEL FOR TAKTSYN	Z	1400.2584.00		M	O
50	3	S		VS 6900/ISR-M3.0X8-A2 COMBINATION SCREWS	Z	2084.7991.00		B	O
60	1	S	W282	DV RF CABLE CLKSYN OUT.W282 RF CABLE REF IN W282	Z	1400.1865.00		M	
65	1	S	W283	DV HF KABEL CLKSYN OUT N W283 RF CABLE REF IN W283	Z	1400.1871.00		M	O
70	1	S	W285	DV HF KABEL REF104OUT-VAR W285 RF CABLE W285	Z	1400.2410.00		M	O
80	1	S	W706	DV HF KABEL REF104 IN W706 RF CABLE REF104 IN W706	Z	1400.2426.00		M	O
90	.2	S	W706L	DV HF KABEL REF104 IN W706L RF CABLE REF104 IN W706L	Z	1400.1913.00		M	
120	4	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
130	1	S		DZ DURCHF.TUELLE6X14X6.4 GROMMET 6X14X6.4		0099.1427.00		B	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
10	1	S	A400	GJ SCHALTNETZTEIL AC 90-264V AC/DC POWER SUPPLY Netzteil für große Höhen 4600 Meter, ersetzt Netztteil 1400.1307.00.		1400.1113.00	X	B	V

ROHDE&SCHWARZ

SMA-B46

Benennung/*Designation*
SMA-B46 NETZTEIL F. GROSSE HOEHE
SMA-B46 POWER SUPPLY F. HIGH ALT.

Datum/*Date* 2006-11-23 | Abt./*Dept.* 1GPK | Name/*Name* BU

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Dokument Nr. / Document No.
1405.1305.01 *ST*

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
20	1	S	A322	EE CF ADAPTER AN LPC CF ADAPTER TO LPC	Z	1405.2101.02		M	O
40	1	S		KM LP-FUEHRUNG GUIDE RAIL F_CIRC BOAR	Z	1405.2176.00		B	O
55	2	S		VS 6900/ISR-M2.5X5-A2 COMBINATION SCREWS		0041.1630.00		B	T
60	1	S		ZN SICHERUNGSBUEGEL F. CF-BOARD PANEL FOR CF BOARD	Z	1405.2318.00		M	
80	1	S	W322	DY CF FLACHBANDKABEL CF CABLE	Z	1405.2182.00		M	O
100	1	S	A323	EE CF ADAPTER AN RUECKW CF ADAPTER TO REAR	Z	1405.2201.02		M	O
110	1	S		ZN BEFEST_WINKEL AN RW ANGLE ON REAR PANEL	Z	1405.2282.00		M	O
120	2	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
130	4	S		VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
150	1	S		ZN ABDECKUNG M RAE_SCHR COVER WITH SCREW	Z	1405.2053.00		M	
180	1	S		PB MONTAGEANWEISUNG F. R&S SMA-B80 MOUNTING INSTR FOR R&S SMA-B80 Diese Montageanweisung besteht aus der Zeichnung 1405.2001.01 D 1 und der Stueckliste 1405.2001.01 ST mit dem jeweils neuesten Änderungszustand	Z	1405.2030.00		M	

ROHDE&SCHWARZ

SMA-B80

Benennung/*Designation*
SMA-B80 CF ADAPTER
SMA-B80 CF ADAPTER

Datum/*Date* 2006-11-24 | Abt./*Dept.* 1GPK | Name/*Name* HI

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Dokument Nr. / Document No.
1405.2001.01 *ST*

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD					
				****VARIANTENERKLAERUNG*** ****EXPLANATION OF MODELS***					
				VAR02=GRUNDVARIANTE ***MOD02=BASIC MODEL***					
20	***1***	***S***	***W81***	***DW HF-KABEL RUECKW W81*** ***RF-CABLE REAR W81***	***Z***	***1405.2460.00***		***M***	***O***
50	***1.5***	***S***		***MP KLEBEFOLIE 80X20 GRAU*** ***COVER***		***1110.2403.00***		***B***	***T***

ROHDE&SCHWARZ

Benennung/*Designation*
GQ SMA-B81 REAR PANEL CONNECTORS
REAR PANEL CONN

Datum/*Date* 2005-12-06 | Abt./*Dept.* 1GPK | Name/*Name* HI

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Dokument Nr. / Document No.
1405.2401.01 *ST*

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
3	0	S	JPB1	PH BEMERKUNG NOTE Die Montage ist in den Zeichnungen 1400.0000.01 D dargestellt / For mounting instruction see drawings 1400.0000.01 D		0999.9610.00		B	O
1020	1	S	A260	EE SMA-CW-OPU SMA-CW-OPU	Z	1400.1707.03		M	
1030	1	S	A240	EE STANDARD SYNTHESE STANDARD SYNTHESE	Z	1141.4220.02		M	
1050	1	S	A300	ED STEP ATTENUATOR CMOS STEP ATTENUATOR CMOS	Z	1400.3400.06		M	
1062	1	S	JZN1	ZN HALTEBL F EICHLEITUNG (KURZ) PANEL FOR ATTENUATOR	Z	1400.3774.00		M	
1070	4	S	JVS1 JVS2 JVS3 JVS4	VS 6900/ISR-M3.0X6-A2 COMBINATION SCREWS		0041.1682.00		B	O
1080	4	S	JVS5 JVS6 JVS7 JVS8	VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
1100	1	S	W301	DY FLACHBAND ATT CABLE ATT	Z	1400.2355.00		M	O
1105	2	S	JDZ1 JDZ2	DZ KABELBI.RD 1 BIS 25 B2 CABLETIE		0015.9038.00		B	O
1120	1	S	W302	DW KABEL RF OPU-ATT W302 RF-CABLE W302	Z	1400.1859.00		M	O
1130	2	S	JDZ3 JDZ4	DZ KABELBI.RD 1 BIS 25 B2 CABLETIE		0015.9038.00		B	O
1150	1	S	W303	DW KABEL ATT-RF OUT W303 RF-CABLE W303	Z	1400.1842.00		M	O
1160	1	S	JMZ1	MZ MONTAGEPLATTE MOUNTING PLATE		1093.4750.00		M	
1170	4	S	JVS9 JVS10 JVS11 JVS12	VS 965/ISR-M2.5X8-A4-PA 965/ISR-M2.5X8-A4-PA		1148.3294.00		B	T
1200	1	S	W244	DW HF KABEL SYNRF RF CABLE SYNRF	Z	1400.2103.00		M	O
1210	1	S	W249	DW HF KABEL RF1040 W249 RF CABLE RF1040 W249	Z	1400.2078.00		M	O
1240	1	S	W246	DV HF KABEL REF IN RF CABLE REF IN	Z	1400.2249.00		M	O
1250	1	S	W245	DV HF KABEL REF OUT	Z	1400.2232.00		M	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
3	0	S	JPB1	PH BEMERKUNG NOTE Die Montage ist in den Zeichnungen 1400.0000.01 D dargestellt / For mounting instruction see drawings 1400.0000.01 D		0999.9610.00		B	O
1020	1	S	A260	EE SMA-CW-OPU SMA-CW-OPU	Z	1400.1707.03		M	
1030	1	S	A240	EE STANDARD SYNTHESE STANDARD SYNTHESE	Z	1141.4220.02		M	
1062	1	S	JZN1	ZN HALTEBL F EICHLEITUNG (KURZ) PANEL FOR ATTENUATOR	Z	1400.3774.00		M	
1063	1	S	JZN2	ZN STUETZE FUER HF-KABEL SUPPORTPANEL	Z	1400.0798.00		M	O
1065	2	S	JZN2.1 JZN2.2	VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS		1148.3059.00		B	T
1080	4	S	W303.1 W303.2 W303.3 W303.4	VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
1125	1	S	W305	DW HF-KABEL W305 (OH ATT) RF-CABLE W305	Z	1400.1888.00		M	O
1130	2	S	W305.1 W305.2	DZ KABELBI.RD 1 BIS 25 B2 CABLETIE		0015.9038.00		B	O
1150	1	S	W303	DW KABEL ATT-RF OUT W303 RF-CABLE W303	Z	1400.1842.00		M	O
1160	1	S	W303.5	MZ MONTAGEPLATTE MOUNTING PLATE		1093.4750.00		M	
1170	4	S	JZN1.1 JZN1.2 JZN1.3 JZN1.4	VS 965/ISR-M2.5X8-A4-PA 965/ISR-M2.5X8-A4-PA		1148.3294.00		B	T
1200	1	S	W244	DW HF KABEL SYNRF RF CABLE SYNRF	Z	1400.2103.00		M	O
1210	1	S	W249	DW HF KABEL RF1040 W249 RF CABLE RF1040 W249	Z	1400.2078.00		M	O
1240	1	S	W246	DV HF KABEL REF IN RF CABLE REF IN	Z	1400.2249.00		M	O
1250	1	S	W245	DV HF KABEL REF OUT RF CABLE REF OUT	Z	1400.2232.00		M	O
1270	1	S	W346	DV HF KABEL CLK IN RF CABLE CLK IN	Z	1400.2290.00		M	O
1300	1	S	JKB1	KB FRONTHAUBE SMA(BEDR.)4.3ZOLL DISPL. FRONT COVER SMA 4.3INCH DISPLAY	Z	1400.3851.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
3	0	S	JPB1	PH BEMERKUNG NOTE Die Montage ist in den Zeichnungen 1400.0000.01 D dargestellt / For mounting instruction see drawings 1400.0000.01 D		0999.9610.00		B	O
1020	1	S	A260	EE SMA-CW-OPU SMA-CW-OPU	Z	1400.1707.06		M	
1030	1	S	A240	EE STANDARD SYNTHESE STANDARD SYNTHESE	Z	1141.4220.02		M	
1050	1	S	A300	ED STEP ATTENUATOR CMOS STEP ATTENUATOR CMOS	Z	1400.3400.06		M	
1062	1	S	JZN1	ZN HALTEBL F EICHLEITUNG (KURZ) PANEL FOR ATTENUATOR	Z	1400.3774.00		M	
1070	4	S	JVS1 JVS2 JVS3 JVS4	VS 6900/ISR-M3.0X6-A2 COMBINATION SCREWS		0041.1682.00		B	O
1080	4	S	JVS5 JVS6 JVS7 JVS8	VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
1100	1	S	W301	DY FLACHBAND ATT CABLE ATT	Z	1400.2355.00		M	O
1105	2	S	JDZ1 JDZ2	DZ KABELBI.RD 1 BIS 25 B2 CABLETIE		0015.9038.00		B	O
1120	1	S	W302	DW KABEL RF OPU-ATT W302 RF-CABLE W302	Z	1400.1859.00		M	O
1130	2	S	JDZ3 JDZ4	DZ KABELBI.RD 1 BIS 25 B2 CABLETIE		0015.9038.00		B	O
1150	1	S	W303	DW KABEL ATT-RF OUT W303 RF-CABLE W303	Z	1400.1842.00		M	O
1160	1	S	JMZ1	MZ MONTAGEPLATTE MOUNTING PLATE		1093.4750.00		M	
1170	4	S	JVS9 JVS10 JVS11 JVS12	VS 965/ISR-M2.5X8-A4-PA 965/ISR-M2.5X8-A4-PA		1148.3294.00		B	T
1200	1	S	W244	DW HF KABEL SYNRF RF CABLE SYNRF	Z	1400.2103.00		M	O
1210	1	S	W249	DW HF KABEL RF1040 W249 RF CABLE RF1040 W249	Z	1400.2078.00		M	O
1230	1	S	W267	DV HF KABEL REF VAR RF CABLE REF VAR	Z	1400.1894.00		M	
1240	1	S	W246	DV HF KABEL REF IN	Z	1400.2249.00		M	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				RF CABLE REF IN					
1250	1	S	W245	DV HF KABEL REF OUT RF CABLE REF OUT	Z	1400.2232.00		M	O
1270	1	S	W346L	DV HF KABEL CLK IN RF CABLE CLK IN	Z	1400.1907.00		M	
1280	1	S	W265	DV HF KABEL FM LOOP RF CABLE FM LOOP	Z	1400.2390.00		M	O
1290	1	S	W266	DV HF KABEL FM VCO RF CABLE FM VCO	Z	1400.2403.00		M	O
1300	1	S	JKB1	KB FRONTHAUBE SMA 6GHZ (BEDR.)4.3ZOLL FRONT COVER SMA6GHZ 4.3INCH DISPLAY	Z	1400.3880.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
3	0	S	JPB1	PH BEMERKUNG NOTE Die Montage ist in den Zeichnungen 1400.0000.01 D dargestellt / For mounting instruction see drawings 1400.0000.01 D		0999.9610.00		B	O
1020	1	S	A260	EE SMA-CW-OPU SMA-CW-OPU	Z	1400.1707.06		M	
1030	1	S	A240	EE STANDARD SYNTHESE STANDARD SYNTHESE	Z	1141.4220.02		M	
1062	1	S	JZN1	ZN HALTEBL F EICHLEITUNG (KURZ) PANEL FOR ATTENUATOR	Z	1400.3774.00		M	
1063	1	S	JZN2	ZN STUETZE FUER HF-KABEL SUPPORTPANEL	Z	1400.0798.00		M	O
1065	2	S	JVS1 JVS2 JVS3 JVS4	VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS		1148.3059.00		B	T
1080	3	S	JVS5 JVS6 JVS7 JVS8	VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
1125	1	S	W305	DW HF-KABEL W305 (OH ATT) RF-CABLE W305	Z	1400.1888.00		M	O
1130	2	S	JDZ1 JDZ2	DZ KABELBI.RD 1 BIS 25 B2 CABLETIE		0015.9038.00		B	O
1150	1	S	W303	DW KABEL ATT-RF OUT W303 RF-CABLE W303	Z	1400.1842.00		M	O
1160	1	S	JMZ1	MZ MONTAGEPLATTE MOUNTING PLATE		1093.4750.00		M	
1170	4	S	JVS9 JVS10 JVS11 JVS12	VS 965/ISR-M2.5X8-A4-PA 965/ISR-M2.5X8-A4-PA		1148.3294.00		B	T
1200	1	S	W244	DW HF KABEL SYNRF RF CABLE SYNRF	Z	1400.2103.00		M	O
1210	1	S	W249	DW HF KABEL RF1040 W249 RF CABLE RF1040 W249	Z	1400.2078.00		M	O
1230	1	S	W267	DV HF KABEL REF VAR RF CABLE REF VAR	Z	1400.1894.00		M	
1240	1	S	W246	DV HF KABEL REF IN RF CABLE REF IN	Z	1400.2249.00		M	O
1250	1	S	W245	DV HF KABEL REF OUT RF CABLE REF OUT	Z	1400.2232.00		M	O
1270	1	S	W346L	DV HF KABEL CLK IN RF CABLE CLK IN	Z	1400.1907.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
1280	1	S	W265	DV HF KABEL FM LOOP RF CABLE FM LOOP	Z	1400.2390.00		M	O
1290	1	S	W266	DV HF KABEL FM VCO RF CABLE FM VCO	Z	1400.2403.00		M	O
1300	1	S	JKB1	KB FRONTHAUBE SMA 6GHZ (BEDR.)4.3ZOLL FRONT COVER SMA6GHZ 4.3INCH DISPLAY	Z	1400.3880.00		M	

ROHDE&SCHWARZ

Mechanical Drawings

CAUTION! ESD

1050 A300

X11 520

auf sicheres Einrasten in Rueckwandblech von 520 achten

Make sure 520 locks securely in rear panel

700

505 **A321** mit SMA-B80 in Rueckw. mont.
with SMA-B80 mounted in rear panel

507 nur mit SMA-B80 (CF-Rueckw.) montiert/geklebt auf CF-Karte
labeled only with SMA-B80 (CF-rear)

530 W12

515

500 **A320**

1080

1100 W301

540 W11

ca./ approx 35mm

1105

490 A340

510

ab hier das Kabel 1x falten u. bis z. Ende mit 1105 zusammengehalten

From here, fold the cable once and fasten it with 1105 (cable tie)

1070

1062

260 W341

1130 W302

1125 W305

1120

2x Kabelbinder zum Befest. im Geraeterahmen (siehe auch Bl.2)
2 cable ties for fastening in instrument frame (see pos. note on Sh. 2)

720

90 W709

556 554

240 A100

250 6 x Schraube
6 screws

20 Geraeterahmen, vormontiert. Die Blech-HF-Kassette zur Montage des Geraets herausgenommen um Motherboard, HF-Baugruppen und die Kabel zu montieren
Instrument frame, premounted. To mount the motherboard, RF modules and cables, remove the metal RF chassis

550 W410

560

561 562 Rueckseitig / innen montiert
Mounted backside of panel

300 Platte nur ohne SMA-B20/-B22 zur Luftfuehrung in mittl. Fuehrungen der HF-Blechkassette eingesetzt
Insert panel, for the purpose of air circulation, in center rails of metal RF chassis only without SMA-B20/-B22

Mit SMA-B20 / -B22 steckt hier A700 20 ⧻
With SMA-B20/-B22, A700 is plugged here 20 ⧻

600

4 x Senkschraube 605
4 countersunk screw

1030 A240

1300

1160

1150 W303

1170

790

780

nur ohne SMA-B81 (Rueckw. Anschl.) montiert
mounted only without SMA-B81 (Rear conn.)

Optionserklaerung / *Explanation of options:*

- ✲ *incl. in SMA-B103 / -B103L / -B106 / -B106L*
- ⧻ *incl. in SMA-B103 / -B106 (with attenuator)*
- △ *incl. in SMA-B103L / -B106L (without attenuator)*
- ⧻ *incl. in SMA-B20 / -B22 (Synthesis extension)*

Variantenerklaerung / *Explanation of models :*
VAR02 = Grundausfuerung *MOD02 = Basic model*

Die in dieser Zeichnung angefuehrten Teile mit Pos.Nr. sind in der Stueckliste 1400.0000.01 ST und in den Optionsstuecklisten aufgefuehrt.

The parts / items mentioned in this drawing are included in the parts list 1400.0000.01 ST and the part lists of options.

Projektionsmethode
Projection Method

Maßstab / Scale 0,75:1	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: SMA100A SIGNAL GENERATOR / SIGNAL GENERATOR	Sprache / Lang. de en	Aend. / C.I. 05.00
		Blatt / Sh. 1	
SMA100A	Datum / Date 2005-12-05	Abteilung / Dept. 1GPK	Name / Name Hi
	Zeichn.-Nr. / Drawing No. 1400.0000.01		D

CAUTION! ESD

680
3 x Mutter M2,5 690
3 nuts M2,5

24 Z1
25 — eingesetzt in *inserted in* 24
26
F1, F2

116

114

670

1250 W245

1240 W246

660

650

110 W401
112 W404 Erdungslitze *Grounding wire*

Diese Blechnase als Orientierungshilfe fuer Lage von W302 oder W305 verwenden
Use the metal nib as an orientation for the position of W302 or W305

1020 A260

1130 zur Befestigung von W302 oder W305 im Geraeterahmen
For fastening W302 or W305 to the instrument frame

580

dient zum Fixieren der Kabel im Kanal, Demontage mittels Druecken des L-foermigen Lappens und verschieben
Is used to hold the cables in the duct; dismount by pressing the L-shaped tab and shift

70
80
85
40 A400
50
70
120 W402
1063
1065
Zur Halterung von 1125
For mounting

Die Nummern der Teile entsprechen der jew. Position in der Stueckliste 1400.0000.01 ST
The parts / items mentioned in this drawing are included in the corresponding parts list 1400.0000.01 ST

Nicht dargestellt / *Not shown :*

750 Tubus, vormont. / *Enclosure, premounted*
800 4 x Rueckwandfuss / *4 rear panel feet*
810 Klebeschild auf Rueckwandfuss / *Label on rear panel foot*

Optionserklaerung / *Explanation of options:*

- incl. in SMA-B103 / -B103L / -B106 / -B106L
- incl. in SMA-B103 / -B106 (with attenuator)
- incl. in SMA-B103L / -B106L (without attenuator)
- incl. in SMA-B20 / -B22 (Synthesis extension)

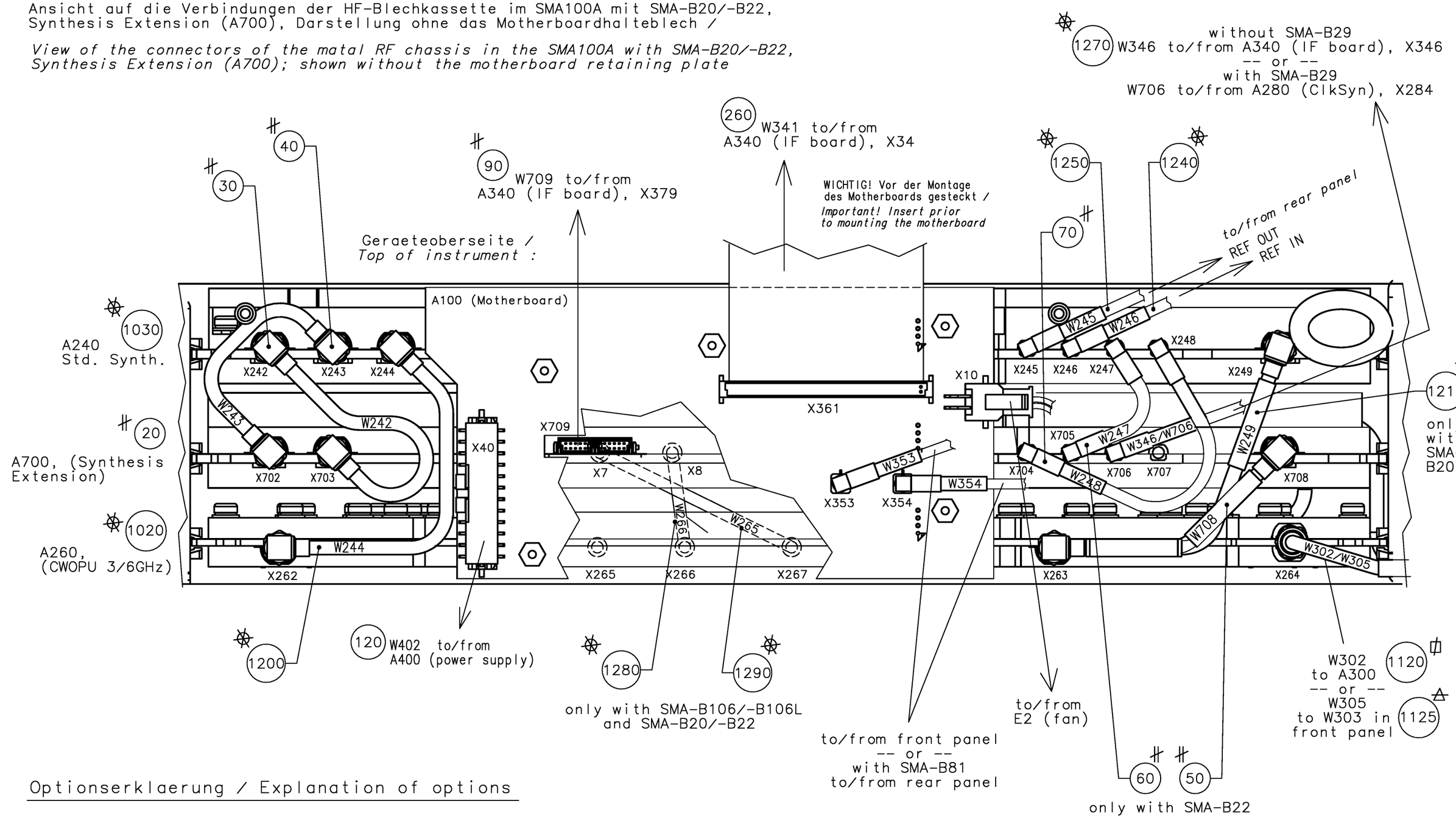
Maßstab / Scale 0,75:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: SMA100A SIGNAL GENERATOR / SIGNAL GENERATOR		Sprache / Lang. de en	Aen. / C.I. 02.00	Blatt / Sh. 2
			Zeichn.Nr. / Drawing No. 1400.0000.01		D
SMA100A	Datum / Date 2005-12-05	Abteilung / Dept. 1GPK	Name / Name Hi		

Projektionsmethode / Projection Method

CAUTION! ESD

Ansicht auf die Verbindungen der HF-Blechkassette im SMA100A mit SMA-B20/-B22, Synthesis Extension (A700), Darstellung ohne das Motherboardhalteblech /

View of the connectors of the matal RF chassis in the SMA100A with SMA-B20/-B22, Synthesis Extension (A700); shown without the motherboard retaining plate



Optionserklaerung / Explanation of options

- ✲ incl. in SMA-B103 / -B103L / -B106 / -B106L
- ⏍ incl. in SMA-B103 / -B106 (with attenuator)
- ⏃ incl. in SMA-B103L / -B106L (without attenuator)
- ⫽ incl. in SMA-B20 / -B22 Synthesis Extension

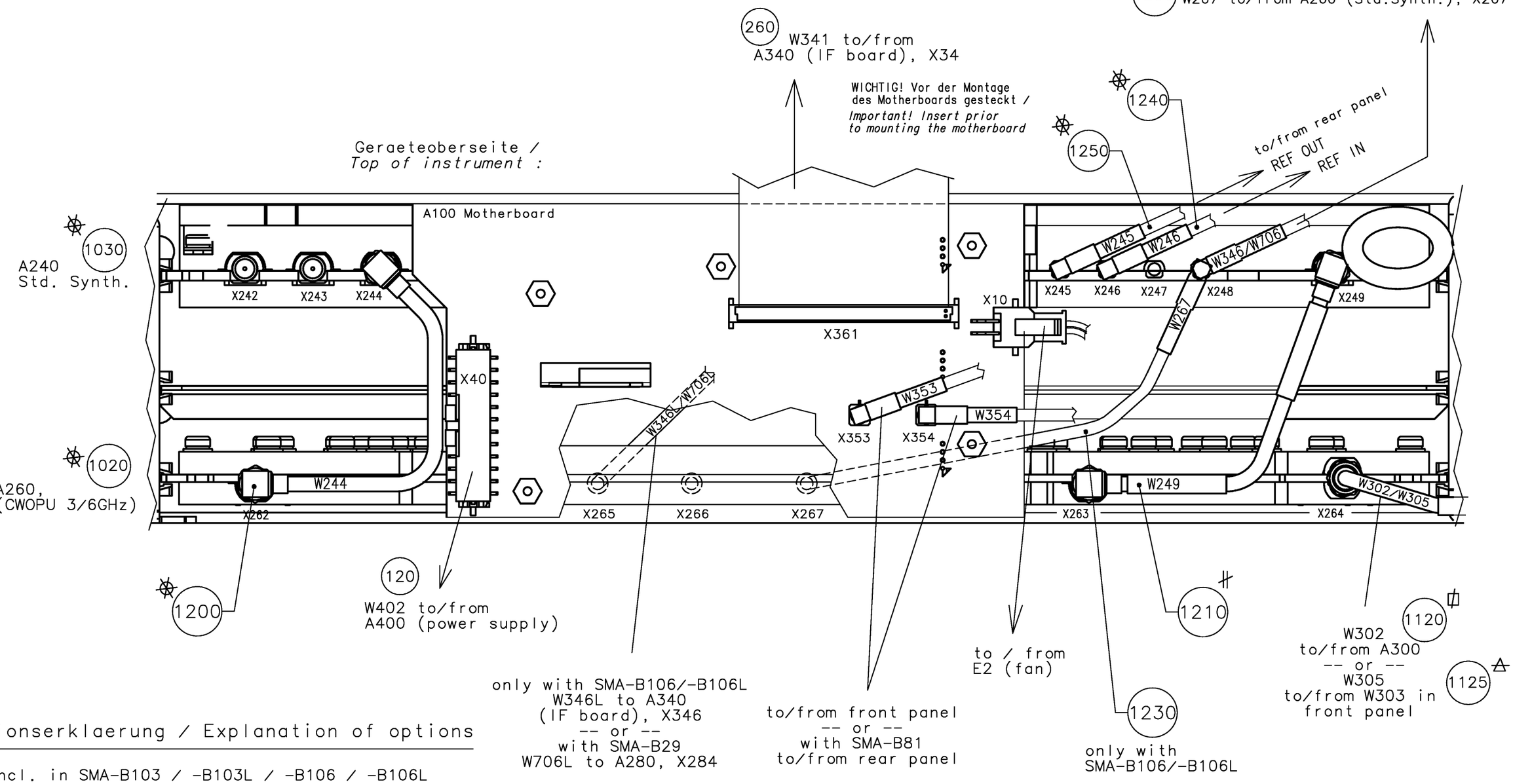
Projektionsmethode
Projection Method

Maßstab *Scale* 1:1	Toleranz *Tol.*	Werkstoff *Material*			
ROHDE&SCHWARZ	Benennung / *Designation* SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Sprache / *Lang.* de en	Aei. / *C.I.* 03.00	Blatt / *Sh.* 3
SMA100A	Datum *Date* 2005-12-05	Abteilung *Dept.* 1GPK	Name *Name* Hi	Zeichn.Nr. / *Drawing No.* 1400.0000.01		D

CAUTION! ESD

Ansicht auf die Verbindungen der HF-Blechkassette im SMA100A mit SMA-B20/-B22, Synthesis Extension (A700), Darstellung ohne das Motherboardhalteblech /

View of the connectors of the matal RF chassis in the SMA100A with SMA-B20/-B22, Synthesis Extension (A700); shown without the motherboard retaining plate



Optionserklaerung / Explanation of options

- incl. in SMA-B103 / -B103L / -B106 / -B106L
- incl. in SMA-B103 / -B106 (with attenuator)
- incl. in SMA-B103L / -B106L (without attenuator)
- incl. in SMA-B20 / -B22 Synthesis Extension

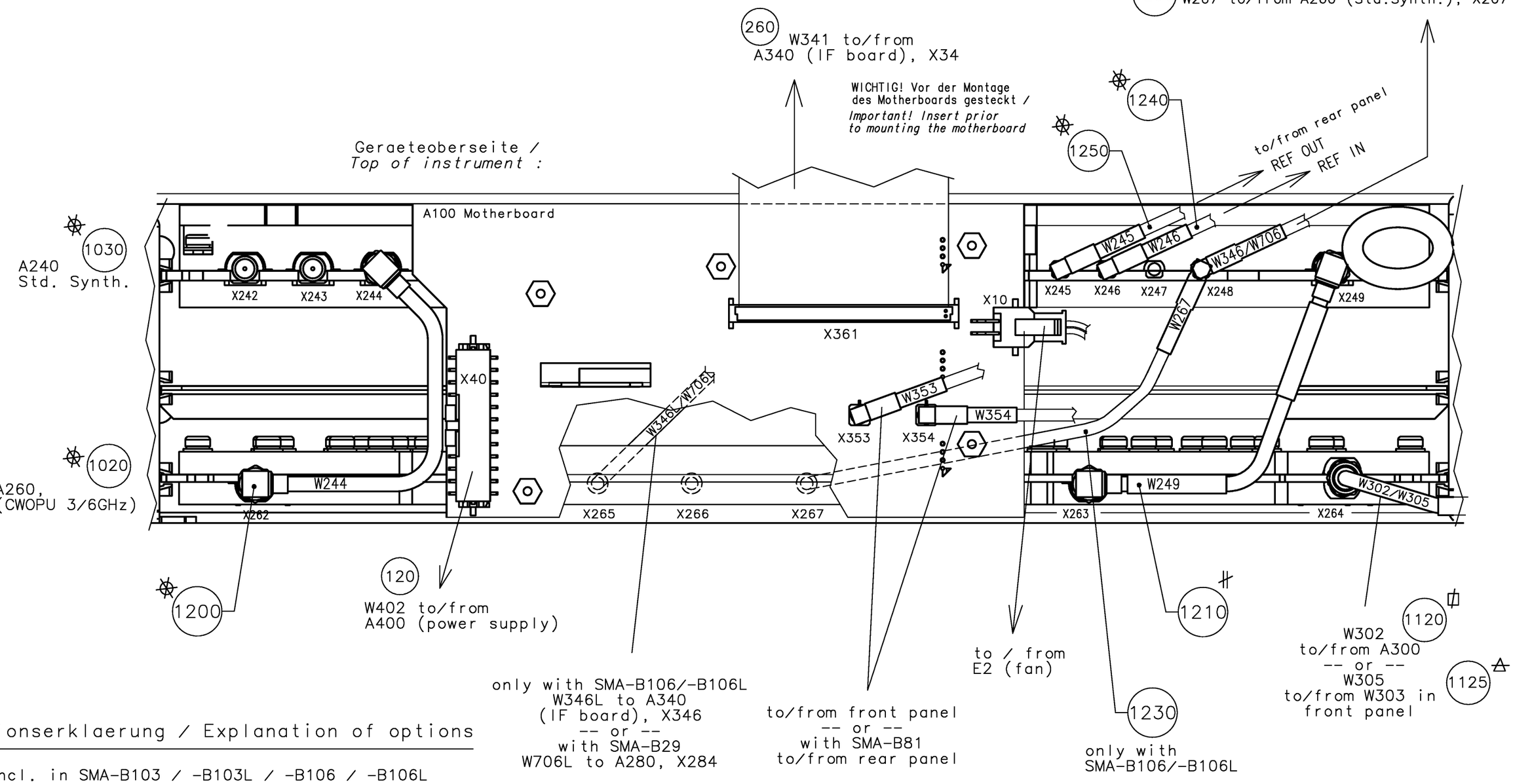
Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Sprache / Lang.: de en	Aei. / C.I.: 03.00	Blatt / Sh.: 4
SMA100A	Datum / Date: 2005-12-05	Abteilung / Dept.: 1GPK	Name / Name: Hi	Zeichn.Nr. / Drawing No.: 1400.0000.01		D

Projektionsmethode
Projection Method

CAUTION! ESD

Ansicht auf die Verbindungen der HF-Blechkassette im SMA100A mit SMA-B20/-B22, Synthesis Extension (A700), Darstellung ohne das Motherboardhalteblech /

View of the connectors of the matal RF chassis in the SMA100A with SMA-B20/-B22, Synthesis Extension (A700); shown without the motherboard retaining plate



Optionserklaerung / Explanation of options

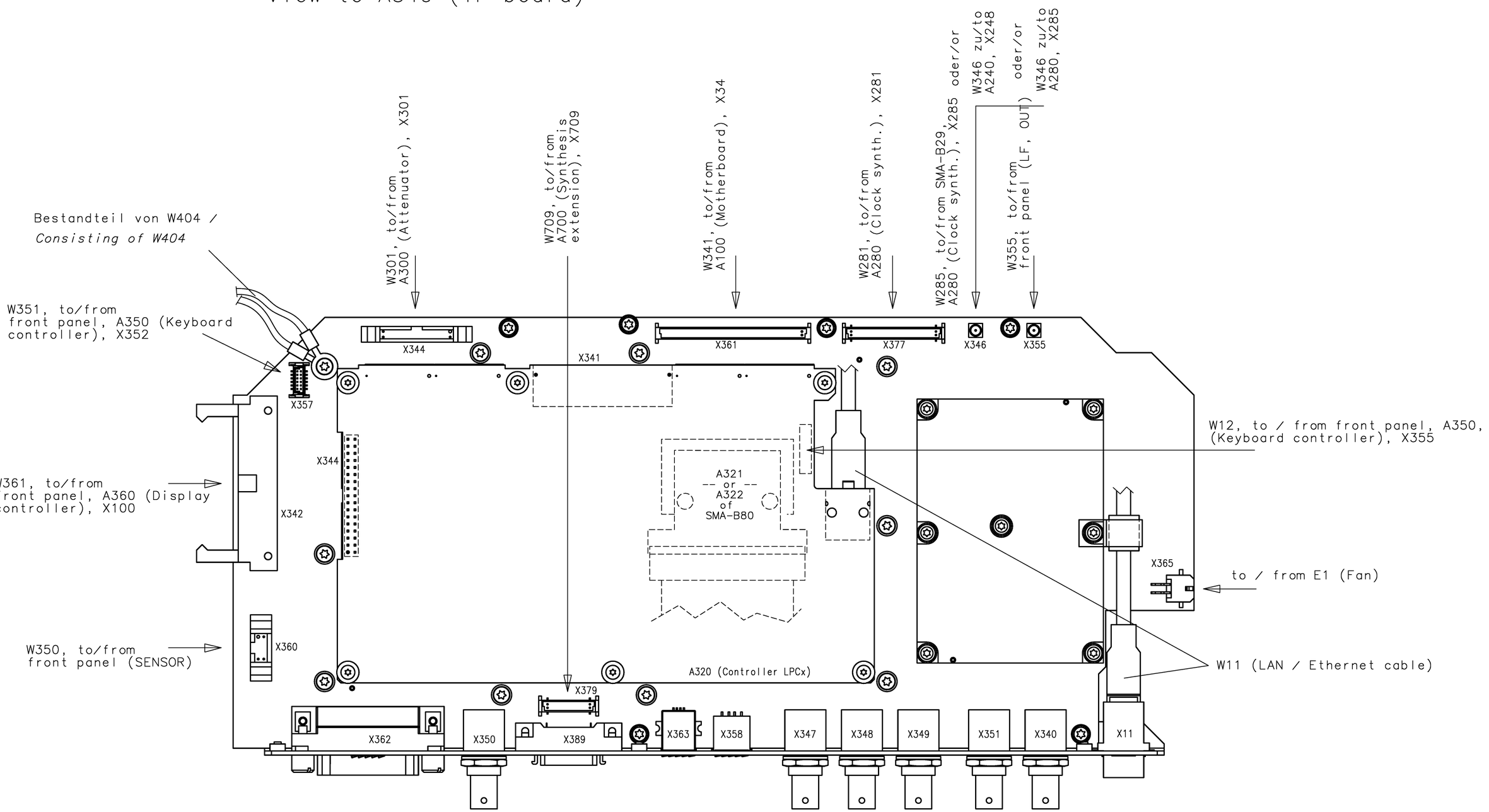
- incl. in SMA-B103 / -B103L / -B106 / -B106L
- incl. in SMA-B103 / -B106 (with attenuator)
- incl. in SMA-B103L / -B106L (without attenuator)
- incl. in SMA-B20 / -B22 Synthesis Extension

Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Sprache / Lang.: de en	Aei. / C.I.: 03.00	Blatt / Sh.: 4
SMA100A	Datum / Date: 2005-12-05	Abteilung / Dept.: 1GPK	Name / Name: Hi	Zeichn.Nr. / Drawing No.: 1400.0000.01		D

Projektionsmethode
Projection Method

CAUTION! ESD

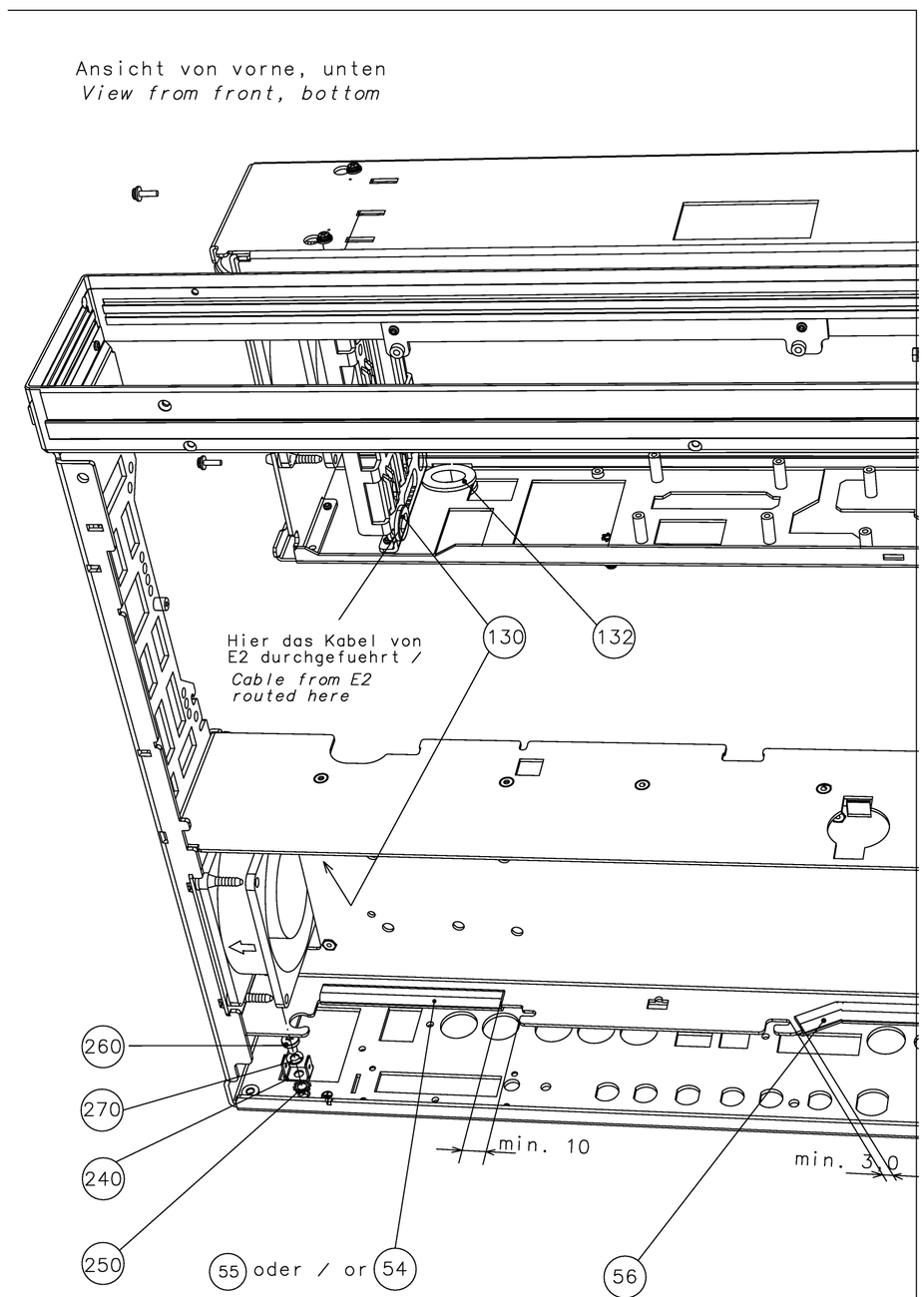
View to A340 (IF board)



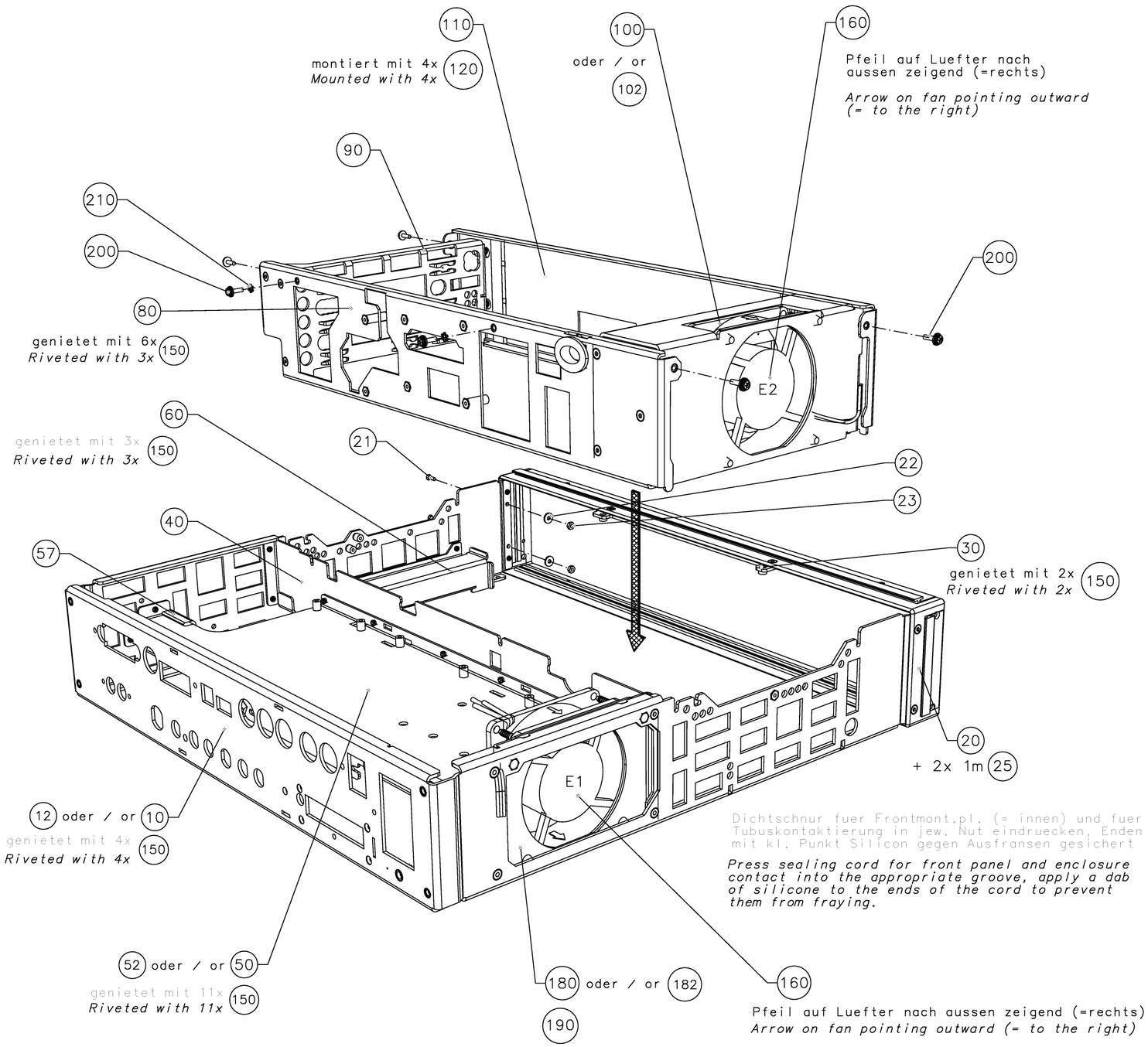
Projektions-methode
Projection Method

Maßstab / *Scale*	Toleranz / *Tol.*	Werkstoff / *Material*	
ROHDE&SCHWARZ	Benennung / *Designation*: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR	Sprache / *Lang.*: de en	Ael. / *C.I.*: 03.00
	Datum / *Date*: 2005-12-05	Abteilung / *Dept.*: 1GPK	Name / *Name*: Hi
	Zeichn.Nr. / *Drawing No.*: 1400.0000.01		Blatt / *Sh.*: 5 D

Ansicht von vorne, unten
View from front, bottom



Ansicht von links, hinten
View from left, back side



Projektions-methode
Projection Method

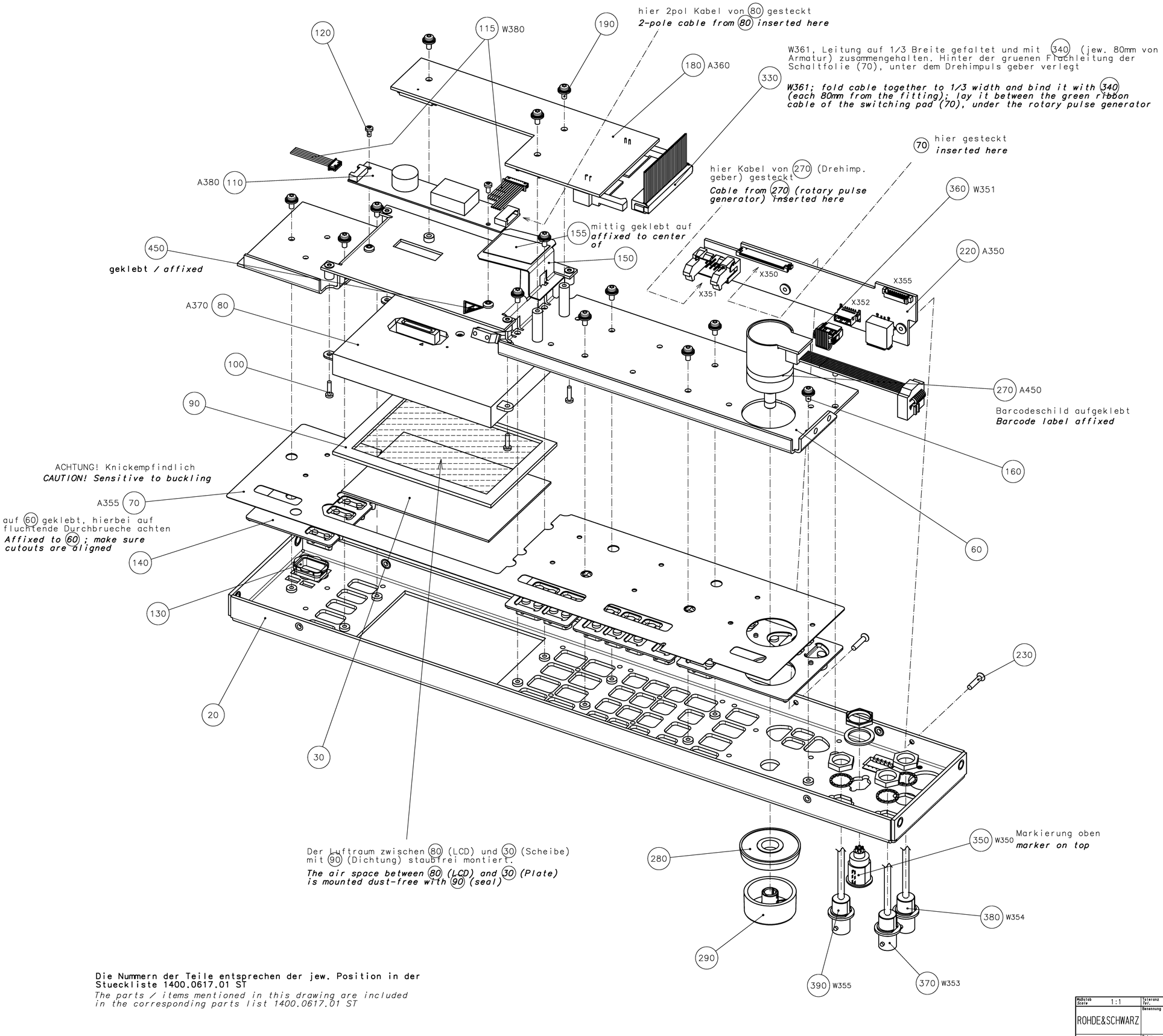
Variantenerklaerung / Explanation of models:

VAR 02 = Grundausfuehrung mit 60mm-Luefter	MOD 02 = Basic version with 60mm fan
VAR 03 = mit 80mm-Luefter	MOD 03 = with 80mm fan

Die Nummern der Teile entsprechen der jew. Position in der Stueckliste 1400.0100.01 ST
The parts / items mentioned in this drawing are included in the corresponding parts list 1400.0100.01 ST

Maßstab / Scale 1:2	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: Rahmen vormont. Equipment frame			Sprache / Lang. de en	Aei. / C.I. 10.00	Blatt / Sh. 1
	Datum / Date 2010-07-05	Abteilung / Dept. MTEK	Name / Name WU	Zeichn.Nr. / Drawing No. 1400.0100.01		D

CAUTION! ESD



Die Nummern der Teile entsprechen der jew. Position in der Stueckliste 1400.0617.01 ST

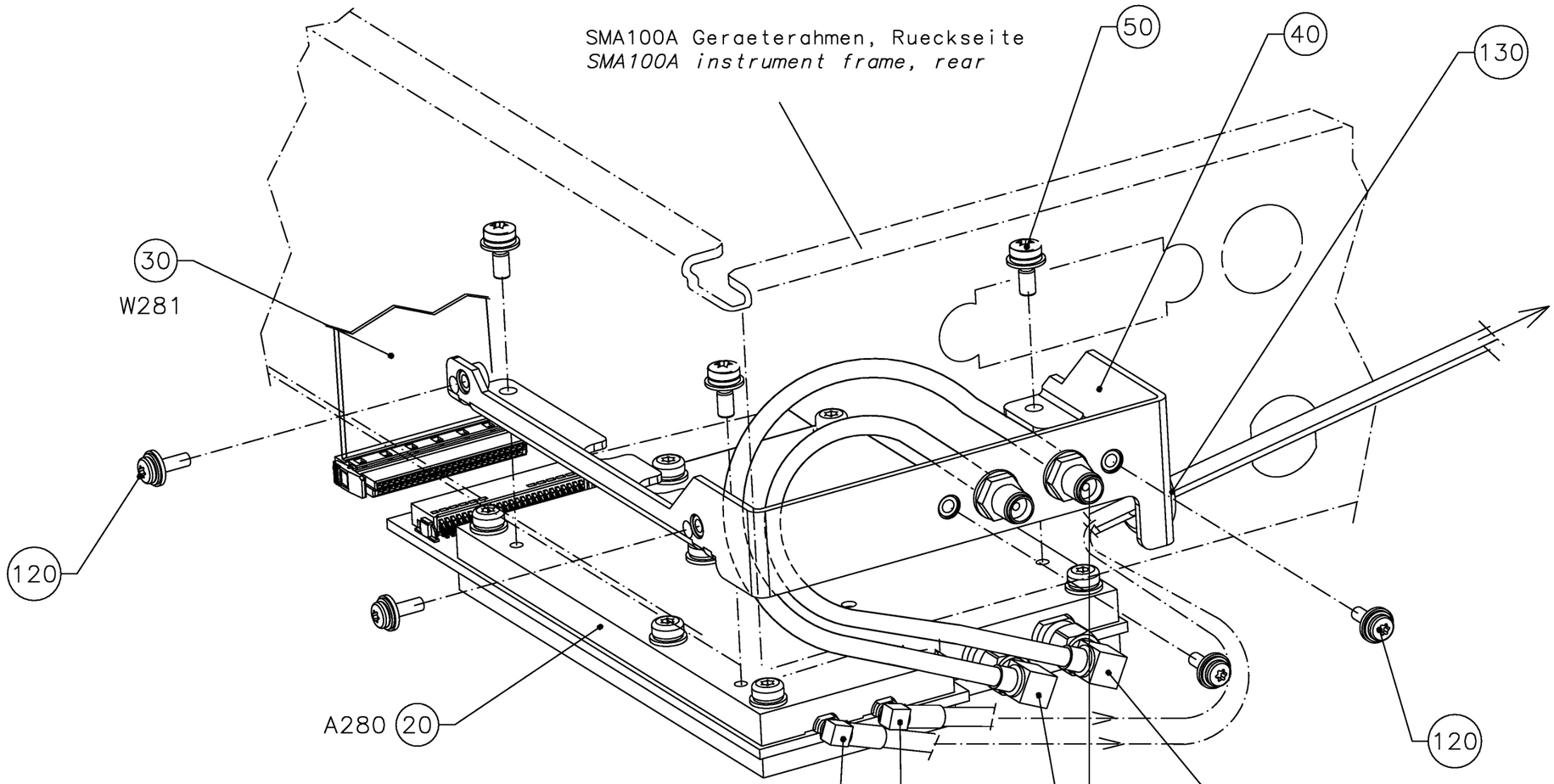
The parts / items mentioned in this drawing are included in the corresponding parts list 1400.0617.01 ST

Maßstab / Scale 1:1	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: FRONTEINHEIT SMA / FRONT PANEL UNIT SMA			Sprache / Lang. de en	Änd. / C.I. 04.00	Blatt / Sh. 1
SMA	Datum / Date 2005-03-09	Abteilung / Dept. 1ZKS	Name / Name wb	Zeichn.Nr. / Drawing No. 1400.0617.01		D

Projektionsmethode
Projection Method

CAUTION!: ESD!

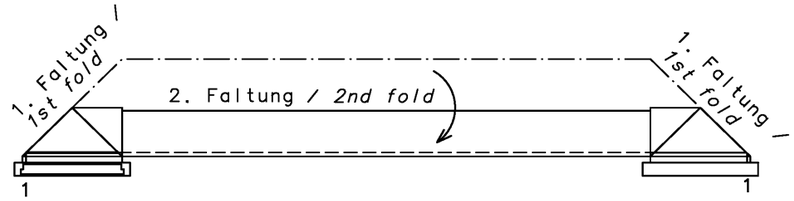
SMA100A Geraeterahmen, Rueckseite
SMA100A instrument frame, rear



Die Kabel im SMA100A gesteckt nach Stromlauf 1400.0000.01 S

Cables in the SMA100A connected in accordance with circuit diagram 1400.0000.01 S

Falten von / *Is fold* (30) (W281), M1:2



wenn im SMA100A die Opt. SMA-106 oder SMA-106A mont. ist /
if Opt SMA106 or SMA-B106L is mounted in SMA100A

Die Option SMA-B29 vor dem Einbau in den SMA100A kompl. (incl. der Kabel) zusammenmontiert, ausser Schrauben (120).

Prior to installation in the SMA100A, option SMA-B29 is completely assembled (incl cables), except (120)

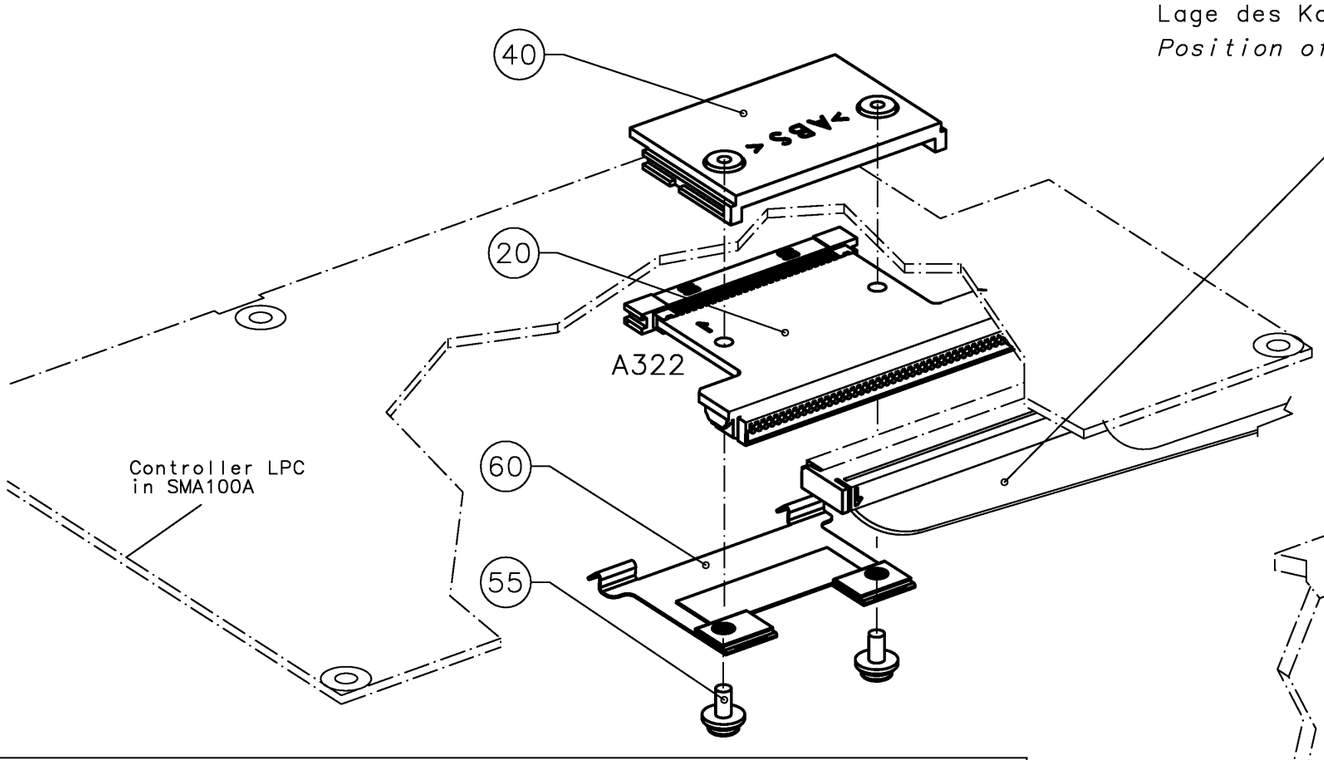
Die Nummern der Teile entsprechen der jew. Position in der Stueckliste 1400.2503.01 ST

The parts / items mentioned in this drawing are included in the corresponding parts list 1400.2503.01 ST

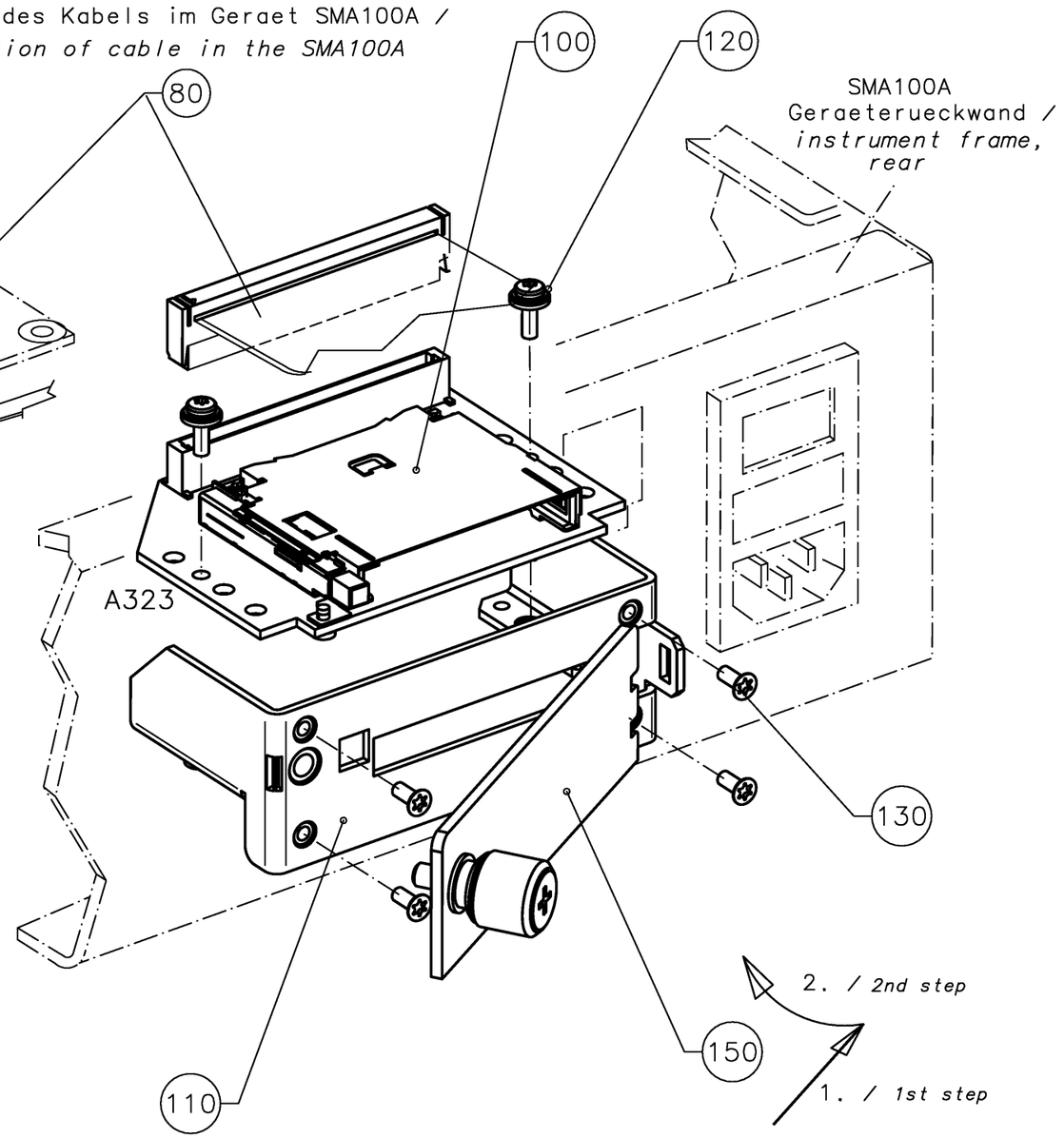
Maßstab / *Scale* 1:1	Toleranz / *Tol.*	Werkstoff / *Material*			
ROHDE&SCHWARZ	Benennung / *Designation* SMA-B29 CLOCK SYNTHESIZER SMA-B29 CLOCK SYNTHESIZER			Sprache / *Lang.* de en	Aei. / *C.I.* 04.00	Blatt / *Sh.* 1
SMA-B29	Datum / *Date* 2006-03-08	Abteilung / *Dept.* 1GPK	Name / *Name* Hi	Zeichn.Nr. / *Drawing No.* 1400.2503.01		D

Projektionsmethode / *Projection Method*

CAUTION! ESD

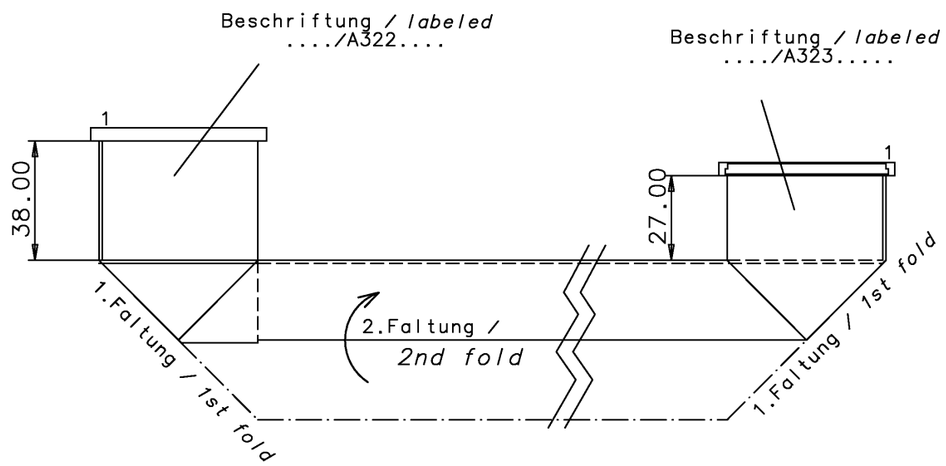


Lage des Kabels im Geraet SMA100A /
Position of cable in the SMA100A



Lage der Abdeckung im Geraet SMA100A /
Position of cover in SMA100A

Falten von / *folding of* (80) (W322)



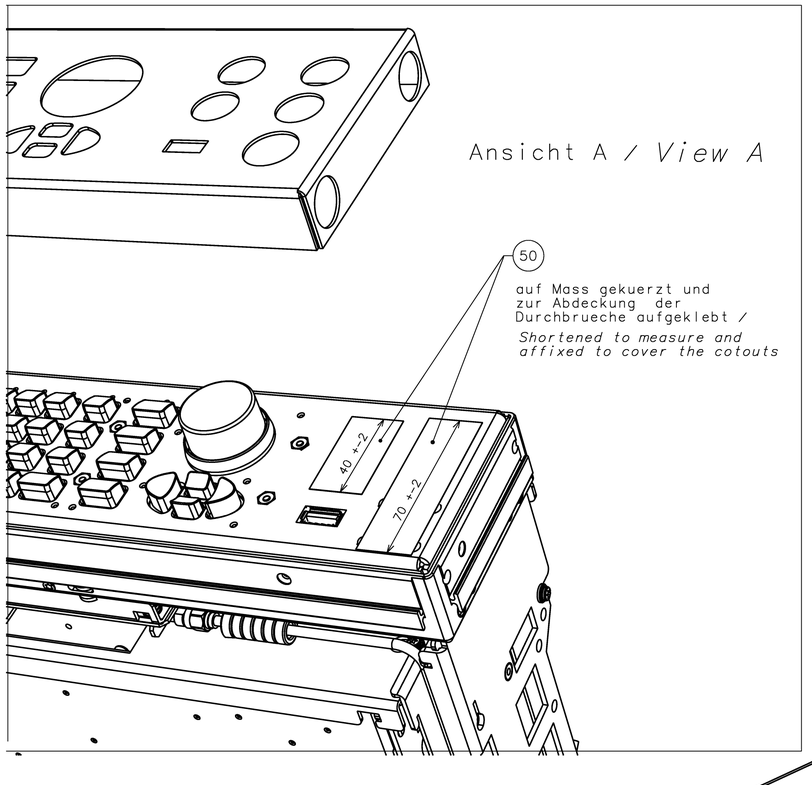
Die Nummern der Teile entsprechen der jew. Position in der Stueckliste 1405.2001.01 ST

The parts / items mentioned in this drawing are included in the corresponding parts list 1405.2001.01 ST

Projektions-methode
Projection Method

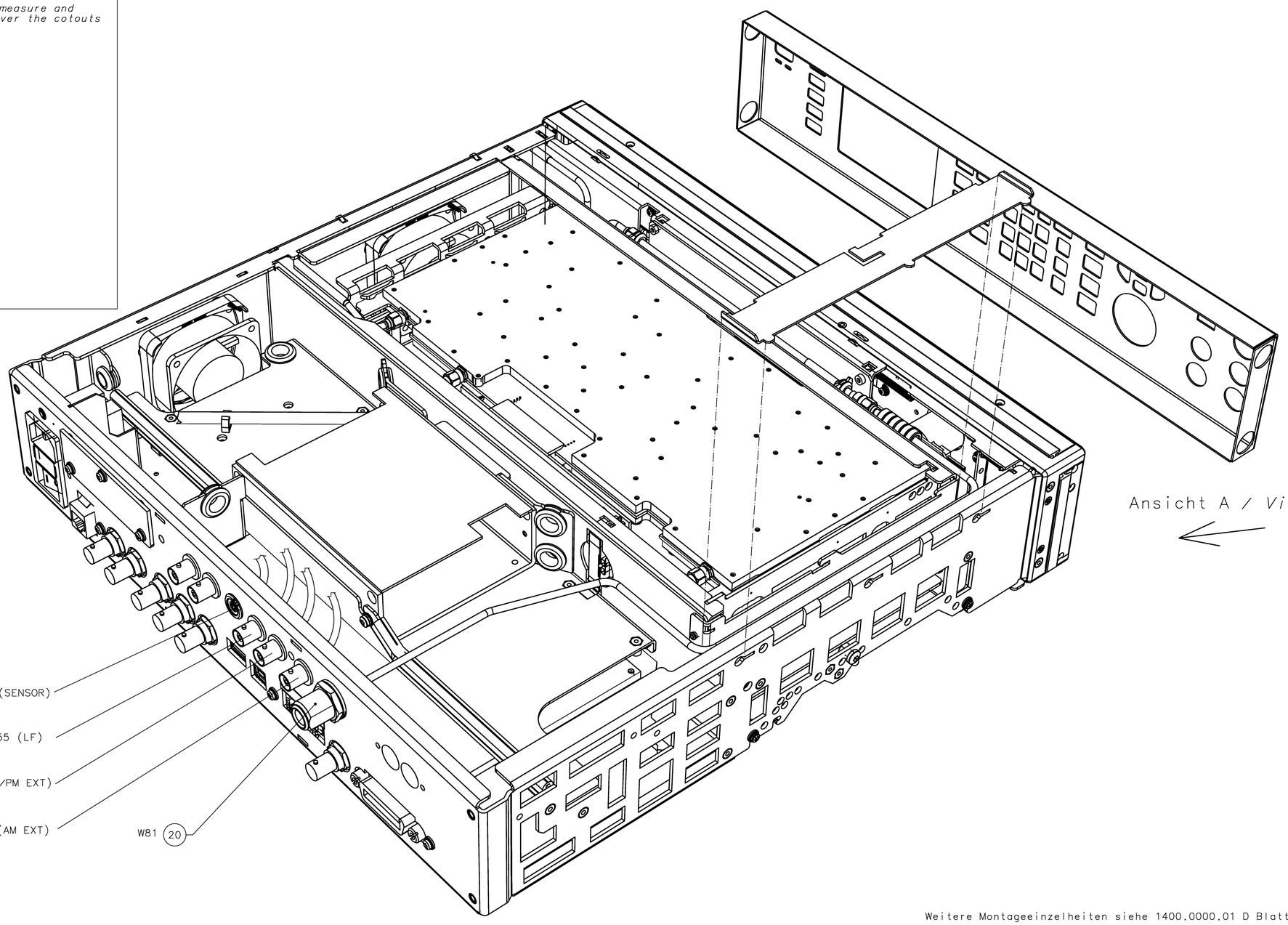
Maßstab / *Scale* 1:1; 1:2	Toleranz / *Tol.* +-2	Werkstoff / *Material*			
ROHDE&SCHWARZ	Benennung / *Designation* SMA-B80 CF ADAPTER SMA-B80 CF ADAPTER			Sprache / *Lang.* de en	Aei. / *C.I.* 04.00	Blatt / *Sh.* 1
SMA-B80	Datum / *Date* 2005-12-05	Abteilung / *Dept.* 1GPK	Name / *Name* Hi	Zeichn.Nr. / *Drawing No.* 1405.2001.01		D

CAUTION! ESD



Ansicht A / *View A*

(50) auf Mass gekuerzt und zur Abdeckung der Durchbrueche aufgeklebt / *Shortened to measure and affixed to cover the cotouts*



Ansicht A / *View A*

Kabel von Fronteinheit nach hier verlegt / *Cables from front panel laid here*

W350 (SENSOR)

W355 (LF)

W354 (FM/PM EXT)

W353 (AM EXT)

W81 (20)

Weitere Montageeinzelheiten siehe 1400.0000.01 D Blatt 1 – 5

More informations for mounting see 1400.0000.01 D sheet 1 – 5

Die Nummern der Teile entsprechen der jew. Position in der Stueckliste 1405.2401.01 ST

The parts / items mentioned in this drawing are included in the corresponding parts list 1405.2401.01 ST

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: SMA-B81 REAR PANEL CONNECTORS REAR PANEL CONN		Sprache / Lang.: de en	Aen. / C.I.: 01.00	Blatt / Sh.: 1
			Zeichn.Nr. / Drawing No.: 1405.2401.01		D
SMA-B81	Datum / Date: 2005-11-09	Abteilung / Dept.: 1GPK	Name / Name: HI		

Projektionsmethode / *Projection Method*

ROHDE&SCHWARZ

Circuit diagrams

FRONT PANEL

M E1

M E2

J1 POWER SUPPLY A400 J2

Z1 F1 F2 L PE N

sw1 sw2 W401 W404 X101

X10 MOTHER BOARD A100

X40 W402 23

X21 AM EXT W353 X353

X22 FM/PM EXT W354 X354

X23 LF W355 X355 X356

X24 to SSYN A240-X241

X70 to SYNEX A700-X701

X361 W341 X34

X26 to CWOP A260-X261

USB POWER SENSOR W350 X360

INTERFACE BOARD A340

X101 DISPLAY CONTROL BOARD A360

A370 X105 X100 X342

X352 X351 X357

A355 X350 TASTATUR CONTROLLER BOARD A350 X355 X343

34 pin

A450 X351

USB X354

X341

A320

A323 X323 W322 X322 A322 X320 CF-SLOT

A321 CF

SMA-B80 1405.2001.02

RF 50Ω W11

X379 W709 to AUX I/O SYNEX A700-X709

X377 W281 to CLKSYN A280-X281

X346 W285/W346 from REF A240-X248/A700-X706/A280-X285

X344 W301 to ATT A300-X301

W303 from RF_OUT

X362 X363 X358 X389 X340 X347 X348 X349 X350 X351

X11

LAN IEC IEEE488 USB USB IN AUX I/O BLANK PULSE EXT PULSE VIDEO PULSE SYNC INST TRIG EXT TUNE

REAR PANEL

mit Option
B80 CompactFlash

Bindende Angaben ueber Varianten, Trimmwerte, Bauteile und nicht bestueckte Bauteile siehe ST.

For binding information on models, trimming and components values and nonfitted components see parts list.

ACHTUNG: ESD!
Elektrostatisch gefaehrdete Bauelemente erfordern eine besondere Handhabung.
ATTENTION: ESD!
Electrostatic sensitiv devices require a special handling.

ROHDE&SCHWARZ	Benennung / Designat.: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Spr.:/Lang.: de	Aei:/C.I.: 06.00	Blatt:/Sh.: 1 +
SMA100A	Datum: 12.08.10	Abteilung: MTEK	Name: EI	Zeichn.Nr.:/Drawing No.: 1400.0000.01 S		

STANDARD SYNTHESE
A240
1141.4220.04
(1141.4208.04)

X249 REF1040
X248 REF VAR
X247 REF 100
X246 EXTREF IN
X245 EXTREF OUT
X241 to Motherboard A100-X24 Sheet 1
X244 SYNRF
X243 SYNEX OUT
X242 SYNEX IN

SYNEX
A700
1142.0270.02
(1142.0070.02)

X708 REF1200
LPN
SMA-B22
X707 REF LPN2
X706 REF DACB
X705 REF 100
X704 REF VAR
X701 to Motherboard A100-X70 Sheet 1
to IF Board A340-X379 Sheet 1 W709 26
X709
X8 FM WIDE
X7 FM LOOP
X703 SYNEX IN
X702 SYNEX OUT

CWOP 3/6
A260
1400.1707.03/06

X264 OPU RF OUT
X263 OPU LO IN
X261 to Motherboard A100-X26 Sheet 1
X267 REFVAR DDS
X266 FM WIDE
X265 REFVAR OUT
X262 OPU RF IN

ATT 3/6
A300
1400.3400.03/06

X302 RF_IN
X303 RF_OUT
X301

CLOCK SYNTHESE
SMA-B29
A280
1400.2749.02
(1400.2703.02)

X282 CLKSYN OUT
X283 CLKSYN OUT_N
X284 REF104 IN
X285 REF104 OUT
X281

W248 W247 W246 W245 W244 W243 W242
W708 W706 W302 W305 *** W303 W301 30
W709 26 W266 * W265 * W282 W283 W285 W281 50

to FRONT PANEL RF OUT 50 Ohm Sheet 1
to IF Board A340-X344 Sheet 1
to IF Board A340-X346 Sheet 1
to IF Board A340-X377 Sheet 1

REF IN
REF OUT
CLK SYN
CLK SYN_N
REAR PANEL

mit Option
B103 / B106
B103L/ B106L without ATT A300
B22 LPN + FM/PM
B29 CLKSYN

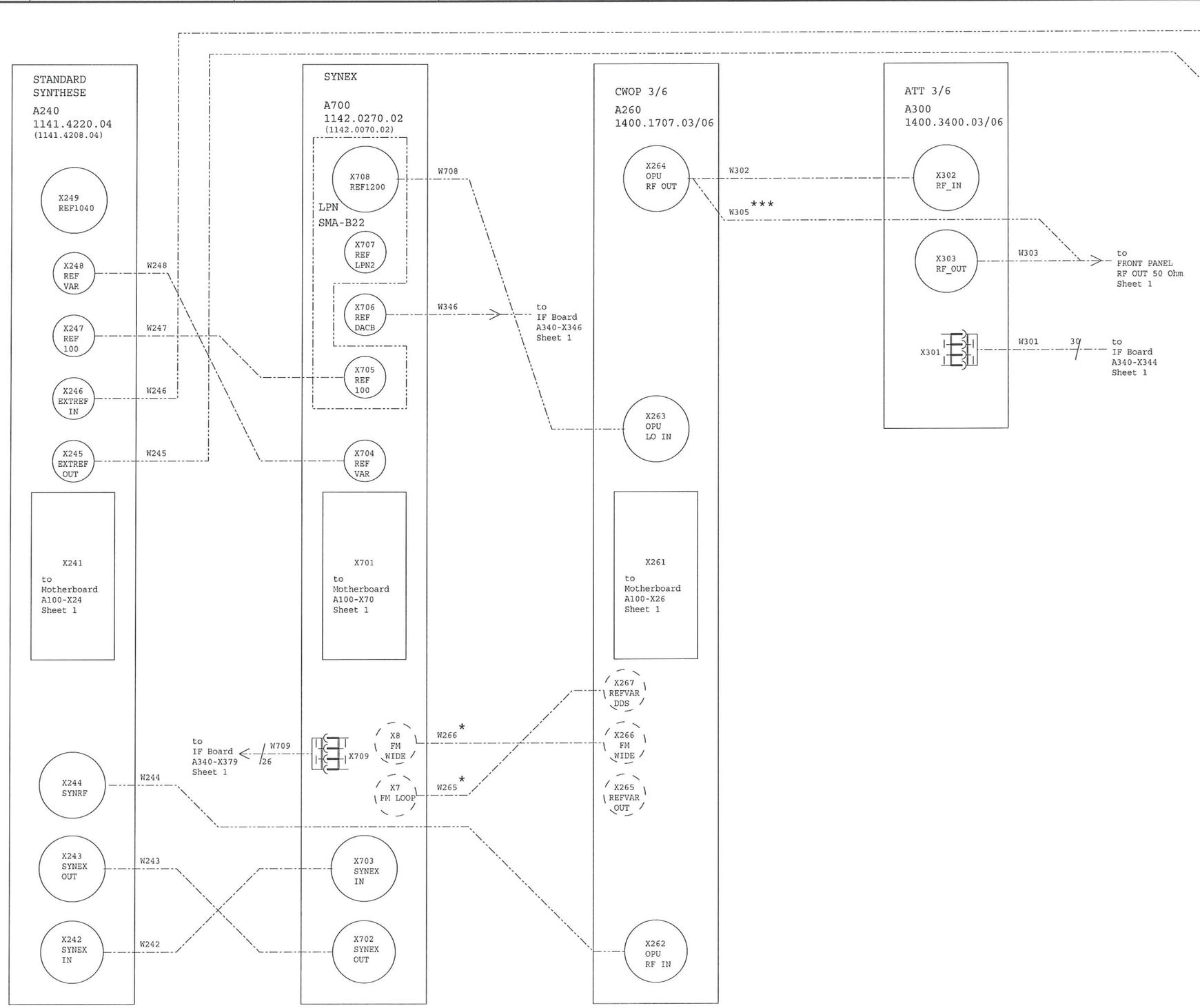
* = only B106/B106L
** = only B103/B103L
*** = only B103L/B106L

Bindende Angaben ueber Varianten, Trimmwerte, Bauteile und nicht bestueckte Bauteile siehe ST.

For binding information on models, trimming and components values and nonfitted components see parts list.

ACHTUNG: ESD!
Elektrostatisch gefaehrdete Bauelemente erfordern eine besondere Handhabung.
ATTENTION: ESD!
Electrostatic sensitiv devices require a special handling.

ROHDE&SCHWARZ	Benennung / Designat.: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Spr.:/Lang.: de	Aei:/C.I.: 06.00	Blatt:/Sh.: 2 +
SMA100A	Datum: Date: 12.08.10	Abteilung: Dept.: MTEK	Name: Name: EI	Zeichn.Nr.:/Drawing No.: 1400.0000.01 S		



* = only B106/B106L
** = only B103/B103L
*** = only B103L/B106L

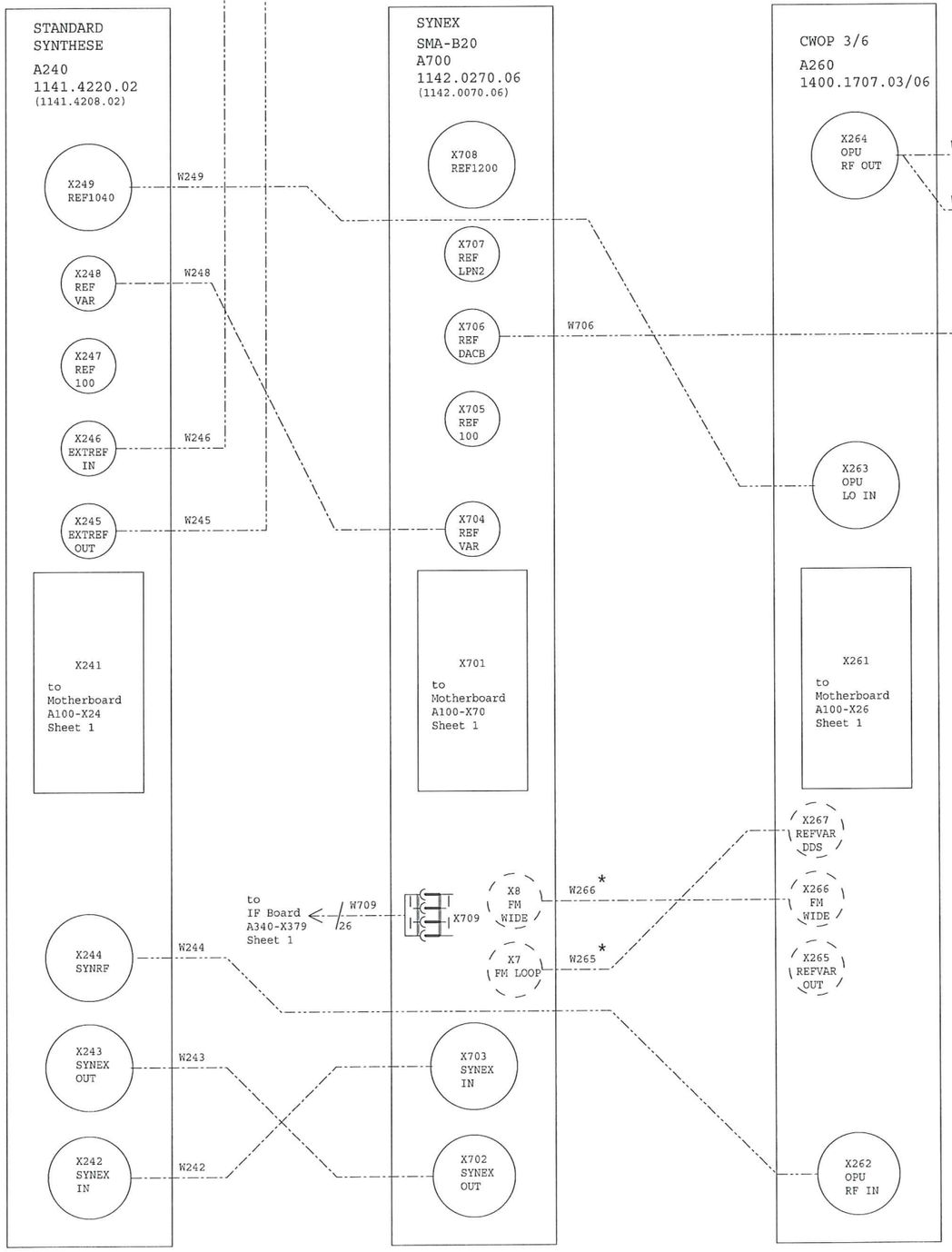
Bindende Angaben ueber Varianten, Trimmwerte, Bauteile und nicht bestueckte Bauteile siehe ST.

For binding information on models, trimming and components values and nonfitted components see parts list.

ACHTUNG: ESD!
Elektrostatisch gefaehrdete Bauelemente erfordern eine besondere Handhabung.
ATTENTION: ESD!
Electrostatic sensitiv devices require a special handling.

mit Option
B103 / B106
B103L/ B106L without ATT A300
B22 LPN + FM/PM

ROHDE&SCHWARZ	Benennung / Designat.: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Spr.:/Lang.: de	Aei:/C.I.: 06.00	Blatt:/Sh.: 3 +
SMA100A	Datum: Date: 12.08.10	Abteilung: Dept.: MTEK	Name: Name: Ei	Zeichn.Nr.:/Drawing No.: 1400.0000.01 S		



mit Option
B103 / B106
B103L/ B106L without ATT A300
B20 FM/PM
B29 CLKSYN

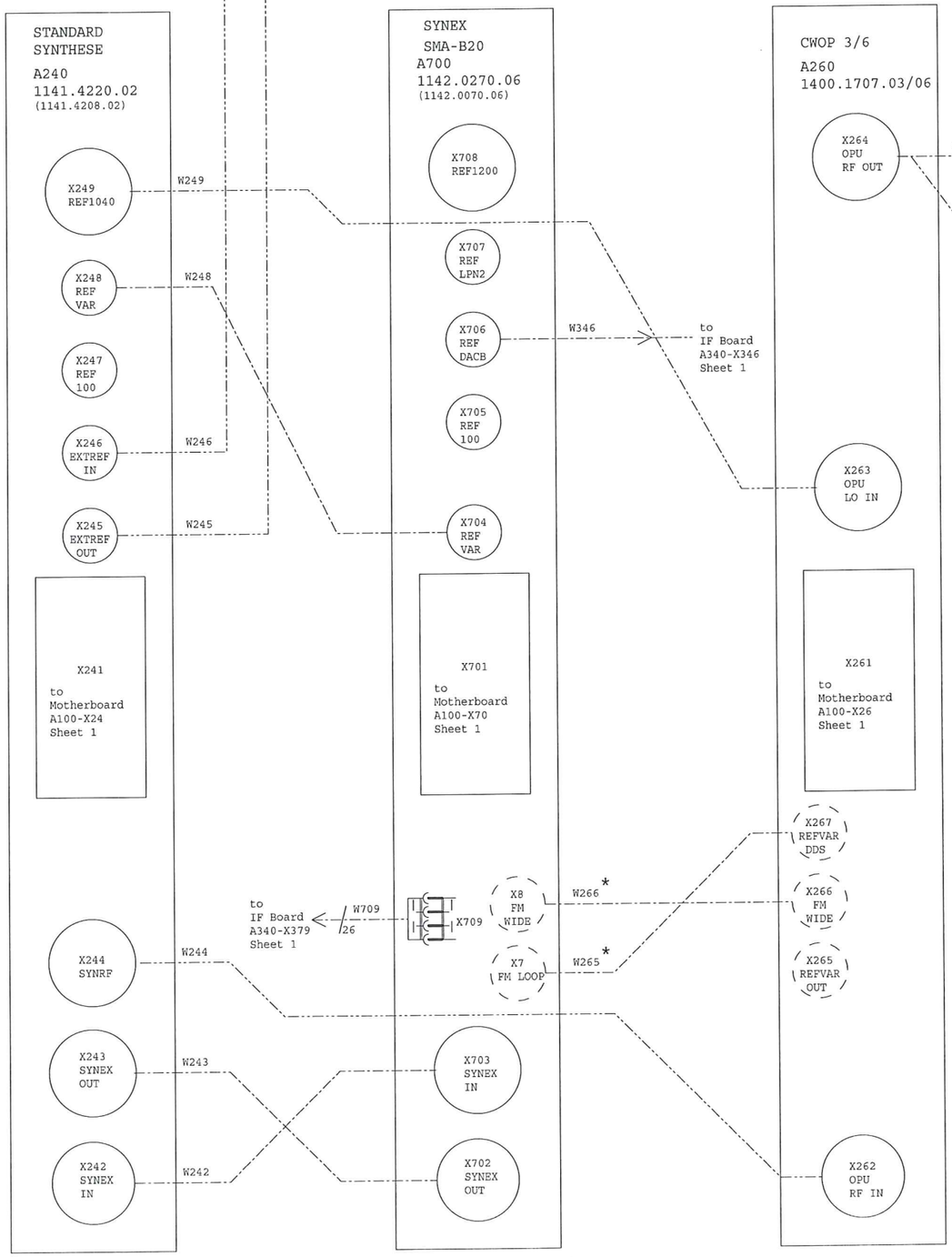
* = only B106/B106L
** = only B103/B103L
*** = only B103L/B106L

Bindende Angaben ueber Varianten, Trimmwerte, Bauteile und nicht bestueckte Bauteile siehe ST.

For binding information on models, trimming and components values and nonfitted components see parts list.

ACHTUNG: ESD!
Elektrostatisch gefaehrdete Bauelemente erfordern eine besondere Handhabung.
ATTENTION: ESD!
Electrostatic sensitiv devices require a special handling.

ROHDE&SCHWARZ	Benennung / Designat.: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Spr.:/Lang.: de	Aei:/C.I.: 06.00	Blatt:/Sh.: 4 +
SMA100A	Datum: 12.08.10 Date:	Abteilung: MTEK Dept.:	Name: EI Name:	Zeichn.Nr.:/Drawing No.: 1400.0000.01 S		



* = only B106/B106L
** = only B103/B103L
*** = only B103L/B106L

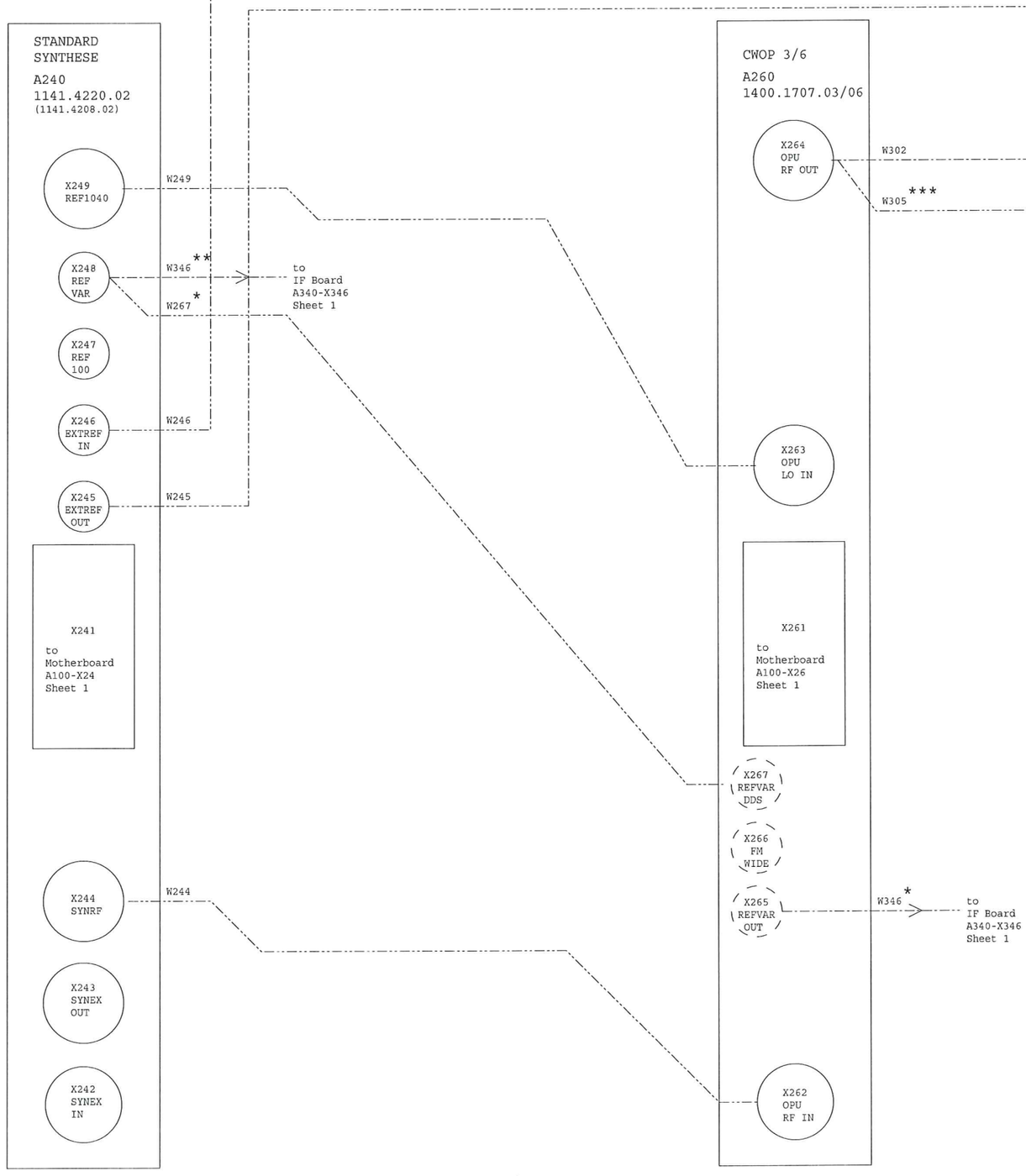
mit Option
B103 / B106
B103L/ B106L without ATT A300
B20 FM/PM

Bindende Angaben ueber Varianten, Trimmwerte, Bauteile und nicht bestueckte Bauteile siehe ST.

For binding information on models, trimming and components values and nonfitted components see parts list.

ACHTUNG: ESD!
Elektrostatisch gefaehrdete Bauelemente erfordern eine besondere Handhabung.
ATTENTION: ESD!
Electrostatic sensitiv devices require a special handling.

ROHDE&SCHWARZ	Benennung / Designat.: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Spr.:/Lang.: de	Aei:/C.I.: 06.00	Blatt:/Sh.: 5 +
SMA100A	Datum: 12.08.10	Abteilung: MTEK	Name: EI	Zeichn.Nr.:/Drawing No.: 1400.0000.01 S		



* = only B106/B106L
** = only B103/B103L
*** = only B103L/B106L

Bindende Angaben ueber Varianten, Trimmwerte, Bauteile und nicht bestueckte Bauteile siehe ST.

For binding information on models, trimming and components values and nonfitted components see parts list.

ACHTUNG: ESD!
Elektrostatisch gefaehrdete Bauelemente erfordern eine besondere Handhabung.

ATTENTION: ESD!
Electrostatic sensitiv devices require a special handling.

mit Option
B103 / B106
B103L/ B106L without ATT A300

ROHDE&SCHWARZ	Benennung / Designat.: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR			Spr.:/Lang.: de	Aei:/C.I.: 06.00	Blatt:/Sh.: 6 +
SMA100A	Datum: 12.08.10	Abteilung: HTEK	Name: EL	Zeichn.Nr.:/Drawing No.: 1400.0000.01 S		

STANDARD
SYNTHESE
A240
1141.4220.02
(1141.4208.02)

X249 REF1040
X248 REF VAR
X247 REF 100
X246 EXTREF IN
X245 EXTREF OUT
X241 to Motherboard A100-X24 Sheet 1
X244 SYNRF
X243 SYNEX OUT
X242 SYNEX IN

W249
W706 **
W267 *
W246
W245
W244

CWOP 3/6
A260
1400.1707.03/06

X264 OPU RF OUT
X263 OPU LO IN
X261 to Motherboard A100-X26 Sheet 1
X267 REFVAR DDS
X266 FM WIDE
X265 REFVAR OUT
X262 OPU RF IN

W302
W305 ***
W706 *

ATT 3/6
A300
1400.3400.03/06

X302 RF_IN
X303 RF_OUT
X301

W303 to FRONT PANEL RF OUT 50 Ohm Sheet 1
W301 30 to IF Board A340-X344 Sheet 1

CLOCK SYNTHESE
SMA-B29
A280
1400.2749.02
(1400.2703.02)

X282 CLKSYN OUT
X283 CLKSYN OUT_N
X284 REF104 IN
X285 REF104 OUT
X281

W282
W283
W285 to IF Board A340-X346 Sheet 1
W281 50 to IF Board A340-X377 Sheet 1

REF IN
REF OUT
CLK SYN
CLK SYN_N
REAR PANEL

mit Option
B103 / B106
B103L/ B106L without ATT A300
B29 CLKSYN

* = only B106/B106L
** = only B103/B103L
*** = only B103L/B106L

Bindende Angaben ueber Varianten, Trimmwerte, Bauteile und nicht bestueckte Bauteile siehe ST.

For binding information on models, trimming and components values and nonfitted components see parts list.

ACHTUNG: ESD!
Elektrostatisch gefaehrdete Bauelemente erfordern eine besondere Handhabung.
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ROHDE&SCHWARZ	Benennung / Designat.: SMA100A SIGNAL GENERATOR SIGNAL GENERATOR		Spr.:/Lang.: de	Aei:/C.I.: 06.00
SMA100A	Datum: 12.08.10	Abteilung: MTEK	Name: EI	Blatt:/Sh.: 7 -
			Zeichn.Nr.:/Drawing No.: 1400.0000.01 S	