R&S®ESU
EMI Test Receiver
Service Manual

1302.6163.82 – 04

Test and Measurement

Service Manual

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ROHDE&SCHWARZ

The Service Manual describes the following R&S®ESU models and options:

- R&S® ESU8 (1302.6005K08)
- R&S® ESU26 (1302.6005K26)
- R&S® ESU40 (1302.6005K40)

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

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

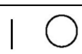
Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are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

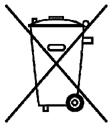
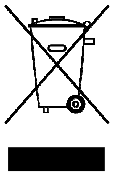
The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English.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

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

Safety labels on products

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

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

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

Signal words and their meaning

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

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 severity 2.
2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or even death.
3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or even death.

Electrical safety

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

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

6. The product may be operated only from TN/TT supply networks fuse-protected with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fuse protection, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

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

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

Repair and service

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

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

Batteries and rechargeable batteries/cells

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

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

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.
2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

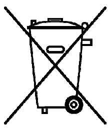
Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa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

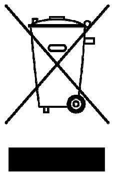
Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto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

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

Palabras de señal y su significado

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

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

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

Estados operativos y posiciones de funcionamiento

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

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.

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.

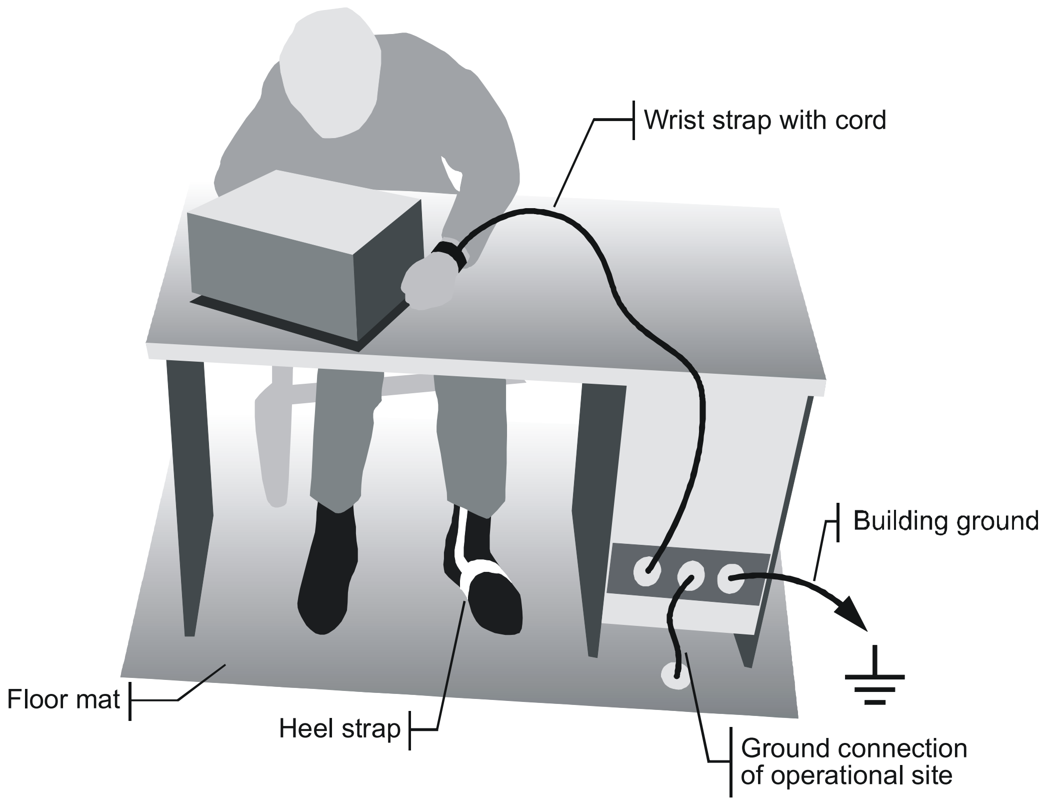
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

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:

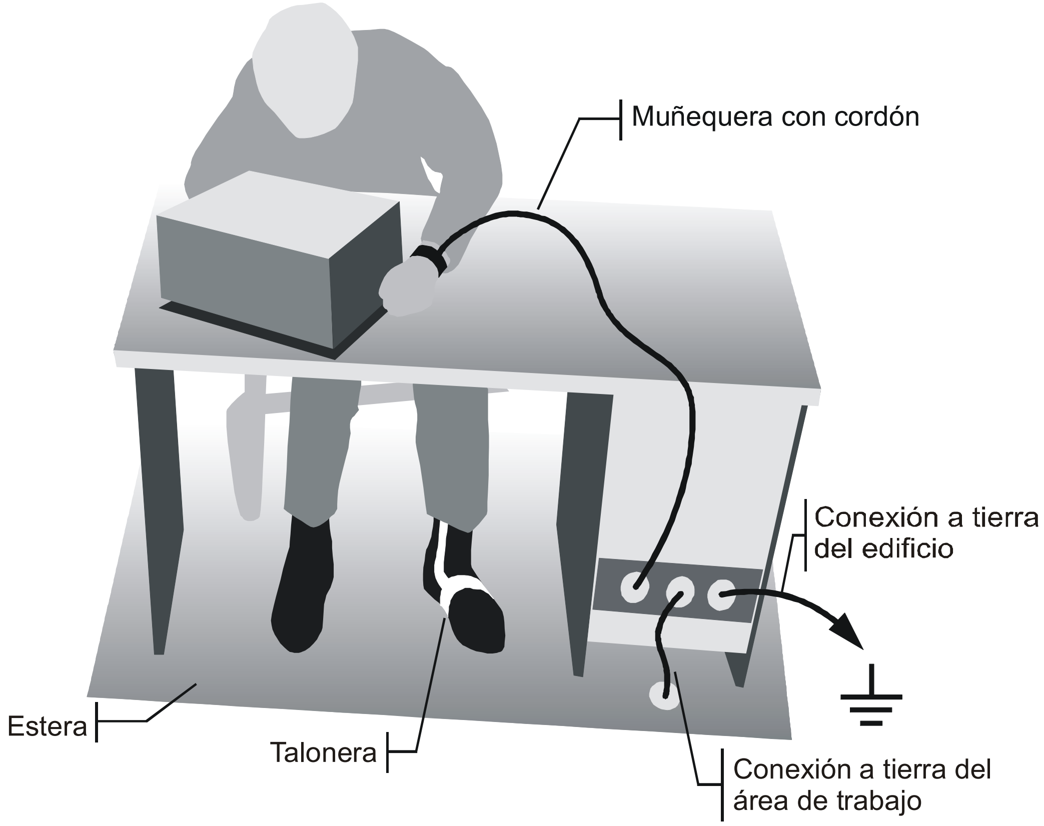
- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

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

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)

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1 Performance Test

1.1 Test Instructions

To ensure that rated specifications are maintained, the following preparations must be made prior to checking the rated characteristics.

- At least 15 minutes warm-up
- All internal adjustments must be carried out. The overall adjustment is performed in the CAL menu
  [CAL : CAL TOTAL].
- Restore the factory preset [FILE : STARTUP RECALL : FACTORY : ENTER].
- Select the Analyzer Preset [SETUP : NEXT : PRESET ANALYZER].
- Press [PRESET] to establish a defined initial state before configuring a new measurement.
- Unless specified otherwise, all measurements will be performed with external reference frequency.

In the following sections, the procedures for checking the rated specifications are described.
The data is given in the specification. The values must be extended by the tolerance of the measurement equipment used in this performance test.

Inputs for settings during measurements are shown as follows:

[<KEY>]	Press a key on the front panel, eg [SPAN]
[<SOFTKEY>]	Press a softkey, eg [MARKER -> PEAK]
[<nn unit>]	Enter a value and terminate by entering the unit, eg [12 kHz]

Successive entries are separated by [:], eg. [BW : RES BW MANUAL : 3 kHz]

1.2 Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
1	Frequency counter	frequency range up to 10 MHz resolution min. 9 digits accuracy < 1x10-9, < 1x10-9 with option FSU-B4	Advantest R5361B with option 23	HP 53132A with option 012 (Agilent)	Frequency accuracy of reference oscillator
2	Signal generator 2 units	ESU 8: 10 MHz to 8 GHz ESU 26: 10 MHz to 27 GHz ESU 40: 10 MHz to 40 GHz	R&S SMP02 R&S SMP03 R&S SMR50	HP 83650 B (Agilent)	Immunity to interference; Third-Order Intercept; Absolute level accuracy at 128 MHz; Frequency response

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
3	Signal generator	100 kHz to 3.6 GHz -30 dBm to +10 dBm harmonics < -30 dBc SSB phase noise at 639 MHz: < -130 dBc(1 Hz) @ 100 kHz < -143 dBc(1 Hz) @ 1 MH	R&S SMHU	HP 8664 A OPT 004 (Agilent)	2nd-Order harmonic distortion; IF Filters; Display linearity; RF attenuator accuracy; Reference level switching; Frequency response; Phase noise (only if used as alternative to item 5)
4	Signal generator	10 MHz to 2.5 GHz -62 dBm to +16 dBm harmonics up to +16 dBm: <-25 dBc SSB phase noise at 639 MHz: < -100 dBc(1 Hz) @ 100 Hz < -115 dBc(1 Hz) @ 1 kHz < -127 dBc(1 Hz) @ 10 kHz		HP 8663 A (Agilent)	Display linearity; RF attenuator accuracy; Reference level switching accuracy (alternative measurement); Phase noise (only if used as alternative to item 5)
5	640 MHz signal source	low-noise signal source for 640 MHz from FSU with synthesizer 1166.2209.02	R&S FSU with option B5		B5 option for the FSU for testing phase noise at 640 MHz
6	Signal source	low-noise signal source for 800 MHz	REFSYN		Phase noise (alternative to item 2, 4 or item 5)
7	Power splitter 2-resistor design	DC to 3.6 GHz equivalent output SWR 10 MHz to 3.6 GHz <1.10	HP 11667 A		Frequency response <3.6 GHz; Display linearity; RF attenuator accuracy; Reference level switching accuracy;
8	Power splitter 2-resistor design	ESU 8: 10 MHz to 8 GHz ESU 26: 10 MHz to 26.5 GHz ESU 40: 10 MHz to 40 GHz level imbalance 3.6 GHz to 8 GHz ≤ 0.3 dB 8 GHz to 22 GHz ≤ 0.4 dB 22 GHz to 40 GHz ≤ 0.5 dB equivalent output SWR 3.6 GHz to 8 GHz ≤ 1.3 8 GHz to 22 GHz ≤ 1.4 22 GHz to 40 GHz ≤ 1.5	HP 11667B (Agilent) HP 11667C + adapter to K (Agilent)		Frequency response >3.6 GHz; Third-Order Intercept
9	50-Ohm termination	ESU 8: 10 MHz to 8 GHz ESU 26: 10 MHz to 26.5 GHz ESU 40: 10 MHz to 40 GHz	R&S RNA Wiltron 28S50 85138A (Agilent)	85138A (Agilent)	Noise display

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
10	Power meter	Dual channel -30 dBm to +10 dBm Instrumentation uncertainty<0.5%	R&S NRVD	HP 483A (Agilent)	Frequency response Absolute level accuracy at 128 MHz; Display Linearity
11	Power sensor 2 units	10 MHz to 3.6 GHz -30 dBm to 0 dBm RSS ≤ 0.8 % Meter noise ≤ 20 pW	R&S NRV-Z4 or R&S NRV-Z5	HP 8482 A (Agilent)	Absolute level accuracy at 128 MHz; Frequency response < 3.6 GHz; Display linearity;
12	Power sensor	ESU 8: 3.6 GHz to 8 GHz ESU 26: 3.6 GHz to 26 GHz ESU 40: 10 MHz to 40 GHz -30 to 0 dBm VSWR / cal unc. % / fact. 50 to 128 MHz 1.15 1.6 3.6 to 8 GHz 1.15 2 8 to 22 GHz 1.25 2.5 22 to 40 GHz 1.35 3	R&S NRV-Z2 R&S NRV-Z55 R&S NRV-Z55	HP 8487 A (Agilent)	Frequency response > 3.6 GHz
13	Step attenuator	variable attenuation 0 dB to 100 dB, 1-dB steps attenuation accuracy < 0.1 dB (f = 5 MHz)	R&S RSP		Reference level switching, Display linearity, RF attenuator
14	Step attenuator	variable attenuation 0 dB to 30 dB in 10 dB steps 30 MHz VSWR <1.5	R&S RSP	HP 8496B/H (Agilent)	Display Linearity (alternative measurement);
15	Precision Step Attenuator	0 dB to 30 dB, 10 dB steps insertion loss at 0dB 20 dB nominal Accuracy at 30 MHz charted Limit of uncertainty: ±(0.005 dB + 0.005 dB / 10 dB step)	R&S FSMR-Z2	Verification Kit Attenuator HP 11812 A (Agilent)	Display Linearity (alternative measurement)
16	Fixed Attenuator (2 units)	fixed attenuation 10 dB	43KC-10 (Anritsu	8490D-010 (Agilent)	Third-Order Intercept
17	Fixed Attenuator	fixed attenuation 3 dB	43KC-3 (Anritsu)	HP 8491B (Agilent)	RF attenuator accuracy; Reference level switching accuracy (alternative measurement);
18	Low pass filter set [1]	Filter 1 cut-off >40 MHz rejection >35 dB at 80 MHz Filter 2 cut-off >290 MHz		HP 0955-0306 HP 0955-0455	2 nd--order harmonic distortion.

[1] if the harmonic suppression of the signal generator is sufficient, the low pass is not needed

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
		rejection >35 dB at 580 MHz Filter 3 cut-off >1800 MHz rejection >35 dB at 3600 MHz		HP 0955-0491 (Agilent)	
19	Measuring Receiver	Range -68 to +2 dBm / 128 MHz Relative Accuracy (RSS): ±0.09 dB within -10 dB to +60 dB from set reference at -58 dBm TAR = 2.2 : 1 ±0.075 dB within -50 dB to +10 dB from set reference at -8 dBm TAR = 2.0 : 1	R&S FSMR 3	HP 8902 (Agilent)	RF Attenuator Accuracy; Reference Level Switching Accuracy (alternative measurement);
20	VSWR-Bridge	directivity >30 dB 9 kHz to 20 (50) MHz	R&S ZRC		VSWR < 20 (50) MHz
21	Power sensor	100 kHz to 3.6 GHz -70 dBm to 0 dBm RSS ≤ 0.8 % Meter noise ≤ 20 pW	R&S NRV-Z4		VSWR < 20 (50) MHz
22	Network Analyzer	9 kHz to 20 (50) MHz	R&S ZVR	HP 3577 A (Agilent)	VSWR < 20 (50) MHz (alternative to item 20, 21)
23	Network Analyzer	ESU 8: 20 (50) MHz to 8 GHz ESU 26: 20 (50) MHz to 26.5 GHz ESU 40: 20 (50) MHz to 40 GHz	R&S ZVK	HP 8722C E8363B (Agilent)	VSWR > 20 (50) MHz
24	CISPR pulse generator	CISPR bands A, B, C/D level at frequency f 101 kHz: >114,6 dBµV/MHz 1.1 MHz: >80 dBµV/MHz 128 MHz: >80 dBµV/MHz	Schwarzbeck IGLK2914 / IGU2912 or IGUU 2916/2918		Checking the Detectors with Pulses
25	Attenuator	Fixed attenuation 10 dB, 9 kHz to 1 GHz, Pulse loading capacity > 200 W/10µs, max. 150 V			Checking the Detectors with Pulses
26	Arbitrary waveform / function generator	Frequency range up to 10 MHz 2 sinusoidal signals with 90 deg phase difference,	R&S ADS	33220A with option 001 (Agilent) (2 units)	Checking the Detectors with Pulses B9: test of modulation
27	Volt meter (2 units)	DC and AC voltage	R&S URE02/03	34401A (Agilent)	B9: test of modulation
28	N cable	attenuation< 0.2 dB up to 3.6 GHz			B9/B12: test of output level
29	Spectrum Analyzer	Frequency range up to 3,6 GHz, nonlinearity < 0.1 dB	R&S FSU see also item 5		Checking pulse levels, B9: test of modulation

1.3 Performance Test R&S ESU

1.3.1 Checking the Reference Frequency Accuracy

Preparation: The measurement can be performed either with a signal generator on the RF INPUT connector (front panel) at 1 GHz or on the EXT REF OUT connector (rear panel) at 10 MHz with a frequency counter.
For adjustment, the R&S ESU must be switched to an internal reference source.

To speed up the measurements, a lower frequency counter resolution can be used for the measurement at 3 GHz.

Measurement with Generator:

Test equipment: Signal generator (Section "Measurement Equipment", item. 2):

Frequency	e.g. 3000 MHz
Level	-20 dBm
Frequency accuracy	$<1x10^{-9}$

If the frequency accuracy of the test transmitter is insufficient, the transmitter can be set to the correct frequency with the aid of the frequency counter prior to the measurement.

Test setup: ► Connect RF output of the signal generator to RF input 1 of the R&S ESU.

R&S ESU settings:
- [**PRESET**]
- [**FREQ** : CENTER : **3 GHz**]
- [**SPAN** : **1 MHz**]
- [**BW** : RES BW MANUAL : **300 kHz]**
- [**AMPT** : REF LEVEL : **-8 dBm**]
- [**AMPT** : RF ATTEN AUTO]
- [**SETUP** : REFERENCE INT / EXT]

► Switch to an internal reference source (INT)

Before the following measurement, the R&S ESU must be on for at least ten minutes with an internal reference, so that the reference oscillator is warmed up.

Measurement:
► Switch marker frequency count:
- [**MKR** : SIGNAL COUNT]

► Set the appropriate resolution:
- [**MKR : NEXT** : CNT RESOL 1 HZ

Model without B4	3 GHz ± 30 Hz (corresponds to 1E-7)
Model with B4	3 GHz ± 10 Hz (corresponds to 0.35E-7)

Measurement with Frequency Counter:

Test equipment: Frequency counter (Section "Measurement Equipment", item 1):
Accuracy < $1x10^{-9}$
Frequency range up to 10 MHz

Test setup: ► Connect frequency counter to 10-MHz reference output of the R&S ESU (rear panel)

R&S ESU settings: - [**SETUP** : REFERENCE INT / EXT]
Toggle to internal reference (INT)

Measurement: Measure frequency with frequency counter

Nominal frequency:
Model without option B4 10 MHz ± 1 Hz
Model with option B4 10 MHz ± 0.3Hz

The frequency of the reference oscillator can be adjusted by means of a service function (see chapter "Adjustment")

1.3.2 Checking Immunity to Interference

Test equipment: Signal generator (Section "Measurement Equipment", item 2):
Frequency range R&S ESU 8: 10 MHz to 13 GHz
R&S ESU 26: 10 MHz to 27 GHz
R&S ESU 40: 10 MHz to 40 GHz
maximum level ≥ 0 dBm

Test setup: ► Connect RF output of the signal generator to RF input 1.

Signal generator settings: Level:adjust the output level of signal generator for an RF-Input level of 0 dBm.

R&S ESU settings: - [**PRESET**]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : REF LEVEL : **-30 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]

1.3.2.1 1st IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 9256.8 MHz

Additional R&S ESU settings: - [**FREQ** : CENTER : {f_{in}}]
See table of performance test report for values of f_{in}

Measurement: ► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker.

1 (L_{dis}):Image frequency rejection = 0dBm – L_{dis}

1.3.2.2 2nd IF Image Frequency Rejection

Additional signal generator settings: - Frequency f_{in} + 808.8 MHz

Additional R&S ESU settings: - [**FREQ** : CENTER : {f_{in}}]
See table of performance test report for values of f_{in}.

Measurement:
► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

Image frequency rejection = 0 dBm – L_{dis}

1.3.2.3 3rd IF Image Frequency Rejection

Additional signal generator settings: - F requency f_{in} + 40.8 MHz

Additional R&S ESU settings: - [**FREQ** : CENTER : {f_{in}}]
See table of performance test report for values of f_{in}.

Measurement:
► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The image frequency rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

Image frequency rejection = 0dBm – L_{dis}

1.3.2.4 1st IF Rejection

Additional signal generator settings: - Frequency 4628.4 MHz

Additional R&S ESU settings: - [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}.

Measurement:
► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}):

IF rejection = 0dBm – L_{dis}

1.3.2.5 2^{nd} IF Rejection

Additional signal generator settings:	- Frequency +/- 808.8 MHz see table "performance test report" for explanation of "+/-"
Additional R&S ESU settings:	- [**FREQ** : CENTER : {f_{in}}] See table of performance test report for values of f_{in}.
Measurement:	► Set marker to peak of signal - [**MKR** ⇒ : PEAK]
Evaluation:	The IF rejection is the difference between the output level of the signal generator and the level reading of marker 1 (L_{dis}): IF rejection = 0dBm – L_{dis}

1.3.3 Checking Nonlinearities

1.3.3.1 Third-Order Intercept Point

Test equipment:

- 2 signal generators (Section "Measurement Equipment", item 2)
  Frequency range:
  R&S ESU 8: 10 MHz to 8 GHz
  R&S ESU 26: 10 MHz to 27 GHz
  R&S ESU 40: 10 MHz to 40 GHz
- 2 attenuators (Section "Measurement Equipment", item 16)
  Attenuation aATT = 10 dB
  Frequency range:
  R&S ESU 8: 10 MHz to 8 GHz
  R&S ESU 26: 10 MHz to 26.5 GHz
  R&S ESU 40: 10 MHz to 40 GHz
- Power splitter/combiner (Section "Measurement Equipment", item 8)
  Frequency range:
  R&S ESU 8: 10 MHz to 8 GHz
  R&S ESU 26: 10 MHz to 26.5 GHz
  R&S ESU 40: 10 MHz to 40 GHz

Third-Order Intercept Point without preselection without preamplifier

Test setup:

► Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the combiner.
► Connect output of the combiner to the RF input 1 of the R&S ESU.

Signal generator settings: (both generators)

- Frequency: generator 1 $f_{g1} = f_{in} – 50$ kHz
  generator 2 $f_{g2} = f_{in} + 50$ kHz
  See table of performance test report for values of f_{in}

► Adjust the output level of the signal generators for an input level at the R&S ESU of –10 dBm.
► Switch off the ALC of the generators to reduce the interference between the

generators.

R&S ESU settings:

- [**PRESET**]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}

Measurement - [**MKR FCTN** : TOI]

Evaluation: The third order intercept point (T.O.I) referred to the input signal is displayed in the marker field by the reading [TOI].

If the input signal is exactly known, the level of the spurious products can alternatively be measured in a span of 20 kHz, for example.
The TOI is then calculated from the average of the two spurious signals and the average of the two useful signals

Third-Order Intercept Point with preselection without preamplifier

Signal generator settings: (both generators)

- Frequency: generator 1 $f_{g1} = f_{in} – 50$ kHz
  generator 2 $f_{g2} = f_{in} + 50$ kHz

  See table of performance test report for values of f_{in}

► Adjust the output level of the signal generators for an input level at the R&S ESU of –10 dBm.

► Switch off the ALC of the generators to reduce the interference between the generators

R&S ESU settings:

- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]

See table of performance test report for values of f_{in}

Measurement - [**MKR FCTN** : TOI]

Evaluation: The third order intercept point (T.O.I) referred to the input signal is displayed in the marker field by the reading [TOI].

If the input signal is exactly known, the level of the spurious products can alternatively be measured in a span of 20 kHz, for example.
The TOI is then calculated from the average of the two spurious signals and the average of the two useful signals

Third-Order Intercept Point with preselection and preamplifier

Signal generator settings:(both generators)

- Frequency: generator 1 $f_{g1} = f_{in} - 50$ kHz
  generator 2 $f_{g2} = f_{in} + 50$ kHz
  See table of performance test report for values of f_{in}

► Adjust the output level of the signal generators for an input level at the R&S ESU of –10 dBm.
► Switch off the ALC of the generators to reduce the interference between the generators.

R&S ESU settings:

- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**SETUP** : PREAMP :PREAMP ON]
- [**AMPT** : RF ATTEN MANUAL : **20 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **500 kHz**]
- [**BW** : RES BW MANUAL : **3 kHz**]
- [**FREQ** : CENTER : {f_{in}}]
  See table of performance test report for values of f_{in}

Measurement

- [**MKR FCTN** : TOI]

Evaluation: The third order intercept point (T.O.I) referred to the input signal is displayed in the marker field by the reading [TOI] – 20 dB.

If the input signal is exactly known, the level of the spurious products can alternatively be measured in a span of 20 kHz, for example.
The TOI is then calculated from the average of the two spurious signals and the average of the two useful signals

1.3.3.2 Second-Order Harmonic Distortion

Test equipment: Signal generator (Section "Measurement Equipment", item 3)
Frequency range: 9 kHz to 1.8 GHz

Recommended harmonic suppression:
f <100 MHz : >35 dBc
100 MHz < f < 1 GHz : >45 dBc
f >1 GHz : >35 dBc

In order to improve the harmonic suppression of the generator it is recommended to insert a low pass filter with a suitable cut-off frequency (Section "Measurement Equipment", item 18) after the generator.

Test setup:

► Connect RF output of signal generator to the input of the low pass
► Connect the output of the low pass to the RF input 1 of the R&S ESU.

Note:
If the harmonic suppression of the signal generator is sufficient, the low pass can be left out.
The RF output of the generator can be connected directly to the RF input of the R&S ESU in this case.

Second-Order Harmonic Distortion without preselection without preamplifier

Signal generator settings:
- Level: -5 dBm
- Frequency: f_{in}
  see table of performance test report for values of f_{in}

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **3 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**FREQ :** CENTER : { f_{in} }]
  See table of performance test report for values of f_{in}

Measurement:

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The level of the input signal L_{IN} is displayed by the marker reading for marker 1.

► Set center frequency of the R&S ESU to the frequency of the 2nd harmonic
- [**FREQ** : CENTER : {2 x f_{in}}]

Measurement:

► Set marker to peak of the 2nd harmonic
- [**MKR** ⇒ : PEAK]

The level of the harmonic signal L_{K2} is displayed by the marker reading for marker 1.

Evaluation: The second order harmonic distortion can be calculated as

$$IP_{k2} \,/\, \mathrm{dBm} = (L_{IN} - L_{K2}) + L_{IN}$$

Second-Order Harmonic Distortion with preselection without preamplifier

Signal generator settings:
- Level: -5 dBm
- Frequency: f_{in}
  see table of performance test report for values of f_{in}

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **3 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**FREQ :** CENTER : { f_{in} }]
  See table of performance test report for values of f_{in}

Measurement:

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

The level of the input signal L_{IN} is displayed by the marker reading for marker 1.

► Set center frequency of the R&S ESU to the frequency of the 2nd harmonic
- [**FREQ** : CENTER : {2 x f_{in}}]

Measurement: ► Set marker to peak of the 2nd harmonic- [MKR ⇒ : PEAK]

The level of the harmonic signal L_{K2} is displayed by the marker reading for marker 1.

Evaluation: The second order harmonic distortion can be calculated as

$$IP_{k2} / dBm = (L_{IN} - L_{K2}) + L_{IN}$$

Second-Order Harmonic Distortion with preselection and preamplifier

Signal generator settings:
- Level: -5 dBm
- Frequency: f_{in}
  see table of performance test report for values of f_{in}

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**SETUP** : PREAMP : PREAMP ON]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **20 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **3 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**FREQ :** CENTER : { f_{in} }]
  See table of performance test report for values of f_{in}

Measurement: ► Set marker to peak of signal
- [**MKR ⇒** : PEAK]

The level of the input signal L_{IN} is displayed by the marker reading for marker 1.

► Set center frequency of the R&S ESU to the frequency of the 2nd harmonic
- [**FREQ** : CENTER : {2 x f_{in}}]

Measurement: ► Set marker to peak of the 2nd harmonic
- [**MKR ⇒** : PEAK]

The level of the harmonic signal L_{K2} is displayed by the marker reading for marker 1.

Evaluation: The second order harmonic distortion can be calculated as

$$IP_{k2} / dBm = (L_{IN} - L_{K2}) + (L_{IN} – 20 dB)$$

1.3.4 Checking IF Filters

Test equipment: Signal generator (Section "Measurement Equipment", item 3):
Frequency 128 MHz
Level ≥ 0 dBm

Test setup: ► Connect RF output of the signal generator to the RF input 1 of the R&S ESU.

1.3.4.1 Checking the bandwidth switching level accuracy

Reference measurement (RBW 10 kHz)

Signal generator settings:
- Frequency: 128 MHz
- Level: -30 dBm

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : **-30 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **5 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : RBW MANUAL : **10** : **kHz**]

Reference measurement:
- ► Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ► Set reference to peak of signal
  - [**MKR** : REFERENCE FIXED]

Checking the level accuracy

R&S ESU settings:
- [**SPAN** : {0.5 x RBW}]
- [**BW** : RBW MANUAL : {RBW} : **ENTER**]

3-dB bandwidth

Measurement:
- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]

Evaluation: The level difference is displayed in the marker field by the reading ´Delta [T1 FXD] {xxx} dB´.

6-dB bandwidth

R&S ESU settings:
- [**SPAN** : {0.5 x RBW}]
- [**BW** : FILTER TYPE : EMI (6 dB)]
- [**BW** : RBW MANUAL : {RBW} : **ENTER**]

Measurement:
- ► Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]

Evaluation: The level difference is displayed in the marker field by the reading ´Delta [T1 FXD] {xxx} dB´.

FFT bandwidth

R&S ESU settings:
- [**SPAN** : {0.5 x RBW}]
- [**BW** : FILTER TYPE : FFT]
- [**BW** : RBW MANUAL : {RBW} : **ENTER**]

1.3.4.2 Checking Bandwidth (3 dB)

Signal generator settings:
- Frequency: 128 MHz
- Level: -10 dBm

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **3** : **ENTER**]

3-dB bandwidth

Determine 3-dB-Bandwith
- [**MKR FCTN** : N DB DOWN : **3 dB**]
- [**SPAN** : {3 x RBW}]
  See table of performance test report for values of RBW.

Note:
To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.

- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5or 10 MHz

Measurement:
- [**MKR ⇒** : PEAK]
The 3 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

1.3.4.3 Checking the Shape Factor

To check the shape factor the values of the 3 dB bandwidth will be needed. Please check before this measurement.

Signal generator settings:
- Frequency: 128 MHz
- Level: 0 dBm

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **20 ENTER**]

3 dB bandwidth

Determine 60-dB-bandwidth
- [**BW** : COUPLING RATIO : RBW/VBW NOISE [10]]
- [**MKR FCTN** : N DB DOWN : **60 dB**]
- [**SPAN** : {20 x RBW}]
  See table of performance test report for values of RBW.

Note:
To check the filters > 3 MHz, the resolution bandwidth has to be set manually to X MHz. All other bandwidths will be set automatically by changing the span.

- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5 or 10 MHz

Measurement:
- [**MKR ⇒** : PEAK]
The 60 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Evaluation: The shape factor is calculated by BW (60dB) / BW (3dB).

1.3.4.4 Checking Bandwidth (6 dB)

6-dB bandwidth

- [**PRESET**]
- [**SWEEP** : SWEEPTIME MANUAL : 200 ms]
  500 ms at RBW 100 Hz
  5 s at RBW 10 Hz
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]

- [**BW** : FILTER TYPE : EMI (6 dB)]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **3** : **ENTER**]

► Determine 6 dB bandwidth
  - [**MKR FCTN** : N DB DOWN : **6 dB**]
  - [**SPAN** : {3 x RBW}]
  See table of performance test report for values of RBW.

Measurement: - [MKR ⇒ : PEAK]
The 6 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

1.3.4.5 Checking the Overall Selectivity

Signal generator settings:
- Frequency: 128 MHz
- Level: 0 dBm

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : FILTER TYPE : EMI (6 dB)]
- [**BW** : COUPLING RATIO : RBW/VBW NOISE [10]]
- [**SWEEP** : SWEEP TIME MANUAL : **1 s**]

- [**BW** : RES BW MANUAL : **{RBW}**]
- [**SPAN** : {SPAN}]
  See table of performance test report for values of RBW and SPAN.

Measurement:
- [**MKR ⇒** : PEAK]
- [**MKR** : MARKER 2]

Evaluation: Check the filter response with the markers versus tolerance mask.

1.3.4.6 Checking the Shape Factor (6 dB)

Note:
To check the shape factor the values of the 6 dB bandwidth will be needed. Please check before this measurement.

Signal generator settings:
- Frequency: 128 MHz
- Level: 0 dBm

R&S ESU settings:
- [**PRESET**]
- [**SWEEP** : SWEEPTIME MANUAL : 500 ms]
  500 ms at RBW 100 Hz
  5 s at RBW 10 Hz
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** : CENTER : **128 MHz**]
- [**BW** : FILTER TYPE : EMI (6 dB)]
- [**BW** : COUPLING RATIO : SPAN/RBW MANUAL : **20 ENTER**]
- [**BW** : COUPLING RATIO : RBW/VBW NOISE [10]]

► Determine 60 dB bandwidth
- [**MKR FCTN** : N DB DOWN : **60 dB**]
- [**SPAN** : {20 x RBW}
  See table of performance test report for values of RBW and SPAN.

Measurement:
- [MKR ⇒ : PEAK]
The 60 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Evaluation: The shape factor is calculated by BW (60dB) / BW (6dB).

► Checking Noise Display

Test equipment: 50 Ω termination (Section "Measurement Equipment", item 9)
Frequency range:

R&S ESU 8:	DC to 8 GHz
R&S ESU 26:	DC to 26.5 GHz
R&S ESU 40:	DC to 40 GHz

Test setup: ► Terminate the RF input 1of the R&S ESU with 50 □

R&S ESU settings:
1. Measurement for $f_n \leq$ 1 kHz(only without preselection):
- [**PRESET**]
- [**SETUP** : PRESEL {state}]
- [**SETUP** : PREAMP : PREAMP {state}]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **10 Hz**]
- [**BW** : BW MODE : **FFT**]

- [**BW** : RES BW MANUAL : **10 Hz**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]
  See table below for values of RefLev.

2. Measurement for f_n >1 kHz (f_n >100 Hz with preselection) :
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [SPAN : 0 Hz]

- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : SWEEP TIME MANUAL : **50 ms**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]
- [**MEAS** : Time Dom Power : **Mean**]

See table of performance test report for values of f_n and state of preselector and preamplifier.

Measurement:

► Set the marker to the center frequency for the value below or equal 1 kHz.
► Read out the mean marker for frequencies above 1 kHz and correct the measurement value by –20 dB for the ratio of 10 Hz / 1 kHz .

Note:
For example the DANL in 1 kHz bandwidth –126 dBm results in a corrected value of –156 dBm in 1 Hz bandwidth.
As both filter designs are digitally and using the same hardware setting, the DANL can be measured also with 1 kHz bandwidth to reduce measurement time.

Evaluation: The noise level is displayed by the level reading of marker 1.

Frequency	< 10kHz	< 100kHz	< 1MHz	< 10MHz	> 10MHz
RefLev	-10 dBm	-20 dBm	-30 dBm	-60 dBm	-60 dBm

1.3.5 Checking the Level accuracy and the Frequency Response

Test equipment:

- Signal Generator (Section "Measurement Equipment", item 3)
  - Frequency range 100 kHz to 3.6 GHz
  - Maximum level ≥ 0 dBm
- Signal Generator (Section "Measurement Equipment", item 2)
  - Frequency range:
    - R&S ESU 8 10 MHz to 8 GHz
    - R&S ESU 26 10 MHz to 26.5 GHz
    - R&S ESU 40 10 MHz to 40 GHz
  - Maximum level ≥ 0 dBm
- Power Meter (Section "Measurement Equipment", item 10)
  - Dual Channel
  - Power range -30 to 0 dBm
  - Instrumentation uncertainty <0.5%
  - Uncertainty of power reference <1.2%
  - VSWR of power reference <1.10
- Power Sensor (Section "Measurement Equipment", item 11 (2x))
  - Frequency range 100 kHz to 3.6 GHz

Power range	-30 to 0 dBm	
Cal factor uncertainty	1 MHz to 3.6 GHz	<1.6 %
VSWR	1 MHz to 3.6 GHz	<1.30
	50 MHz to 128 MHz	<1.10

- Power Sensor (Section "Measurement Equipment", item 12)

Frequency range:		
R&S ESU 8	50 MHz to 8 GHz	
R&S ESU 26	50 MHz to 26.5 GHz	
R&S ESU 40	50 MHz to 40 GHz	
Power range	-30 to 0 dBm	
Cal factor uncertainty	50 to 128 MHz	<1.6 %
	3.6 to 8 GHz	<2 %
	8 to 22 GHz	<2.5 %
	22 to 40 GHz	<3 %
VSWR	50 to 128 MHz	<1.15
	3.6 to 8 GHz	<1.15
	8 to 22 GHz	<1.25
	22 to 40 GHz	<1.35

- 6 dB Power Splitter (Section "Measurement Equipment", item 7)

Frequency range	DC to 3.6 GHz	
Level imbalance	10 MHz to 3.6 GHz	n/a
Equivalent output VSWR	10 MHz to 3.6 GHz	≤ 1.1

- 6 dB Power Splitter (Section "Measurement Equipment", item 8)

Frequency range:		
R&S ESU 8	DC to 8 GHz	
R&S ESU 26	DC to 26.5 GHz	
R&S ESU 40	DC to 40 GHz	
Level imbalance	3.6 to 8 GHz	≤ 0.3 dB
	8 to 22 GHz	≤ 0.4 dB
	22 to 40 GHz	≤ 0.5 dB
Equivalent output VSWR	3.6 to 8 GHz	≤ 1.3
	8 to 22 GHz	≤ 1.4
	22 to 40 GHz	≤ 1.5

1.3.5.1 Absolute level accuracy at 128 MHz

Test setup:

- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 128 MHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal Generator settings:

- Frequency 128 MHz
- Level -10 dBm

Measurement:

- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.

RF input 1 without preselection

Measurement:

- ► Connect the cable to RF input 1 of the R&S ESU

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated as:

Level $\text{accuracy}_{128MHz} = L_{ESU} - L_{powermeter}$

RF input 1 with preselection without preamplifier

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated as:

Level $\text{accuracy}_{128MHz} = L_{ESU} - L_{powermeter}$

RF input 1 with preselection with preamplifier

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**SETUP** : PREAMP : PREAMP ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **-10 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated as:

$\text{Level accuracy}_{128MHz} = L_{ESU} - L_{powermeter}$

RF input 2 without preselection

Measurement: Connect the cable to RF input 2 of the R&S ESU

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF INPUT 2]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated as:

$\text{Level accuracy}_{128MHz} = L_{ESU} - L_{powermeter}$

RF input 2 with preselection without preamplifier

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**AMPT** : RF INPUT 2]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation: The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated as:

$\text{Level accuracy}_{128MHz} = L_{ESU} - L_{powermeter}$

RF input 2 with preselection with preamplifier

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**SETUP** : PREAMP : PREAMP ON]
- [**AMPT** : RF INPUT 2]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **-10 dBm**]

- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK

Evaluation:

The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated as:

Level $accuracy_{128MHz} = L_{ESU} - L_{powermeter}$

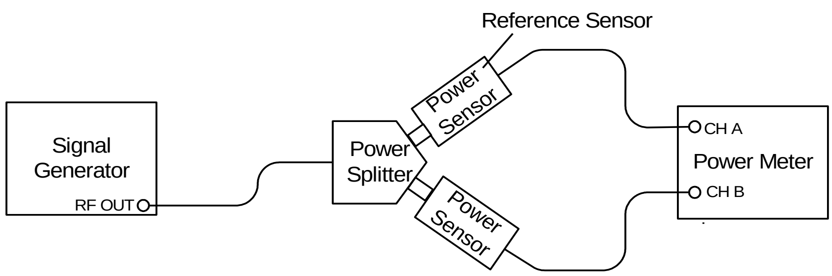
1.3.5.2 Frequency response < 3.6 GHz

Power splitter calibration

This section can be skipped, if a power splitter with a level imbalance <0.1 dB is available.

Test setup:

► Standardize the Power Meter and both Power Sensors (item 10, 11).
► Use Power Splitter (item) and connect equipment as shown below.



Signal Generator settings:

- Level 0 dBm

Measurement:

a) Set the Signal Generator frequency to the first value listed in the table below.

b) Set the Power Meter Channel A Cal Factor to the appropriate value for the Power Sensor for the first frequency listed in the table below (Reference Sensor).

c) Set the Power Meter Channel B CAL Factor to 100%.

d) Calculate the Power Splitter imbalance as
Imbalance / dB = LCHA / dBm - LCHB / dBm
(LCHA = Reference Sensor

e) Record the calculated value in the table below.

Repeat steps a), b), d), e) for the remaining frequencies listed in the table below.

Power Splitter calibration data	Applied frequency (f_{fresp})	Imbalance / dB
	100 kHz	_______
	1 MHz	_______
	10 MHz	_______
	50 MHz	_______
	100 MHz	_______
	128 MHz	_______
	200 MHz	_______
	300 MHz	_______
	400 MHz	_______
	500 MHz	_______
	600 MHz	_______
	700 MHz	_______
	800 MHz	_______
	900 MHz	_______
	1000 MHz	_______
	1500 MHz	_______
	2000 MHz	_______
	2500 MHz	_______
	3000 MHz	_______
	3599 MHz	_______

RF input 1 without preselection

Reference Measurement

Test setup:
- ► Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ► Connect the open port of the Power Splitter directly to the RF input 1 of the R&S ESU.

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ► Set marker to peak of signal
  - [**MKR ⇒** : PEAK]
- ► Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation: ▶ Calculate
ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
Take value of Imbalance(128 MHz) from the table above.
▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings: - Frequency f_{fresp}
See table in performance test report for values of $f_{fresp.}$

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}
▶ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]
▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation: ▶ The frequency response can be calculated as:
▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
▶ Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

RF input 1 with preselection without preamplifier

Reference Measurement

Test setup: ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
▶ Connect the open port of the Power Splitter directly to the RF input 1 of the R&S ESU.

Signal Generator settings: - Level 0 dBm
- Frequency 128 MHz

R&S ESU settings: - [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings: ▶ Set marker to peak of signal
- [**MKR** ⇒ : PEAK]
▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings:
- Frequency f_{fresp}

See table in performance test report for values of f_{fresp}.

R&S ESU settings:
- [**FREQ** : CENTER : {f_{fresp}}]

See table in performance test report for values of f_{fresp}

- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
- ▶ Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

RF input 1 with preselection and preamplifier

Reference Measurement

Test setup:
- ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ▶ Connect the open port of the Power Splitter directly to the RF input 1 of the R&S ESU.

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**SETUP** : PREAMP : PREAMP ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings: - Frequency f_{fresp}
See table in performance test report for values of f_{fresp}.

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
- ▶ Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

RF input 2 without preselection

Reference Measurement

Test setup:
- ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ▶ Connect the open port of the Power Splitter directly to the RF input 2 of the R&S ESU.

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator - Frequency f_{fresp}

settings: See table in performance test report for values of f_{fresp}.

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]

See table in performance test report for values of f_{fresp}

- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
- ▶ Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

RF input 2 with preselection without preamplifier

Reference Measurement

Test setup:

- ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ▶ Connect the open port of the Power Splitter directly to the RF input 2 of the R&S ESU.

Signal Generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:

- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:

- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:

- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings:

- Frequency f_{fresp}

See table in performance test report for values of f_{fresp}.

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
  Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
  Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

RF input 2 with preselection and preamplifier

Reference Measurement

Test setup:
- ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ▶ Connect the open port of the Power Splitter directly to the RF input 1 of the R&S ESU.

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**SETUP** : PREAMP : PREAMP ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings:
- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}.

R&S ESU settings: - [FREQ : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

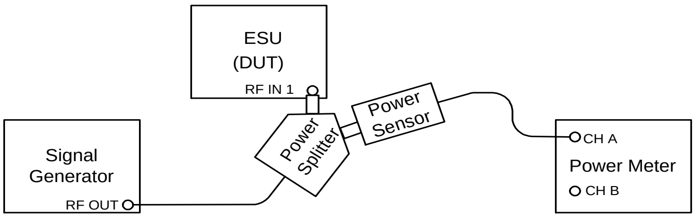
- ▶ Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
- ▶ Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

Frequency response > 3.6 GHz

Test setup:
- ▶ Standardize the Power Meter and Power Sensor (item 10, 12).
- ▶ Use Power Splitter/Combiner (item 8) and connect equipment as shown below.
- ▶ Connect the power splitter directly to the R&S ESU RF input 1.



Note:
Throughout the remaining steps set the Power Meter Cal Factor as appropriate!

Reference Measurement

Signal Generator settings:	- Level	0 dBm
	- Frequency	128 MHz

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings:
- Frequency f_{fresp}
  See table in performance test report for values of f_{fresp}

R&S ESU settings:
- [**FREQ** : CENTER : {f_{fresp}}]
  See table in performance test report for values of f_{fresp}

▶ Set marker to peak of signal
  - [**MKR ⇒** : PEAK]
▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
▶ The frequency response can be calculated as:
▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - ΔRef / dB
▶ Take the value of ΔRef as ascertained before.

RF input 1 with preselection without preamplifier

Reference Measurement

Test setup:
▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
▶ Connect the open port of the Power Splitter directly to the RF input 1 of the R&S ESU.

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
▶ Set marker to peak of signal
  - [**MKR ⇒** : PEAK]
▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings:
- Frequency f_{fresp}
  See table in performance test report for values of f_{fresp}.

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
- ▶ Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

RF input 1 with preselection and preamplifier

Reference Measurement

Test setup:
- ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ▶ Connect the open port of the Power Splitter directly to the RF input 1 of the R&S ESU.

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**SETUP** : PREAMP : PREAMP ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings: - Frequency f_{fresp}
See table in performance test report for values of f_{fresp}.

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB
- ▶ Take the value of Imbalance(f_{fresp}) from the table above and ΔRef as ascertained before.

RF input 2 without preselection

Reference Measurement

Test setup:
- ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ▶ Connect the open port of the Power Splitter directly to the RF input 2 of the R&S ESU.

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ➢ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings: - Frequency f_{fresp}
See table in performance test report for values of f_{fresp}.

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ► The frequency response can be calculated as:
- ► Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ∆Ref / dB
- ► Take the value of Imbalance(f_{fresp}) from the table above and ∆Ref as ascertained before.

RF input 2 with preselection without preamplifier

Reference Measurement

Test setup:
- ► Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ► Connect the open port of the Power Splitter directly to the RF input 2 of the R&S ESU.

Signal Generator settings:

- Level	0 dBm
- Frequency	128 MHz

R&S ESU settings:

- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ► Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ► Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ► Calculate
  ∆Ref / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ► Record ∆Ref / dB

Frequency Response Measurement

Signal Generator settings: - Frequency f_{fresp}
See table in performance test report for values of f_{fresp}.

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

- ► Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ► Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
  Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ∆Ref / dB
  Take the value of Imbalance(f_{fresp}) from the table above and ∆Ref as ascertained before.

RF input 2 with preselection and preamplifier

Reference Measurement

Test setup:
- ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ▶ Connect the open port of the Power Splitter directly to the RF input 1 of the R&S ESU.

Signal Generator settings
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PRESEL ON]
- [**SETUP** : PREAMP : PREAMP ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ∆Ref / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ∆Ref / dB

Frequency Response Measurement

Signal Generator settings:
- Frequency f_{fresp}
  See table in performance test report for values of f_{fresp}.

R&S ESU settings:
- [FREQ : CENTER : {f_{fresp}}]
  See table in performance test report for values of f_{fresp}

- ▶ Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

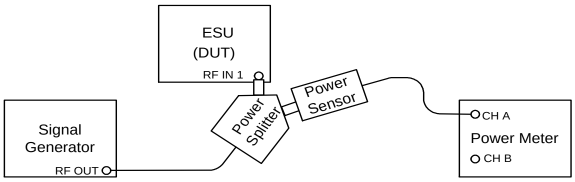
Evaluation:

- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ∆Ref / dB
- ▶ Take the value of Imbalance(f_{fresp}) from the table above and ∆Ref as ascertained before.

1.3.5.3 Frequency response > 3.6 GHz

Test setup:

- ▶ Standardize the Power Meter and Power Sensor (item 10, 12).
- ▶ Use Power Splitter/Combiner (item 8) and connect equipment as shown below.
- ▶ Connect the power splitter directly to the R&S ESU RF input 1.



Note:
Throughout the remaining steps set the Power Meter Cal Factor as appropriate!

Reference Measurement

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ES}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ∆Ref / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm
- ▶ Record ∆Ref / dB

Frequency Response Measurement

Signal Generator settings:
- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}

R&S ESU settings: - [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter: ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - ΔRef / dB
- ▶ Take the value of ΔRef as ascertained before.

1.3.6 Checking the Display Linearity

Test equipment: - Signal generator (Section "Measurement Equipment", item 3)
Frequency 128 MHz [2]
Maximum level ≥ 10 dBm
- Step attenuator (Section "Measurement Equipment", item 13)
Frequency 128 MHz [1)]
Attenuation 0 to 100 dB in 1 dB steps
Attenuation accuracy < 0.1 dB

Test setup:
- ▶ Connect RF output of the signal generator to RF input of the step attenuator
- ▶ Connect RF output of the step attenuator to RF input 1 of the R&S ESU.

Signal generator settings: - Frequency 128 MHz [1)]
- Level +10 dBm

Step attenuator settings: Attenuation 20 dB

R&S ESU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** :CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**TRACE** : DETECTOR : AV]
- [**SWEEP** : SWEEP TIME MANUAL : **200 ms**]
- [**MEAS** : TIME DOM POWER : MEAN]

1. Measurement:
- [**BW** : RES BW MANUAL : **500 Hz**]

2. Measurement:
- [**BW** : RES BW MANUAL : **300 kHz**]

Reference measurement:
- ▶ Read out the mean marker
- ▶ Set reference

- [**MEAS** : TIME DOM POWER : **NEXT** : SET REFERENCE]
- [**MEAS** : TIME DOM POWER : **NEXT** : POWER REL]

[2] A frequency between 5 MHz and 1 GHz may be used. It is recommended to use correction values for the uncertainty of the attenuator.

Measurement

Step attenuator settings: Attenuation {a_{ATT}}
See table of performance test report for values of a_{ATT}.

Sweep time settings: - [**SWEEP** : SWEEP TIME MANUAL : {sweep time}]

a_{ATT}	≤ 50 dB	50 dB < a_{ATT} ≤ 70 dB	> 70 dB
Sweep time	200 ms	600 ms	2 s

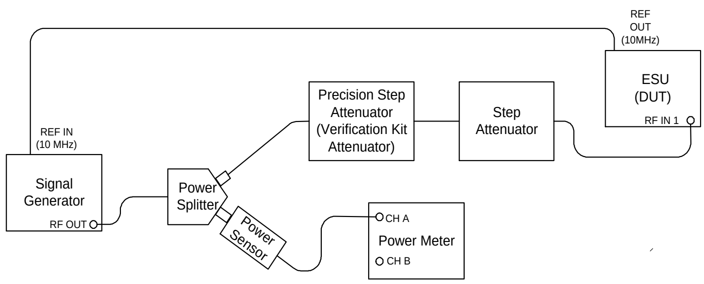
Evaluation: The difference between the level of the input signal of the R&S ESU and the reference (about 10 dB below the reference level) is displayed in the marker field by the reading `POWER [T1] MEAN ´.

1.3.7 Checking the Display Linearity (alternative Measurement)

Test equipment:
- Signal Generator (Section "Measurement Equipment", item 4)
  Frequency 30 MHz
  Maximum level 16 dBm
  Harmonics < -25 dBc
- Power Meter (Section "Measurement Equipment", item 10)
  Dual Channel
  Power range -30 to 0 dBm
- Power Splitter (Section "Measurement Equipment", item 7)
- Power Sensor (Section "Measurement Equipment", item 11)
  Frequency 30 MHz
  Power -15 to +10 dBm
- Precision Step Attenuator (Verification Kit Attenuator, Section "Measurement Equipment", item 15)
  Frequency 30 MHz
  Uncertainty of charted attenuation values:
  ±(0.005 dB + 0.005 dB / 10dB step)
  Attenuation 0 to 30 dB in 10 dB steps
  Insertion loss 20 dB nominal (two 10 dB pads permanently attached one on each side)
- Step Attenuator (Section "Measurement Equipment", item 14)
  0 dB / 30 dB

Test setup:

► Standardize the Power Meter and Power Sensor.
► Connect equipment as shown below:



Signal Generator settings: - Frequency 30 MHz
- Reference Frequency (10 MHz) External

R&S ESU settings:
- [**PRESET**]
- [**FREQ** : **30 MHz**]
- [**SPAN** : **0 Hz**]
- [**AMPT** : **-10 dBm:** RF ATTEN MANUAL : **10 dB**]
- [**BW** : **500 Hz**]
- [**TRACE** : DETECTOR : DETECTOR AVERAGE]
- [**SWEEP** : **500 ms**]
- [**MEAS** : TIME DOM POWER : MEAN]
- [**NEXT** : POWER REL]

Measurement - RBW 500 Hz

Signal Generator Power dBm	Verification Kit Attenuation dB	Power Meter indication dB (relative)		Signal Generator Level Error ∆GEN dB (relative)
16	0	0.00		0.00
10	0	_____	+6 =	_____
14	10	_____	+2 =	_____
8	10	_____	+8 =	_____
12	20	_____	+4 =	_____
6	20	_____	+10 =	_____
10	30	_____	+6 =	_____
4	30	_____	+12 =	_____
-2	30	_____	+18 =	_____
-8	30	_____	+24 =	____

Step 1

- ► Set the power of the Signal Generator and the attenuation of the Verification Kit to the first value listed in the table above.
- ► Set the Step Attenuator to 0 dB.
- ► R&S ESU setting
  - [MEAS : TIME DOM POWER]
  - [NEXT : SET REFERENCE]
- ► Set Power Meter to relative indication (dB) and store actual value as reference value.

Step 2

- ► Set the power of the Signal Generator and the attenuation of the Verification Kit to the second value listed in the table above.
- ► Record the power meter indication in column 3 of the table above.
  Add the figure given in the table above and record the result in column 4 (= ∆GEN).

- ► Read the R&S ESU relative power indication[3] subtract the appropriate value ΔGEN and add the appropriate value V-Kit-Error [4].
- ► Record the result in the Performance Test Report, item "Display linearity, RBW 500 Hz".
- ► Repeat step 2 for the remaining values listed in the table above.
- ► Record the corrected R&S ESU relative power indication (same value as recorded in the Performance Test Report) appendant to the last setting of the table above:

L_{-54a} = _________ dB

Signal Generator Power dBm	**Verification Kit Attenuation dB**	**Power Meter indication dB (relative)**		**Signal Generator Level Error ΔGEN dB (relative)**
-8	0	0.00		0.00
-4	10	_____	-4 =	_____
0	20	_____	-8 =	_____
4	30	_____	-12 =	_____
-2	30	_____	-6 =	_____
-8	30	_____	-0 =	_____

Step 3

- ► Set the power of the Signal Generator and the attenuation of the Verification Kit to the first value listed in the table above.
- ► Set the Step Attenuator to 30 dB.
- ► Record the R&S ESU relative power indication:
  L_{-54b} = _________ dB
- ► Calculate $\Delta L = L_{-54b} - L_{-54a}$ = _________ dB
- ► Set Power Meter to relative indication (dB) and store actual value as reference value.

Step 4

- ► Set the power of the Signal Generator and the attenuation of the Verification Kit to the second value listed in the table above.
- ► Record the power meter indication in column 3 of the table above.
  Subtract the figure given in the table above and record the result in column 4 (= ΔGEN).
- ► Read the R&S ESU relative power indication and subtract both the appropriate value ΔGEN and ΔL. Then add the appropriate value V-Kit-Error.
- ► Record the result in the Performance Test Report, item "Display linearity, RBW 500 Hz".
- ► Repeat step 4 for the remaining values listed in the table above.

---

[3] Relative power in dB is indicated by the marker read-out:
POWER [T1]
MEAN xx.xx dB

[4] Refer to charted attenuation accuracy of the Verification Kit.
V-Kit-Error = actual attenuation (charted) – nominal attenuation (10, 20 or 30 dB).
V-Kit-Error is referenced to the 0 dB setting, i.e. V-Kit-Error = 0 with the 0 dB setting.

Measurement - RBW 300 kHz

Signal Generator Power dBm	Verification Kit Attenuation dB	Power Meter indication dB (relative)		Signal Generator Level Error ∆GEN dB (relative)
16	0	0.00		
10	0	_____	+6 =	_____
14	10	_____	+2 =	_____
8	10	_____	+8 =	_____
12	20	_____	+4 =	_____
6	20	_____	+10 =	_____
10	30	_____	+6 =	_____
4	30	_____	+12 =	_____
-4	30	_____	+20 =	_____
-10	30	_____	+26 =	_____
-16	30	_____	+32 =	_____

Step 1

- ▶ Set the power of the Signal Generator and the attenuation of the Verification Kit to the first value listed in the table above.
- ▶ Set the Step Attenuator to 0 dB.
- ▶ R&S ESU setting
- ▶ - [**BW** : **300 kHz**]
  - [**MEAS** : TIME DOM POWER]
  - [**NEXT** : SET REFERENCE]
- ▶ Set Power Meter to relative indication (dB) and store actual value as reference value.

Step 2

- ▶ Set the power of the Signal Generator and the attenuation of the Verification Kit to the second value listed in the table above.
- ▶ Record the power meter indication in column 3 of the table above.
  Add the figure given in the table above and record the result in column 4 (= ∆GEN).
- ▶ Read the R&S ESU relative power indication, subtract the appropriate value ∆GEN and add the appropriate value V-Kit-Error.
- ▶ Record the result in the Performance Test Report, item "Display linearity, RBW 300 kHz".
- ▶ Repeat step 2 for the remaining values listed in the table above.

1.3.8 Checking the RF Attenuator Accuracy

Test equipment:
- Signal generator (Section "Measurement Equipment", item 3)
  Frequency 128 MHz
  Maximum level ≥ 10 dBm
- Step attenuator (Section "Measurement Equipment", item 13)
  Frequency 128 MHz
  Attenuation 0 to 80 dB in 5 dB steps
  Attenuation accuracy < 0.1 dB

Test setup:
► Connect RF output of the signal generator to RF input of the step attenuator
► Connect RF output of the step attenuator to RF input 1 of the R&S ESU

Signal generator settings:
- Frequency 128.1 MHz
- Level 10 dBm

Step attenuator settings: Attenuation 70 dB

R&S ESU settings:
- [**PRESET**]
- [**FREQ** : CENTER : **128.1 MHz**]
- [**SPAN** : **500 Hz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [AMPT : -35 dBm]

Reference measurement:
► Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
► Set reference to peak of signal
  - [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation { 80 dB - a_{ESU} }
See table below for values of a_{ATT}.

R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : { a_{ESU} }]
- [**AMPT** : {-45 dBm + a_{ESU} } **dBm**]
- [**MKR** ⇒ : PEAK]

See table below for values of a_{ESU} , a_{ATT} and reference level.

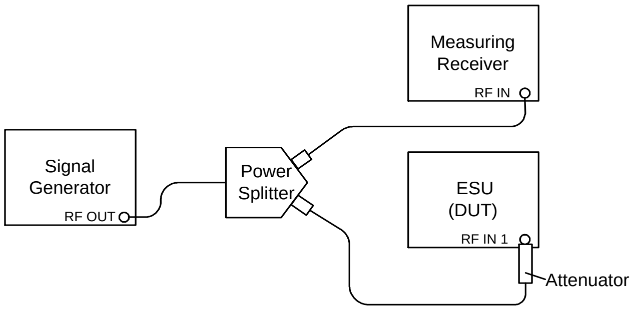
Evaluation: The difference between the level of the input signal of the R&S ESU and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading Delta [T1 FXD].

a_{ATT}	70 dB	75 dB	65 dB	60 dB	55 dB	50 dB	40dB	30 dB	20 dB	10 dB
a_{ESU}	10 dB	5 dB	15 dB	20 dB	25 dB	30 dB	40dB	50 dB	60 dB	70 dB
reference level	-35 dBm	-40 dBm	-30 dBm	-25 dBm	-20 dBm	-15 dBm	-5 dBm	5 dBm	+15 dBm	+25 dBm

1.3.9 Checking the RF Attenuator Accuracy (alternative Measurement)

Test equipment:
- Signal Generator (Section "Measurement Equipment", item 4)
  Frequency 128 MHz
  Level range -62 to +8 dBm
- Power Splitter (Section "Measurement Equipment", item 7)
- Fixed Attenuator (Section "Measurement Equipment", item 17)
  3 dB / 128 MHz
- Measuring Receiver (Section "Measurement Equipment", item 19)
  Range +2 to -68dBm / 128 MHz
  Relative Accuracy (RSS): ±0.09 dB
  within -10 dB to +60 dB from set reference at -58 dBm

Test setup:
► Connect equipment as shown below:



R&S ESU settings:
- [**PRESET**]
- [**FREQ** : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**TRACE** : DETECTOR : DETECTOR AVERAGE]
- [**BW** : RES BW MANUAL: **1 kHz**: VIDEO BW MANUAL : **100 Hz**]

R&S ESU RF Attenuation dB	R&S ESU Ref Level dBm	Signal Generator Power dBm
10	-60	-52
5	-65	-57
15	-55	-47
20	-50	-42
25	-45	-37
30	-40	-32
40	-30	-22
50	-20	-12
60	-10	-2
70	0	+8

Step 1

- ► Set the power of the Signal Generator to the first value listed in the table above
- ► Set RF Attenuation and Reference Level of the R&S ESU to the first value listed in the table above:
  - [**AMPT** : RF ATTEN MANUAL : **xx dB :** REF LEVEL **xx dBm**]
- ► Set R&S ESU Delta Marker Reference
  - [**MKR** : REFERENCE FIXED]
- ► Set Measuring Receiver Reference (SET REF)

Step 2

- ► Set the power of the Signal Generator to the second value listed in the table above.
- ► Set RF Attenuation and Reference Level of the R&S ESU to the second value listed in the table above.
- ► Record the difference
  R&S ESU Delta Marker indication[5] - Measuring Receiver indication in the Performance Test Report.
- ► Repeat step 2 for the remaining values of the table above.

1.3.10 Checking the Reference Level Switching Accuracy

Test principle: The IF gain of the R&S ESU can be switched from 0 to 50 dB by changing the reference level at fixed RF attenuation. To prevent the IF gain accuracies to be mixed up with the log amplifier accuracy it is determined by comparison using an external precision attenuator.

Test equipment: Signal generator (Section "Measurement Equipment", item 3)
frequency 5 MHz
maximum level ≥ -10 dBm
Step attenuator (Section "Measurement Equipment", item 13)
frequency 5 MHz
attenuation 0 to 60 dB in 1 dB steps
attenuation accuracy < 0.1 dB

Test setup:
- ► Connect RF output of the signal generator to RF input of the step attenuator
- ► Connect RF output of the step attenuator to RF input of the R&S ESU.

Signal generator settings:
- frequency 5 MHz
- level -10 dBm

Step attenuator settings: Attenuation 20 dB

[5] Delta 2 [T1 FXD] xx.xx dB

R&S ESU settings:
- [**PRESET**]
- [**FREQ** : CENTER : **5 MHz**]
- [**SPAN** : **2 kHz**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : VIDEO BW MANUAL : **100 Hz**]
- [**TRACE** : DETECTOR : RMS]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10 dBm**]

Reference measurement:

► Set marker to peak of signal
- [**MKR ⇒** : PEAK]

► Set reference to peak of signal
- [**MKR** : REFERENCE FIXED]

Measurement

Step attenuator settings: Attenuation {a_{ATT}}
See table below for values of a_{ATT}.

R&S ESU settings:
- [**AMPT** : {reference level} **dBm**]
  See table below for values of reference level.
- [**MKR ⇒** : PEAK]

Evaluation: The difference between the level of the input signal of the R&S ESU and the reference (at 10 dB IF-Gain) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

10 dB gain steps:

a_{ATT}	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB
reference level	0 dBm	-10 dBm	-20 dBm	-30 dBm	-40 dBm	-50 dBm

1 dB gain steps:

► Set marker to peak of signal
- [**MKR ⇒** : PEAK]

Set reference to peak

a_{ATT}	20 dB	21 dB	22 dB	23 dB	24 dB	25 dB	26 dB	27 dB	28 dB	29 dB
reference level	-10 dBm	-11 dBm	-12 dBm	-13 dBm	-14 dBm	-15 dBm	-16 dBm	-17 dBm	-18 dBm	-19 dBm

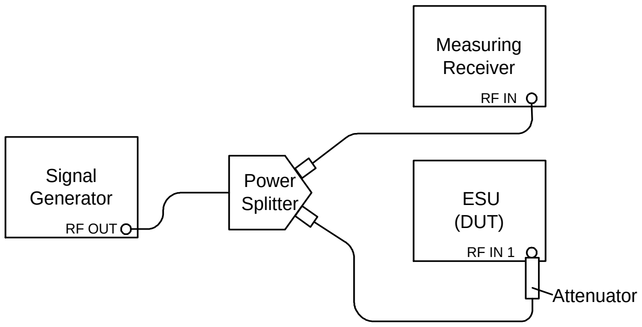
1.3.11 Checking the Reference Level Switching Accuracy (alternative Measurement)

Test equipment:

- Signal Generator (Section "Measurement Equipment", item 4)
  Frequency 128 MHz
  Level range -52 to +8 dBm
- Power Splitter (Section "Measurement Equipment", item 7)
- Fixed Attenuator (Section "Measurement Equipment", item 17)
  3 dB / 128 MHz
- Measuring Receiver (Section "Measurement Equipment", item 19)
  Range -58 to +2 dBm / 128 MHz
  Relative Accuracy (RSS): ±0.075 dB
  within +10 dB to -50 dB from set reference at -8 dBm

Test setup:

➢ Connect equipment as shown below:



R&S ESU settings:

- [**PRESET**]
- [**FREQ** : **128 MHz**]
- [**SPAN** : **500 Hz**]
- [**TRACE** : DETECTOR : DETECTOR AVERAGE]
- [**BW** : RES BW MANUAL: **1 kHz**: VIDEO BW MANUAL : **100 Hz**]
- [**AMPT** : RF ATTEN MANUAL: **10 dB**]

ESU Ref Level dBm	Signal Generator Power dBm
-10	-2
0	+8
-11	-3
-12	-4
-13	-5
-14	-6
-15	-7
-16	-8
-18	-10
-20	-12
-30	-22
-40	-32
-50	-42
-60	-52

Step 1

- ► Set the power of the Signal Generator to the first value listed in the table above.
- ► Set the Reference Level of the R&S ESU to the first value listed in the table above.:
  - [**AMPT** : REF LEVEL **xx dBm**]
- ► Set R&S ESU Delta Marker Reference
  - [**MKR** : REFERENCE FIXED]
- ► Set Measuring Receiver Reference (SET REF)

Step 2

- ► Set the power of the Signal Generator to the second value listed in the table above.
- ► Set the Reference Level of the R&S ESU to the second value listed in the table above.
- ► Record the difference
  R&S ESU Delta Marker indication[6] - Measuring Receiver indication in the Performance Test Report.
- ► Repeat step 2 for the remaining values of the table above.

[6]) Delta 2 [T1 FXD xx.xx dB

1.3.12 Checking the Detectors according CISPR16-1-1 (Receiver Mode)

1.3.12.1 Sine-wave voltage accuracy

Test equipment:
- Signal generator (Section "Measurement Equipment", item 2)
  Frequency range 100 kHz to 1 GHz
  Max. level ≥ 0 dBm
- Power Meter (Section "Measurement Equipment", item 10)
- Power Sensor (Section "Measurement Equipment", item 11)
- 6 dB Power Splitter (Section "Measurement Equipment", item 8)

CISPR Band A

Test setup:
▶ Standardize the Power Meter and Power Sensor (item 10, 11).
▶ Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 101 kHz.
▶ Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator settings:
- Frequency 101 kHz
- Level -10 dBm (= 97 dBµV)

Measurement:
▶ Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
▶ Record the Power Meter indication.
▶ Disconnect Power Sensor from the cable.
▶ Connect the cable to RF input 1 of the R&S ESU

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **40 dB**]
- [**MEAS** : DETECTOR : {Detector}
- [**BW** : CISPR RBW UNCOUPLED]
- [**BW** : RES BW : **200 Hz**]
- [**MEAS** : MEAS TIME : **100 ms**]
- [**FREQ** : RECEIVER FREQUENCY : **101 kHz**]

▶ Perform the measurement with the detectors MAX PEAK (PK+), QUASIPEAK (QPK), CISPR AVERAGE (CAV) und CISPR (CRMS).

Evaluation:
▶ The difference between the signal levels measured with the power meter and the R&S ESU (´LEVEL {Detector}´)) reflects the absolute level accuracy of the R&S ESU. It can be calculated for each detector as:

Sine-wave accuracy$_{\text{Band A}}$ = L_{ESU} - $L_{powermeter}$

CISPR Band B

Test setup:

- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 1.1 MHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator settings:

- Frequency 1.1 MHz
- Level -10 dBm (= 97 dBµV)

Measurement:

- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.
- ► Connect the cable to RF input 1 of the R&S ESU

Additional R&S ESU settings:

- [**FREQ** : RECEIVER FREQUENCY : **1.1 MHz**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**BW** : RES BW : **9 kHz**]

- ► Perform the measurement with the detectors MAX PEAK (PK+), QUASIPEAK (QPK), CISPR AVERAGE (CAV) und CISPR (CRMS).

Evaluation:

The difference between the signal levels measured with the power meter and the R&S ESU (´LEVEL {Detector}´)) reflects the absolute level accuracy of the R&S ESU. It can be calculated for each detector as:

Sine-wave accuracy$_{\text{Band B}}$ = L_{ESU} - $L_{\text{powermeter}}$

CISPR Band C/D

Test setup:

- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 128 MHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator setting:

- Frequency 128 MHz
- Level -10 dBm (= 97 dBµV)

Measurement:

- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.
- ► Connect the cable to RF input 1 of the R&S ESU

Additional R&S ESU settings:

- [**FREQ** : RECEIVER FREQUENCY : **128 MHz**]
- [**BW** : RES BW : **120 kHz**]

- ► Perform the measurement with the detectors MAX PEAK (PK+), QUASIPEAK (QPK), CISPR AVERAGE (CAV) und CISPR (CRMS).

Evaluation: The difference between the signal levels measured with the power meter and the R&S ESU (´LEVEL {Detector}´)) reflects the absolute level accuracy of the R&S ESU. It can be calculated for each detector as:

Sine-wave accuracy$_{\text{Band C}}$ = L_{ESU} - $L_{powermeter}$

CISPR Band E

Test setup:
- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 1001 MHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator setting:
- Frequency 1001 MHz
- Level -10 dBm (= 97 dBµV)

Measurement:
- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.
- ► Connect the cable to RF input 1 of the R&S ESU

Additional R&S ESU settings:
- [**FREQ** : RECEIVER FREQUENCY : **1001 MHz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**BW** : RES BW : **1 MHz**]

- ► Perform the measurement with the detectors MAX PEAK (PK+), CISPR AVERAGE (CAV) und CISPR (CRMS).

Evaluation: The difference between the signal levels measured with the power meter and the R&S ESU (´LEVEL {Detector}´)) reflects the absolute level accuracy of the R&S ESU. It can be calculated for each detector as:

Sine-wave accuracy$_{\text{Band E}}$ = L_{ESU} - $L_{powermeter}$

1.3.12.2 Peak and Quasi-peak detector

Test equipment:
- CISPR pulse generator (Section "Measurement Equipment", item 24):
- Attenuator, impulse resistant (Section "Measurement Equipment", item 25):
  frequency range 9 kHz to 1 GHz
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 2 GHz
- Function generator (Section "Measurement Equipment", item 26)

Amplitude relationship

Test setup:
- ► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR-Band A

Additional CISPR generator settings:	- CISPR-band A - Level 114.7 dBµV/MHz or 35 dBµV [CISPR 16 A] - Pulse frequency 25 Hz
R&S ESU settings:	- [**PRESET**] - [**RECEIVER**] - [**AMPT** : RF INPUT DC] - [**AMPT** : RF ATTEN MANUAL : **10 dB**] - [**MEAS** : DETECTOR : MAX PEAK] - [**MEAS** : DETECTOR : QUASIPEAK] - [**MEAS** : MEAS TIME : **100 ms**] - [**FREQ** : RECEIVER FREQUENCY : **101 kHz**]
Measurement:	► The measured level is indicated with the reading ´LEVEL PK+´ and 'LEVEL QPK' (= reference value L_{Ref}).

CISPR-Band B

Additional CISPR generator settings:	- CISPR-band B - Level 96.1 dBµV/MHz or 49 dBµV [CISPR 16 B] - Pulse frequency 100 Hz
Additional R&S ESU settings:	- [**FREQ** : RECEIVER FREQUENCY : **1,1 MHz**]
Measurement:	► The measured level is indicated with the reading ´LEVEL PK+´ and 'LEVEL QPK' (= reference value L_{Ref}).

CISPR-Band C/D

Additional CISPR generator settings:	- CISPR band C/D - Level 84 dBµV/MHz or 54 dBµV [CISPR 16 C/D] - Pulse frequency 100 Hz
Additional R&S ESU settings:	- [**FREQ** : RECEIVER FREQUENCY : **128 MHz**]
Measurement:	► The measured level is indicated with the reading ´LEVEL PK+´ and 'LEVEL QPK' (= reference value L_{Ref}).

CISPR-Band E

Test setup:
- ► Connect output of function generator with pulse modulation input of the signal generator.
- ► Adjust the output level of the function generator according to the input of the generator.
- ► Connect RF output of signal generator to RF input 1 of R&S ESU

Signal generator settings:
- Frequency 1001 MHz
- Level -33 dBm

Function generator settings:
- Period 20 µs (f_P = 50 kHz)
- Pulse width 200 ns

Checking the pulse level: Level 60 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex..

Additional R&S ESU settings:
- [**BW** : CISPR RBW UNCOUPLED]
- [**BW** : RES BW : **1 MHz**]
- [**BW** : DETECTOR : MAX PEAK]
- [**FREQ** : RECEIVER FREQUENCY : **1001 MHz**]

Measurement: ► The measured level is indicated with the reading ´LEVEL PK+´.

Variation with repetition frequency

CISPR-Band A

Test setup: ► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU

Note:
Switch on pulse generator only after setting R&S ESU..

CISPR generator settings:
- CISPR-band A
- Level 114.7 dBµV/MHz or 35 dBµV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**MEAS** : DETECTOR : MAX PEAK]
- [**MEAS** : DETECTOR : QUASIPEAK]
- [**MEAS** : MEAS TIME : **4 s**]
- [**FREQ** : RECEIVER FREQUENCY : **101 kHz**]

Reference measurement: ► The measured level is indicated with the reading ‘LEVEL QPK’ (= reference value $L_{Ref\ Band\ A}$).

CISPR generator settings:	- Pulse frequency: see table of performance test report for values of f_P.
Measurement:	► The measured level is indicated with the reading 'LEVEL QP' (L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement L_{Ref} is to be determined for each pulse frequencies as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ Band\ A}$$

CISPR-Band B

CISPR generator settings:	- CISPR-band B - Level 96.1 dBµV/MHz or 49 dBµV [CISPR 16 B] - Pulse frequency 100 Hz
Additional R&S ESU settings:	- [**FREQ** : RECEIVER FREQUENCY : **1,1 MHz**]
Reference measurement:	► The measured level is indicated with the reading 'LEVEL QPK' (= reference value $L_{Ref\ Band\ B}$).
CISPR generator settings:	- Pulse frequency: see table of performance test report for values of f_P.
Measurement:	► The measured level is indicated with the reading 'LEVEL QP' (L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement L_{Ref} is to be determined for each pulse frequencies as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ Band\ B}$$

CISPR-Band C/D

CISPR generator settings:	- CISPR band C/D - Level 84 dBµV/MHz or 54 dBµV [CISPR 16 C/D] - Pulse frequency 100 Hz
Additional R&S ESU settings:	- [**FREQ** : RECEIVER FREQUENCY : **128 MHz**]
Reference measurement:	► The measured level is indicated with the reading 'LEVEL QPK' (= reference value $L_{Ref\ Band\ C/D}$).
CISPR generator settings:	- Pulse frequency: see table of performance test report for values of f_P.
Measurement:	► The measured level is indicated with the reading 'LEVEL QP' (L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement L_{Ref} is to be determined for each pulse frequencies as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ Band\ C/D}$$

Measurement at 1 kHz pulse frequency

Test equipment:
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 1 GHz
- Function generator (Section "Measurement Equipment", item 26)

Test setup:
► Connect output of function generator with pulse modulation input of the signal generator.
► Adjust the output level of the function generator according to the input of the generator.
► Connect RF output of signal generator to RF input 1 of R&S ESU

CISPR-Band B

►

Additional signal generator settings:
- Frequency 1.1 MHz
- Level -10 dBm
- Modulation Pulse

Function generator settings:
- Waveform Pulse Continue
- Pulse width 5 µs
- Period 10 ms (f_P = 100 Hz)

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**MEAS** : DETECTOR : MAX PEAK]
- [**MEAS** : DETECTOR : QUASIPEAK]
- [**MEAS** : MEAS TIME : **100 ms**]
- [**FREQ** : RECEIVER FREQUENCY : **1.1 MHz**]

Reference measurement:
► The measured level is indicated with the reading ‘LEVEL QP’ (= reference value $L_{Ref\ 1\ kHz}$)

Level PK+ is evaluated to control the input signal

Function generator settings:
- Period 1 ms (f_P = 1 kHz)

Measurement of the weighting curve:
► The measured level is indicated with the reading ‘LEVEL QP’ (L_{MEAS}).

Evaluation:
The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ 1\ kHz}$ is to be determined as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ 1\ kHz}$$

CISPR-Band C/D

Additional signal generator settings: - Frequency 128 MHz

Function generator settings: - Period 10 ms (f_P = 100 Hz)

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **40 dB**]
- [**FREQ** : RECEIVER FREQUENCY : 128 MHz]

Reference measurement:
► The measured level is indicated with the reading 'LEVEL QP' (= reference value $L_{Ref\ 1\ kHz}$)

Level PK+ is evaluated to control the input signal

Function generator settings: - Period 1 ms (f_P = 1 kHz)

Measurement of the weighting curve:
► The measured level is indicated with the reading 'LEVEL QP' (L_{MEAS}).

Evaluation: The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ 1\ kHz}$ is to be determined as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ 1\ kHz}$$

1.3.12.3 CISPR Average Detector

Amplitude relationship

Test equipment:
-CISPR pulse generator (Section "Measurement Equipment", item 24):
- Attenuator, impulse resistant (Section "Measurement Equipment", item 25):
  Frequency range 9 kHz to 150 kHz (Band A)
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 2 GHz
- Function generator (Section "Measurement Equipment", item 26), (Bands B to E)

CISPR-Band A

Test setup:
► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:
- CISPR-band A
- Level 139,6 dBµV/MHz or 60 dBµV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF ATTEN MANUAL : **45 dB**]
- [**AMPT** : RF INPUT DC]
- [**MEAS** : DETECTOR : CISPR AVERAGE]
- [**MEAS** : MEAS TIME : **100 ms**]
- [**FREQ** : RECEIVER FREQUENCY : **101 kHz**
- [**BW** : CISPR RBW UNCOUPLED]
- [**BW** : RES BW : **200 Hz**]

Measurement:
► The measured level is indicated with the reading ‘LEVEL CAV’ (L_{CAV}).

CISPR-Band B

Test setup:
► Connect output of function generator with pulse modulation input of the signal generator.
► Adjust the output level of the function generator according to the input of the generator.
► Connect RF output of signal generator to RF input 1 of R&S ESU

Signal generator settings:
- Frequency 1.1 MHz
- Level -7 dBm

Function generator settings
- Period 2 ms (f_P = 500 Hz)
- Pulse width 20 µs

Checking the pulse level:
- Level 126 dBµV-

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **1.1 MHz**]
- [**BW** : RES BW : **9 kHz**]

Measurement:
► The measured level is indicated with the reading ‘LEVEL CAV’ (L_{CAV}).

CISPR-Band C/D

Signal generator settings
- Frequency 128 MHz
- Level -7 dBm

Function generator settings
- Period 200 µs (f_P = 5 kHz)
- Pulse width 2 µs

Checking the pulse level:
Level: 106 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **128 MHz**]
- [**BW** : RES BW : **120 kHz**]

Measurement: The measured level is indicated with the reading ‘LEVEL CAV’ (L_{CAV}).

CISPR-Band E

Signal generator settings:
- Frequency 1001 MHz
- Level -7 dBm

Function generator settings:
- Period 20 µs (f_P = 50 kHz)
- Pulse width 200 ns

Checking the pulse level: Level: 86 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex..

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **1001 MHz**]
- [**BW** : RES BW : **1 MHz**]

Measurement: ► The measured level is indicated with the reading ‘LEVEL CAV’ (L_{CAV}).

Variation with repetition frequency

CISPR-Band A

Test setup: ► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU.

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:
- CISPR-band A
- Level 139,6 dBµV/MHz or 60 dBµV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF ATTEN MANUAL : **45 dB**]
- [**AMPT** : RF INPUT DC]
- [**MEAS** : DETECTOR : CISPR AVERAGE]
- [**MEAS** : MEAS TIME : **1 s**]
- [**FREQ** : RECEIVER FREQUENCY : **101 kHz**]
- [**BW** : CISPR RBW UNCOUPLED]
- [**BW** : RES BW : **200 Hz**]

Reference measurement: ► The measured level is indicated with the reading ´LEVEL CAV´ (= reference value $L_{Ref\ Band\ A}$).

CISPR generator settings:	- Pulse frequency: see table of performance test report for values of f_P
Measurement:	► The measured level is indicated with the reading ´LEVEL CAV´ (L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ A}$ is to be determined for each pulse frequency as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ Band\ A}$$

CISPR-Band B

Test setup:	► Connect output of function generator with pulse modulation input of the signal generator. ► Adjust the output level of the function generator according to the input of the generator. ► Connect RF output of signal generator to RF input 1 of R&S ESU
Signal generator settings:	- Frequency 1.1 MHz - Level -7 dBm
Function generator settings	- Period 2 ms (f_P = 500 Hz) - Pulse width 20 µs
Checking the pulse level:	Level: 126 dBµV/MHz ± 0.1 dB **Note:** For measurement of the pulse-modulated signal see annex.
R&S ESU settings:	- [**PRESET**] - [**RECEIVER**] - [**AMPT** : RF ATTEN MANUAL : **30 dB** - [**AMPT** : RF INPUT DC] - [**MEAS** : DETECTOR : CISPR AVERAGE] - [**MEAS** : MEAS TIME : **1 s**] - [**FREQ** : RECEIVER FREQUENCY : **1,1 MHz**] - [**BW** : CISPR RBW UNCOUPLED] - [**BW** : RES BW : **9 kHz**]
Reference measurement:	► The measured level is indicated with the reading ´LEVEL CAV´ (= reference value $L_{Ref\ Band\ B}$).
Function generator settings:	- Period T_P: see table of performance test report for values of T_P. $T_P = 1/ f_P$
Measurement:	► The measured level is indicated with the reading ´LEVEL CAV´ (L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ B}$ is to be determined for each pulse frequency as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ Band\ B}$$

CISPR-Band C/D

Signal generator settings	- Frequency - Level	128 MHz -7 dBm
Function generator settings	- Period - Pulse width	200 µs (f_P = 5 kHz) 2 µs
Checking the pulse level:	Level:	106 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **128 MHz**]
- [**BW** : RES BW : **120 kHz**]

Reference measurement: The measured level is indicated with the reading ´LEVEL CAV´ (= reference value $L_{Ref\ Band\ C/D}$).

Function generator settings: - Period T_P: see table of performance test report for values of T_P.

$T_P = 1/ f_P$

Measurement: ► The measured level is indicated with the reading (L_{MEAS}).

Evaluation: The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ C/D}$ is to be determined for each pulse frequency as follows:

$\Delta L = L_{MEAS} - L_{Ref\ Band\ C/D}$

CISPR-Band E

Signal generator settings:	- Frequency - Level	1001 MHz -7 dBm
Function generator settings:	- Period - Pulse width	20 µs (f_P = 50 kHz) 200 ns
Checking the pulse level:	Level:	86 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **1001 MHz**]
- [**BW** : RES BW : **1 MHz**]

Reference measurement: ► The measured level is indicated with the reading ´LEVEL CAV´ (= reference value $L_{Ref\ Band\ E}$).

Function generator settings: - Period T_P: see table of performance test report for values of T_P.

$T_P = 1/ f_P$

Measurement: ► The measured level is indicated with the reading (L_{MEAS}).

Evaluation: The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ E}$ is to be determined for each pulse frequency as follows:

$\Delta L = L_{MEAS} - L_{Ref\ Band\ E}$

Response to intermittent, unsteady and drifting narrowband disturbance

Test equipment:
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 2 GHz
- Function generator (Section "Measurement Equipment", item 26)

Test setup:
- ► Connect output of function generator with pulse modulation input of the signal generator.
- ► Adjust the output level of the function generator according to the input of the generator.
- ► Connect RF output of signal generator to RF input 1 of R&S ESU

CISPR Band A/B

Signal generator settings:
- Frequency 1.1 MHz
- Level -7 dBm
- Modulation Pulse

Function generator settings:
- Waveform Pulse Continue
- Pulse width 160 ms
- Period 1.6 s

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : RF INPUT DC]
- [**MEAS** : DETECTOR : MAX PEAK]
- [**MEAS** : DETECTOR : CISPR AVERAGE]
- [**MEAS** : MEAS TIME : **2 s**]
- [**FREQ** : RECEIVER FREQUENCY : **1.1 MHz**]
- [**BW** : CISPR RBW UNCOUPLED]
- [**BW** : RES BW : **9 kHz**]

Measurement:
- ► The measured level is indicated with the reading 'LEVEL PK+' (L_{PK+}) and 'LEVEL CAV ' (L_{CAV}).

Evaluation: The difference between level L_{PK+} and L_{CAV} is to be determined as follows:

$\Delta L = L_{PK+} - L_{CAV}$

CISPR Band C/D/E

Signal generator settings:	- Frequency	128 MHz
	- Level	-7 dBm
	- Modulation	Pulse
Function generator settings:	- Waveform	Pulse Continue
	- Pulse width	100 ms
	- Period	1.6 s

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **128 MHz**]
- [**BW** : RES BW : **120 kHz**]

Measurement:
► The measured level is indicated with the reading ‘LEVEL PK+’ (L_{PK+}) and ‘LEVEL CAV ’ (L_{CAV}).

Evaluation: The difference between level L_{PK+} and L_{CAV} is to be determined as follows:

$$\Delta L = L_{PK+} - L_{CAV}$$

1.3.12.4 RMS-Average Detector (CISPR RMS)

Test equipment:
- CISPR pulse generator (Section "Measurement Equipment", item 24):
- Attenuator, impulse resistant (Section "Measurement Equipment", item 25):
  Frequency range 9 kHz to 150 kHz (Band A)
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 1 GHz
  Function generator (Section "Measurement Equipment", item 26) (Bands B to E)

Amplitude relationship

CISPR-Band A

Test setup:
► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU.

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:
- CISPR-band A
- Level 139.6 dBµV/MHz or 60 dBµV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF ATTEN MANUAL : **45 dB**]
- [**AMPT** : RF INPUT DC]
- [**MEAS** : DETECTOR : CISPR RMS]
- [**MEAS** : MEAS TIME : **1 s**]
- [**FREQ** : RECEIVER FREQUENCY : **101 kHz**]
- [**BW** : CISPR RBW UNCOUPLED]
- [**BW** : RES BW : **200 Hz**]

Measurement:
► The measured level is indicated with the reading 'LEVEL CRMS' (L_{CRMS}).

CISPR-Band B

Test setup:
► Connect output of function generator with pulse modulation input of the signal generator.
► Adjust the output level of the function generator according to the input of the generator.
► Connect RF output of signal generator to RF input 1 of R&S ESU.

Signal generator settings:
- Frequency 1.1 MHz
- Level -21.1 dBm

Function generator settings:
- Period 1 ms (f_P = 1000 Hz)
- Pulse width 20 µs

Checking the pulse level: Level: 111.9 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF ATTEN MANUAL : **20 dB**]
- [**AMPT** : RF INPUT DC]
- [**MEAS** : DETECTOR : CISPR RMS]
- [**MEAS** : MEAS TIME : **1 s**]
- [**FREQ** : RECEIVER FREQUENCY : **1.1 MHz**]
- [**BW** : CISPR RBW UNCOUPLED]
- [**BW** : RES BW : **9 kHz**]

Measurement:
► The measured level is indicated with the reading 'LEVEL CRMS' (L_{CRMS}).

CISPR-Band C/D

Signal generator settings:
- Frequency 128 MHz
- Level -12.4 dBm

Function generator settings:
- Period 1 ms (f_P = 1000 Hz
- Pulse width 2 µs

Checking the pulse level:	Level:	100.6 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **20 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **128 MHz**]
- [**BW** : RES BW : **120 kHz**]
- [**MEAS** : MEAS TIME : **1 s**]

Measurement: ► The measured level is indicated with the reading 'LEVEL CRMS' (L_{CRMS}).

CISPR-Band E

Signal generator settings:	- Frequency	1001 MHz
	- Level	-1.6 dBm
Function generator settings:	- Period	1 ms (f_P = 1000 Hz)
	- Pulse width	200 ns
Checking the pulse level:	Level:	91.4 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **20 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **1001 MHz**]
- [**BW** : RES BW : **1 MHz**]

Measurement: ► The measured level is indicated with the reading 'LEVEL CRMS' (L_{CRMS}).

Variation with repetition frequency

CISPR-Band A

Test setup: ► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU.

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:	- CISPR-band A	
	- Level	139.6 dBµV/MHz or 60 dBµV [CISPR 16 A]
	- Pulse frequency	25 Hz

R&S ESU settings:	- [**PRESET**] - [**RECEIVER**] - [**AMPT** : RF ATTEN MANUAL : **45 dB**] - [**AMPT** : RF INPUT DC] - [**MEAS** : DETECTOR : CISPR RMS] - [**MEAS** : MEAS TIME : **1 s**] - [**FREQ** : RECEIVER FREQUENCY : **101 kHz**] - [**BW** : CISPR RBW UNCOUPLED] - [**BW** : RES BW : **200 Hz**]
Reference measurement:	► The measured level is indicated with the reading 'LEVEL CRMS' (= reference value LRef Band A).
CISPR generator settings:	- Pulse frequency: see table of performance test report for values of f_P.
Measurement:	► The measured level is indicated with the reading 'LEVEL CRMS' (L_{MEAS})
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ A}$ is to be determined for each pulse frequency as follows: $\Delta L = L_{MEAS} - L_{Ref\ Band\ A}$

CISPR-Band B

Test setup:	► Connect output of function generator with pulse modulation input of the signal generator. ► Adjust the output level of the function generator according to the input of the generator. ► Connect RF output of signal generator to RF input 1 of R&S ESU	
Signal generator settings:	- Frequency - Level - Modulation	1.1 MHz -21.1 dBm Pulse
Function generator settings:	- Period - Pulse width	1 ms (f_P = 1000 Hz) 20 µs
Checking the pulse level:	- Level	111.9 dBµV/MHz ± 0.1 dB
	Note: For measurement of the pulse-modulated signal see annex.	
R&S ESU settings:	- [**PRESET**] - [**RECEIVER**] - [**AMPT** : RF ATTEN MANUAL : **20 dB**] - [**AMPT** : RF INPUT DC] - [**MEAS** : DETECTOR : CISPR RMS] - [**MEAS** : MEAS TIME : **1 s**] - [**FREQ** : RECEIVER FREQUENCY : **1.1 MHz**] - [**BW** : CISPR RBW UNCOUPLED] - [**BW** : RES BW : **9 kHz**]	

Reference measurement:	► The measured level is indicated with the reading 'LEVEL CRMS' (= reference value $L_{Ref\ Band\ B}$).
Function generator settings:	- Period T_P: see table of performance test report for values of T_P. $T_P = 1/ f_P$
Measurement:	► The measured level is indicated with the reading 'LEVEL CRMS' (L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ B}$ is to be determined for each pulse frequency as follows: $\Delta L = L_{MEAS} - L_{Ref\ Band\ B}$

CISPR-Band C/D

Signal generator settings:	- Frequency - Level	128 MHz -12.4 dBm
Function generator settings:	- Period - Pulse width	1 ms (f_P = 1000 Hz) 2 µs
Checking the pulse level:	Level:	100.6 dBµV/MHz ± 0.1 dB
	Note: For measurement of the pulse-modulated signal see annex.	
Additional R&S ESU settings:	- [**AMPT** : RF ATTEN MANUAL : **20 dB**] - [**FREQ** : RECEIVER FREQUENCY : **128 MHz**] - [**BW** : RES BW : **120 kHz**] - [**MEAS** : MEAS TIME : **100 ms**]	
Reference measurement:	► The measured level is indicated with the reading 'LEVEL CRMS' (= reference value $L_{Ref\ Band\ C/D}$).	
Function generator settings:	- Period T_P: see table of performance test report for values of T_P. $T_P = 1/ f_P$	
Measurement:	► The measured level is indicated with the reading 'LEVEL CRMS' (L_{MEAS}).	
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ C/D}$ is to be determined for each pulse frequency as follows: $\Delta L = L_{MEAS} - L_{Ref\ Band\ C/D}$	

CISPR-Band E

Signal generator settings:	- Frequency - Level	1001 MHz -1.6 dBm
Function generator settings:	- Period - Pulse width	1ms (f_P = 1000 Hz) 200 ns

Checking the pulse level: Level: 91.4 dBμV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **20 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **1001 MHz**]
- [**BW** : RES BW : **1 MHz**]

Reference measurement:
► The measured level is indicated with the reading 'LEVEL CRMS' (= reference value LRef Band E).

Function generator settings:
- Period T_P: see table of performance test report for values of T_P.

$T_P = 1/ f_P$

Measurement:
► The measured level is indicated with the reading 'LEVEL CRMS' (L_{MEAS}).

Evaluation: The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ E}$ is to be determined for each pulse frequency as follows:

$\Delta L = L_{MEAS} - L_{Ref\ Band\ E}$

Response to intermittent, unsteady and drifting narrowband disturbance

Test equipment:
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 2 GHz
- Function generator (Section "Measurement Equipment", item 26)

Test setup:
► Connect output of function generator with pulse modulation input of the signal generator.
► Adjust the output level of the function generator according to the input of the generator.
► Connect RF output of signal generator to RF input 1 of R&S ESU

CISPR Band A/B

Signal generator settings:
- Frequency 1.1 MHz
- Level -10 dBm
- Modulation Pulse

Function generator settings:
- Waveform Pulse Continue
- Pulse width 160 ms
- Period 1.6 s

R&S ESU settings:
- [**PRESET**]
- [**RECEIVER**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : RF INPUT DC]
- [**MEAS** : DETECTOR : MAX PEAK]
- [**MEAS** : DETECTOR : CISPR RMS]
- [**MEAS** : MEAS TIME : **2 s**]
- [**FREQ** : RECEIVER FREQUENCY : **1.1 MHz**]
- [**BW** : CISPR RBW UNCOUPLED]
- [**BW** : RES BW : **9 kHz**]

Measurement: ► The measured level is indicated with the reading 'LEVEL PK+' (L_{PK+}) and 'LEVEL CRMS' (L_{CRMS}).

Evaluation: The difference between level L_{PK+} and L_{CRMS} is to be determined as follows:

$\Delta L = L_{PK+} - L_{CRMS}$

CISPR Band C/D/E

Signal generator settings:
- Frequency 128 MHz
- Level -10 dBm
- Modulation Pulse

Function generator settings:
- Waveform Pulse Continue
- Pulse width 100 ms
- Period 1.6 s

Additional R&S ESU settings:
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**FREQ** : RECEIVER FREQUENCY : **128 MHz**]
- [**BW** : RES BW : **120 kHz**]

Measurement: ► The measured level is indicated with the reading 'LEVEL PK+' (L_{PK+}) and 'LEVEL CRMS' (L_{CRMS}).

Evaluation: The difference between level L_{PK+} and L_{CRMS} is to be determined as follows:

$\Delta L = L_{PK+} - L_{CRMS}$

1.3.13 Checking the Detectors according CISPR16-1-1 (TD Scan, with R&S ESU-K53 option only)

The measurements are performed with the Time Domain Scan using the following basic settings:

TIME DOMAIN SCAN TABLE					
Scan Start	100.5 kHz				
Scan Stop	101.5 kHz				
Step Mode	AUTO PULSE				
	RANGE 1	RANGE 2	RANGE 3	RANGE 4	RANGE 5
Start	9 kHz	150 kHz	30 MHz	1 GHz	
Stop	150 kHz	30 MHz	1 GHz	2 GHz	
Step Size(A)	50 Hz	2.25 kHz	30 kHz	250 kHz	
Res BW(A)	200 Hz	9 kHz	120 kHz	1 MHz	
Meas Time	100 ms	100 ms	100 ms	100 ms	
Auto Ranging	OFF	OFF	OFF	OFF	
RF Attn	20 dB	25 dB	10 dB	5 dB	
Preamp	OFF	OFF	OFF	OFF	
Auto Preamp	OFF	OFF	OFF	OFF	
RF Input	INPUT 1	INPUT 1	INPUT 1	INPUT 1	

The settings for Scan Start and Scan Stop are adjusted during the measurements. The settings for measurement time, RF attenuation, resolution bandwidths must be changed in the scan table.

The detectors are selected in the trace menu.

1.3.13.1 Sine-wave voltage accuracy

Test equipment:

- Signal generator (Section "Measurement Equipment", item 2)
  Frequency range 100 kHz to 1 GHz
  Max. level ≥ 0 dBm
- Power Meter (Section "Measurement Equipment", item 10)
- Power Sensor (Section "Measurement Equipment", item 11)
- 6 dB Power Splitter (Section "Measurement Equipment", item 8)

CISPR Band A

Test setup:

- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 101 kHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator settings:

- Frequency 101 kHz
- Level -10 dBm (= 97 dBµV)

Measurement:

- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.
- ► Connect the cable to RF input 1 of the R&S ESU

R&S ESU settings:
- [**RECEIVER**]
- [**AMPT** : RF INPUT DC]
- [**SWEEP** : TD SCAN]
- [**FREQ** : START : **100.5 kHz**]
- [**FREQ** : STOP : **101.5 kHz**]
- [**TRACE** : DETECTOR : {DETECTOR}]
- [**SWEEP** : SINGLE SCAN]
- [**SWEEP** : RUN SCAN]
- [RANGE 1 : MEAS TIME: 1 s]

► Perform the measurement with the detectors MAX PEAK (PK+), QUASIPEAK (QPK), CISPR AVERAGE (CAV) und CISPR (CRMS).

Measurement:
► Set marker to peak of signal.
- [MKR ⇒ : PEAK]

Evaluation:
The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated for each detector as:

Sine-wave accuracy$_{\text{Band A}}$ = L_{ESU} - $L_{powermeter}$

CISPR Band B

Test setup:
► Standardize the Power Meter and Power Sensor (item 10, 11).
► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 1.1 MHz.
► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator settings:

- Frequency	1.1 MHz
- Level	-10 dBm (= 97 dBµV)

Measurement:
► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
► Record the Power Meter indication.
► Disconnect Power Sensor from the cable.
► Connect the cable to RF input 1 of the R&S ESU

Additional R&S ESU settings:
- [**FREQ** : START : **1.075 MHz**]
- [**FREQ** : STOP : **1.125 MHz**]
- [**TRACE** : DETECTOR : {DETECTOR}]
- [**SWEEP** : RUN SCAN]
- [RANGE 2 : MEAS TIME: 1 s]
- [RUN SCAN]

► Perform the measurement with the detectors MAX PEAK (PK+), QUASIPEAK (QPK), CISPR AVERAGE (CAV) und CISPR (CRMS).

Measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]

Evaluation:
The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated for each detector as:$_r$

Sine-wave accuracy$_{Band A}$ = L_{ESU} - $L_{powermeter}$

CISPR Band C/D

Test setup:

- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 128 MHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator setting:

- Frequency 128 MHz
- Level -10 dBm (= 97 dBµV)

Measurement:

- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.
- ► Connect the cable to RF input 1 of the R&S ESU

Additional R&S ESU settings:

- [**FREQ** : START : **127.75 MHz**]
- [**FREQ** : STOP : **128.25 MHz**]
- [**TRACE** : DETECTOR : {DETECTOR}]
- [**SWEEP** : RUN SCAN]
- [RANGE 3 : MEAS TIME: 1 s]
- [RUN SCAN]

- ► Perform the measurement with the detectors MAX PEAK (PK+), QUASIPEAK (QPK), CISPR AVERAGE (CAV) und CISPR (CRMS).

Measurement:

- ► Set marker to peak of signal
  - [**MKR ⇒** : PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated for each detector as:

Sine-wave accuracy$_{Band A}$ = L_{ESU} - $L_{powermeter}$

CISPR Band E

Test setup:

- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 1001 MHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal generator setting:

- Frequency 1002.5 MHz
- Level -10 dBm (= 97 dBµV)

Measurement:

- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.
- ► Connect the cable to RF input 1 of the R&S ESU

Additional R&S ESU settings:

- [**FREQ** : START : **1000 MHz**]
- [**FREQ** : STOP : **1005 MHz**]
- [**TRACE** : DETECTOR : {DETECTOR}]
- [**SWEEP** : RUN SCAN]
- [RANGE 4 : MEAS TIME: 1 s]
- [RANGE 4 : RF ATT : 10 dB]
- [RUN SCAN]

► Perform the measurement with the detectors MAX PEAK (PK+), CISPR AVERAGE (CAV) und CISPR (CRMS).

Measurement:

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated for each detector as:

► Sine-wave $\text{accuracy}_{\text{Band E}} = L_{\text{ESU}} - L_{\text{powermeter}}$

1.3.13.2 Peak and Quasi-peak detector

Test equipment:

- CISPR pulse generator (Section "Measurement Equipment", item 24):
- Attenuator, impulse resistant (Section "Measurement Equipment", item 25): frequency range 9 kHz to 1 GHz
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 2 GHz
- Function generator (Section "Measurement Equipment", item 26)

Amplitude relationship

Test setup:

► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU.

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR-Band A

Additional CISPR generator settings:

- CISPR-band A
- Level 114.7 dBμV/MHz or 35 dBμV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:

- [**TRACE** : DETECTOR : MAX PEAK]
- [**TRACE** : SELECT TRACE : **2**]
- [**TRACE** : CLEAR / WRITE]
- [**TRACE** : DETECTOR : QUASIPEAK]
- [**FREQ** : START : **100.5 kHz**]
- [**FREQ** : STOP : **101.5 kHz**
- [**SWEEP** : TD SCAN]
- [RANGE 1 : MEAS TIME: 2 s]
- [RANGE 1 : RF ATT : 20 dB]
- [RUN SCAN]

Measurement:

► Set marker to peak of signal
- [MKR ⇒ : PEAK]

Trace 1: Level PK+

Trace 2: Level QPK (= reference value $L_{Ref\ Band\ A}$).

CISPR-Band B

Additional CISPR generator settings:

- CISPR-band B
- Level 96.1 dBμV/MHz or 49 dBμV [CISPR 16 B]
- Pulse frequency 100 Hz

Additional R&S ESU settings:

- [**FREQ** : START : **1.075 MHz**]
- [**FREQ** : STOP : **1.125 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 2 : MEAS TIME: 2 s]
- [RANGE 2 : RF ATT : 20 dB]
- [RUN SCAN]

Measurement:

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

Trace 1: Level PK+

Trace 2: Level QPK (= reference value $L_{Ref\ Band\ B}$).

CISPR-Band C/D

Additional CISPR generator settings:	- CISPR band C/D - Level 84 dBµV/MHz or 54 dBµV [CISPR 16 C/D] - Pulse frequency 100 Hz
Additional R&S ESU settings:	- [**FREQ** : START : **127.75 MHz**] - [**FREQ** : STOP : **127.25 MHz**] - [**SWEEP** : TD SCAN] - [RANGE 3 : MEAS TIME: 2 s] - [RANGE 3 : RF ATT : 15 dB] - [RUN SCAN]
Measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK] Trace 1: Level PK+ Trace 2: Level QPK (= reference value $L_{Ref\ Band\ C/D}$).

CISPR-Band E

Test setup:	► Connect output of function generator with pulse modulation input of the signal generator. ► Adjust the output level of the function generator according to the input of the generator. ► Connect RF output of signal generator to RF input 1 of R&S ESU
Signal generator settings:	- Frequency 1002.5 MHz - Level -33 dBm
Function generator settings:	- Period 20 µs (f_P = 50 kHz) - Pulse width 200 ns
Checking the pulse level:	Level 60 dBµV/MHz ± 0.1 dB **Note:** For measurement of the pulse-modulated signal see annex.
Additional R&S ESU settings:	- [**FREQ** : START : **1000 MHz**] - [**FREQ** : STOP : **1005 MHz**] - [**TRACE** : DETECTOR : {DETECTOR} - [**SWEEP** : RUN SCAN] ► Perform the measurement with the detectors MAX PEAK (PK+).
Measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK]

Variation with repetition frequency

CISPR-Band A

Test setup:

► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU.

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:

- CISPR-band A
- Level 114.7 dBµV/MHz or 35 dBµV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:

- [**TRACE** : DETECTOR : MAX PEAK]
- [**TRACE** : SELECT TRACE : **2**]
- [**TRACE** : CLEAR / WRITE]
- [**TRACE** : DETECTOR : QUASIPEAK]
- [**FREQ** : START : **100.5 kHz**]
- [**FREQ** : STOP : **101.5 kHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 1 : RF ATT : 20 dB]
- [RANGE 1 : MEAS TIME: 2 s]
- [RUN SCAN]

Reference measurement:

► Set marker to peak of signal
- [MKR ⇒ : PEAK]

► Trace 2: Level QPK (= reference value $L_{Ref\ Band\ A}$).

CISPR generator settings:

- Pulse frequency: see table of performance test report for values of f_P.

Measurement:

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

► Trace 2: Level QPK (= L_{MEAS}).

Evaluation:

The difference between level L_{MEAS} and the value recorded in the reference measurement L $L_{Ref\ Band\ A}$ is to be determined for each pulse frequencies as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ Band\ A}$$

CISPR-Band B

CISPR generator settings:

- CISPR-band B
- Level 96.1 dBµV/MHz or 49 dBµV [CISPR 16 B]
- Pulse frequency 100 Hz

Additional R&S ESU settings:

- [**FREQ** : START : **1.075 MHz**]
- [**FREQ** : STOP : **1.125 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 2 : RF ATT : 20 dB]
- [RANGE 2 : MEAS TIME: 2 s]
- [RUN SCAN]

Reference measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 2: Level QPK (= reference value $L_{Ref\ Band\ B}$).

CISPR generator settings:
- Pulse frequency: see table of performance test report for values of f_P.

Measurement:
► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]
► Trace 2: Level QPK (= L_{MEAS}).

Evaluation:
The difference between level L_{MEAS} and the value recorded in the reference measurement L $L_{Ref\ Band\ A}$ is to be determined for each pulse frequencies as follows:

$\Delta L = L_{MEAS} - L_{Ref\ Band\ B}$

CISPR-Band C/D

CISPR generator settings:
- CISPR band C/D
  - Level 84 dBµV/MHz or 54 dBµV [CISPR 16 C/D]
  - Pulse frequency100 Hz

Additional R&S ESU settings:
- [**FREQ** : START : **127.75 MHz**]
- [**FREQ** : STOP : **127.25 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 3 : RF ATT : 15 dB]
- [RANGE 3 : MEAS TIME: 2 s]
- [RUN SCAN]

Reference measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 2: Level QPK (= reference value $L_{Ref\ Band\ C/D}$).

CISPR generator settings:
- Pulse frequency: see table of performance test report for values of f_P.

Measurement:
► The measured level is indicated with the reading ‘LEVEL QP’ (L_{MEAS}).

Evaluation:
The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ C/D}$ is to be determined for each pulse frequencies as follows:

$\Delta L = L_{MEAS} - L_{Ref\ Band\ C/D}$

Measurement at 1 kHz pulse frequency

Test equipment:
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 1 GHz
- Function generator (Section "Measurement Equipment", item 26)

Test setup:

- ► Connect output of function generator with pulse modulation input of the signal generator.
- ► Adjust the output level of the function generator according to the input of the generator.
- ► Connect RF output of signal generator to RF input 1 of R&S ESU

CISPR-Band B

Additional signal generator settings:

- Frequency 1.1 MHz
- Level -10 dBm
- Modulation Pulse

Function generator settings:

- Waveform Pulse Continue
- Pulse width 5 µs
- Period 10 ms (f_P = 100 Hz)

R&S ESU settings:

- [**FREQ** : START : **1.075 MHz**]
- [**FREQ** : STOP : **1.125 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 2 : RF ATT : 40 dB]
- [RANGE 2 : MEAS TIME: 100 ms]
- [RUN SCAN]

Reference measurement:

- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 2: Level QPK (= reference value $L_{Ref\ 1\ kHz}$)

Level PK+ is evaluated to control the input signal

Function generator settings:

- Period 1 ms (f_P = 1 kHz)

Measurement of the weighting curve:

- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 2: Level QPK (= L_{MEAS}).

Evaluation:

The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ 1\ kHz}$ is to be determined as follows:

$\Delta L = L_{MEAS} - L_{Ref\ 1\ kHz}$

CISPR-Band C/D

Additional signal generator settings:

- Frequency 128 MHz

Function generator settings:

- Period 10 ms (f_P = 100 Hz)

Additional R&S ESU settings:
- [**FREQ** : START : **127.75 MHz**]
- [**FREQ** : STOP : **127.25 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 3 : RF ATT : 40 dB
- [RANGE 3 : MEAS TIME: 100 ms]
- [RUN SCAN]

Reference measurement:
- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 2: Level QPK (= reference value $L_{Ref\ 1\ kHz}$)

Level PK+ is evaluated to control the input signal

Function generator settings:
- Period 1 ms (f_P = 1 kHz)

Measurement of the weighting curve:
- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 2: Level QPK (= L_{MEAS}).

Evaluation: The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ 1\ kHz}$ is to be determined as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ 1\ kHz}$$

1.3.13.3 CISPR Average Detector

Amplitude relationship

Test equipment: CISPR pulse generator (Section "Measurement Equipment", item 24):
- Attenuator, impulse resistant (Section "Measurement Equipment", item 25):
  Frequency range 9 kHz to 150 kHz (Band A)
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 2 GHz
- Function generator (Section "Measurement Equipment", item 26), (Bands B to E)

CISPR-Band A

Test setup:
- ► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:
- CISPR-band A
- Level 139,6 dBµV/MHz or 60 dBµV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:	- [**TRACE** : DETECTOR : CISPR AVERAGE] - [**FREQ** : START : **100.5 kHz**] - [**FREQ** : STOP : **101.5 kHz**] - [**SWEEP** : TD SCAN] - [RANGE 1 : RF ATT : 40 dB] - [RANGE 1 : MEAS TIME : 1 s] - [RUN SCAN]
Measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK] ► Trace 1: Level CA

CISPR-Band B

Test setup:	► Connect output of function generator with pulse modulation input of the signal generator. ► Adjust the output level of the function generator according to the input of the generator. ► Connect RF output of signal generator to RF input 1 of R&S ESU	
Signal generator settings:	- Frequency - Level	1.1 MHz -7 dBm
Function generator settings	- Period - Pulse width	2 ms (f_P = 500 Hz) 20 µs
Checking the pulse level:	Level:	126 dBµV/MHz ± 0,1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:	- [**FREQ** : START : **1.075 MHz**] - [**FREQ** : STOP : **1.125 MHz**] - [**SWEEP** : TD SCAN] - [RANGE 2 : RF ATT : 30 dB] - [RANGE 2 : MEAS TIME: 1 s] - [RUN SCAN]
Measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK] ► Trace 1: Level CA

CISPR-Band C/D

Signal generator settings	- Frequency - Level	128 MHz -7 dBm
Function generator settings	- Period - Pulse width	200 µs (f_P = 5 kHz) 2 µs

Checking the pulse level:	Level:	106 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**FREQ** : START : **127.75 MHz**]
- [**FREQ** : STOP : **127.25 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 3 : RF ATT : 30 dB]
- [RANGE 3 : MEAS TIME: 1 s]
- [RUN SCAN]

Measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CA

CISPR-Band E

Signal generator settings:	- Frequency - Level	1002.5 MHz -7 dBm
Function generator settings:	- Period - Pulse width	20 µs (f_P = 50 kHz) 200 ns
Checking the pulse level:	Level:	86 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**FREQ** : START : **1000 MHz**]
- [**FREQ** : STOP : **1005 MHz**]
- [RANGE 4 : RF ATT : 10 dB]
- [RANGE 3 : MEAS TIME: 1 s]
- [RUN SCAN]

Measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CA

Variation with repetition frequency

CISPR-Band A

Test setup:
► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:	- CISPR-**band** A	
	- Level	139,6 dBµV/MHz or 60 dBµV [CISPR 16 A]
	- Pulse frequency	25 Hz

R&S ESU settings:
- [**TRACE** : DETECTOR : CISPR AVERAGE]
- [**FREQ** : START : **100.5 kHz**]
- [**FREQ** : STOP : **101.5 kHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 1 : RF ATT : 40 dB]
- [RANGE 1 : MEAS TIME : 2 s]
- [RUN SCAN]

Reference measurement:
- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 1: Level CA (= reference value $L_{Ref\ Band\ A}$).

CISPR generator settings:
- Pulse frequency: see table of performance test report for values of f_P

Measurement:
- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 1: Level CA (= L_{MEAS}).

Evaluation:
The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ A}$ is to be determined for each pulse frequency as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ Band\ A}$$

CISPR-Band B

Test setup:
- ► Connect output of function generator with pulse modulation input of the signal generator.
- ► Adjust the output level of the function generator according to the input of the generator.
- ► Connect RF output of signal generator to RF input 1 of R&S ESU

Signal generator settings:
- Frequency 1.1 MHz
- Level -7 dBm

Function generator settings
- Period 2 ms (f_P = 500 Hz)
- Pulse width 20 µs

Checking the pulse level:
Level: 126 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

R&S ESU settings:
- [**FREQ** : START : **1.075 MHz**]
- [**FREQ** : STOP : **1.125 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 2 : RF ATT : 30 dB]
- [RANGE 2 : MEAS TIME : 1 s]
- [RUN SCAN]

Reference measurement:
- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 1: Level CA (= reference value $L_{Ref\ Band\ B}$).

Function generator settings:	- Period T_P: see table of performance test report for values of T_P. $T_P = 1/ f_P$
Measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK] ► Trace 1: Level CA (= L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ B}$ is to be determined for each pulse frequency as follows: $\Delta L = L_{MEAS} - L_{Ref\ Band\ B}$

CISPR-Band C/D

Signal generator settings	- Frequency - Level	128 MHz -7 dBm
Function generator settings	- Period - Pulse width	200 µs (f_P = 5 kHz) 2 µs
Checking the pulse level:	Level:	106 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:	- [**FREQ** : START : **127.75 MHz**] - [**FREQ** : STOP : **127.25 MHz**] - [**SWEEP** : TD SCAN] - [RANGE 3 : RF ATT : 30 dB] - [RANGE 3 : MEAS TIME : 1 s] - [RUN SCAN]
Reference measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK] ► Trace 1: Level CA (= reference value $L_{Ref\ Band\ C/D}$).
Function generator settings:	- Period T_P: see table of performance test report for values of T_P. $T_P = 1/ f_P$
Measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK] ► Trace 1: Level CA (= L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ C/D}$ is to be determined for each pulse frequency as follows: $\Delta L = L_{MEAS} - L_{Ref\ Band\ C/D}$

CISPR-Band E

Signal generator settings:	- Frequency - Level	1002.5 MHz -7 dBm
Function generator settings:	- Period - Pulse width	20 µs (fP = 50 kHz) 200 ns
Checking the pulse level:	Level:	86 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**FREQ** : START : **1000 MHz**]
- [**FREQ** : STOP : **1005 MHz**]
- [RANGE 4 : RF ATT : 10 dB]
- [RANGE 4 : MEAS TIME : 1 s]
- [RUN SCAN]

Reference measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CA (= reference value $L_{Ref\ Band\ E}$).

Function generator settings:
- Period T_P: see table of performance test report for values of T_P.

$T_P = 1/ f_P$

Measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CA = (L_{MEAS}).

Evaluation:
The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ E}$ is to be determined for each pulse frequency as follows:

$\Delta L = L_{MEAS} - L_{Ref\ Band\ E}$

Response to intermittent, unsteady and drifting narrowband disturbance

Test equipment:
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3) Frequency range 9 kHz to 2 GHz
- Function generator (Section "Measurement Equipment", item 26)

Test setup:
► Connect output of function generator with pulse modulation input of the signal generator.
► Adjust the output level of the function generator according to the input of the generator.
► Connect RF output of signal generator to RF input 1 of R&S ESU

CISPR Band A/B

Signal generator settings:	- Frequency - Level - Modulation	1.1 MHz -7 dBm Pulse
Function generator settings:	- Waveform - Pulse width - Period	Pulse Continue 160 ms 1.6 s

R&S ESU settings:

- [**TRACE** : DETECTOR : MAX PEAK]
- [**TRACE** : SELECT TRACE : **2**]
- [**TRACE** : CLEAR / WRITE]
- [**TRACE** : DETECTOR : CISPR AVERAGE]
- [**FREQ** : START : **1.075 MHz**]
- [**FREQ** : STOP : **1.125 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 2 : RF ATT : 45 dB]
- [RANGE 2 : MEAS TIME: 2 s]
- [RUN SCAN]

Measurement:

► Set marker to peak of signal
- [MKR ⇒ : PEAK]

► Trace 1: Level PK+
Trace 2: Level CA

Evaluation: The difference between level L_{PK+} and L_{CAV} is to be determined as follows:

$$\Delta L = L_{PK+} - L_{CA}$$

CISPR Band C/D/E

Signal generator settings:	- Frequency - Level - Modulation	128 MHz -7 dBm Pulse
Function generator settings:	- Waveform - Pulse width - Period	Pulse Continue 100 ms 1.6 s

Additional R&S ESU settings:

- [**FREQ** : START : **127.75 MHz**]
- [**FREQ** : STOP : **127.25 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 3 : RF ATT : 45 dB]
- [RANGE 3 : MEAS TIME: 2 s]
- [RUN SCAN]

Measurement:

► Set marker to peak of signal
- [MKR ⇒ : PEAK]

► Trace 1: Level PK+
Trace 2: Level CA

Evaluation: The difference between level L_{PK+} and L_{CAV} is to be determined as follows:

$\Delta L = L_{PK+} - L_{CAV}$

1.3.13.4 RMS-Average Detector (CISPR RMS)

Test equipment:

- CISPR pulse generator (Section "Measurement Equipment", item 24):
- Attenuator, impulse resistant (Section "Measurement Equipment", item 25):
  Frequency range 9 kHz to 150 kHz (Band A)
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 1 GHz
  Function generator (Section "Measurement Equipment", item 26)
  (Bands B to E)

Amplitude relationship

CISPR-Band A

Test setup:

► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:

- CISPR-band A
- Level 139.6 dBµV/MHz or 60 dBµV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:

- [**TRACE** : DETECTOR : CISPR RMS]
- [**FREQ** : START : **100.5 kHz**]
- [**FREQ** : STOP : **101.5 kHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 1 : RF ATT : 40 dB]
- [RANGE 1 : MEAS TIME : 1 s]
- [RUN SCAN]

Measurement:

► Set marker to peak of signal
- [MKR ⇒ : PEAK]

► Trace 1: Level CR

CISPR-Band B

Test setup:

► Connect output of function generator with pulse modulation input of the signal generator.

► Adjust the output level of the function generator according to the input of the generator.

► Connect RF output of signal generator to RF input 1 of R&S ESU

Signal generator settings:

- Frequency 1.1 MHz
- Level -21.1 dBm

Function generator settings:	- Period - Pulse width	1 ms (fP = 1000 Hz) 20 µs
Checking the pulse level:	Level:	111.9 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

R&S ESU settings:
- [**FREQ** : START : **1.075 MHz**]
- [**FREQ** : STOP : **1.125 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 2 : RF ATT : 20 dB]
- [RANGE 2 : MEAS TIME: 1 s]
- [RUN SCAN]

Measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CR

CISPR-Band C/D

Signal generator settings:	- Frequency - Level	128 MHz -12.4 dBm
Function generator settings:	- Period - Pulse width	1 ms (fP = 1000 Hz) 2 µs
Checking the pulse level:	Level:	100.6 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**FREQ** : START : **127.75 MHz**]
- [**FREQ** : STOP : **127.25 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 3 : RF ATT : 20 dB]
- [RANGE 3 : MEAS TIME: 1 s]
- [RUN SCAN]

Measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CR

CISPR-Band E

Signal generator settings:	- Frequency - Level	1001 MHz -1.6 dBm
Function generator settings:	- Period - Pulse width	1 ms (fP = 1000 Hz) 200 ns

Checking the pulse level: Level: 91.4 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**FREQ** : START : **1000 MHz**]
- [**FREQ** : STOP : **1005 MHz**]
- [RANGE 4 : RF ATT : 10 dB]
- [RANGE 4 : MEAS TIME: 1 s]
- [RUN SCAN]

Measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CR

Variation with repetition frequency

CISPR-Band A

Test setup:
► Connect RF output of the generator via the attenuator to RF input 1 of R&S ESU.

Note:
Switch on pulse generator only after setting R&S ESU.

CISPR generator settings:
- CISPR-band A
- Level 139.6 dBµV/MHz or 60 dBµV [CISPR 16 A]
- Pulse frequency 25 Hz

R&S ESU settings:
- [**TRACE** : DETECTOR : CISPR RMS]
- [**FREQ** : START : **100.5 kHz**]
- [**FREQ** : STOP : **101.5 kHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 1 : RF ATT : 40 dB]
- [RANGE 1 : MEAS TIME : 4 s]
- [RUN SCAN]

Reference measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CR (= reference value $L_{Ref\ Band\ A}$).

CISPR generator settings:
- Pulse frequency: see table of performance test report for values of f_P.

Measurement:
► Set marker to peak of signal
- [MKR ⇒ : PEAK]
► Trace 1: Level CR (= L_{MEAS})

Evaluation: The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ A}$ is to be determined for each pulse frequency as follows:

$$\Delta L = L_{MEAS} - L_{Ref\ Band\ A}$$

CISPR-Band B

Test setup:
- ► Connect output of function generator with pulse modulation input of the signal generator.
- ► Adjust the output level of the function generator according to the input of the generator.
- ► Connect RF output of signal generator to RF input 1 of R&S ESU

Signal generator settings:
- Frequency 1.1 MHz
- Level -21.1 dBm
- Modulation Pulse

Function generator settings:
- Period 1 ms (fP = 1000 Hz)
- Pulse width 20 µs

Checking the pulse level:
Level: 111.9 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

R&S ESU settings:
- [**FREQ** : START : **1.075 MHz**]
- [**FREQ** : STOP : **1.125 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 2 : RF ATT : 20 dB]
- [RANGE 2 : MEAS TIME : 1 s]
- [RUN SCAN]

Reference measurement:
- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 1: Level CR (= reference value $L_{Ref\ Band\ B}$).

Function generator settings:
- Period T_P: see table of performance test report for values of T_P.

$T_P = 1/f_P$

Measurement:
- ► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
- ► Trace 1: Level CR (= L_{MEAS}).

Evaluation:
The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ B}$ is to be determined for each pulse frequency as follows:

$\Delta L = L_{MEAS} - L_{Ref\ Band\ B}$

CISPR-Band C/D

Signal generator settings:
- Frequency 128 MHz
- Level -12.4 dBm

Function generator settings:
- Period 1 ms (fP = 1000 Hz)
- Pulse width 2 µs

Checking the pulse level:	- Level:	100.6 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**FREQ** : START : **127.75 MHz**]
- [**FREQ** : STOP : **127.25 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 3 : RF ATT : 20 dB]
- [RANGE 3 : MEAS TIME : 1 s]
- [RUN SCAN]

Reference measurement:
► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
► Trace 1: Level CR (= reference value $L_{Ref\ Band\ C/D}$).

Function generator settings:
- Period T_P: see table of performance test report for values of T_P.

$T_P = 1/ f_P$

Measurement:
► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
► Trace 1: Level CR (= L_{MEAS}).

Evaluation:
The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ C/D}$ is to be determined for each pulse frequency as follows:

$\Delta L = L_{MEAS} - L_{Ref\ Band\ C/D}$

CISPR-Band E

Signal generator settings:	- Frequency - Level	1001 MHz -1.6 dBm
Function generator settings:	- Period - Pulse width	1ms (fP = 1000 Hz) 200 ns
Checking the pulse level:	Level:	91.4 dBµV/MHz ± 0.1 dB

Note:
For measurement of the pulse-modulated signal see annex.

Additional R&S ESU settings:
- [**FREQ** : START : **1000 MHz**]
- [**FREQ** : STOP : **1005 MHz**]
- [RANGE 4 : RF ATT : 10 dB]
- [RANGE 4 : MEAS TIME : 1 s]
- [RUN SCAN]

Reference measurement:
► Set marker to peak of signal
  - [MKR ⇒ : PEAK]
► Trace 1: Level CR (= reference value $L_{Ref\ Band\ E}$).

Function generator settings:
- Period T_P: see table of performance test report for values of T_P.

$T_P = 1/ f_P$

Measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK] ► Trace 1: Level CR (= L_{MEAS}).
Evaluation:	The difference between level L_{MEAS} and the value recorded in the reference measurement $L_{Ref\ Band\ E}$ is to be determined for each pulse frequency as follows: $\Delta L = L_{MEAS} - L_{Ref\ Band\ E}$

Response to intermittent, unsteady and drifting narrowband disturbance

Test equipment:	- Signal generator with pulse modulation (Section "Measurement Equipment", item 3) Frequency range 9 kHz to 2 GHz - Function generator (Section "Measurement Equipment", item 26)
Test setup:	► Connect output of function generator with pulse modulation input of the signal generator. ► Adjust the output level of the function generator according to the input of the generator. ► Connect RF output of signal generator to RF input 1 of R&S ESU

CISPR Band A/B

Signal generator settings:	- Frequency - Level - Modulation	1.1 MHz -10 dBm Pulse
Function generator settings:	- Waveform - Pulse width - Period	Pulse Continue 160 ms 1.6 s

R&S ESU settings:	- [**TRACE** : DETECTOR : MAX PEAK] - [**TRACE** : SELECT TRACE : **2**] - [**TRACE** : CLEAR / WRITE] - [**TRACE** : DETECTOR : CISPR RMS] - [**FREQ** : START : **1.075 MHz**] - [**FREQ** : STOP : **1.125 MHz**] - [**SWEEP** : TD SCAN] - [RANGE 2 : RF ATT : 45 dB] - [RANGE 2 : MEAS TIME: 2 s] - [RUN SCAN]
Measurement:	► Set marker to peak of signal - [MKR ⇒ : PEAK] ► Trace 1: Level PK+ Trace 2: Level CR
Evaluation:	The difference between level L_{PK+} and L_{CRMS} is to be determined as follows: $\Delta L = L_{PK+} - L_{CR}$

CISPR Band C/D/E

Signal generator settings:	- Frequency - Level - Modulation	128 MHz -10 dBm Pulse
Function generator settings:	- Waveform - Pulse width - Period	Pulse Continue 100 ms 1.6 s

Additional R&S ESU settings:
- [**FREQ** : START : **127.75 MHz**]
- [**FREQ** : STOP : **127.25 MHz**]
- [**SWEEP** : TD SCAN]
- [RANGE 3 : RF ATT : 45 dB]
- [RANGE 3 : MEAS TIME: 2 s]
- [RUN SCAN]

Measurement:

► Set marker to peak of signal
- [MKR ⇒ : PEAK]

► Trace 1: Level PK+
Trace 2: Level CR

Evaluation: The difference between level L_{PK+} and L_{CRMS} is to be determined as follows:

$$\Delta L = L_{PK+} - L_{CRMS}$$

1.3.14 Testing the Phase Noise at 639 MHz or 640 MHz

Measuring equipment:

Test generator (Section "Measurement Equipment", item 5)

Frequency	640 MHz
Level	5 dBm to 9 dBm (on the R&S ESU)
Phase noise at 640 MHz:	< -103 dBc (1 Hz) at 100 Hz
	< -123 dBc (1 Hz) at 1 kHz
	< -130 dBc (1 Hz) at 10 kHz
	< -143 dBc (1 Hz) at 100 kHz
	< -143 dBc (1 Hz) at 1 MHz

or

Signal Generator (Section "Measurement Equipment", item 4)

Frequency	639 MHz
Level	5 dBm
Phase Noise at 639 MHz:	< -103 dBc(1 Hz) @ 100 Hz
	< -123 dBc(1 Hz) @ 1 kHz
	< -130 dBc(1 Hz) @ 10 kHz

Signal Generator (Section "Measurement Equipment", item 3)

Frequency	639 MHz
Level	5 dBm
Phase Noise at 639 MHz:	< -143 dBc(1 Hz) @ 100 kHz
	< -143 dBc(1 Hz) @ 1 MHz

Test setup:

► Connect the RF output of the signal generator or the 640 MHz reference output (rear panel of the R&S FSU generator) to the RF input 1 of the R&S ESU.

► The external reference of the two instruments should be disconnected to avoid correlation of the synthesizer phase noise.

R&S FSU generator settings:
- [**PRESET**]
- [**SETUP** : SERVICE : INPUT CAL : NEXT : CALGEN COMB 640 MHZ]
- [**SWEEP** : SINGLE SWEEP]

or

Signal Generator settings:
- Frequency 639 MHz
- Level 5 dBm

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : REFERENCE INT]
- [**FREQ** : CENTER : **640** or **639 MHz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : 1 kHz]

► Correct frequency deviation f_{dev} between signal generator or R&S FSU (generator) and R&S ESU:
- [**FREQ** : FREQUENCY OFFSET {f_{dev}}]
- [**FREQ** : CENTER **640** or **639 MHz**]

► Continue with R&S ESU settings:
- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**TRACE 1** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]
- [**MKR FCTN**: PHASE NOISE]

► See table below for the values of the following parameters:
- [**FREQ** : CENTER : **{640** or **639 MHz +** f_{Offset}**}**]
- [**SPAN** : {Span}]
- [**SWEEP** : SWEEP TIME MANUAL {s_{ESU}}]
- [**BW** : RES BW MANUAL : {RES BW}]
- [**AMPT** : RF ATTEN MANUAL : {a_{ESU}}]
- [**AMPT** : REF LEVEL : {Reference level}]
- [**MKR :** MARKER 2 : {Offset}]

Note:
Please make sure not to measure on a spurious signal.

Evaluation: The phase noise is displayed in the marker information field by delta 2 [T1 PHN].

Note:
To avoid correlation during the phase noise measurement, (especially at 100 Hz), the R&S ESU and generator references should not be connected.

Setting for phase noise measurements				
Offset	**Span**	**RES BW / SWEEPTIME**	**Reference level l**	**a_{ESU}**
100 Hz	0 Hz	10 Hz / 10s	+ 8 dBm	10 dB
1 kHz	0 Hz	100 Hz / 10s	+8 dBm	10 dB
10 kHz	0 Hz	500Hz / 5s	-5 dBm	10 dB
100 kHz	0 Hz	10 kHz / 2s	-2 dBm	5 dB

1 MHz	0 Hz	30 kHz / 2s	-20 dBm	5 dB

To obtain an accurate phase noise measurement at high offsets, the level at the R&S ESU input is 10 dB to 30 dB higher than the reference level. An analog filter located before the AD converter prevents the ADC from being overdriven.

1.3.15 Alternative Phase Noise Testing at 800 MHz

Measuring equipment: Alternative measuring at 800 MHz
(Section "Measurement Equipment", item 6)

This measurement can be performed , if no signal source at 640 or 639 MHz is available.

Frequency	800 MHz
Level	5 dBm to 9 dBm (at the R&S ESU)
Phase noise at 800 MHz:	< -103 dBc (1 Hz) at 100 Hz < -123 dBc (1 Hz) at 1 kHz < -130 dBc (1 Hz) at 10 kHz < -143 dBc (1 Hz) at 100 kHz < -143 dBc (1 Hz) at 1 MHz

Test setup:

- ► Connect the 800 MHz RF output of the REFSYN to the RF input 1 of the R&S ESU.
- ► The external reference of the two instruments should be disconnected to avoid correlation of the synthesizer phase noise.

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : REFERENCE INT]
- [**FREQ** : CENTER : **800 MHz**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : 1 kHz]

► Correct frequency deviation f_{dev} between REFSYN and R&S ESU:
- [**FREQ** : FREQUENCY OFFSET {f_{dev}}]
- [**FREQ** : CENTER 800 MHz]

► Continue with R&S ESU settings:
- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**TRACE 1** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]
- [**MKR FCTN**: PHASE NOISE]

► See table below for the values of the following parameters:
- [**FREQ** : CENTER : **{800 MHz +** f_{Offset}**}**]
- [**SPAN** : {Span}]
- [**SWEEP** : SWEEP TIME MANUAL {s_{ESU}}]
- [**BW** : RES BW MANUAL : {RES BW}]
- [**AMPT** : RF ATTEN MANUAL : {a_{ESU}}]
- [**AMPT** : REF LEVEL : {Reference level}]
- [**MKR :** MARKER 2 : {Offset}]

Note:
Please make sure not to measure on a spurious signal.

Evaluation: The phase noise is displayed in the marker information field by Delta 2 [T1 PHN].

Setting for phase noise measurement				
Offset	**Span**	**RES BW / SWEEP TIME**	**Reference level**	**a_{ESU}**
100 Hz	0 Hz	10 Hz/10s	+ 8 dBm	10 dB
1 kHz	0 Hz	100 Hz/10s	+8 dBm	10 dB
10 kHz	0 Hz	500Hz/5s	-5 dBm	10 dB
100 kHz	0 Hz	10 kHz/2s	-2 dBm	5 dB
1 MHz	0 Hz	30 kHz/2s	-20 dBm	5 dB

To obtain a precise phase noise measurement at high offsets, the level used at the R&S ESU input is 10 dB to 30 dB higher than the reference level. An analog filter located before the AD converter prevents the ADC from being overdriven.

1.3.16 Checking the VSWR at the RF Input

1.3.16.1 RF Input 1

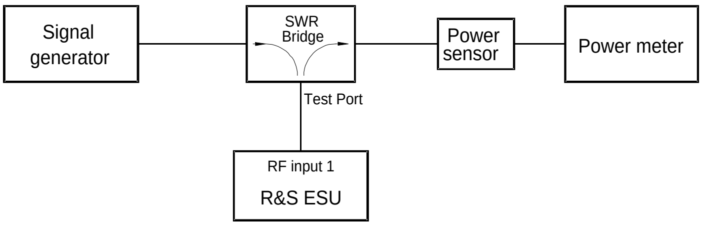
Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  Frequency range: 100 kHz to 20 MHz

  Level range: ≥ -10 dBm
- Power meter (Section "Measurement Equipment", item 10)
- Power sensor (Section "Measurement Equipment", item 21)
  Frequency range 100 kHz to 20 MHz
- SWR bridge (Section "Measurement Equipment", item 20)
  Frequency range 100 kHz to 20 MHz

  Note:
  As alternative to the VSWR bridge a network analyzer (item 22) can be used.
- Network analyzer (Section "Measurement Equipment", item 23)

Test setup (f_{in} < 20 MHz):



Signal generator settings:

- Level -10 dBm
- Frequency {f_{in}}

See performance test report for values of f_{in}.

R&S ESU settings:

- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]

Calibration:

► Use total reflection (OPEN or SHORT) at the test port of the SWR bridge as a reference:

► Remove cable from RF input 1 of the R&S ESU and connect precision short or open to the cable. Determine reflected power with the power meter and store measured level LRef as reference. Repeat this procedure for every measurement over the whole frequency range.

Measurement:

- ► Connect the RF input 1 of the R&S ESU to the test port of the SWR bridge.
- ► Measure reflected power Lr with the power meter. The return loss ar of the RF input 1 of the R&S ESU can be calculated as:

$a_r = L_{Ref} - L_r$.

The VSWR can be calculated as:

$$s = \frac{10^{0.05a_r} + 1}{10^{0.05a_r} - 1}$$

Test setup ($f_{in} \geq 20$ MHz):

- ► Connect the test port of the network analyzer to the RF input 1 of the R&S ESU.

Measurement:

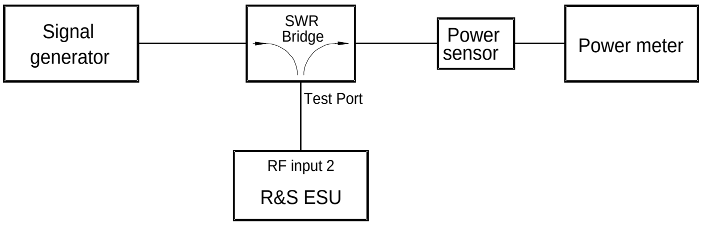
Determine VSWR of the R&S ESU at the frequencies shown in the performance test report. See operating manual of the network analyzer for detailed information about VSWR measurement.

1.3.16.2 RF Input 2

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  Frequency range: 100 kHz to 20 MHz
  Level range: ≥ -10 dBm
- Power meter (Section "Measurement Equipment", item 10)
- Power sensor (Section "Measurement Equipment", item 21)
  Frequency range 100 kHz to 20 MHz
- SWR bridge (Section "Measurement Equipment", item 20)
  Frequency range 100 kHz to 20 MHz
  Note:
  As alternative to the VSWR bridge a network analyzer (item 22) can be used.
- Network analyzer (Section "Measurement Equipment", item 23)

Test setup (f_{in} < 20 MHz):



Signal generator settings:

- Level -10 dBm
- Frequency {fin}

See performance test report for values of f_{in}.

R&S ESU settings:

- [**PRESET**]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]

Calibration:

- ► Use total reflection (OPEN or SHORT) at the test port of the SWR bridge as a reference:
- ► Remove cable from RF input 2 of the R&S ESU and connect precision short or open to the cable. Determine reflected power with the power meter and store measured level LRef as reference. Repeat this procedure for every measurement over the whole frequency range.

Measurement:

- ► Connect the RF input 2 of the R&S ESU to the test port of the SWR bridge.
- ► Measure reflected power Lr with the power meter. The return loss ar of the RF input 1 of the R&S ESU can be calculated as:

$a_r = L_{Ref} - L_r$.

The VSWR can be calculated as:

$$s = \frac{10^{0.05a_r} + 1}{10^{0.05a_r} - 1}$$

Test setup ($f_{in} \geq 20$ MHz):

- ► Connect the test port of the network analyzer to the RF input 2 of the R&S ESU.

Measurement: Determine VSWR of the R&S ESU at the frequencies shown in the performance test report. See operating manual of the network analyzer for detailed information about VSWR measurement.

1.4 Option Tracking Generator R&S FSU-B9 with Option Attenuator R&S FSU-B12

1.4.1 Checking the output level

Test equipment: - N cable (Section "Measurement Equipment", item 28)
Frequency up to 3.6 GHz
Maximum attenuation < 0.2 dB

Test setup:

- ► Connect the tracking generator output to the RF input 1 of the R&S ESU.

R&S ESU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **300 Hz**]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [**TRACE** : AVERAGE : SWEEP COUNT : **10 ENTER]**
- [**NETWORK** : SOURCE POWER {level}]

Without option B12:
{level}: check from 0 dBm to –20 dBm in 5 dB steps

With option B12:
{level}: check 0 dBm, -10 dBm, -20 dBm, -40 dBm

- [**SETUP** : SERVICE : ENTER PASSWORD **894129**]
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.1.0**]

Switch B12 to 0 dB (fixed value) with service command 2.29.21.1.0e
(after entering the password)
{level} : check from 0 dBm to –20 dBm in 5 dB steps

- [**SETUP** : SERVICE FUNCTIONS **2.29.21.0**]

Reactivate B12 with service command 2.29.21.0

Measurement:

► Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Read the value and store it as a reference for the frequency response measurement.

1.4.2 Checking the frequency response

Test equipment:

- N cable (section "Measurement Equipment", item 28)
Frequency up to 3.6 GHz
Maximum attenuation < 0.2 dB

Test setup:

► Connect the tracking generator output to the RF input 1 of the R&S ESU.

R&S ESU settings:

- [**PRESET**]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [**AMPT** : RF INPUT DC]
- [**FREQ** : START : **100 kHz**]
- [**FREQ** : STOP : **3.6 GHz**]
- [**BW** : RES BW MANUAL : **30 kHz**]
- [**NETWORK** : SOURCE POWER {level}]

Without option B12:
{level} : check from 0 dBm to –20 dBm in 5 dB steps

With option B12:
{level}: check 0 dBm, -10 dBm, -20 dBm, -40 dBm
- [**SETUP** : SERVICE : ENTER PASSWORD **894129**]
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.1.0**]

► Switch B12 to 0 dB (fixed value) with service command 2.29.21.1.0.
{level}: check from 0 dBm to –20 dBm in 5 dB steps
- [**SETUP** : SERVICE FUNCTIONS **2.29.21.0**]

Reactivate B12 with service command 2.29.21.0.

Measurement:

► Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

► Set marker to minimum value:
- [**MKR** ⇒ : NEXT : MIN]

Evaluation:

The difference between the min and max of the reference value at 128 MHz yields the frequency response.

1.4.3 Checking the dynamic range

Test equipment: - N cable (section "Measurement Equipment", item 28)
Frequency up to 3.6 GHz
Maximum attenuation < 0.2 dB

Test setup: ► Connect the tracking generator output to the RF input of the R&S ESU.

R&S ESU settings:
- [**PRESET**]
- [**FREQ : 128 MHz**]
- [**SPAN** : ZERO SPAN]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**BW** : RES BW MANUAL : **1 kHz**]
- [**AMPT** : RANGE LOG MANUAL : **120 dB**]
- [**NETWORK** : SOURCE POWER : **0 dBm**]
- [**MKR** : REFERENCE FIXED]

Disconnect the cable and connect a 50 Ω termination to the tracking generator output and the RF input 1.

Measurement: - [**TRACE** : AVERAGE : SWEEP COUNT : **50 ENTER]**

Read off delta marker

1.4.4 Checking Modulation

1.4.4.1 Checking the I/Q modulator

Test equipment:
- Arbitrary waveform generator (section "Measurement Equipment", item 26)
- Spectrum analyzer (section "Measurement Equipment", item 29)
- Voltmeter, 2 units (refer to "Measurement Equipment", item 27)
- 2 BNC T pieces

Test setup with ADS:
► Connect the I and Q outputs of the generator to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces.
► Connect the spectrum analyzer to the tracking generator output.

Test setup with 33220A:
► Connect the outputs of the two generators to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces. Synchronize the two 33220A via Option 001.
► Connect the spectrum analyzer to the tracking generator output.

Generator settings:
► Set DC voltage (offset) to 0 mV ± 3 mV
AC voltage: V(pp) = 1 V ± 10 mV
Frequency: 200 kHz
Phase (I/Q) = 90 degrees

Spectrum analyzer settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **1 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

R&S ESU settings:
- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm**]
- [MODULATION: EXT I/Q]

Measuring the residual carrier:

► Switch off the outputs on the generator.
Voltmeter display: DC voltage < 3 mV
AC voltage < 3 mV
Set marker to peak:

► Set marker to peak of signal:
- [**MKR** ⇒ : PEAK]

Read off the measured value on the spectrum analyzer (Marker Peak)

Measuring the impairment (imbalance between the I and Q path):

► Switch on the I and Q channels on the generator.
Measure the carrier amplitude at 1 GHz and the lateral component amplitudes at 1 GHz + 200 kHz and 1 GHz - 200 kHz.

1.4.4.2 Checking the amplitude modulation

Test equipment:
- Arbitrary waveform generator (section "Measurement Equipment", item 26)
- Spectrum analyzer (section "Measurement Equipment", item 29)
- Voltmeter, 2 units (refer to "Measurement Equipment", item 27)
- 2 BNC T pieces

Test setup with ADS:

► Connect the I and Q outputs of the generator to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces.

► Connect the spectrum analyzer to the tracking generator output.

Test setup with 33220A:

► Connect the outputs of the two generators to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces.

► Synchronize the two 33220A via Option 001.

► Connect the spectrum analyzer to the tracking generator output.

Generator settings:

► AC voltage: V(pp) = 1 V ± 10 mV
Frequency: 1 MHz

Spectrum analyzer settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **10 MHz**]
- [**AMPT** : REF LEVEL : **10 dBm**]

R&S ESU settings:
- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm]**
- [MODULATION : EXT AM]

Measurement:
- ▶ Determine the level difference between the carrier signal at 1 GHz and the modulation lateral components at 1 GHz ± 1 MHz.

1.4.4.3 Checking the frequency modulation

Test equipment:
- Arbitrary waveform generator (section "Measurement Equipment", item 26)
- Spectrum analyzer (section "Measurement Equipment", item 29)
- Voltmeter, 2 units (refer to "Measurement Equipment", item 27)
- 2 BNC T pieces

Test setup with ADS:
- ▶ Connect the I and Q outputs of the generator to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces.
- ▶ Connect the spectrum analyzer to the tracking generator output.

Test setup with 33220A:
- ▶ Connect the outputs of the two generators to the I and Q inputs of the analyzer. Check the generator voltages in parallel via T pieces.
- ▶ Synchronize the two 33220A via Option 001.
- ▶ Connect the spectrum analyzer to the tracking generator output.

Generator settings:
- ▶ AC voltage: V(pp) = 100 mV ± 10 mV
  Frequency: 100 kHz

Spectrum analyzer settings:
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **1 MHz**]
- [**BW** : **10 kHz**]
- [**AMPT** : REF LEVEL : **0 dBm**]

R&S ESU settings:
- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**NETWORK** : SOURCE POWER: **0 dBm**]
- [MODULATION : EXT FM : **100 kHz**]

Measurement:
- ▶ Determine the level difference between the carrier signal at 1 GHz and the modulation lateral components at 1 GHz ± 100 kHz.

1.5 Option Low-Noise Preamplifier R&S ESU-B24

1.5.1 Checking Noise Display

Test equipment: 50 Ω termination (Section "Measurement Equipment", item 9)

Frequency range:

R&S ESU 8:	DC to 8 GHz
R&S ESU 26:	DC to 26.5 GHz
R&S ESU 40:	DC to 40 GHz

Test setup: ► Terminate the RF input 1of the R&S ESU with 50 Ω

R&S ESU settings:

- [**PRESET**]
- [**AMPT** : 10 dB MIN OFF]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : 0 Hz]
- [**SETUP** : PREAMP : LNA ON]

- [**BW** : RES BW MANUAL : **1 kHz**]
- [**BW** : SWEEP TIME MANUAL : **50 ms**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**
- [**AMPT** : {RefLev}]
- [**FREQ** : CENTER : {f_n}]
- [**MEAS** : Time Dom Power : **Mean**]

See table of performance test report for values of $f_{n.}$

Measurement:

► Set the marker to the center frequency for the value below or equal 1 kHz.

► Read out the mean marker for frequencies above 1 kHz and correct the measurement value by –20 dB for the ratio of 10 Hz / 1 kHz.

Note:
For example the DANL in 1 kHz bandwidth –126 dBm results in a corrected value of –156 dBm in 1 Hz bandwidth.
As both filter designs are digitally and using the same hardware setting, the DANL can be measured also with 1 kHz bandwidth to reduce measurement time.

Evaluation: The noise level is displayed by the level reading of marker 1.

Frequency	< 1MHz	< 10MHz	> 10MHz
RefLev	-30 dBm	-60 dBm	-60 dBm

1.5.2 Checking the Level accuracy and the Frequency Response

Test equipment:

- Signal Generator (Section "Measurement Equipment", item 3)

Frequency range	100 kHz to 3.6 GHz
Maximum level	≥ 0 dBm

- Signal Generator (Section "Measurement Equipment", item 2)

Frequency range:	
R&S ESU 8	10 MHz to 8 GHz
R&S ESU 26	10 MHz to 26.5 GHz
R&S ESU 40	10 MHz to 40 GHz
Maximum level	≥ 0 dBm

- Power Meter (Section "Measurement Equipment", item 10)

  Dual Channel
  Power range -30 to 0 dBm
  Instrumentation uncertainty <0.5%
  Uncertainty of power reference <1.2%
  VSWR of power reference <1.10

- Power Sensor (Section "Measurement Equipment", item 11 (2x))

Frequency range	100 kHz to 3.6 GHz	
Power range	-30 to 0 dBm	
Cal factor uncertainty	1 MHz to 3.6 GHz	<1.6 %
VSWR	1 MHz to 3.6 GHz	<1.30
	50 MHz to 128 MHz	<1.10

- Power Sensor (Section "Measurement Equipment", item 12)

Frequency range:		
R&S ESU 8	50 MHz to 8 GHz	
R&S ESU 26	50 MHz to 26.5 GHz	
R&S ESU 8	50 MHz to 40 GHz	
Power range	-30 to 0 dBm	
Cal factor uncertainty	50 to 128 MHz	<1.6 %
	3.6 to 8 GHz	<2 %
	8 to 22 GHz	<2.5 %
	22 to 40 GHz	<3 %
VSWR	50 to 128 MHz	<1.15
	3.6 to 8 GHz	<1.15
	8 to 22 GHz	<1.25
	22 to 40 GHz	<1.35

- 6 dB Power Splitter (Section "Measurement Equipment", item 7)

Frequency range	DC to 3.6 GHz	
Level imbalance	10 MHz to 3.6 GHz	n/a
Equivalent output VSWR	10 MHz to 3.6 GHz	≤ 1.1

- 6 dB Power Splitter (Section "Measurement Equipment", item 8)

Frequency range:		
R&S ESU 8	DC to 8 GHz	
R&S ESU 26	DC to 26.5 GHz	
R&S ESU 40	DC to 40 GHz	
Level imbalance	3.6 to 8 GHz	≤ 0.3 dB
	8 to 22 GHz	≤ 0.4 dB
	22 to 40 GHz	≤ 0.5 dB
Equivalent output VSWR	3.6 to 8 GHz	≤ 1.3
	8 to 22 GHz	≤ 1.4
	22 to 40 GHz	≤ 1.5

1.5.2.1 Absolute level accuracy at 128 MHz

Test setup:

- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for 128 MHz.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal Generator settings:

- Frequency 128 MHz
- Level -10 dBm

Measurement:

- ► Adjust level to -10 dBm ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.

R&S ESU settings:

- [**PRESET**]
- [**SETUP** : PREAMP : LNA ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **-10 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

► Set marker to peak of signal
- [**MKR ⇒** : PEAK]

Evaluation:

The difference between the signal levels measured with the power meter and the R&S ESU (level reading of marker 1) reflects the absolute level accuracy of the R&S ESU. It can be calculated as:

$$\text{Level accuracy}_{128\text{MHz}} = L_{ESU} - L_{powermeter}$$

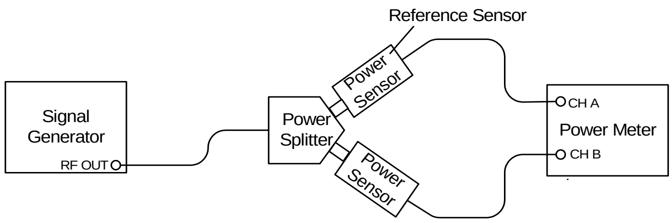
1.5.2.2 Frequency response < 3.6 GHz

Power splitter calibration

This section can be skipped, if a power splitter with a level imbalance <0.1 dB is available.

Test setup:

- ► Standardize the Power Meter and both Power Sensors (item 10, 11)..
- ► Use Power Splitter (item) and connect equipment as shown below.



Signal Generator settings: - Level 0 dBm

Measurement:

a) Set the Signal Generator frequency to the first value listed in the table below.

b) Set the Power Meter Channel A Cal Factor to the appropriate value for the Power Sensor for the first frequency listed in the table below Reference Sensor).

c) Set the Power Meter Channel B CAL Factor to 100%.

d) Calculate the Power Splitter imbalance as

$$\text{Imbalance / dB} = L_{CHA} \text{ / dBm} - L_{CHB} \text{ / dBm}$$

(L_{CHA} = Reference Sensor)

e) Record the calculated value in the table below.

Repeat steps a), b), d), e) for the remaining frequencies listed in the table below.

Power Splitter calibration data

Applied frequency (ffresp)	Imbalance / dB
100 kHz	________
1 MHz	________
10 MHz	________
50 MHz	________
100 MHz	________
128 MHz	________
200 MHz	________
300 MHz	________
400 MHz	________
500 MHz	________
600 MHz	________
700 MHz	________
800 MHz	________
900 MHz	________

1000 MHz	________
1500 MHz	________
2000 MHz	________
2500 MHz	________
3000 MHz	________
3599 MHz	________

Reference Measurement

Test setup:
- ▶ Disconnect the Power Sensor (CHA, Reference Sensor) from the Power Splitter.
- ▶ Connect the open port of the Power Splitter directly to the RF input 1 of the R&S ESU.

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PREAMP : LNA ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]
- ▶ Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ Calculate
  ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm - Imbalance(128 MHz) / dB
  Take value of Imbalance(128 MHz) from the table above.
- ▶ Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings:
- Frequency f_{fresp}
  See table in performance test report for values of f_{fresp}.

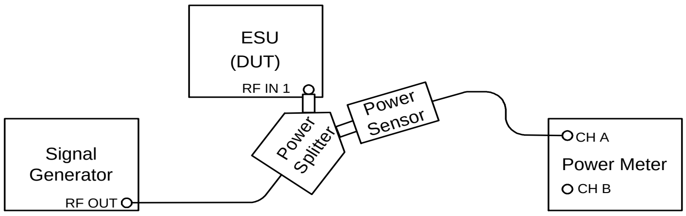
R&S ESU settings:
- [**FREQ** : CENTER : {f_{fresp}}]
  See table in performance test report for values of f_{fresp}
- ▶ Set marker to peak of signal
  - [**MKR** ⇒ : PEAK]Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
- ▶ Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ▶ The frequency response can be calculated as:
- ▶ Freq. response / dB = LESU - LPowerMeter - Imbalance (f_{fresp}) / dB - ΔRef / dB
- ▶ Take the value of Imbalance(ffresp) from the table above and ΔRef as ascertained before.

1.5.2.3 Frequency response > 3.6 GHz

Test setup:
- ► Standardize the Power Meter and Power Sensor (item 10, 12).
- ► Use Power Splitter/Combiner (item 8) and connect equipment as shown below.
- ► Connect the power splitter directly to the R&S ESU RF input 1.



Note:
Throughout the remaining steps set the Power Meter Cal Factor as appropriate!

Reference Measurement

Signal Generator settings:
- Level 0 dBm
- Frequency 128 MHz

R&S ESU settings:
- [**PRESET**]
- [**SETUP** : PREAMP : LNA ON]
- [**AMPT** : RF INPUT DC]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S ESU settings:
► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]
► Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
► Calculate
ΔRef / dB = L_{ESU} / dBm - $L_{PowerMeter}$ / dBm
► Record ΔRef / dB

Frequency Response Measurement

Signal Generator settings:
- Frequency f_{fresp}
See table in performance test report for values of f_{fresp}

R&S ESU settings:
- [**FREQ** : CENTER : {f_{fresp}}]
See table in performance test report for values of f_{fresp}

► Set marker to peak of signal
- [**MKR** ⇒ : PEAK]
► Read level indication from R&S ESU (reading of marker 1): L_{ESU}

Power Meter:
► Read level indication from Power Meter : $L_{PowerMeter}$

Evaluation:
- ► The frequency response can be calculated as:
- ► Freq. response / dB = L_{ESU} - $L_{PowerMeter}$ - ΔRef / dB
- ► Take the value of ΔRef as ascertained before.

1.6 Annex - Measurement of pulse-modulated signals (pulse spectral density)

The pulse spectral density is determined by measuring the level of one spectral line (CISPR 16-1-1, annex E7, method 2).

1.6.1 Absolute level accuracy at the carrier frequency (f_C)

Test equipment:
- Signal Generator (Section "Measurement Equipment", item 3)
- Frequency range 100 kHz to 3.6 GHz
- Power Meter (Section "Measurement Equipment", item 10)
- Power Sensor (Section "Measurement Equipment", item 11)

Test setup:
- ► Standardize the Power Meter and Power Sensor (item 10, 11).
- ► Set the Power Meter Cal Factor to the appropriate value for the Power Sensor for fc.
- ► Connect Power Sensor through a cable to RF output of Signal Generator.

Signal Generator settings:
- Frequency f_C
- Level L_{Gen}

Measurement:
- ► Adjust level to LGen ± 0.1 dB as viewed on the Power Meter.
- ► Record the Power Meter indication.
- ► Disconnect Power Sensor from the cable.
- ► Connect the cable to the input of the spectrum analyzer.

Spectrum analyzer settings:
- Center frequency {f_C }
- Span span}
- RBW {rbw}
- Reference level {ref. level}

Measurement:
- ► Set marker to peak of signal.

Evaluation:
The difference between the signal levels measured with the power meter and the spectrum analyzer (level reading of marker) reflects the absolute level accuracy of the spectrum analyzer at f_C. It can be calculated as:

$$\Delta Ref / dB = L_{SA} /dBm - L_{powermeter} /dBm$$

See table below for values of L_{GEN}, f_C, span, rbw and reference level.

1.6.2 Pulse spectral density

Test equipment:
- Signal generator with pulse modulation (Section "Measurement Equipment", item 3)
  Frequency range 9 kHz to 2 GHz

- Function generator (Section "Measurement Equipment", item 26)

Test setup:
- ► Connect output of function generator with pulse modulation input of the signal generator.
- ► Adjust the output level of the function generator according to the input of the generator.
- ► Connect RF output of signal generator to RF input of spectrum analyzer.

Signal generator settings:
- Frequency f_C
- Level L_{GEN}

Function generator settings
- Period $\{T_P\}$
- Pulse width {pw}

Note:
$f_p = 1/ T_P$

Spectrum analyzer settings:
- Center frequency $\{f_C\}$
- Span {span}
- RBW {rbw}
- Reference level {ref. level}

Measurement:
- ► Set marker to peak of signal (= $L_{\text{single spectral line}}$)

Evaluation

Pulse spectral density can be calculated as

$$D = L_{\text{single spectral line}} + \Delta\text{Ref / dB} + 20 \times \log (1\text{ MHz} / f_p)$$

Adjust the generator level if necessary to achieve the nominal level.

PEAK detector

	Band E
$\mathbf{f_C}$	1001 MHz
Ref. level	77 dBµV
RBW	5 kHz
Span	50 kHz
$\mathbf{L_{GEN}}$	-33 dBm
$\mathbf{T_P}$	20 µs (f_P = 50 kHz)
pw	200 ns
$\mathbf{L_{single\ spectral\ line}}$	34 dBµV ± 0.1 dB
D	60 dBµV/MHz ± 0.1 dB

CISPR AV detector

	Band B	Band C/D	Band E
f_C	1.1 MHz	128 MHz	1001 MHz
Ref. level	107 dBµV	107 dBµV	107 dBµV
RBW	50 Hz	500 Hz	5 kHz
Span	500 Hz	5 kHz	50 kHz
L_{GEN}	-7 dBm	-7 dBm	-7 dBm
T_P	2 ms (f_P = 500 Hz)	200 µs (f_P = 5 kHz)	20 µs (f_P = 50 kHz)
pw	20 µs	2 µs	200 ns
$L_{single\ spectral\ line}$	60 dBµV ± 0.1 dB	60 dBµV ± 0.1 dB	60 dBµV ± 0.1 dB
D	126 dBµV/MHz ± 0,1 dB	106 dBµV/MHz ± 0.1 dB	86 dBµV/MHz ± 0.1 dB

CISPR RMS detector

	Band B	Band C/D	Band E
f_C	1.1 MHz	128 MHz	1001 MHz
Ref. level	87 dBµV	97 dBµV	107 dBµV
RBW	100 Hz	100 Hz	100 Hz
Span	1000 Hz	1000 Hz	1000 Hz
L_{GEN}	-21.1 dBm	-12.4 dBm	-1.6 dBm
T_P	1 ms (f_P = 1000 Hz)	1 ms (f_P = 1000 Hz)	1 ms (f_P = 1000 Hz)
pw	20 µs	2 µs	200 ns
$L_{single\ spectral\ line}$	51,9 dBµV ± 0.1 dB	40,6 dBµV ± 0.1 dB	31,4 dBµV ± 0.1 dB
D	111.9 dBµV/MHz ± 0.1 dB	100.6 dBµV/MHz ± 0.1 dB	91.4 dBµV/MHz ± 0.1 dB

1.7 Performance Test Report R&S ESU

Table 1-1-1 Performance Test report

ROHDE & SCHWARZ Performance Test Report EMI Test Receiver R&S ESU Version 14-04-15
Model (R&S ESU 8 / R&S ESU 26 / R&S ESU 40): Order number: 1302.6005.08 /1302.6005.26 /1302.6005.40: Serial number: Test person: Date: Signature:

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency accuracy Reference oscillator	Page 17					
Model w/o Opt. B4		9.999999	________	10.000001	MHz	
Model with Opt. B4		9.9999997	________	10.0000003	MHz	
Image frequency rejection,1st IF f_{in}	Page 18					
11 MHz		90	________	-	dB	
100 MHz		90	________	-	dB	
1701 MHz		90	________	-	dB	
3001 MHz		90	________	-	dB	
Image frequency rejection 2nd IF f_{in} **f_{in} + 808.8 MHz** ***) f_{in} – 808.8 MHz**	Page 19					
100 MHz		90	________	-	dB	
3700 MHz		70	________	-	dB	
5000 MHz		70	________	-	dB	
7999 MHz		70	________	-	dB	
R&S ESU 26 / 40: 26000 MHz *)		70	________	-	dB	
R&S ESU 40: 35000 MHz		70	________	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Image frequency rejection 3rd IF f_{in}	Page 19					
100 MHz		90	________	-	dB	
4500 MHz		70	________	-	dB	
R&S ESU 26 / 40:						
26000 MHz		70	________	-	dB	
R&S ESU 40:						
35000 MHz		70	________	-	dB	
1st IF rejection f_{in}	Page 19					
11 MHz		90	________	-	dB	
100 MHz		90	________	-	dB	
1701 MHz		90	________	-	dB	
2990 MHz		90	________	-	dB	
2^{nd} IF rejection f_{in}	Page 20					
100 MHz		90	________	-	dB	
4500 MHz		70	________	-	dB	

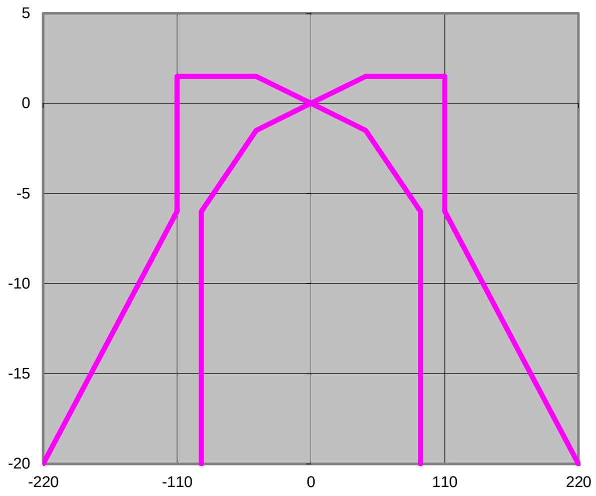
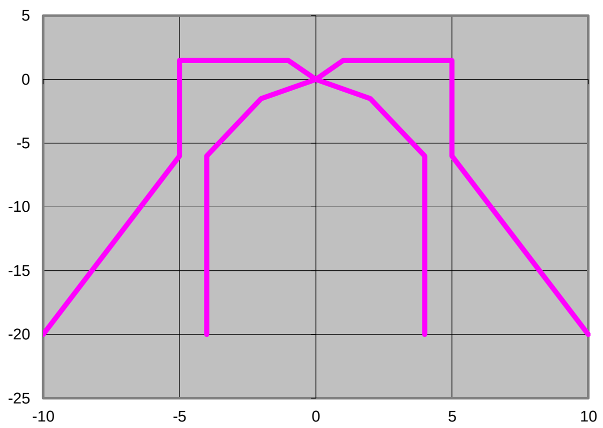
Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
T.O.I without preselection, without Preamplifier f_{in}	Page 20					
ESU 8:						
28 MHz		17	________	-	dBm	
106 MHz		17	________	-	dBm	
261 MHz		17	________	-	dBm	
640 MHz		20	________	-	dBm	
1000 MHz		20	________	-	dBm	
1700 MHz		20	________	-	dBm	
2500 MHz		20	________	-	dBm	
3590 MHz		20	________	-	dBm	
4001 MHz		18	________	-	dBm	
5001 MHz		18	________	-	dBm	
7999 MHz		18	________	-	dBm	
R&S ESU 26 / 40:						
28 MHz		17	________	-	dBm	
106 MHz		17	________	-	dBm	
261 MHz		17	________	-	dBm	
640 MHz		22	________	-	dBm	
1000 MHz		22	________	-	dBm	
1700 MHz		22	________	-	dBm	
2500 MHz		22	________	-	dBm	
3590 MHz		22	________	-	dBm	
4001 MHz		12	________	-	dBm	
5001 MHz		12	________	-	dBm	
7999 MHz		12	________	-	dBm	
12000 MHz		12	________	-	dBm	
20000 MHz		12	________	-	dBm	
26000 MHz		12	________	-	dBm	
R&S ESU 40:						
32000 MHz		12	________	-	dBm	
38000 MHz		12	________	-	dBm	

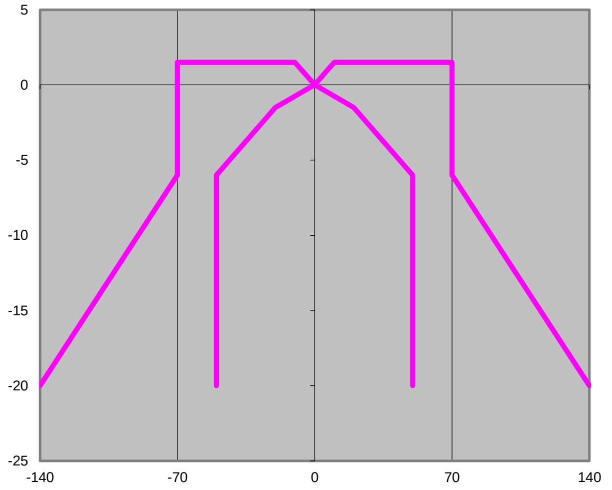
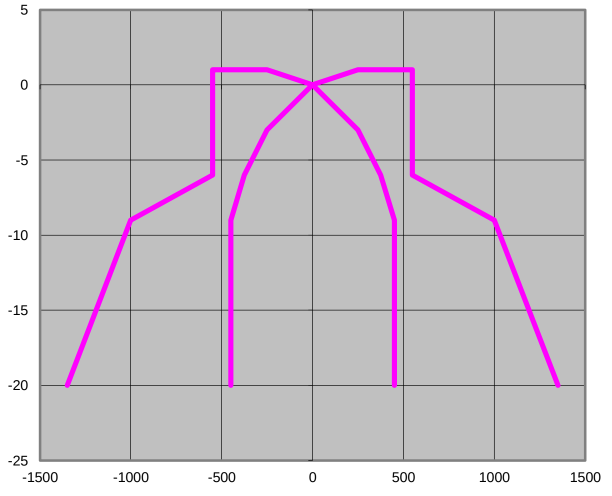
Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
T.O.I with preselection, without Preamplifier f_{in}	Page 20					
28 MHz		9	________	-		
106 MHz		9	________	-	dBm	
261 MHz		9	________	-	dBm	
640 MHz		12	________	-	dBm	
1000 MHz		12	________	-	dBm	
1700 MHz		12	________	-	dBm	
2500 MHz		12	________	-	dBm	
3590 MHz		12	________	-	dBm	
T.O.I with preselection, with Preamplifier f_{in}	Page 20					
28 MHz		-10	________	-	dBm	
106 MHz		-10	________	-	dBm	
261 MHz		-10	________	-	dBm	
640 MHz		-10	________	-	dBm	
1000 MHz		-10	________	-	dBm	
1700 MHz		-10	________	-	dBm	
2500 MHz		-10	________	-	dBm	
3590 MHz		-10	________	-	dBm	
2^{nd}-order harmonic distortion without preselection, without preamplifier f_{in}	Page 20					
40 MHz		35	________	-	dBm	
290 MHz		45	________	-	dBm	
1790 MHz		35	________	-	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
2nd-order harmonic distortion with preselection, without preamplifier f_{in}	Page 20					
40 MHz		40	________	-	dBm	
290 MHz		55	________	-	dBm	
1790 MHz		55	________	-	dBm	
2nd-order harmonic distortion with preselection, with preamplifier f_{in}	Page 20					
40 MHz		35	________	-	dBm	
290 MHz		45	________	-	dBm	
1790 MHz		45	________	-	dBm	
IF bandwidth (3 dB) level accuracy RBW	Page 25					
100 Hz		-0.1	________	+0.1	dB	
1 kHz		-0.1	________	+0.1	dB	
10 kHz		-	reference	-		
100 kHz		-0.1	________	+0.1	dB	
300 kHz		-0.2	________	+0.2	dB	
1 MHz		-0.2	________	+0.2	dB	
3 MHz		-0.2	________	+0.2	dB	
10 MHz		-0.5	________	+0.5	dB	
IF bandwidth (6 dB) level accuracy RBW	Page 25					
100 Hz		-0.1	________	+0.1	dB	
200 Hz		-0.1	________	+0.1	dB	
1 kHz		-0.1	________	+0.1	dB	
9 kHz		-0.1	________	+0.1	dB	
10 kHz (3 dB)		-	reference	-		
100 kHz		-0.1	________	+0.1	dB	
120 kHz		-0.1	________	+0.1	dB	
1 MHz		-0.2	________	+0.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
FFT Bandwidth level accuracy RBW	Page 25					
100 Hz		-0.2	________	+0.2	dB	
300 Hz		-0.2	________	+0.2	dB	
1 kHz		-0.2	________	+0.2	dB	
3 kHz		-0.2	________	+0.2	dB	
IF bandwidth (3 dB) Bandwidth RBW	Page 25					
100 Hz		97	________	103	Hz	
1 kHz		970	________	1030	Hz	
10 kHz		9.7	________	10.3	kHz	
100 kHz		97	________	103	kHz	
300 kHz		270	________	330	kHz	
1 MHz		900	________	1100	kHz	
3 MHz		2.7	________	3.3	MHz	
10 MHz		7	________	11	MHz	
IF bandwidth (6 dB) Bandwidth RBW	Page 25					
100 Hz		97	________	103	Hz	
200 Hz		194	________	206	Hz	
1 kHz		970	________	1030	Hz	
9 kHz		8.73	________	9.27	kHz	
10 kHz		9.7	________	10.3	kHz	
100 kHz		97	________	103	kHz	
120 kHz		116.4	________	123.6	kHz	
1 MHz		970	________	1030	MHz	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
IF Bandwidths (3 dB)	Page 25					
Shape factor						
RBW						
100 Hz		-	________	6	-	
1 kHz		-	________	6	-	
10 kHz		-	________	6	-	
100 kHz		-	________	6	-	
300 kHz		-	________	12	-	
1 MHz		-	________	12	-	
3 MHz		-	________	7	-	
10 MHz		-	________	7	-	
IF Bandwidths (6 dB)	Page 25					
Shape factor						
RBW						
100 Hz		-	________	5	-	
200 Hz		-	________	5	-	
1 kHz		-	________	5	-	
9 kHz		-	________	5	-	
10 kHz		-	________	5	-	
100 kHz		-	________	5	-	
120 kHz		-	________	5	-	
1 MHz		-	________	5	-	
IF Bandwidth						
Overall Selectivity						
RBW						
200 Hz						
$B_{1.5\,dB}$		90	________	220	Hz	
$B_{6\,dB}$		180	________	220	Hz	
$B_{20\,dB}$		180	________	440	Hz	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
						
9 kHz $B_{1.5\ dB}$ $B_{6\ dB}$ $B_{20\ dB}$		 4 8 8	 ________ ________ ________	 10 10 20	 kHz kHz kHz	
						
120 kHz $B_{1.5\ dB}$ $B_{6\ dB}$ $B_{20\ dB}$		 40 100 100	 ________ ________ ________	 140 140 280	 kHz kHz kHz	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
						
1 MHz $B_{3\,dB}$ $B_{6\,dB}$ $B_{9\,dB}$ $B_{20\,dB}$		 0.5 0.75 0.9 0.9	 ________ ________ ________ ________	 1.1 1.1 2 2.7	 MHz MHz MHz MHz	
						

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz without preselection [7] f_{noise}	Page 28					
R&S ESU 8:						
20 Hz		-	________	-90	dBm	
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–153	dBm	
19.99 MHz		-	________	–154	dBm	
49.99 MHz		-	________	–154	dBm	
99.99 MHz		-	________	–154	dBm	
199.9 MHz		-	________	–154	dBm	
499.9 MHz		-	________	–154	dBm	
999.9 MHz		-	________	–154	dBm	
1499 MHz		-	________	–152	dBm	
1999 MHz		-	________	–152	dBm	
2499 MHz		-	________	–148	dBm	
2999 MHz		-	________	–148	dBm	
3599 MHz		-	________	–148	dBm	
3601 MHz		-	________	-152	dBm	
6999 MHz		-	________	-152	dBm	
7999 MHz		-	________	-150	dBm	

[7] Noise Display with option R&S ESU-B24 installed see performance test report of R&S ESU-B24.

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz without preselection [8] f_{noise}	Page 28					
R&S ESU 26:						
20 Hz		-	________	-90	dBm	
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–153	dBm	
19.99 MHz		-	________	–152	dBm	
49.99 MHz		-	________	–152	dBm	
99.99 MHz		-	________	–152	dBm	
199.9 MHz		-	________	–152	dBm	
499.9 MHz		-	________	–152	dBm	
999.9 MHz		-	________	–152	dBm	
1499 MHz		-	________	–150	dBm	
1999 MHz		-	________	–150	dBm	
2499 MHz		-	________	–147	dBm	
2999 MHz		-	________	–147	dBm	
3599 MHz		-	________	–147	dBm	
3601 MHz		-	________	–152	dBm	
6999 MHz		-	________	–152	dBm	
9999 MHz		-	________	–150	dBm	
12999 MHz		-	________	–150	dBm	
17999 MHz		-	________	–148	dBm	
21999 MHz		-	________	–147	dBm	
26499 MHz		-	________	–145	dBm	

[8] Noise Display with option R&S ESU-B24 installed see performance test report of R&S ESU-B24.

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz without preselection [9] f_{noise}						
R&S ESU 40:						
20 Hz		-	________	-90	dBm	
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	-130	dBm	
95 kHz		-	________	-130	dBm	
999 kHz		-	________	-140	dBm	
9.99 MHz		-	________	-153	dBm	
19.99 MHz		-	________	–152	dBm	
49.99 MHz		-	________	–152	dBm	
99.99 MHz		-	________	–152	dBm	
199.9 MHz		-	________	–152	dBm	
499.9 MHz		-	________	–152	dBm	
999.9 MHz		-	________	–152	dBm	
1499 MHz		-	________	-150	dBm	
1999 MHz		-	________	-150	dBm	
2499 MHz		-	________	-147	dBm	
2999 MHz		-	________	-147	dBm	
3599 MHz		-	________	-147	dBm	
3601 MHz		-	________	-150	dBm	
6999 MHz		-	________	-150	dBm	
9999 MHz		-	________	-148	dBm	
12999 MHz		-	________	-148	dBm	
17999 MHz		-	________	-146	dBm	
21999 MHz		-	________	-145	dBm	
26499 MHz		-	________	-143	dBm	
26799 MHz		-	________	-141	dBm	
30999 MHz		-	________	-141	dBm	
34999 MHz		-	________	-138	dBm	
39999 MHz		-	________	-138	dBm	

[9] Noise Display with option R&S ESU-B24 installed see performance test report of R&S ESU-B24.

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with preselection, without preamplifier [10] f_{noise}	Page 28					
R&S ESU 8:						
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–153	dBm	
19.99 MHz		-	________	–155	dBm	
49.99 MHz		-	________	–155	dBm	
99.99 MHz		-	________	–155	dBm	
199.9 MHz		-	________	–155	dBm	
499.9 MHz		-	________	–155	dBm	
999.9 MHz		-	________	–155	dBm	
1499 MHz		-	________	–155	dBm	
1999 MHz		-	________	–155	dBm	
2499 MHz		-	________	–153	dBm	
2999 MHz		-	________	–150	dBm	
3599 MHz		-	________	–145	dBm	

[10] Noise Display with option R&S ESU-B24 installed see performance test report of R&S ESU-B24.

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with preselection, without preamplifier [11] f_{noise}	Page 28					
R&S ESU 26/40:						
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–153	dBm	
19.99 MHz		-	________	–155	dBm	
49.99 MHz		-	________	–155	dBm	
99.99 MHz		-	________	–155	dBm	
199.9 MHz		-	________	–155	dBm	
499.9 MHz		-	________	–155	dBm	
999.9 MHz		-	________	–155	dBm	
1499 MHz		-	________	–153	dBm	
1999 MHz		-	________	–153	dBm	
2499 MHz		-	________	–151	dBm	
2999 MHz		-	________	–147	dBm	
3599 MHz		-	________	–142	dBm	

[11] Noise Display with option R&S ESU-B24 installed see performance test report of R&S ESU-B24.

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with preselection, with preamplifier [12] f_{noise}	Page 28					
R&S ESU 8:						
900 Hz		-	________	-130	dBm	
9 kHz		-	________	–140	dBm	
95 kHz		-	________	–140	dBm	
999 kHz		-	________	–150	dBm	
9.99 MHz		-	________	–165	dBm	
19.99 MHz		-	________	–165	dBm	
49.99 MHz		-	________	–165	dBm	
99.99 MHz		-	________	–165	dBm	
199.9 MHz		-	________	–165	dBm	
499.9 MHz		-	________	–165	dBm	
999.9 MHz		-	________	–163	dBm	
1499 MHz		-	________	–163	dBm	
1999 MHz		-	________	–163	dBm	
2499 MHz		-	________	–161	dBm	
2999 MHz		-	________	–161	dBm	
3599 MHz		-	________	–157	dBm	

[12] Noise Display with option R&S ESU-B24 installed see performance test report of R&S ESU-B24.

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with preselection, with preamplifier [13] f_{noise}	Page 28					
R&S ESU 26/40:						
900 Hz		-	________	-130	dBm	
9 kHz		-	________	–140	dBm	
95 kHz		-	________	–140	dBm	
999 kHz		-	________	–150	dBm	
9.99 MHz		-	________	–165	dBm	
19.99 MHz		-	________	–163	dBm	
49.99 MHz		-	________	–163	dBm	
99.99 MHz		-	________	–163	dBm	
199.9 MHz		-	________	–163	dBm	
499.9 MHz		-	________	–163	dBm	
999.9 MHz		-	________	–161	dBm	
1499 MHz		-	________	–161	dBm	
1999 MHz		-	________	–161	dBm	
2499 MHz		-	________	–160	dBm	
2999 MHz		-	________	–160	dBm	
3599 MHz		-	________	–155	dBm	
Level accuracy RF input 1 at 128 MHz. –30 dBm	Page 29					
without preselection, without preamplifier		-0.2	________	+0.2	dB	
with preselection, without preamplifier		-0.3	________	+0.3	dB	
with preselection and preamplifier		-0.3	________	+0.3	dB	

[13] Noise Display with option R&S ESU-B24 installed see performance test report of R&S ESU-B24.

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level accuracy RF input 2 at 128 MHz. –30 dBm	Page 29					
without preselection, without preamplifier		-0.2	________	+0.2	dB	
with preselection, without preamplifier		-0.3	________	+0.3	dB	
with preselection and preamplifier		-0.3	________	+0.3	dB	
Frequency response <3.6 GHz RF input 1 RF Attenuation 10 dB DC coupling without preselection without preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.5	________	+0.5	dB	
1 MHz		-0.5	________	+0.5	dB	
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
300 MHz		-0.3	________	+0.3	dB	
400 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
600 MHz		-0.3	________	+0.3	dB	
700 MHz		-0.3	________	+0.3	dB	
800 MHz		-0.3	________	+0.3	dB	
900 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.5	________	+0.5	dB	
2500 MHz		-0.5	________	+0.5	dB	
3000 MHz		-0.5	________	+0.5	dB	
3599 MHz		-0.5	________	+0.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response <3.6 GHz RF input 1 RF Attenuation 10 dB AC coupling without preselection without preamplifier	Page 29					
f_{fresp}						
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
300 MHz		-0.3	________	+0.3	dB	
400 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
600 MHz		-0.3	________	+0.3	dB	
700 MHz		-0.3	________	+0.3	dB	
800 MHz		-0.3	________	+0.3	dB	
900 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.5	________	+0.5	dB	
2500 MHz		-0.5	________	+0.5	dB	
3000 MHz		-0.5	________	+0.5	dB	
3599 MHz		-0.5	________	+0.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response <3.6 GHz RF input 1 RF Attenuation 15 dB DC coupling without preselection without preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.5	________	+0.5	dB	
1 MHz		-0.5	________	+0.5	dB	
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
300 MHz		-0.3	________	+0.3	dB	
400 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
600 MHz		-0.3	________	+0.3	dB	
700 MHz		-0.3	________	+0.3	dB	
800 MHz		-0.3	________	+0.3	dB	
900 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.5	________	+0.5	dB	
2500 MHz		-0.5	________	+0.5	dB	
3000 MHz		-0.5	________	+0.5	dB	
3599 MHz		-0.5	________	+0.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response <3.6 GHz RF input 1 RF Attenuation 20 dB DC coupling without preselection without preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.5	________	+0.5	dB	
1 MHz		-0.5	________	+0.5	dB	
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
300 MHz		-0.3	________	+0.3	dB	
400 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
600 MHz		-0.3	________	+0.3	dB	
700 MHz		-0.3	________	+0.3	dB	
800 MHz		-0.3	________	+0.3	dB	
900 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.5	________	+0.5	dB	
2500 MHz		-0.5	________	+0.5	dB	
3000 MHz		-0.5	________	+0.5	dB	
3599 MHz		-0.5	________	+0.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response <3.6 GHz RF input 1 RF Attenuation 40 dB DC coupling without preselection without preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.5	________	+0.5	dB	
1 MHz		-0.5	________	+0.5	dB	
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
300 MHz		-0.3	________	+0.3	dB	
400 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
600 MHz		-0.3	________	+0.3	dB	
700 MHz		-0.3	________	+0.3	dB	
800 MHz		-0.3	________	+0.3	dB	
900 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.5	________	+0.5	dB	
2500 MHz		-0.5	________	+0.5	dB	
3000 MHz		-0.5	________	+0.5	dB	
3599 MHz		-0.5	________	+0.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response <3.6 GHz RF input 1 RF Attenuation 10 dB DC coupling with preselection, without preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.8	________	+0.8	dB	
1 MHz		-0.8	________	+0.8	dB	
10 MHz		-0.6	________	+0.6	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
1000 MHz		-0.6	________	+0.6	dB	
1500 MHz		-0.6	________	+0.6	dB	
2000 MHz		-0.8	________	+0.8	dB	
2500 MHz		-0.8	________	+0.8	dB	
3000 MHz		-0.8	________	+0.8	dB	
3599 MHz		-0.8	________	+0.8	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response <3.6 GHz RF input 1 RF Attenuation 30 dB DC coupling with preselection and preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.8	________	+0.8	dB	
1 MHz		-0.8	________	+0.8	dB	
10 MHz		-0.6	________	+0.6	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
1000 MHz		-0.6	________	+0.6	dB	
1500 MHz		-0.6	________	+0.6	dB	
2000 MHz		-0.8	________	+0.8	dB	
2500 MHz		-0.8	________	+0.8	dB	
3000 MHz		-0.8	________	+0.8	dB	
3599 MHz		-0.8	________	+0.8	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response < 3.6 GHz RF input 2 RF Attenuation 10 dB DC coupling without preselection, without preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.5	________	+0.5	dB	
1 MHz		-0.5	________	+0.5	dB	
10 MHz		-0.3	________	+0.3	dB	
50 MHz		-0.3	________	+0.3	dB	
100 MHz		-0.3	________	+0.3	dB	
200 MHz		-0.3	________	+0.3	dB	
300 MHz		-0.3	________	+0.3	dB	
400 MHz		-0.3	________	+0.3	dB	
500 MHz		-0.3	________	+0.3	dB	
600 MHz		-0.3	________	+0.3	dB	
700 MHz		-0.3	________	+0.3	dB	
800 MHz		-0.3	________	+0.3	dB	
900 MHz		-0.3	________	+0.3	dB	
999 MHz		-0.3	________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response < 3.6 GHz RF input 2 RF Attenuation 10 dB DC coupling with preselection, without preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.8	________	+0.8	dB	
1 MHz		-0.8	________	+0.8	dB	
10 MHz		-0.6	________	+0.6	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
999 MHz		-0.6	________	+0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response < 3.6 GHz RF input 2 RF Attenuation 30 dB DC coupling with preselection and preamplifier	Page 29					
f_{fresp}						
100 kHz		-0.8	________	+0.8	dB	
1 MHz		-0.8	________	+0.8	dB	
10 MHz		-0.6	________	+0.6	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
999 MHz		-0.6	________	+0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response > 3.6 GHz RF input 1 RF Attenuation 10 dB DC coupling	Page 29					
f_{fresp}						
3610 MHz		-1.5	________	+1.5	dB	
4000 MHz		-1.5	________	+1.5	dB	
4500 MHz		-1.5	________	+1.5	dB	
5000 MHz		-1.5	________	+1.5	dB	
5500 MHz		-1.5	________	+1.5	dB	
6000 MHz		-1.5	________	+1.5	dB	
6500 MHz		-1.5	________	+1.5	dB	
7000 MHz		-1.5	________	+1.5	dB	
7500 MHz		-1.5	________	+1.5	dB	
7990MHz		-1.5	________	+1.5	dB	
R&S ESU 26 / 40						
9000 MHz		-2	________	+2	dB	
10000 MHz		-2	________	+2	dB	
11000 MHz		-2	________	+2	dB	
12000 MHz		-2	________	+2	dB	
13000 MHz		-2	________	+2	dB	
14000 MHz		-2	________	+2	dB	
15000 MHz		-2	________	+2	dB	
16000 MHz		-2	________	+2	dB	
17000 MHz		-2	________	+2	dB	
18000 MHz		-2	________	+2	dB	
19000 MHz		-2	________	+2	dB	
20000 MHz		-2	________	+2	dB	
21000 MHz		-2	________	+2	dB	
22000 MHz		-2	________	+2	dB	
23000 MHz		-2	________	+2	dB	
24000 MHz		-2	________	+2	dB	
25000 MHz		-2	________	+2	dB	
26000 MHz		-2	________	+2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S ESU 40:						
f_{fresp}						
27000 MHz		-2	________	+2	dB	
28000 MHz		-2	________	+2	dB	
29000 MHz		-2	________	+2	dB	
30000 MHz		-2	________	+2	dB	
31000 MHz		-2	________	+2	dB	
32000 MHz		-2	________	+2	dB	
33000 MHz		-2	________	+2	dB	
34000 MHz		-2	________	+2	dB	
35000 MHz		-2	________	+2	dB	
36000 MHz		-2	________	+2	dB	
37000 MHz		-2	________	+2	dB	
38000 MHz		-2	________	+2	dB	
39000 MHz		-2	________	+2	dB	
39999 MHz		-2	________	+2	dB	
Display linearity	Page 30					
RBW 500 Hz						
a_{ATT} :						
10 dB		9.9	________	10.1	dB	
15 dB		4.9	________	5.1	dB	
20 dB		-	reference	-	-	
25 dB		-5.1	________	-4.9	dB	
30 dB		-10.1	________	-9.9	dB	
35 dB		-15.1	________	-14.9	dB	
40 dB		-20.1	________	-19.9	dB	
45 dB		-25.1	________	-24.9	dB	
50 dB		-30.1	________	-29.9	dB	
55 dB		-35.1	________	-34.9	dB	
60 dB		-40.1	________	-39.9	dB	
65 dB		-45.1	________	-44.9	dB	
70 dB		-50.1	________	-49.9	dB	
75 dB		-55.1	________	-54.9	dB	
80 dB		-60.1	________	-59.9	dB	
85 dB		-65.3	________	-64.7	dB	
90 dB		-70.3	________	-69.7	dB	
95 dB		-75.3	________	-74.7	dB	
100 dB		-80.3	________	-79.7	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 300 kHz	Page 46					
a_{ATT} :						
10 dB		9.8	________	10.2	dB	
15 dB		4.8	________	5.2	dB	
20 dB		-	reference	-	-	
25 dB		-5.2	________	-4.8	dB	
30 dB		-10.2	________	-9.8	dB	
35 dB		-15.2	________	-14.8	dB	
40 dB		-20.2	________	-19.8	dB	
45 dB		-25.2	________	-24.8	dB	
50 dB		-30.2	________	-29.8	dB	
55 dB		-35.2	________	-34.8	dB	
60 dB		-40.2	________	-39.8	dB	
65 dB		-45.5	________	-44.5	dB	
70 dB		-50.5	________	-49.5	dB	
75 dB		-55.5	________	-54.5	dB	
80 dB		-60.5	________	-59.5	dB	
Display linearity alternative measurement RBW 500 Hz						
relative input level						
0 dB		------	0.00	------	dB	
-6 dB		-6.1	________	-5.9	dB	
-12 dB		-12.1	________	-11.9	dB	
-18 dB		-18.1	________	-17.9	dB	
-24 dB		-24.1	________	-23.9	dB	
-30 dB		-30.1	________	-29.9	dB	
-36 dB		-36.1	________	-35.9	dB	
-42 dB		-42.1	________	-41.9	dB	
-48 dB		-48.1	________	-47.9	dB	
-54 dB		-54.1	________	-53.9	dB	
-60 dB		-60.1	________	-59.9	dB	
-66 dB		-66.1	________	-65.9	dB	
-72 dB		-72.3	________	-71.7	dB	
-78 dB		-78.3	________	-77.7	dB	
-84 dB		-84.3	________	-83.7	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity alternative measurement RBW 300 kHz						
relative input level						
0 dB		------	0.00	------	dB	
-6 dB		-6.2	________	-5.8	dB	
-12 dB		-12.2	________	-11.8	dB	
-18 dB		-18.2	________	-17.8	dB	
-24 dB		-24.2	________	-23.8	dB	
-30 dB		-30.2	________	-29.8	dB	
-36 dB		-36.2	________	-35.8	dB	
-42 dB		-42.2	________	-41.8	dB	
-50 dB		-50.2	________	-49.8	dB	
-56 dB		-56.5	________	-55.5	dB	
-62 dB		-62.5	________	-61.5	dB	
RF Attenuator accuracy	Page 48					
RF Attenuation						
10 dB		-	reference	-	-	
5 dB		-5.2	________	-4.8	dB	
15 dB		+4.8	________	+5.2	dB	
20 dB		+9.8	________	+10.2	dB	
25 dB		+14.8	________	+15.2	dB	
30 dB		+19.8	________	+20.2	dB	
35 dB		+24.8	________	+25.2	dB	
40 dB		+29.8	________	+30.2	dB	
50 dB		+39.8	________	+40.2	dB	
60 dB		+49.8	________	+50.2	dB	
70 dB		+59.8	________	+60.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
RF Attenuator accuracy alternative measurement	Page 48					
RF Attenuation						
10 dB		-	0 (reference)	-	dB	
5 dB		-0.2	________	0.2	dB	
15 dB		-0.2	________	0.2	dB	
20 dB		-0.2	________	0.2	dB	
25 dB		-0.2	________	0.2	dB	
30 dB		-0.2	________	0.2	dB	
40 dB		-0.2	________	0.2	dB	
50 dB		-0.2	________	0.2	dB	
60 dB		-0.2	________	0.2	dB	
70 dB		-0.2	________	0.2	dB	
Reference level switching accuracy	Page 53					
Reference level						
0 dBm		+9,85	________	+10,15	dB	
-10 dBm		-	reference	-	-	
-20 dBm		-10.15	________	-9,85	dB	
-30 dBm		-20.15	________	-19,85	dB	
-40 dBm		-30.15	________	-29,85	dB	
-50 dBm		-40.15	________	-39,85	dB	
-11 dBm		-1.15	________	-0,85	dB	
-12 dBm		-2.15	________	-1,85	dB	
-13 dBm		-3.15	________	-2,85	dB	
-14 dBm		-4.15	________	-3,85	dB	
-15 dBm		-5.15	________	-4,85	dB	
-16 dBm		-6.15	________	-5,85	dB	
-17 dBm		-7.15	________	-6,85	dB	
-18 dBm		-8.15	________	-7,85	dB	
-19 dBm		-9.15	________	-8,85	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Reference level switching accuracy alternative measurement	Page 53					
Reference level						
-10 dBm		-	0 (reference)	-	dB	
0 dBm		-0.15	________	0.15	dB	
-11 dBm		-0.15	________	0.15	dB	
-12 dBm		-0.15	________	0.15	dB	
-13 dBm		-0.15	________	0.15	dB	
-14 dBm		-0.15	________	0.15	dB	
-15 dBm		-0.15	________	0.15	dB	
-16 dBm		-0.15	________	0.15	dB	
-18 dBm		-0.15	________	0.15	dB	
-20 dBm		-0.15	________	0.15	dB	
-30 dBm		-0.15	________	0.15	dB	
-40 dBm		-0.15	________	0.15	dB	
-50 dBm		-0.15	________	0.15	dB	
-60 dBm		-0.15	________	0.15	dB	
Detectors according CISPR 16-1-1 Receiver Mode: Sine-wave voltage accuracy	Page 58					
Band A						
Pk+		95	________	99	dBµV	
QPK		95	________	99	dBµV	
CAV		95	________	99	dBµV	
CRMS		95	________	99	dBµV	
Band B	Page 59					
Pk+		95	________	99	dBµV	
QPK		95	________	99	dBµV	
CAV		95	________	99	dBµV	
CRMS		95	________	99	dBµV	
Band C/D	Page 59					
Pk+		95	________	99	dBµV	
QPK		95	________	99	dBµV	
CAV		95	________	99	dBµV	
CRMS		95	________	99	dBµV	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Band E	Page 60					
Pk+		95	________	99	dBµV	
CAV		95	________	99	dBµV	
CRMS		95	________	99	dBµV	
Peak and Quasi-Peak-Detector Amplitude relationship	Page 61					
Band A						
Pk		39.6	________	42.6	dBµV	
QP		33.5	________	36.5	dBµV	
Band B	Page 61					
Pk		54.1	________	57.1	dBµV	
QP		47.5	________	50.5	dBµV	
Band C/D	Page 61					
Pk		64.5	________	67.5	dBµV	
QP		52.5	________	55.5	dBµV	
Band E	Page 62					
Pk		58.5	________	61.5	dBµV	
Quasi-peak, variation with repetition frequency	Page 62					
Band A						
f_P						
25 Hz (Reference)		-	________	-	dBµV	
100 Hz		+3	________	+5	dB	
60 Hz		+2	________	+4	dB	
10 Hz		-5	________	-3	dB	
5 Hz		–9	________	–6	dB	
2 Hz		–15	________	–11	dB	
1 Hz		–19	________	-15	dB	
Single		-21	________	-17	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Band B	Page 63					
f_P:						
100 Hz (Reference)		-	________	-	dBµV	
20 Hz		-7.5	________	-5.5	dB	
10 Hz		–11.5	________	–8.5	dB	
2 Hz		–22.5	________	–18.5	dB	
1 Hz		–24.5	________	–20.5	dB	
Single		-25,5	________	-21,5	dB	
L_{Peak}		68	________	73	dBµV	
100 Hz (Ref_{1kHz})		-	________	-	dBµV	
1 kHz		+3,5	________	+5,5	dB	
Band C/D	Page 63					
f_P:						
100 Hz (Reference)		-	________	-	dBµV	
20 Hz		-10.0	________	-8.0	dB	
10 Hz		–15.5	________	–12.5	dB	
2 Hz		–28.0	________	–24.0	dB	
1 Hz		–30.5	________	–26.5	dB	
Single		-33,5	________	-29,5	dB	
L_{Peak}		90	________	96	dBµV	
100 Hz (Ref_{1kHz})		-	________	-	dBµV	
1 kHz		+7	________	+9	dB	
CISPR Average Amplitude relationship	Page 65					
Band A		47.1	________	50.1	dBµV	
Band B		59.5	________	62.5	dBµV	
Band C/D		59.5	________	62.5	dBµV	
Band E		58.5	________	61.5	dBµV	
CISPR Average, variation with repetition frequency:	Page 67					
Band A						
f_P						
25 Hz (Reference)		-	________	-	dBµV	
50 Hz		+5	________	+9	dB	
12 Hz		-7	________	-3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Band B	Page 66					
f_P						
500 Hz (Reference)		-	________	-	dBµV	
50 Hz		-21	________	-17	dB	
Band C/D	Page 66					
f_P						
5000 Hz (Reference)		-	________	-	dBµV	
500 Hz		-21	________	-17	dB	
Band E	Page 67					
f_P						
50000 Hz (Reference)		-	________	-	dBµV	
5000 Hz		-21	________	-17	dB	
Response to intermittent disturbance	Page 70					
Band A/B		-10	________	-8	dB	
Band C/D/E		-10	________	-8	dB	
RMS-average Amplitude relationship	Page 71					
Band A		54.3	________	57.3	dBµV	
Band B		58.5	________	61.5	dBµV	
Band C/D		58.5	________	61.5	dBµV	
Band E		58.5	________	61.5	dBµV	
RMS-average, variation with repetition frequency:	Page 73					
Band A						
f_P						
25 Hz (Reference)		-	________	-	dBµV	
100 Hz		+5.4	________	+6.6	dB	
10 Hz		-4.4	________	-3.6	dB	
5 Hz		-9.7	________	-8.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Band B	Page 74					
f_P						
1000 Hz (Reference)		-	________	-	dBµV	
316 Hz		-5.5	________	-4.5	dB	
100 Hz		-11	________	-9	dB	
32 Hz		-16.5	________	-13.5	dB	
25 Hz		-17.6	________	-14.4	dB	
10 Hz		-22	________	-18	dB	
5 Hz		-27.3	________	-22.7	dB	
Band C/D	Page 75					
f_P						
1000 Hz (Reference)		-	________	-	dBµV	
10000 Hz		+9	________	+11	dB	
316 Hz		-5.5	________	-4.5	dB	
100 Hz		-11	________	-9	dB	
32 Hz		-22	________	-18	dB	
Band E	Page 75					
f_P						
1000 Hz (Reference)		-	________	-	dBµV	
100000 Hz		+18	________	+22	dB	
10000 Hz		+9	________	+11	dB	
316 Hz		-11	________	-9	dB	
Response to intermittent disturbance	Page 77					
Band A/B		-8.9	________	-6.9	dB	
Band C/D/E		-10	________	-8	dB	
Detectors according CISPR 16-1-1 TD Scan (ESU-K53): Sine-wave voltage accuracy	Page 78					
Band A						
Pk+		95	________	99	dBµV	
QPK		95	________	99	dBµV	
CAV		95	________	99	dBµV	
CRMS		95	________	99	dBµV	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Band B	Page 79					
Pk+		95	________	99	dBµV	
QPK		95	________	99	dBµV	
CAV		95	________	99	dBµV	
CRMS		95	________	99	dBµV	
Band C/D	Page 80					
Pk+		95	________	99	dBµV	
QPK		95	________	99	dBµV	
CAV		95	________	99	dBµV	
CRMS		95	________	99	dBµV	
Band E	Page 80					
Pk+		95	________	99	dBµV	
CAV		95	________	99	dBµV	
CRMS		95	________	99	dBµV	
Peak and Quasi-Peak-Detector Amplitude relationship	Page 82					
Band A						
Pk		39.6	________	42.6	dBµV	
QP		33.5	________	36.5	dBµV	
Band B	Page 82					
Pk		54.1	________	57.1	dBµV	
QP		47.5	________	50.5	dBµV	
Band C/D	Page 83					
Pk		64.5	________	67.5	dBµV	
QP		52.5	________	55.5	dBµV	
Band E	Page 83					
Pk		58.5	________	61.5	dBµV	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Quasi-peak, variation with repetition frequency	Page 84					
Band A						
f_P						
25 Hz (Reference)		-	________	-	dBµV	
100 Hz		+3	________	+5	dB	
60 Hz		+2	________	+4	dB	
10 Hz		-5	________	-3	dB	
5 Hz		–9	________	–6	dB	
2 Hz		–15	________	–11	dB	
1 Hz		–19	________	-15	dB	
Single		-21	________	-17	dB	
Band B	Page 84					
f_P:						
100 Hz (Reference)		-	________	-	dBµV	
20 Hz		-7.5	________	-5.5	dB	
10 Hz		–11.5	________	–8.5	dB	
2 Hz		–22.5	________	–18.5	dB	
1 Hz		–24.5	________	–20.5	dB	
Single		-25,5	________	-21,5	dB	
L_{Peak}		68	________	73	dBµV	
100 Hz (Ref_{1kHz})		-	________	-	dBµV	
1 kHz		+3,5	________	+5,5	dB	
Band C/D	Page 85					
f_P:						
100 Hz (Reference)		-	________	-	dBµV	
20 Hz		-10.0	________	-8.0	dB	
10 Hz		–15.5	________	–12.5	dB	
2 Hz		–28.0	________	–24.0	dB	
1 Hz		–30.5	________	–26.5	dB	
Single		-33,5	________	-29,5	dB	
L_{Peak}		90	________	96	dBµV	
100 Hz (Ref_{1kHz})		-	________	-	dBµV	
1 kHz		+7	________	+9	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
CISPR Average Amplitude relationship	Page 87					
Band A		47.1	________	50.1	dBµV	
Band B		59.5	________	62.5	dBµV	
Band C/D		59.5	________	62.5	dBµV	
Band E		58.5	________	61.5	dBµV	
CISPR Average, variation with repetition frequency:	Page 89					
Band A						
f_P						
25 Hz (Reference)		-	________	-	dBµV	
50 Hz		+5	________	+9	dB	
12 Hz		-7	________	-3	dB	
Band B	Page 90					
f_P						
500 Hz (Reference)		-	________	-	dBµV	
50 Hz		-21	________	-17	dB	
Band C/D	Page 91					
f_P						
5000 Hz (Reference)		-	________	-	dBµV	
500 Hz		-21	________	-17	dB	
Band E	Page 92					
f_P						
50000 Hz (Reference)			________	-	dBµV	
5000 Hz		-21	________	-17	dB	
Response to intermittent disturbance	Page 92					
Band A/B		-10	________	-8	dB	
Band C/D/E		-10	________	-8	dB	
RMS-average Amplitude relationship	Page 94					
Band A		54.3	________	57.3	dBµV	
Band B		58.5	________	61.5	dBµV	
Band C/D		58.5	________	61.5	dBµV	
Band E		58.5	________	61.5	dBµV	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
RMS-average, variation with repetition frequency:	Page 96					
Band A						
f_P						
25 Hz (Reference)		-	________	-	dBµV	
100 Hz		+5.4	________	+6.6	dB	
10 Hz		-4.4	________	-3.6	dB	
5 Hz		-9.7	________	-8.3	dB	
Band B	Page 97					
f_P						
1000 Hz (Reference)		-	________	-	dBµV	
316 Hz		-5.5	________	-4.5	dB	
100 Hz		-11	________	-9	dB	
32 Hz		-16.5	________	-13.5	dB	
25 Hz		-17.6	________	-14.4	dB	
10 Hz		-22	________	-18	dB	
5 Hz		-27.3	________	-22.7	dB	
Band C/D	Page 97					
f_P						
1000 Hz (Reference)		-	________	-	dBµV	
10000 Hz		+9	________	+11	dB	
316 Hz		-5.5	________	-4.5	dB	
100 Hz		-11	________	-9	dB	
32 Hz		-22	________	-18	dB	
Band E	Page 98					
f_P						
1000 Hz (Reference)		-	________	-	dBµV	
100000 Hz		+18	________	+22	dB	
10000 Hz		+9	________	+11	dB	
316 Hz		-11	________	-9	dB	
Response to intermittent disturbance	Page 99					
Band A/B		-8.9	________	-6.9	dB	
Band C/D/E		-10	________	-8	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Phase noise at 639 / 640 MHz	Page 56					
Offset:						
100 Hz		-	________	-98	dBc (1Hz)	
1 kHz		-	________	-116	dBc (1Hz)	
10 kHz		-	________	-128	dBc (1Hz)	
100 kHz		-	________	-128	dBc (1Hz)	
1 MHz		-	________	-140	dBc (1Hz)	
Phase noise testing at 800 MHz alternative measurement	Page 102					
Offset:						
100 Hz		-	________	-98	dBc (1Hz)	
1 kHz		-	________	-116	dBc (1Hz)	
10 kHz		-	________	-128	dBc (1Hz)	
100 kHz		-	________	-128	dBc (1Hz)	
1 MHz		-	________	-140	dBc (1Hz)	
VSWR RF input 1 RF att 10 dB / DC f_{in}	Page 104					
100 kHz		-	________	1.2		
1 MHz		-	________	1.2		
10 MHz		-	________	1.2		
250 MHz		-	________	1.2		
500 MHz		-	________	1.2		
750 MHz		-	________	1.2		
1000 MHz		-	________	1.2		
1250 MHz		-	________	1.5		
1500 MHz		-	________	1.5		
1750 MHz		-	________	1.5		
2000 MHz		-	________	1.5		
2250 MHz		-	________	1.5		
2500 MHz		-	________	1.5		
2750 MHz		-	________	1.5		
3000 MHz		-	________	1.5		
3250 MHz		-	________	1.5		
3500 MHz		-	________	1.5		

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S ESU 8:						
4000 MHz		-	________	2		
6000 MHz		-	________	2		
7990 MHz		-	________	2		
R&S ESU 26 / 40:						
4000 MHz		-	________	1.8		
6000 MHz		-	________	1.8		
7990 MHz		-	________	1.8		
10000 MHz		-	________	1.8		
12000 MHz		-	________	1.8		
14000 MHz		-	________	1.8		
16000 MHz		-	________	1.8		
18000 MHz		-	________	2		
20000 MHz		-	________	2		
22000 MHz		-	________	2		
24000 MHz		-	________	2		
26000 MHz		-	________	2		
R&S ESU 40:						
28000 MHz		-	________	2.5		
30000 MHz		-	________	2.5		
32000 MHz		-	________	2.5		
34000 MHz		-	________	2.5		
36000 MHz		-	________	2.5		
38000 MHz		-	________	2.5		
40000 MHz		-	________	2.5		

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
VSWR	Page 104					
RF input 1						
RF att 0 dB / DC						
f_{in}						
100 kHz		-	________	2		
1 MHz		-	________	2		
10 MHz		-	________	2		
250 MHz		-	________	2		
500 MHz		-	________	2		
750 MHz		-	________	2		
1000 MHz			________	2		
1250 MHz		-	________	3		
1500 MHz		-	________	3		
1750 MHz		-	________	3		
2000 MHz		-	________	3		
2250 MHz		-	________	3		
2500 MHz		-	________	3		
2750 MHz		-	________	3		
3000 MHz		-	________	3		
3250 MHz		-	________	3		
3500 MHz		-	________	3		
4000 MHz		-	________	3		
6000 MHz		-	________	3		
7990 MHz		-	________	3		
R&S ESU 26 / 40:						
10000 MHz		-	________	3		
12000 MHz		-	________	3		
14000 MHz		-	________	3		
16000 MHz		-	________	3		
18000 MHz		-	________	3		
20000 MHz		-	________	3		
22000 MHz		-	________	3		
24000 MHz		-	________	3		
26000 MHz		-	________	3		

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S ESU 40:						
28000 MHz		-	________	3		
30000 MHz		-	________	3		
32000 MHz		-	________	3		
34000 MHz		-	________	3		
36000 MHz		-	________	3		
38000 MHz		-	________	3		
40000 MHz		-	________	3		
VSWR RF input 2 RF att 10 dB / DC f_{in}	Page 104					
100 kHz		-	________	1.2		
1 MHz		-	________	1.2		
10 MHz		-	________	1.2		
250 MHz		-	________	1.2		
500 MHz		-	________	1.2		
750 MHz		-	________	1.2		
999 MHz		-	________	1.2		
VSWR RF input 2 RF att 0 dB / DC f_{in}	Page 104					
100 kHz		-	________	2		
1 MHz		-	________	2		
10 MHz		-	________	2		
250 MHz		-	________	2		
500 MHz		-	________	2		
750 MHz		-	________	2		
999 MHz		-	________	2		

1.8 Performance Test Report Option R&S FSU-B9

Table 1-1-2: Performance Test Report Option R&S FSU-B9, B12

ROHDE & SCHWARZ Performance Test Report	Option R&S FSU-B9, B12	Version 14-04-15
Serial number: Option B12 installed: yes / no Test person: Date: Signature:		

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level accuracy of the output level at 128 MHz:	Page 106					
Without option B12						
0 dBm		- 1	________	+ 1	dBm	
- 5 dBm		- 6	________	- 4	dBm	
-10 dBm		- 11	________	- 9	dBm	
-15 dBm		- 16	________	- 14	dBm	
-20 dBm		– 21	________	- 19	dBm	
With option B12						
0 dBm		– 1	________	+ 1	dBm	
-10 dBm		– 11	________	– 9	dBm	
-20 dBm		– 21	________	– 19	dBm	
-40 dBm		– 41	________	– 39	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response Tracking generator 100 kHz to 3.6 GHz output level, referenced to 128 MHz:	Page 107					
Without option B12						
0 dBm		- 3	________	+ 3	dB	
- 5 dBm		– 3	________	+ 3	dB	
– 10 dBm		– 3	_______	+ 3	dB	
– 15 dBm		– 3	________	+ 3	dB	
– 20 dBm		– 3	________	+ 3	dB	
With option B12						
0 dBm		- 4	________	+ 4	dB	
-10 dBm		– 4	________	+ 4	dB	
-20 dBm		– 4	________	+ 4	dB	
-40 dBm		– 4	________	+ 4	dB	
Dynamic range Tracking generator at 128 MHz:	Page 110					
reference level		- 1	________	+ 1	dBm	
isolation		-	________	- 100	dBc	
Checking modulation Tracking generator I/Q modulation +90 ° output level:	Page 108					
Signal 1000.2 MHz		- 3	________	+ 3	dBm	
residual carrier		-	________	- 30	dBc	
sideband 999.8 MHz		-	________	- 30	dBc	
Checking Modulation Tracking generator AM modulation	Page 109					
Carrier level		- 3	________	+ 3	dBm	
Signal spacing 1001 MHz		- 8	________	- 4	dBc	
Signal spacing 999 MHz		- 8	________	- 4	dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Checking modulation Tracking generator FM modulation	Page 110					
Carrier level		- 5	________	+ 1	dBm	
Signal spacing 1000.1 MHz		- 5	________	- 3	dBc	
Signal spacing 999.9 MHz		- 5	________	- 3	dBc	

1.9 Performance Test Report Option R&S ESU-B24

Table 1-1-3: Performance Test Report Option R&S ESU-B24

ROHDE & SCHWARZ Performance Test Report	Option R&S ESU-B24 Version 14-04-15
Serial number: Test person: Date: Signature:	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz without preselection f_{noise}	Page 28					
R&S ESU 8:						
20 Hz		-	________	-90	dBm	
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–153	dBm	
19.99 MHz		-	________	–154	dBm	
49.99 MHz		-	________	–154	dBm	
99.99 MHz		-	________	–154	dBm	
199.9 MHz		-	________	–154	dBm	
499.9 MHz		-	________	–154	dBm	
999.9 MHz		-	________	–154	dBm	
1499 MHz		-	________	–151	dBm	
1999 MHz		-	________	–151	dBm	
2499 MHz		-	________	–146	dBm	
2999 MHz		-	________	–146	dBm	
3599 MHz		-	________	–145	dBm	
4001 MHz		-	________	-148	dBm	
5501 MHz		-	________	-147	dBm	
6999 MHz		-	________	-144	dBm	
7999 MHz		-	________	-144	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz without preselection f_{noise}	Page 28					
R&S ESU 26:						
20 Hz		-	________	-90	dBm	
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–153	dBm	
19.99 MHz		-	________	–152	dBm	
49.99 MHz		-	________	–152	dBm	
99.99 MHz		-	________	–152	dBm	
199.9 MHz		-	________	–152	dBm	
499.9 MHz		-	________	–152	dBm	
999.9 MHz		-	________	–152	dBm	
1499 MHz		-	________	–150	dBm	
1999 MHz		-	________	–150	dBm	
2499 MHz		-	________	–145	dBm	
2999 MHz		-	________	–145	dBm	
3599 MHz		-	________	–145	dBm	
3601 MHz		-	________	–147	dBm	
6999 MHz		-	________	–147	dBm	
9999 MHz		-	________	–147	dBm	
12999 MHz		-	________	–145	dBm	
17999 MHz		-	________	–145	dBm	
21999 MHz		-	________	–142	dBm	
26499 MHz		-	________	–140	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz without preselection **R&S ESU 40:**	Page 28					
20 Hz		-	________	-90	dBm	
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	-130	dBm	
95 kHz		-	________	-130	dBm	
999 kHz		-	________	-140	dBm	
9.99 MHz		-	________	-153	dBm	
19.99 MHz		-	________	–152	dBm	
49.99 MHz		-	________	–152	dBm	
99.99 MHz		-	________	–152	dBm	
199.9 MHz		-	________	–152	dBm	
499.9 MHz		-	________	–152	dBm	
999.9 MHz		-	________	–152	dBm	
1499 MHz		-	________	-150	dBm	
1999 MHz		-	________	-150	dBm	
2499 MHz		-	________	-145	dBm	
2999 MHz		-	________	-145	dBm	
3599 MHz		-	________	-145	dBm	
3601 MHz		-	________	-147	dBm	
6999 MHz		-	________	-147	dBm	
9999 MHz		-	________	-147	dBm	
12999 MHz		-	________	-145	dBm	
17999 MHz		-	________	-145	dBm	
21999 MHz		-	________	-142	dBm	
26499 MHz		-	________	-140	dBm	
26799 MHz		-	________	-135	dBm	
30999 MHz		-	________	-135	dBm	
34999 MHz		-	________	-133	dBm	
39999 MHz		-	________	-133	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with preselection, without preamplifier f_{noise}	Page 28					
R&S ESU 8:						
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–153	dBm	
19.99 MHz		-	________	–155	dBm	
49.99 MHz		-	________	–155	dBm	
99.99 MHz		-	________	–155	dBm	
199.9 MHz		-	________	–155	dBm	
499.9 MHz		-	________	–155	dBm	
999.9 MHz		-	________	–155	dBm	
1499 MHz		-	________	–155	dBm	
1999 MHz		-	________	–155	dBm	
2499 MHz		-	________	–151	dBm	
2999 MHz		-	________	–148	dBm	
3599 MHz		-	________	–142	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with preselection, without preamplifier f_{noise}	Page 28					
R&S ESU 26/40:						
90 Hz		-	________	-110	dBm	
900 Hz		-	________	-120	dBm	
9 kHz		-	________	–130	dBm	
95 kHz		-	________	–130	dBm	
999 kHz		-	________	–140	dBm	
9.99 MHz		-	________	–153	dBm	
19.99 MHz		-	________	–152	dBm	
49.99 MHz		-	________	–152	dBm	
99.99 MHz		-	________	–152	dBm	
199.9 MHz		-	________	–152	dBm	
499.9 MHz		-	________	–152	dBm	
999.9 MHz		-	________	–152	dBm	
1499 MHz		-	________	–152	dBm	
1999 MHz		-	________	–152	dBm	
2499 MHz		-	________	–147	dBm	
2999 MHz		-	________	–147	dBm	
3599 MHz		-	________	–142	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with preselection, with preamplifier f_{noise}	Page 28					
R&S ESU 8:						
900 Hz		-	________	-130	dBm	
9 kHz		-	________	–140	dBm	
95 kHz		-	________	–140	dBm	
999 kHz		-	________	–150	dBm	
9.99 MHz		-	________	–165	dBm	
19.99 MHz		-	________	–165	dBm	
49.99 MHz		-	________	–165	dBm	
99.99 MHz		-	________	–165	dBm	
199.9 MHz		-	________	–165	dBm	
499.9 MHz		-	________	–165	dBm	
999.9 MHz		-	________	–162	dBm	
1499 MHz		-	________	–162	dBm	
1999 MHz		-	________	–162	dBm	
2499 MHz		-	________	–159	dBm	
2999 MHz		-	________	–159	dBm	
3599 MHz		-	________	–154	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with preselection, with preamplifier f_{noise}	Page 28					
R&S ESU 26/40:						
900 Hz		-	________	-130	dBm	
9 kHz		-	________	–140	dBm	
95 kHz		-	________	–140	dBm	
999 kHz		-	________	–150	dBm	
9.99 MHz		-	________	–165	dBm	
19.99 MHz		-	________	–162	dBm	
49.99 MHz		-	________	–162	dBm	
99.99 MHz		-	________	–162	dBm	
199.9 MHz		-	________	–162	dBm	
499.9 MHz		-	________	–162	dBm	
999.9 MHz		-	________	–162	dBm	
1499 MHz		-	________	–162	dBm	
1999 MHz		-	________	–162	dBm	
2499 MHz		-	________	–158	dBm	
2999 MHz		-	________	–158	dBm	
3599 MHz		-	________	–155	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with low-noise preamplifier B24 f_{noise}	Page 111					
R&S ESU 8:						
101 kHz		-	________	-140	dBm	
999 kHz		-	________	–150	dBm	
9.99 MHz		-	________	–163	dBm	
19.99 MHz		-	________	–165	dBm	
49.99 MHz		-	________	–165	dBm	
99.99 MHz		-	________	–165	dBm	
199.9 MHz		-	________	–165	dBm	
499.9 MHz		-	________	–165	dBm	
999.9 MHz		-	________	–165	dBm	
1499 MHz		-	________	–165	dBm	
1999 MHz		-	________	–165	dBm	
2499 MHz		-	________	–163	dBm	
2999 MHz		-	________	–163	dBm	
3599 MHz		-	________	–163	dBm	
4001 MHz		-	________	-162	dBm	
5999 MHz		-	________	-162	dBm	
6999 MHz		-	________	-160	dBm	
7999 MHz		-	________	-160	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with low-noise preamplifier B24 f_{noise}	Page 111					
R&S ESU 26:						
101 kHz		-	________	–140	dBm	
999 kHz		-	________	–150	dBm	
9.99 MHz		-	________	–163	dBm	
19.99 MHz		-	________	–164	dBm	
49.99 MHz		-	________	–164	dBm	
99.99 MHz		-	________	–164	dBm	
199.9 MHz		-	________	–164	dBm	
499.9 MHz		-	________	–164	dBm	
999.9 MHz		-	________	–164	dBm	
1499 MHz		-	________	–164	dBm	
1999 MHz		-	________	–164	dBm	
2499 MHz		-	________	–163	dBm	
2999 MHz		-	________	–163	dBm	
3599 MHz		-	________	–163	dBm	
3601 MHz		-	________	–165	dBm	
6999 MHz		-	________	–164	dBm	
9999 MHz		-	________	–165	dBm	
12999 MHz		-	________	–165	dBm	
17999 MHz		-	________	–163	dBm	
21999 MHz		-	________	–163	dBm	
26499 MHz		-	________	–160	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 1 Hz with low-noise preamplifier B24 f_{noise}	Page 111					
R&S ESU 40:						
101 kHz		-	________	-140	dBm	
999 kHz		-	________	-150	dBm	
9.99 MHz		-	________	-163	dBm	
19.99 MHz		-	________	–164	dBm	
49.99 MHz		-	________	–164	dBm	
99.99 MHz		-	________	–164	dBm	
199.9 MHz		-	________	–164	dBm	
499.9 MHz		-	________	–164	dBm	
999.9 MHz		-	________	–164	dBm	
1499 MHz		-	________	-164	dBm	
1999 MHz		-	________	-164	dBm	
2499 MHz		-	________	-163	dBm	
2999 MHz		-	________	-163	dBm	
3599 MHz		-	________	-163	dBm	
3601 MHz		-	________	-165	dBm	
6999 MHz		-	________	-165	dBm	
9999 MHz		-	________	-165	dBm	
12999 MHz		-	________	-165	dBm	
17999 MHz		-	________	-163	dBm	
21999 MHz		-	________	-163	dBm	
26499 MHz		-	________	-160	dBm	
26799 MHz		-	________	-160	dBm	
30999 MHz		-	________	-160	dBm	
34999 MHz		-	________	-155	dBm	
39999 MHz		-	________	-155	dBm	
Level accuracy RF input 1 at 128 MHz –30 dBm with low-noise preamplifier B24	Page 113	-0.3	________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response <3.6 GHz RF input 1 RF Attenuation 10 dB DC coupling with low-noise preamplifier B24	Page 114					
f_{fresp}						
100 kHz		-0.8	________	+0.8	dB	
1 MHz		-0.8	________	+0.8	dB	
10 MHz		-0.6	________	+0.6	dB	
50 MHz		-0.6	________	+0.6	dB	
100 MHz		-0.6	________	+0.6	dB	
200 MHz		-0.6	________	+0.6	dB	
300 MHz		-0.6	________	+0.6	dB	
400 MHz		-0.6	________	+0.6	dB	
500 MHz		-0.6	________	+0.6	dB	
600 MHz		-0.6	________	+0.6	dB	
700 MHz		-0.6	________	+0.6	dB	
800 MHz		-0.6	________	+0.6	dB	
900 MHz		-0.6	________	+0.6	dB	
1000 MHz		-0.6	________	+0.6	dB	
1500 MHz		-0.6	________	+0.6	dB	
2000 MHz		-0.6	________	+0.6	dB	
2500 MHz		-0.6	________	+0.6	dB	
3000 MHz		-0.6	________	+0.6	dB	
3599 MHz		-0.6	________	+0.6	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF input 1 RF Attenuation 10 dB DC coupling with low-noise preamplifier B24	Page 116					
f_{fresp}						
3610 MHz		-1.5	________	+1.5	dB	
4000 MHz		-1.5	________	+1.5	dB	
4500 MHz		-1.5	________	+1.5	dB	
5000 MHz		-1.5	________	+1.5	dB	
5500 MHz		-1.5	________	+1.5	dB	
6000 MHz		-1.5	________	+1.5	dB	
6500 MHz		-1.5	________	+1.5	dB	
7000 MHz		-1.5	________	+1.5	dB	
7500 MHz		-1.5	________	+1.5	dB	
7990MHz		-1.5	________	+1.5	dB	
R&S ESU 26 / 40						
9000 MHz		-2	________	+2	dB	
10000 MHz		-2	________	+2	dB	
11000 MHz		-2	________	+2	dB	
12000 MHz		-2	________	+2	dB	
13000 MHz		-2	________	+2	dB	
14000 MHz		-2	________	+2	dB	
15000 MHz		-2	________	+2	dB	
16000 MHz		-2	________	+2	dB	
17000 MHz		-2	________	+2	dB	
18000 MHz		-2	________	+2	dB	
19000 MHz		-2	________	+2	dB	
20000 MHz		-2	________	+2	dB	
21000 MHz		-2	________	+2	dB	
22000 MHz		-2	________	+2	dB	
23000 MHz		-2	________	+2	dB	
24000 MHz		-2	________	+2	dB	
25000 MHz		-2	________	+2	dB	
26000 MHz		-2	________	+2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S ESU 40:						
f_{fresp}						
27000 MHz		-2	________	+2	dB	
28000 MHz		-2	________	+2	dB	
29000 MHz		-2	________	+2	dB	
30000 MHz		-2	________	+2	dB	
31000 MHz		-2	________	+2	dB	
32000 MHz		-2	________	+2	dB	
33000 MHz		-2	________	+2	dB	
34000 MHz		-2	________	+2	dB	
35000 MHz		-2	________	+2	dB	
36000 MHz		-2	________	+2	dB	
37000 MHz		-2	________	+2	dB	
38000 MHz		-2	________	+2	dB	
39000 MHz		-2	________	+2	dB	
39999 MHz		-2	________	+2	dB	

2 Adjustment

NOTICE

Risk of erroneous measurement results

Adjustment must be carried out exclusively by qualified personnel since any changecan considerably affect the instrument´s measurement accuracy

This chapter describes the adjustment of the reference sources as well as the software-controlled adjustment of individual module data following module replacement.

The R&S ESU permits the following manual adjustments:

- Adjustment of the 10 MHz reference oscillator which determines the frequency accuracy of the R&S ESU
- Adjustment of the 128 MHz calibration source which determines the level accuracy of the R&S ESU
- Adjustment of the level offset of the RF input 2 which determines the level accuracy of the R&S ESU

The adjustment permits the data integrity of the instrument to be maintained and restored.

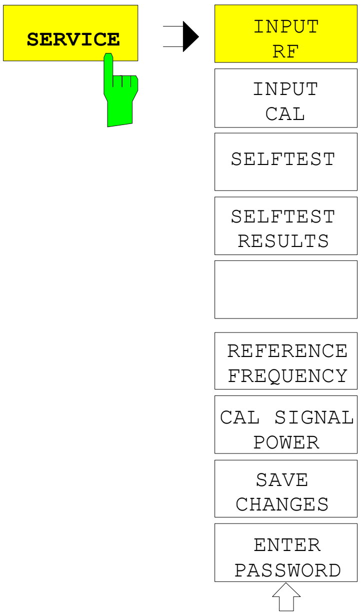
Manual adjustments must be performed at an ambient temperature of between +20 °C and +30 °C after the instrument has warmed up.

After the adjustment and an internal total calibration has been performed, the R&S ESU is ready for use and offers full data integrity.

2.1 Service Menu

The service functions for adjusting the boards are only usable after the entry of a password to prevent impairment of instrument functionality by unintended data changes.

SETUP menu:



The *SERVICE* softkey opens a submenu for selecting the service function

2.1.1 Entering Password

SETUP SERVICE submenu:

ENTER PASSWORD

The *ENTER PASSWORD* softkey allows the entry of a password. The R&S ESU contains a variety of service functions which, if incorrectly used, can impair the functionality of the analyzer. These functions are normally not accessible and are only usable after the entry of a password. The password permits data to be changed that is required in order to calibrate or repair the instrument (for example, reference frequency adjustment, level adjustment, general board data). The password is "894129".

`Remote command:: SYST:PASS "<Password>`

2.1.2 Adjustment Functions

NOTICE

The realignment should be carried out by qualified personnel since any change considerably influences the measurement accuracy of the instrument. This is the reason why the softkeys REF FREQUENCY, CAL SIGNAL POWER and SAVE CHANGES can only be accessed after entering a password.

SETUP SERVICE submenu:

REF FREQUENCY

The *REF FREQUENCY* softkey opens the data input for the adjustment of the reference frequency. Values can be selected between 0 and 255 (without option R&S FSU-B4 OCXO) or between 0 to 4095 (with option R&S FSU-B4 OXCO). They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store the setting permanently in nonvolatile memory.

`Remote command:` *`SENS:ROSC:INT:TUN 155`*

CAL SIGNAL POWER

The *CAL SIGNAL POWER* softkey opens the data input for the adjustment of the currently set level of the calibration signal (0 dBm or -30 dBm, compare *INPUT CAL* softkey). Values can be selected between 0 and 255. They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store the setting permanently in nonvolatile memory.

`Remote command: ---`

SAVE CHANGES

The SAVE CHANGES softkey stores the modifications in the nonvolatile memory of the instrument. Since these modifications considerably influence the measurement accuracy of the instrument, confirmation by the user is requested before storing.

`Remote command:: SENS:ROSC:INT:TUN:SAV`

2.2 Manual Adjustment

This section explains the measuring instruments and auxiliary means required when manually adjusting the R&S ESUFSP, the appropriate preparations of the instrument as well as the individual adjustments.

2.2.1 Test Instructions

- The adjustment of the analyzer must be done after a warm-up time of at least 30 minutes and overall calibration. Only in this case can compliance with the guaranteed data be ensured.
- Restore the factory preset [FILE : STARTUP RECALL : FACTORY : ENTER].
- Select the the Analyzer Preset [SETUP : NEXT : PRESET ANALYZER].
- Inputs for setting the R&S ESU during measurements are shown as following:

[<KEY>] Press a key on the front panel, e.g. [SPAN]
[<SOFTKEY>] Press a softkey, e.g. [MARKER -> PEAK]
[<nn unit>] Enter a value and terminate by entering the unit, e.g. [12 kHz]
Successive entries are separated by [:], e.g. [**BW** : RES BW MANUAL : **3 kHz**]

2.2.2 Measuring Equipment and Accessories

Table 2-1 Measuring equipment and accessories for manually adjusting the R&S ESU

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Frequency counter	error < $1x10^{-9}$, frequency range up to 10 MHz	Advantest R5361B with option 23		Frequency Accuracy of Reference Oscillator
2	Signal generator	frequency range to 1 GHz: output level -10 dBm	R&S SMHU	0835.8011.52	Calibration Source 128 MHz Frequency Accuracy of Reference Oscillator
3	Power meter		R&S NRVD	0857.8008.02	Calibration Source 128 MHz
4	Power sensor	1 MHz to 3 GHz RSS ≤ 0.8% meter noise ≤ 20 pW	R&S NRV-Z4	0828.3618.02	Calibration Source 128 MHz

2.2.3 Adjusting Level Measurement Accuracy

Test equipment:

- Signal generator (Section "Measuring Equipment", item 2):
  frequency 128 MHz
  level -30 dBm
- Power meter (Section "Measuring Equipment", item 3)
- Power sensor (Section "Measuring Equipment", item 4)
  frequency 128 MHz
  maximum power $P_{max} \geq 1\ \mu W$
  meter noise ≤ 20 pW
  RSS ≤ 0.8% referred to indicated power
  impedance Z = 50 Ω

Power meter settings:

► Connect power sensor to power meter and carry out function ´ZERO´ when no signal is applied to the power sensor.
► Connect power sensor to RF output of signal generator.

Signal generator settings:	- Frequency 128 MHz - Level –30 dBm ± 0.05 dB ► Use power meter for exact level adjustment.
Test setup:	► Connect RF output of the signal generator to RF input 1 of the R&S ESU.
Overall calibration of the R&S ESU:	- [**PRESET**] - [**CAL** : CAL TOTAL]
R&S ESU settings:	- [**FREQ** : CENTER : **128 MHz**] - [**SPAN** : **15 kHz**] - [**BW** : RES BW MANUAL : **10 kHz**] - [**BW** : VID BW MANUAL : **1 kHz**] - [**TRACE** : DETEKTOR : RMS] - [**AMPT** : REF LEVEL : **-20 dBm**] - [**AMPT** : RF ATTEN MANUAL : **10 dB**]
Reference measurement	► Set marker to peak of signal - [**MKR SEARCH** : PEAK] ► Set reference to peak of signal - [**MKR** : REFERENCE FIXED] ► Switch internal reference generator to RF input - [**SETUP** : SERVICE : INPUT CAL] ► Set marker to peak of signal - [**MKR ⇒** : PEAK]
Adjustment:	The reading ´Delta [T1 FXD]´ displays the difference between the output level of the signal generator and the level of the calibration source.

NOTICE

The following realignment changes the level of the internal calibration source. Since this adjustment influences the level measurement accuracy of the R&S ESU, it is strongly recommended that this adjustment be performed only if the level is not within the tolerance.

R&S ESU settings:	- [**SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER**] - [**SETUP :** SERVICE : CAL SIGNAL POWER] ► The correction value for the calibration signal level will be displayed in the data entry field. Change the value with the step keys or spin wheel until the marker reading ´Delta [T1 FXD]´ displays a value of 0 ± 0,05 dB.
Store value in instrument	- [**SETUP :** SERVICE : SAVE CHANGES] ► Confirm message on display with ´YES´ . The correction values will be stored in non-volatile memory on the boards. **Note:** The changed level of the calibration source will be used with the following total calibration. - [**CAL :** TOTAL CALIBRATION] - [**CAL :** CALIBRATION RESULTS

Check the calibration results. The calibration must be performed with the status ´PASSED.

2.2.4 Adjusting Frequency Accuracy

Preparation: The measurement can be performed either with a signal generator at connector RF INPUT (front of the R&S ESU) at 1 GHz or at connector EXT REF OUT (rear of the R&S ESU) at 10 MHz using a frequency counter.

To be adjusted, the R&S ESU must be set to internal reference.

The measurement at 1 GHz can be performed with a lower frequency counter resolution in order to achieve faster adjustment

Preparations for adjustment with signal generator:

Test equipment: - Signal generator (Section "Measuring Equipment", item 2):

frequency	1000 MHz
level	-20 dBm
frequency accuracy	$<1x10^{-9}$

If the frequency accuracy of the signal generator is not sufficient, adjust the frequency with a frequency counter to the correct frequency before the adjustment.

Test setup: ► Conn ect the RF output of the signal generator to RF input of the R&S ESU.

R&S ESU settings:
- [**PRESET**]
- [**FREQ** : CENTER : **1 GHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **1 MHz**]
- [**AMPT** : REF LEVEL : **-20 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SETUP** : REFERENCE INT / EXT]

► Toggle to internal reference (INT)

Note:
Before the following measurement, the R&S ESU must warm up for at least 30 minutes to heat the reference oscillator.

Measurement:

► Switch on marker frequency counting:
- [**MKR** : SIGNAL COUNT]

► Set the necessary resolution:

► Model without OCXO (Option B4) 1 GHz ± 1 kHz
- [**MKR** : **NEXT** : CNT RESOL 100 HZ]

Model with OCXO (Option B4) 1 GHz ± 100 Hz
- [**MKR** : **NEXT**: CNT RESOL 10 HZ]

Preparation for adjustment with frequency counter:

Test equipment: Frequency counter (Section "Measuring Equipment", item 1):
error $< 1x10^{-9}$
frequency range up to 10 MHz

Test setup: ► Connect frequency counter to 10 MHz reference output of the R&S ESU (rear panel).

R&S ESU settings: - [**SETUP** : REFERENCE INT / EXT]

► Toggle to internal reference (INT).

Frequency counter settings: Set the necessary resolution:
model without OCXO (option B4): 1 Hz
model with OCXO (option B4): 0.1 Hz

Before the following measurement, the R&S ESU must warm up at least 30 minutes to heat the reference oscillator.

Measurement: ► Measure frequency with frequency counter:

Nominal frequency:
model without OCXO (option R&S FSU-B4) ....10 MHz ± 10 Hz
model with OCXO (option R&S FSU-B4) ....10 MHz ± 1 Hz

Adjustment:

NOTICE

The following adjustment changes the frequency of the internal reference source. Since this adjustment influences the frequency accuracy of the R&S ESU, it is strongly recommended that this adjustment be performed only if the frequency is not within the tolerance.

R&S ESU settings: - [**SETUP :** SERVICE : ENTER PASSWORD : **894129 ENTER**]
- [**SETUP :** SERVICE : REF FREQUENCY]

► The correction value for the reference frequency adjustment will be displayed in the data entry field. Change the value with the step keys or spin wheel until the frequency counter reading or the marker count reading displays a value within the tolerance.

Store value in instrument - [**SETUP :** SERVICE : SAVE CHANGES]

► Confirm message on display with ´YES´ . The correction values will be stored in non-volatile memory on the boards.

Preparation: The measurement can be performed either with a signal generator at connector RF INPUT (front of the R&S ESU) at 1 GHz or at connector EXT REF OUT (rear of the R&S ESU) at 10 MHz using a frequency counter.

To be adjusted, the R&S ESU must be set to internal reference.

Note:
The measurement at 1 GHz can be performed with a lower frequency counter resolution in order to achieve faster adjustment.

2.2.5 Adjusting RF input 2 level offset

Test equipment:	- Signal generator (Section "Measuring Equipment", item 2): frequency 128 MHz level -30 dBm
Test setup:	► Connect RF output of the signal generator to RF input 1 of the R&S ESU.
R&S ESU settings:	- [**PRESET**] - [**CAL** : CAL TOTAL] - [**FREQ** : CENTER : **128 MHz**] - [**SPAN** : **15 kHz**] - [**BW** : RES BW MANUAL : **10 kHz**] - [**BW** : VID BW MANUAL : **1 kHz**] - [**TRACE** : DETEKTOR : RMS] - [**AMPT** : REF LEVEL : **-20 dBm**] - [**AMPT** : RF ATTEN MANUAL : **10 dB**]
Reference measurement	► Set marker to peak of signal - [**MKR SEARCH** : PEAK] ► The signal level is displayed by the level reading of marker 1 (= L_{Ref})
Additonal R&S ESU settings:	- [**AMPT** : RF Input 2]
Measurement:	► Connect RF output of the signal generator to RF input 2 of the R&S ESU. ► Set marker to peak of signal - [**MKR SEARCH** : PEAK] ► The signal level is displayed by the level reading of marker 1 (= $L_{Input\ 2}$)
Evaluation:	The level offset is calculated as: $L_{Offset} = L_{Ref} - L_{Input\ 2}$
Adjustment:	- [**SETUP :** SERVICE : ENTER PASSWORD : **30473035 ENTER**] ► Read out actual offset correction value (= $value_{old}$) via service function: - [**SETUP :** SERVICE FUNCTION : **3.0.8.21065.1 ENTER**] ► Calculate the new offset correction: $value = value_{old} + L_{Offset}$ ► Write the new value via service function to RAM - [**SETUP :** SERVICE FUNCTION : **3.0.9.21065.1.value ENTER**] ► The new value is active, after the center frequency has been changed: - [**FREQ** : CENTER : **128.1 MHz**] - [**FREQ** : CENTER : **128 MHz**] ► Verify that the level offset is < 0.05 dB and repeat steps if necessary. ► Save value to EEPROM: - [**SETUP :** SERVICE FUNCTION : **3.40.1 ENTER**]
Example:	Level at input 1 -30.05 dBm Level at input 2 -30.20 dBm L_{Offset} = 0.17 dB [**SETUP :** SERVICE FUNCTION : **3.0.8.21065.1 ENTER**] shows the Value

3.100000E-001

New value = 0.17 + 0.31 = 0.48

► Enter the new value:
[**SETUP :** SERVICE FUNCTION : **3.0.9.21065.1.0.48 ENTER**]
► Save to EEPROM:
[**SETUP :** SERVICE FUNCTION : **3.40.1 ENTER**]

2.3 Adjustment of Module Data

All boards of the R&S ESU contain EEPROMS for storing board data.
In addition to some standard information such as module name, serial number, hardware status and date of manufacture, these stored data items contain important pieces of information within value tables from module pre-testing, e.g. frequency responses for module error data. When a cold start is performed, this EEPROM data is read out and stored on hard disk. During normal operation, the data set stored on hard disk is always used.
In order to synchronize the data stored in EEPROMs on the respective modules with the complete instrument, a cold start must be performed after each module replacement so that the module data will be updated.
The complete contents of the new module are read from the EERPOM and copied to the hard disk of the R&S ESU. The existing calibration data (results from the latest total calibration) are deleted and the instruments displays UNCAL. Thus, the R&S ESU must always be calibrated again after a module is replaced (softkey *CAL TOTAL*).

After a full calibration has been completed successfully, a backup of the EEPROM files to hard disk must be performed using a service function.

Settings on the R&S ESU:

- [**SETUP :** SERVICE : ENTER PASSWORD : **30473035 ENTER**]
- [**SETUP :** SERVICE : SERVICE FUNCTION : **3.0.11 ENTER**]

If the IF filter module has been replaced, the calibration data should also be copied back to the EEPROM:

Settings on the R&S ESU:

- [**SETUP :** SERVICE : SERVICE FUNCTION : **3.0.7 ENTER**]

If an option module is removed from an instrument (downgrade), the EEPROM file associated with the module as well as any ".bak" file(s) present under path D:\r_s\instr\eeprom\ and C:\r_s\instr\eeprom\backup must be deleted.

2.4 Frequency Response Correction

With some boards (see chapter 3, section "Module Replacement"), frequency response correction is necessary in addition to the automatic adjustment of module data. This correction is performed by means of software. The program is available on the GLORIS server.
For information on when to perform the frequency response correction, see chapter 3, section "Module Replacement".

3 Repair

This chapter describes the design of the R&S ESU, simple measures for repair and troubleshooting and the replacement of modules. For troubleshooting and diagnostics, a selftest is available that can be used to poll diagnostic voltages of the modules and signal limit violations.

The firmware update and the installation of options are described in chapter 4 of this service manual.

3.1 Instrument Design and Function Description

A detailed schematic of the R&S ESU design is presented in the block diagrams below and in the exploded views (see also chapter 5).

The following description of instrument functions refers to the block diagram.

3.1.1 Block Diagram

See also chapter 5 illustrations for a detailed block diagram.

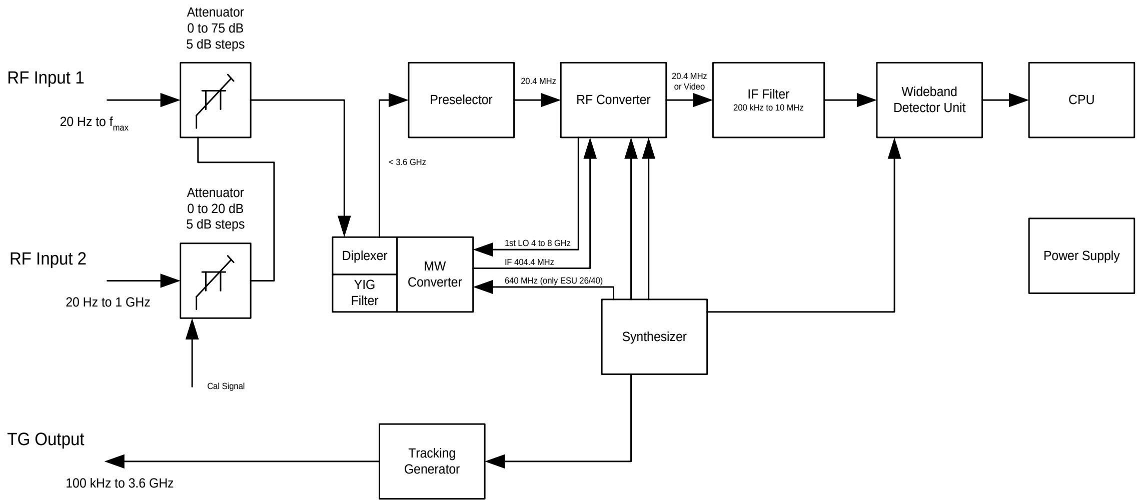


Figure 3-1: Block diagram of instrument

3.1.2 Description of Block Diagram

The R&S ESU is a triple-conversion superhet receiver (double-conversion for receive frequencies >3.6 GHz) for the frequency range 20 Hz to 8 GHz, 26.5 or 40 GHz (depending on the instrument model). The signals are processed by one RF board (two for models > 3.6 GHz), one IF board, one signal detection board and a controller consisting of a Pentium industry PC, an I/O interface and a graphics controller. The instrument can be upgraded to meet future requirements by retrofitting options in the analog and digital sections.

The input signal is reduced in level by the attenuator and routed to the RF modules depending on the instrument type. The attenuator is followed by the diplexer. The signal component < 3.6 GHz is routed to the preselector and RF converter, the high-frequency signal component >3.6 GHz is routed to the microwave converter module. The IF module is the same in all instrument models, and likewise for the signal path through signal detection to the display.

The internal reference and calibration signals are generated in the frequency and level reference part on the synthesizer board. Here the 128 MHz reference frequency is generated and made available to the instrument as a reference frequency, and a level-controlled output signal is generated as an internal level reference for instrument calibration.

A detailed description of the modules is given in the following.

3.1.2.1 Attenuator

The RF signal passes from the input connector via the input switch to the attenuator, which can be set. Different attenuators are used: the 8 GHz attenuator in the R&S ESU8, and the microwave attenuators up to 26 GHz or 40 GHz. All attenuators switch in steps of 5 dB and have maximum total attenuation of 75 dB; the attenuators contain an AC coupling that can be bypassed. The lower limit frequency of AC coupling is 1 MHz with the 8 GHz attenuator and < 10 MHz with the attenuator in the R&S ESU26 / 40.

The signal from RF input 2 is routed to the pulse power attenuator. The AC coupling can also be bypassed. The lower frequency limit of AC coupling is 9 kHz.

The input signal is applied to the attenuator as well as a 128 MHz signal, which has a close-tolerance level of -30 dBm for calibration purposes or 0 dBm for the self test of the instrument.

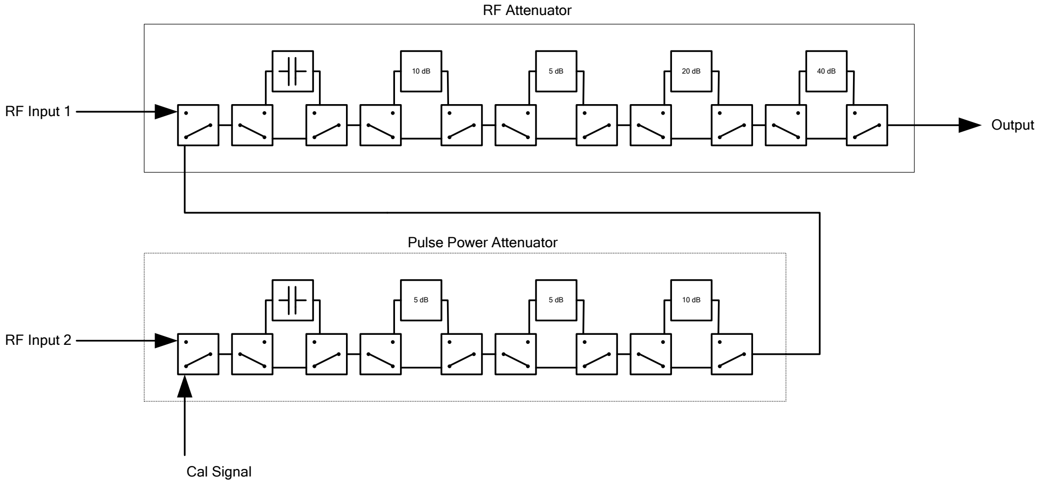


Figure 3-2: Input attenuator

3.1.2.2 Preselector

The preselector is fitted in the RF signal pass directly behind diplexer. The preselector module contains three fixed and six variable preselection filters. The filters are inserted before a switchable preamplifier. The module can be switched off in the analyzer mode.

3.1.2.3 RF to IF Conversion for Frequencies < 3.6 GHz – RF Converter

The RF converter is used to convert the signal in the reception range from 20 Hz to 3.6 GHz to a low intermediate frequency of 20.4 MHz.

The balanced input mixer first converts the input signal to an intermediate frequency of approx. 4.63 GHz. The symmetric design reduces second-order intermodulation.

The first local oscillator in the frequency range 4.63 to 8.23 GHz is implemented with a YIG-tuned oscillator. This oscillator is synchronized via several dividers to the signal from the synthesizer module (600 to 620 MHz). The balanced output of the first mixer is amplified with two bipolar transistors to prevent 1/f noise. This balanced signal is fed to a three-stage filter with dielectric resonators. Flatness and group delay of the filter are optimized for broadband vector analysis in a bandwidth of 30 MHz. The filter feeds a second mixer, which converts the signal to the second IF of 404.4 MHz. The balanced output is amplified with two amplifiers to reduce intermodulation products. The output signals from the two amplifiers are combined in a transformer to form an unbalanced signal. Due to the symmetric design, there is no need for transformers in the mixers so that the conversion loss is reduced.

The second IF can be filtered to a bandwidth of 10 or 20 MHz using two five-stage filters with ceramic resonators. A bypass for a 50 MHz bandwidth (= 3 dB bandwidth of the first IF filter) can be selected also. The signal is fed to the third mixer via an attenuator pad that can be switched in steps of 1 dB. With 30 MHz FFT span, the K2 of the 3rd mixer causes spurious noise within the band. Therefore, the level has to be reduced before this mixer stage if high input levels are used (> -25 dBm). The attenuator can also be used to drive the input mixer up to +10 dBm, thus allowing a better dynamic range in phase noise or spurious measurements with a large carrier offset (> 1 MHz).

Fast overload detectors are used to detect compression in the stages of the first and second intermediate frequencies. The bandwidth of these detectors is above 100 MHz so that pulse signals can be detected as well with a preselector of the same width. The output signal of the detector on the second IF is also used with a logarithmic amplifier as an RF power trigger with a dynamic range of 70 dB.

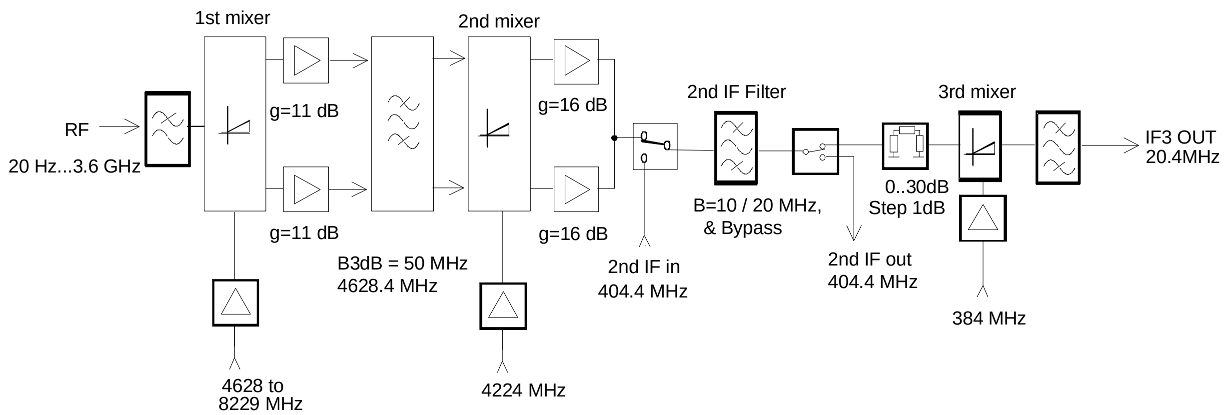


Figure 3-3: Conversion of the RF to the third IF from 20 Hz to 3.6 GHz

3.1.2.4 RF to IF Conversion for Frequencies > 3.6 GHz - MW Converter

The R&S ESU comprise a microwave converter board for the frequency range > 3.6 GHz. After the RF attenuator, the input signals are fed to the microwave converter and split up in the diplexer to frequencies below 3.6 GHz and above 3.6 GHz. Signals below 3.6 GHz are forwarded to the RF converter. Signals above 3.6 GHz are taken via the YIG filter to the mixer, where they are directly converted to the 2^{nd} IF of 404.4 MHz. In the range >26 GHz, the signals are converted to the 404.4 MHz IF in two stages.

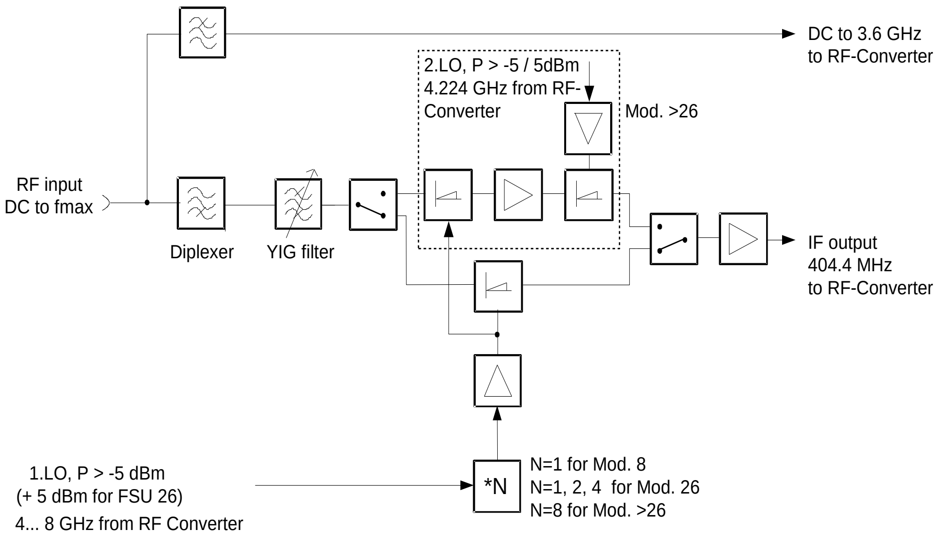


Figure 3-4: Conversion of the RF to the IF from 3.6 GHz

The first LO converts the input frequency to the 404.4 MHz IF. For this purpose, the LO signal (4 GHz to 8 GHz) generated in the RF converter is amplified to the required LO level. The R&S ESU 26 has two additional doubler stages that can be bypassed and generate the LO signal for conversion to 26.5 GHz. Models >26 GHz have an additional doubler stage. The eight-way LO converts the signals to an initial IF of 3819.6 MHz or 4628.4 MHz. The second LO then converts the signal to the 404.4 MHz IF.

The basic model is equipped with the necessary interfaces (IF input 404.4 MHz, LO output 4 to 7.6 GHz) for extending the frequency range by simply adding a microwave converter.

3.1.2.5 IF Filter Module

The RF converter is followed by the analog IF filter module:

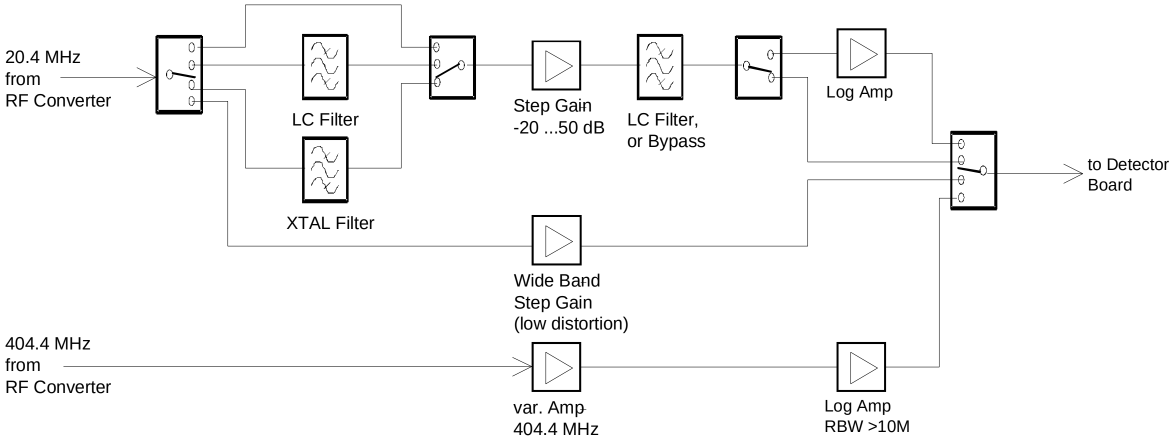


Figure 3-5: IF filter

The R&S ESU offers resolution bandwidths from 1 Hz to 10 MHz in steps of 1/2/3/5. For the bandwidths above 5 MHz, the selection filter is provided in the RF converter. There is no selection at the 20.4 MHz IF; a logarithmic amplification to 404.4 MHz is performed.

The tuneable bandwidths 100 kHz to 5 MHz are at the 3rd IF (20.4 MHz) on the IF filter module. The bandwidths 100 kHz to 5 MHz are provided by 5 LC circuits.

The step gain can be set from -20 to 50 dB in 0.1 dB steps and is adjusted as a function of the reference level and the input attenuation.

The IF filters are followed by a log detector to obtain the dynamic range of the display.

A limiting amplifier in the log amp provides the TTL output for the frequency counter.

With a 10 MHz bandwidth, the LC filters are bypassed; however, step gain and log amp are used as with the analog bandwidths between 200 kHz and 5 MHz.

For the digital resolution filters from 10 Hz to 100 kHz, the 20.4 MHz IF signal at the IF filter output is routed to the A/D converter. With bandwidths below or equal to 30 kHz, a two-stage crystal filter is used to prevent the step gain and the ADC from being overdriven. This filter can be tuned from about 2.5 to 70 kHz in bandwidth. With the bandwidths 50 kHz and 100 kHz, the LC filter is set to about 400 kHz for the same reason.

An additional path without any filtering is used for the broadband vector analysis. The step gain is optimized for low distortion; as with a bandwidth of 30 MHz at a center frequency of 20.4 MHz, the harmonics of the IF are also present at the input of the ADC.

The R&S ESU contains an AM/FM demodulator on the IF filter. In the spectrum analysis mode, the signal applied at the position of the reference marker can be demodulated during the sweep. For this purpose, the R&S ESU stops the frequency sweep for a selectable period of time and demodulates the input signal. The volume is set using the spin wheel on the front panel (AF OUTPUT). The demodulator bandwidth corresponds to that of the input filter in the case of digital filters. To ensure good reception, the 30-kHz filter should be used, with the filter preceding the demodulator being at approx. 70 kHz.

3.1.2.6 Processing of Measured Data - Detector Board

The sections below explain the signal and data paths required for result processing in the various operating modes:

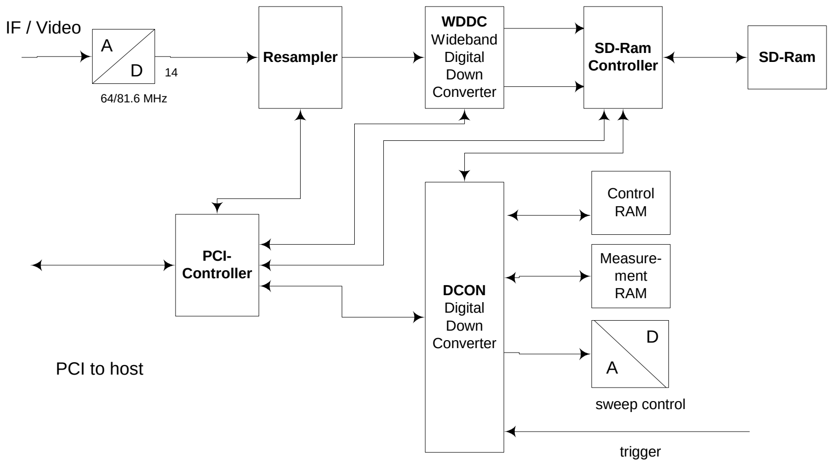


Figure 3-6: Processing of measured data

Spectrum Analysis Using an RBW >100 kHz

In this mode, only the analog resolution filters on the IF filter board are used. The signal applied to the A/D converter via the input IF/Video is therefore already a log video signal. The signal is continuously sampled at 32 MHz in the ADC and digitized.

The signal path is now directly routed to the DCON.

In the DCON, the data is directly applied to the noise filter. The noise filter is used to limit the video bandwidth or to average the noise content. The signal path is routed to the detector logic where the results are processed, i.e. peak max, peak min, sample, average and RMS values as well as the number of measured max. peak, min. peak, sample, average, RMS and quasi peak values are determined.

With measurement data rates > 1 MHz, detector data has to be stored in the measurement RAM because online storage is no longer possible at these high speeds. Upon completion of the sweep, the sweep data is read by the host from the measurement RAM, processed and displayed.

Spectrum Analysis Using an RBW ≤ 100 kHz

In this operating mode the resolution bandwidths are generated digitally with the aid of the WDDC (wideband digital down converter). The IF filter module provides an IF signal pre-filtered at 20.4 MHz. The WDDC mixes the input signal into the complex baseband using an NCO, and then filters the obtained I/Q signal via an HDF (high decimation filter) and an FIR (finite impulse response) filter. The magnitude and phase are calculated from the I/Q data and transferred to a second gate array in the DCON. As in operating mode RBW > 100 kHz, the signal is video-filtered and weighted depending on the set detector.

FFT Bandwidths

In FFT bandwidth mode, the synthesizer is set to the desired frequency via the DCON, which also generates the tuning voltages for the analog hardware. The signal path is routed via ADC, Corr RAM and WDDC. The WDDC first mixes the input IF into the baseband using an NCO; then the obtained I/Q signal is filtered in an HDF (**h**igh **d**ecimation **f**ilter) and FIR stage (**f**inite **i**mpulse **r**esponse). The I/Q output data is then transferred by the WDDC to the SDRAM controller, which stores the data in SDRAM1 or SDRAM2. With data logging completed the I/Q data from the SDRAM controller is fetched from the SDRAM, transferred to the PCI interface, which transmits the I/Q data to the memory of the host. The host then performs the FFT for this sweep section.

Video Bandwidths (VBW)

The video filters of the R&S ESU can be adjusted between 1 Hz and 10 MHz in steps of 1/2/3/5. They are designed as a digital low pass filter for the video signal. The video bandwidth can either be coupled to the resolution bandwidth (= default setting) or manually set to a fixed value.

Detectors

The R&S ESU uses a detector for the positive peak (peak+) and one for the negative peak value (peak-). In the sample mode, the video signal can also be directly sampled by the A/D converter without a peak detector being required. *Quasi-Peak, Average* and *RMS* detectors are available in addition. The RMS detector forms the rms value of the input signal for one point in the display during the measurement time.

3.1.2.7 1st Local Oscillator- RF Converter

The 1st local oscillator is a YIG oscillator on the RF converter. It is synchronized via a fractional N divider to the synthesizer signal of 600 to 620 MHz or 20 to 40 MHz. This signal can be set with very high resolution in steps of less than MHz. With 20 to 40 MHz, a whole octave can be swept with one divider setting. This setting is used with a fast sweep time over big spans. The 600 MHz setting is used with spans below 200 MHz because of the better phase noise.

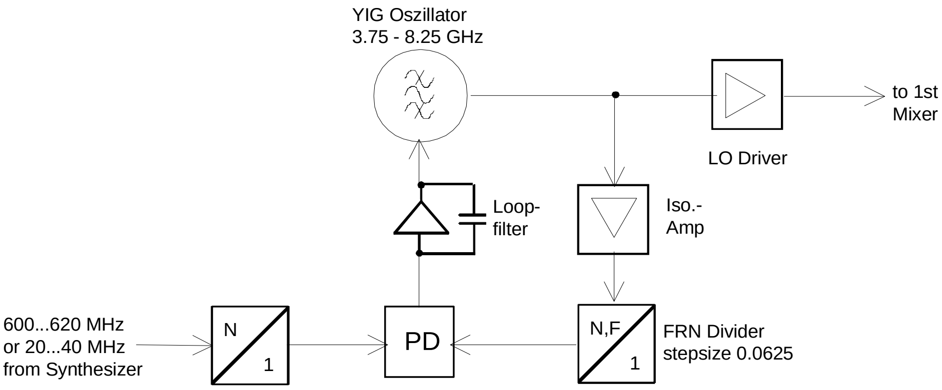


Figure 3-7: Synchronization of 1st local oscillator

3.1.2.8 2nd Local Oscillator - Synthesizer

The second local oscillator is a DRO (dielectric resonator oscillator) on the synthesizer board at 4224 MHz. This oscillator is synchronized to a harmonic of the 3rd LO (384 MHz). This type of oscillator features excellent phase noise values.

3.1.2.9 3rd Local Oscillator- Synthesizer

The third oscillator is a VCO with ceramic resonator, which is synchronized via a mixer to the third harmonic of the crystal oscillator at 128 MHz.

3.1.2.10 Reference Frequency 128 MHz – Synthesizer

This reference is generated on the synthesizer board. To ensure perfect phase noise performance, an SC cut crystal is used as a resonator. The oscillator is synchronized with a bandwidth of approx. 30 Hz to the internal 10 MHz reference or to an external reference.

Harmonics of this signal are used for the synchronization of the 3rd local oscillator and the sweep oscillator 600 to 620 MHz.

It is also used to generate the 128 MHz calibration signal via automatic level control. The level can be switched between 0 dBm and -30 dBm and adjusted with a D/A converter.

A 4:1 divider generates the 32 MHz clock for the detector board (A/D converter).

3.1.2.11 Reference Frequency 10 MHz – Synthesizer

The reference frequency is generated by an OCXO, and the frequency is adjustable by a D/A converter. If the external reference input is used, this OCXO is switched off and the external signal is used instead.

3.1.2.12 OCXO Reference (Option R&S FSU-B4)

The R&S ESU contains the option R&S FSU-B4, an oven-controlled reference oscillator with extra low aging and improved phase noise at 10 Hz offset. If the option is installed, this OCXO is used instead of the OCXO on the synthesizer board. If an external reference is used, both OCXOs are switched off. The heater of the B4 option stays on.

3.1.2.13 Sweep VCO - Synthesizer

The sweep VCO on the synthesizer board is used to synchronize the YIG oscillator on the RF converter. An oscillator with ceramic resonator at approx. 600 MHz is used. This VCO can be tuned over quite a small range of about 20 MHz for good phase noise performance. A bigger tuning range would reduce the quality factor of the resonator. The oscillator is mixed with a comb line of the 128 MHz crystal oscillator to an IF between 20 and 40 MHz. Via this IF, the VCO is synchronized to a digitally generated signal from a fractional N divider. This signal can be tuned in steps of smaller than 1 MHz in frequency. For small spans with a good phase-noise performance, the YIG oscillator is synchronized to the VCO, for fast sweeps and a big span to the IF.

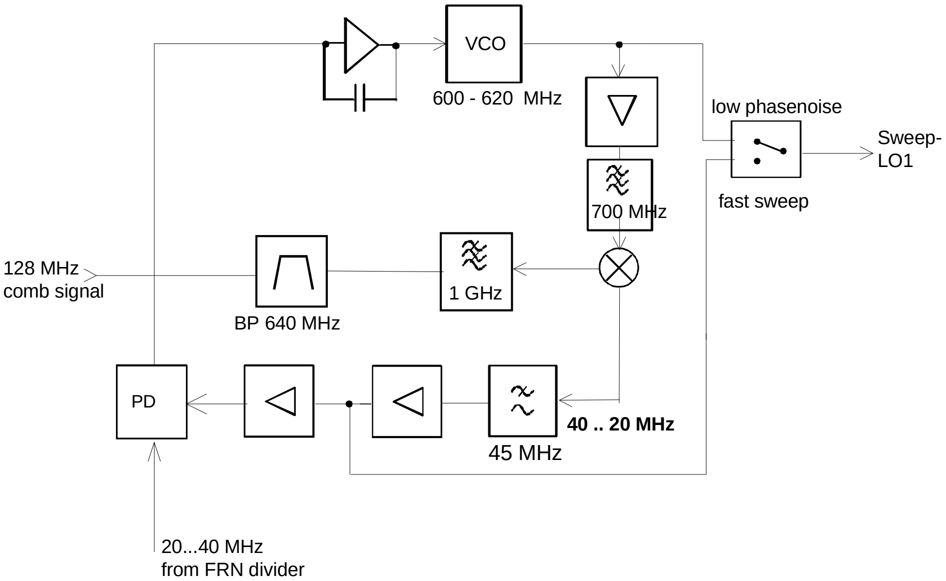


Figure 3-8: Sweep synthesizer

3.1.2.14 Front Panel

The front panel consists of a mounting plate that accommodates the LCD, the keyboard mat with the membrane and the spinwheel. The case panel incorporates the front-module controller.

LCD

The colour LCD provides visible output of any information, measurements, etc, to the user. The resolution of the LCD is 800 * 600 pixels (SVGA).

The display includes a LED backlight for illumination. The voltage required for this purpose is generated in an extra DC/DC converter mounted next to the display on the mounting plate and connected both to the display and the controller board via a cable.

Keyboard

The keyboard consisting of a keyboard mat and a membrane releases a contact when the rubber key is pressed. Two LEDs for the STANDBY/ON key (yellow for STANDBY/green for ON) are also accommodated on this membrane.

The key evaluation and LED control are carried out via a film cable connector on the controller board. Like the control of the two LEDs, control is performed in a special microprocessor on the controller board by means of a matrix technique. This microprocessor permits the status of the STANDBY/ON key to be stored when switch-off is performed with the power switch.

Front module controller

The front module controller contains all the necessary components on a board such as processor, memory chips (SIMM modules), I/O devices (PCI bus), lithium battery, IEC/IEEE-bus controller, two serial interfaces (COM1/2), a parallel interface (LPT), four USB interfaces, LCD graphics controller, external VGA monitor graphics interface (monitor) and an external mouse connection (PS/2).

In addition, a floppy controller for an external floppy disk drive and an IDE hard disk controller are integrated on the controller board.

Hard disk

The hard disk is screwed to the rear panel of the front module controller and connected to the printed circuit board via two cables.

3.1.2.15 Power Supply Module

The power supply module provides all currents necessary for operating the R&S ESU. It can be switched off by means of the power switch on the rear panel.

The power supply module is a primary-clocked switching power supply with power factor correction (PFC) and standby circuit (+12 V standby).

On the secondary side, it generates DC voltages (+3.3 V; +5.2 V; +6 V; +8 V; +12 V; +12 VFAN; +12 V standby; +28 V; -12 V).

The control signal STANDBY/ON controlled by the front module controller (depending on the operating key STANDBY/ON on the front of the instrument frame) activates the power supply. In standby operation, it only supplies the 12 V standby voltage for the crystal oscillator and the LED STANDBY on the front panel.

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

An over-temperature protective circuit is additionally installed to prevent overheating. The status is taken to the front module controller via a status signal (*OT*).

Fuses

Two fuses are also installed in the power supply as a means of fire protection.

> **Note:**
> These fuses are not accessible to the user from outside and are blown only in the case of a serious fault in the power supply (servicing required!).

3.1.2.16 Motherboard

The motherboard generates the -6 V supply for the analog boards with an integrated DC/DC converter.

The noise source output (28 V noise source) is also generated on this board.

All external supplies (probe, keyboard, etc) are short-circuit-protected by polyswitches (current-dependent, self-opening and closing fuses).

On the motherboard, a circuit for temperature-dependent instrument fan control is also implemented.

Probe Board

The probe PCB is located at the front of the instrument frame and accommodates the PROBE POWER connectors. For connection with the motherboard, a ribbon cable is used.

Volume / Phones

The volume/phones board is located on the front mounting plate and accommodates the external interfaces PHONES (headphones connector) and the volume control (rotary encoder) for the AF demodulator.

For connection with the motherboard, a ribbon cable is used.

Tracking Generator (Option R&S FSU-B9)

In normal operation (no frequency offset), the tracking generator generates a signal exactly at the input frequency of the R&S ESU in the frequency range up to 3.6 GHz.

To support frequency-converting measurements, a constant frequency offset of ±200 MHz between the input frequency of the R&S ESU and the output signal of the tracking generator can be set. In addition, I/Q modulation or AM or FM of the output signal can be performed using two analog input signals.

The output level is controlled and can be adjusted between -30 dBm and 0 dBm in 0.1 dB steps (between -100 dBm and + 5 dBm with the option R&S FSU-B12).

External Generator Control (Option R&S FSP-B10)

The external generator control option permits a number of commercially available generators to be operated as tracking generators on the R&S ESU. The generator is controlled via the – optional – second IEC bus interface of the R&S ESU (= IEC2, supplied together with the option); with some Rohde & Schwarz generators, it can also be controlled via the TTL synchronization interface included in the AUX interface of the R&S ESU.

Removable Hard Disk (Option R&S ESU –B18)

If the option R&S ESU-B18 is used, a removable flash disk can be substituted for the hard disk in the instrument. The compact flash board contains a connector for a compact flash card of type 1 and one connector for a link to the serial ATA interface of the front module processor.

Low Noise Amplifier (Option R&S ESU-B24)

The option low noise preamplifier ESU-B24 increase the sensitivity in the frequency range 10MHz up to 40GHz.

The preamplifier is placed between input RF-Attenuator and the MWC-Unit.

At frequency below 3.6GHz the preamplifier is used in analyzer mode only, with the setting (preselector on) the built-in preamplifier on the preselector is used instead.

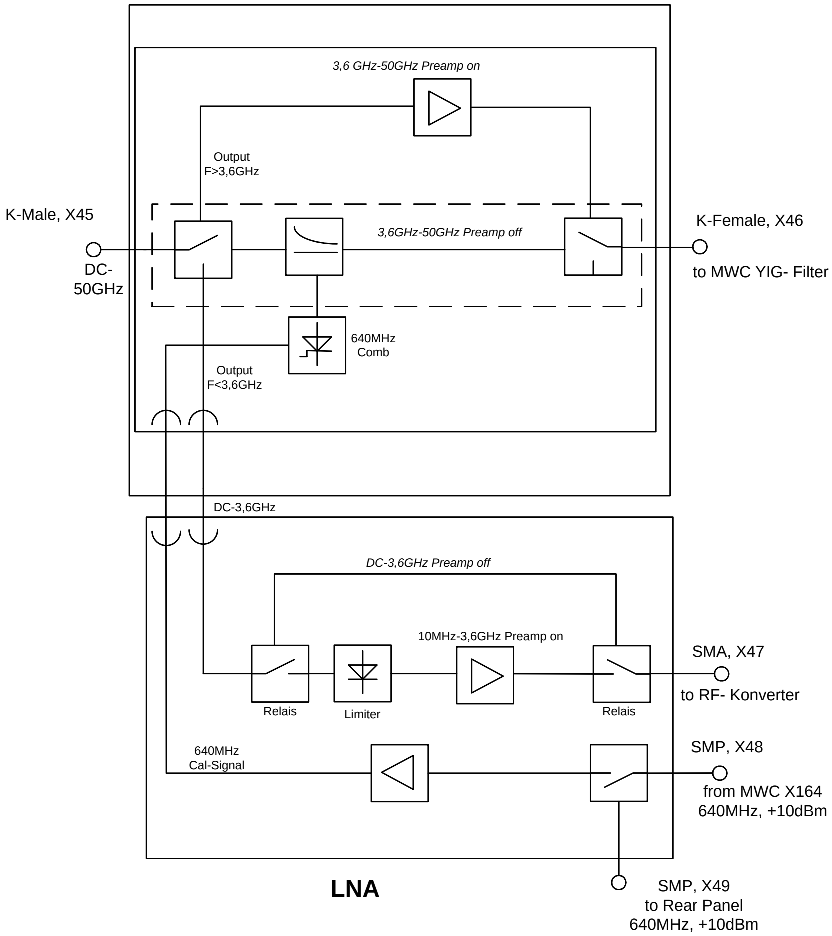


Figure 3-9: Block diagram of the preamplifier option ESU-B24 (Mod. 26GHz/40GHz)

Mod. 26GHz/40GHz

The Preamplifier 26GHz/40GHz has a diplexer integrated at the input, it switches the signal the signal path DC…3.6GHz and 3.6GHz…26GHz/40GHz.

Two low noise preamplifiers are placed behind the diplexer to improve the noise performance.

One preamplifier covers the frequency range up to 3.6GHz and a other preamplifier covers from 3.6GHz to 26GHz respectively 40GHz.

For YIG Filter self alignment purpose a 640MHz comb signal can be coupled into the MW path (F>3.6GHz) by using coupler, the 640MHz fundamental of the comb signal is provided by the 640MHz reference signal from MWC-unit X164.

3.2 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 board replacement.

The numbers indicated in brackets refer to the item position in the list of mechanical parts in chapter 5.

These items correspond to the item numbers in the illustrations for board replacement (see also chapter 5):

1302.6005 (R&S ESU Basic Model, items 1-499),

1166.1677 (Dig. Basic Unit, items 500-775),

1093.4708 (Display Unit, items 800-950),

1144.9017 (option R&S FSU-B4, items 1100-1130).

1303.0475 (option R&S ESU-B18, items 1500-1560)

1129.7317 (option R&S FSP-B10, items 1600-1630)

1142.9090 (option R&S FSU-B9, items 1800-1960)

1130.2544 (8 GHz MW Converter, items 2000-2035)

1130.4982.42 (40 GHz MW Converter, items 2100-2165)

1142.9361.00 (option R&S FSU-B12, items 2400-2445)

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

3.2.1 Performing a Cold Start

A cold start has to be performed as described below each time a module containing an EEPROM has been replaced.
Connect the power cable and press the power switch.

While the ON key is pressed, the decimal point key must be pressed and held down until the computer responds with a beep.

After this, Windows XP starts the device firmware.

3.2.2 Overview of the Modules

Table 3-1 Overview - module replacement

Module	Required tests and adjustments after replacement		
	Function tests and system error correction	**Adjustment**	**Other**
Front module controller	SYSTEM MESSAGES/ SELFTEST / CAL		DOS/BIOS update
Lithium battery	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Hard disk	SYSTEM MESSAGES/ SELFTEST / CAL	I/Q frequency response (if the file is lost)	Cold boot / FW update
LCD / DC/DC-converter			
Flexible switchfoil or flexible switchboard			
Front cover			
Power supply	SYSTEM MESSAGES/ SELFTEST / CAL		
Fan			
RF input connector	SELFTEST / CAL	Frequency response	
Motherboard	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot EEPROM entry
RF attenuator	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Pulse Power attenuator	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Probe Board and vol./phone			
RF Converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Synthesizer	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Detector	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
IF filter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ cal. Source	Cold boot
MW Converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy/ frequency response	Cold boot
OCXO-B4	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy	Cold boot
External Generator Control-B10	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
Compact Flash Board-B18			Cold boot
Tracking Generator-B9	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Attenuator for Generator-B12	SYSTEM MESSAGES/ SELFTEST / CAL		
Preamplifier ESU-B24	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Preselector	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot

3.2.3 Replacing Front Module Controller A90

(see chapter 5, spare parts list, item 573 and illustrations 1302.6005 and 1166.1677)
The front module controller is mounted behind the front panel.

3.2.3.1 Opening Instrument and Removing Front Panel

- Switch off the instrument and pull the mains plug.
- Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- Pull off the front cover (280) towards the front.
- Undo 2 countersunk screws (610) in the front frame, at the top and at the bottom.
- Remove the front panel with keyboard and display (601, 621, 631, 641, 650, 660) towards the front and turn it toward the top of the instrument.

CAUTION

Note that the connecting cables are still connected to the controller.

- Disconnect the connecting cables to the LCD, DC/DC illumination converter, flexible switchfoil, spinwheel and network connector.

Note:
When removing the connecting cables, be careful with the cable connecting the keyboard. It is a film cable that can only be disconnected after sliding up the lock of the film cable plug.

3.2.3.2 Removing Front Module Controller

- Undo the 9 screws with washers (590) of the front module controller board and take out the front module controller as follows (see also Fig. 3-9):

Note:
It can be pulled off towards the front using the slots at the bottom of the mounting plate.

Carefully push the board towards the front step by step using a flat, blunt tool.

CAUTION

The front module controller is tightly inserted on the motherboard.
Do not insert the tool too far into the slots and press only against the PC board!
To pull out the board, carefully it pry off at all slots alternately.
The board must not be bent!

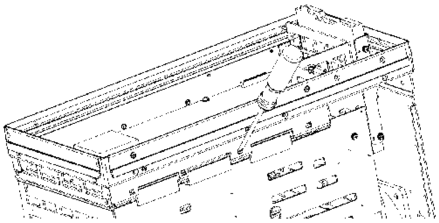


Figure 3-10: Removing the front module controller

3.2.3.3 Installing New Front Module Controller and Completing Instrument

► Carefully plug the new front module controller to the motherboard and fasten it in place using the 9 screws with washers (590).
► Carefully plug the cable connectors to the controller board, taking care not to reverse the polarities.

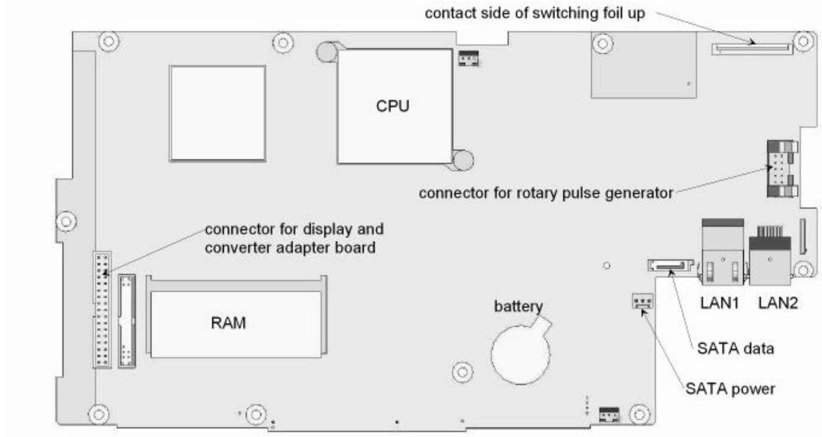


Figure 3-11: Position of connectors on front module controller

► Rotate the front panel into the R&S ESU and fasten in place using 4 countersunk screws (610) in the front frame.

CAUTION

Make sure to route the cables properly.

► Install the front cover (280).
► Mount the 2 front handles (420) on the instrument using the 4 screws (430).

Putting Instrument into Operation

► Connect the instrument to AC supply and switch on the power switch. The instrument is now in stand-by mode.
► Insert a floppy disk with DOS and BIOS update into the floppy disk drive.
► Switch on the R&S ESU and wait until the first beep. Press the FILE key. The BIOS update starts.
► When programming the flash EEPROM, the R&S ESU must not be switched off.
► Follow the message indicated in the display, then switch the R&S ESU off and on.

- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check the results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

3.2.3.4 Replacing Lithium Battery on Front Module Controller

(see chapter 5, spare parts list, item 776 and illustrations 1302.6005 and 1166.1677)

The lithium battery is accommodated on the front module controller board behind the front panel.

⚠ CAUTION

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

Keep away from children.

If the battery is replaced improperly, there is a danger of explosion. Only replace the battery by an R&S type (see chapter 5, spare parts list, item 776 for type FMR7). Lithium batteries are hazardous waste and must be disposed of in dedicated containers.

3.2.3.5 Opening Instrument and Removing Front Panel

- ► Switch off the instrument and pull the mains plug.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (280) towards the front.
- ► Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- ► Remove the front panel with keyboard and display (601, 621, 631, 641, 650, 660) towards the front and rotate it to the top of the instrument.

⚠ CAUTION

Note that the connecting cables are still connected to the controller.

3.2.3.6 Removing Lithium Battery

► Carefully lift and remove the battery.

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

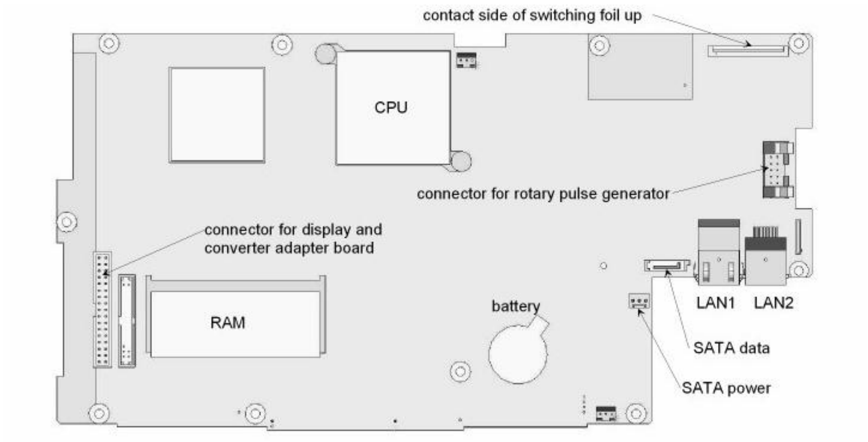


Figure 3-12: Position of lithium battery on front module controller

3.2.3.7 Installing New Battery and Completing Instrument

⚠ CAUTION

Do not short-circuit the battery.

► Insert battery into holder below the spring.

Note:
The positive pole (+) of the battery points up.

► Rotate the front panel back into the R&S ESU and fasten in place using 4 countersunk screws (610) in the front frame.

⚠ CAUTION

Make sure to route the cables properly.

► Install the front cover (280).
► Mount the 2 front handles (420) again using the 4 screws (430).

3.2.3.8 Putting Instrument into Operation

► Connect the instrument to the AC supply and switch on the power switch. The instrument is now in the stand-by mode.

- After battery replacement, a cold boot is required. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages: - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check the result:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

3.2.4 Replacing Hard Disk A60

(see chapter 5, spare parts list, item 711, and illustrations 1302.6005 and 1166.1677)

The S-ATA hard disk is located between the front module and the boards.

The spare part contains the complete software.

3.2.4.1 Opening Instrument and Replacing Hard Disk

- Switch off the instrument, disconnect the AC supply plug, unscrew the 4 rear-panel feet (450) and pull off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Disconnect the SATA data cable (721) and the SATA power cable (722) at the hard disk.
- Undo the 2 countersunk screws (740) on the hard disk mounting plate (730).
- Take the hard disk (711) with the mounting plate (730) out of the R&S ESU.
- Undo the 4 countersunk screws (750), remove the hard disk and mount a new hard disk to the mounting plate (730).
- If possible: Backup the file options.ini in folder D:\R_S\Instr\ini\

3.2.4.2 Installing New Hard Disk and Putting Instrument into Operation

- Mount the hard disk with the mounting plate into the instrument using 2 screws (740).

  Note:
  Be careful with the lower cover plate locking in the provided opening.

- Connect the SATA data cable (721) and the SATA power cable (722) to the hard disk.

  Note:
  Connect cable according to illustration 1166.1677 in chapter 5.

- Place the top cover (240) onto the instrument and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and fasten the 4 rear-panel feet (450) using screws.
- Connect the instrument to the AC supply and switch on the power switch. The instrument is now in the stand-by mode.

► After replacement of the hard disk, a cold boot is required. See section **Fehler! Verweisquelle konnte nicht gefunden werden.**.
  After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
► Start total calibration and check the results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
► If a backup of the options.ini was successful; Replace the file options.ini in folder D:\R_S\Instr\ini\. Otherwise reinstall the software options via options key codes.

3.2.5 Replacing LCD and DC/DC Converter in Front Module

(see chapter 5, spare parts list, items 601, 923 and 872, and illustrations 1302.6005, 1166.1677, 1093.4708)

The LCD is accommodated on the mounting plate together with the associated DC/DC converter. It is connected to the front module controller via cables, which can also be replaced individually. For replacement, proceed as follows:

3.2.5.1 Opening Instrument and Removing Front Module

► Switch off the instrument and pull the mains plug.
► Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
► Pull off the front cover (280) towards the front.
► Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
► Pull out the front module with keyboard and display (601, 621, 631, 641, 650, 660) towards the front as far at it goes.

⚠ CAUTION

Note that the connecting cables are still connected to the controller.

► Disconnect the cables to the LCD, DC/DC illumination converter, flexible switchfoil and spinwheel and network connector on the front module controller.

  Note:
  When removing the connecting cables, be careful with the cable connecting the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.

Place the front module with the keys onto a clean surface.

3.2.5.2 Removing DC/DC Converter

► Pull off the connecting cable (935) from the display (923) to the DC/DC converter (872).

► Disconnect cable (908) to DC/DC converter (872).
► Remove the DC/DC converter (872) after undoing the 2 screws (892).

3.2.5.3 Removing LCD

► Unscrew 2 screws with washers (950) and lift up the LST-Adapter (953).
► Disconnect LST-Adapter (953) from the display (923)
► Undo the 4 screws with washers (930) and remove the display (921).

3.2.5.4 Installing New LCD and/or DC/DC Converter and Putting into Operation

► To insert the new LCD and/or DC/DC converter, proceed in the reverse order, connect all cables in the correct position and tighten all screws (drawing 1093.4708).
► Place the front panel with the keys on top of the instrument so that the cables can be connected to the front module controller.
► Carefully plug the cable connectors to the controller board without reversing the polarities.

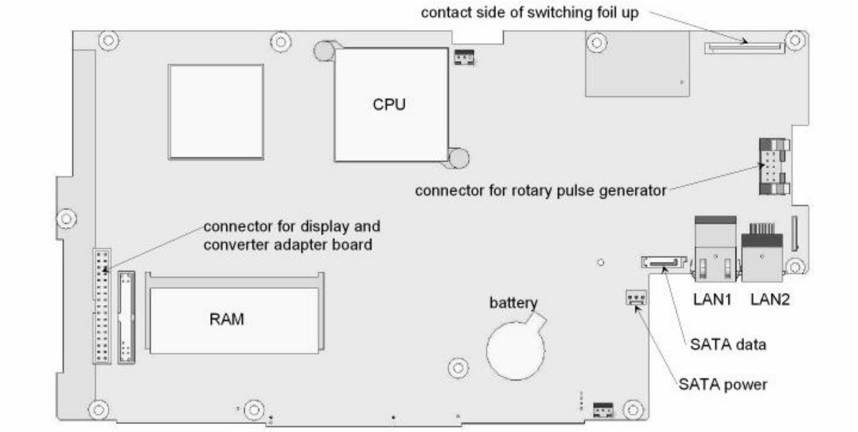


Figure 3-13: Position of connectors on front module controller

► Rotate the front panel back into the instrument and fasten it in place using 4 countersunk screws (610) in the front frame.

CAUTION

Make sure to route the cables properly.

► Install the front cover (280).
► Mount the 2 front handles (420) again using the 4 screws (430).
► Connect the instrument to the AC supply, switch on the power switch and press the ON key.

3.2.5.5 Replacing Flexible Switchboard or Switchfoil on Front Module

(see chapter 5, spare parts list items 631 and 641, and illustrations 1302.6005, 1166.1677)

The flexible switchfoil is the contact film for the rubber keys (flexible switchboard) behind the front cover and the keyboard frame.

3.2.5.6 Opening Instrument and Removing Front Panel

- ► Switch off the instrument and pull the mains plug.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (280) towards the front.
- ► Undo 2 countersunk screws (610) in the front frame at the top and at the bottom.
- ► Pull out the front module with keyboard and display (601, 621, 631, 641, 650, 660) towards the front and put it on top of the instrument with the keys facing the instrument.

⚠ CAUTION

The cables are still connected to the controller

- ► Disconnect the connecting cables to the LCD, DC/AC illumination converter, flexible switchfoil and spinwheel and the network connector.

  Note:
  When removing the cables, be careful with the cable connecting the keyboard. It is a film cable that can only be disconnected after sliding up the lock of the film cable plug.

3.2.5.7 Removing Membrane

- ► Place the front panel onto a clean surface with the keys pointing upwards.
- ► Pull off the knob (650) of the spinwheel.
- ► Undo the 10 countersunk screws (660) and remove the keyboard frame (621).
- ► The flexible switchfoil (641) as well as the flexible switchboard (631) can now be replaced.

3.2.5.8 Installing New Membrane and Completing Instrument

- ► Insert the new flexible switchboard (631) into the keyboard frame (621) from the back.

  Note:
  The pins of the flexible switchboard must be inserted into the holes at the keyboard frame.

► Position the new flexible switchfoil (641) on the back of the flexible switchboard (631).

Note:
Push the foil cable of the membrane through the slot in the mounting panel.
The membrane must be positioned so that the pins of the flexible switchboard are inserted into the holes in the membrane.

► Position the mounting plate with the display on the membrane (641).

Note:
The display must be positioned so that the pins of the flexible switchboard are inserted in the holes in the mounting plate (805).

► Press the front panel together, turn the keys to the top and fasten in the keyboard frame using 10 countersunk screws (660).
► Place the front panel with the keys on the top of the instrument so that the cables can be connected to the front module controller.
► Carefully plug the cable connectors to the controller board without reversing the polarities.

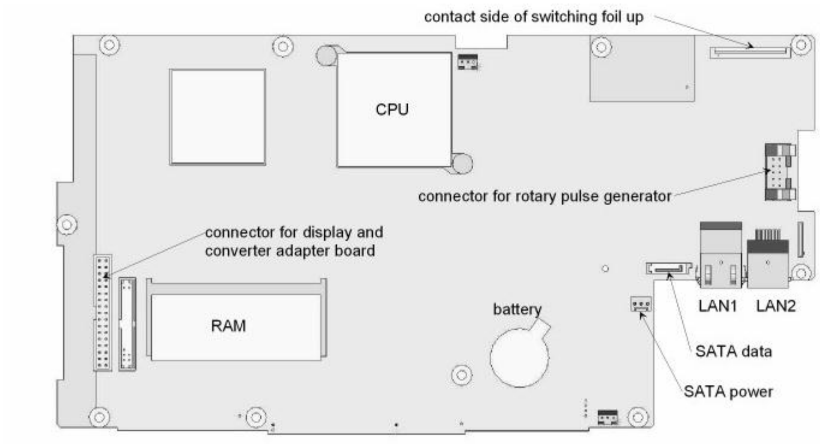


Figure 3-14: Position of connectors on front module controller

➢ Rotate the front panel back into the R&S ESU and fasten it in the front frame using 4 countersunk screws (610).

CAUTION

Make sure to route the cables properly.

► Install the front cover (280).
► Mount the 2 front handles (420) using the 4 screws (430).
► Connect the instrument to the AC supply, switch on the power switch and press the ON key.

3.2.6 Replacing Front Cover on Front Module

(see chapter 5, spare parts list, items 280/290/292, and illustration *1302.6005*)

The front cover is the outer front panel that carries the labels. Each model has its own front cover.

- ► Switch off the instrument and pull the mains plug.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (280) towards the front.
- ► Install the new front cover and reassemble the instrument in the reverse order.
- ► Connect the instrument to the AC supply, switch on the power switch and press the ON key.

3.2.7 Replacing Power Supply A20

(see chapter 5, spare parts list, item 550, and illustration *1166.1677*)

The power supply is installed at the rear of the instrument frame.

3.2.7.1 Removing Power Supply

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the rear.
- ► Undo the 10 screws (560) at the rear of the power supply.
- ► Pull out the power supply approx. 20 mm towards the rear, slightly tilt it towards the bottom and then pull it out completely.

3.2.7.2 Installing New Power Supply

- ► Place the instrument onto the front handles and install the new power supply in the reverse order.

Note:
Make sure that the 96-contact connector to the MOTHERBOARD locks in place correctly.

- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the AC supply and switch it on.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check resultw:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

3.2.8 Replacing Fan

(see chapter 5, spare parts list, item 15, and illustration 1302.6005)

The fan is installed at the right side of the frame.

3.2.8.1 Opening Instrument and Removing Fan

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Remove the fan (15) by loosening the 4 screws.
- ► Disconnect the fan cable at the motherboard connector X35 (FAN) .

3.2.8.2 Installing New Fan and Completing Instrument

- ► Connect the fan cable to the motherboard connector X35 (FAN)
- ► Mount the new fan using 4 screws.

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

- ► Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the AC supply, switch on the power switch and press the ON key.

3.2.9 Replacing RF Input Connector (Cable W1) R&S ESU8

(see chapter 5, spare parts list, item 295, and illustration 1302.6005)

The RF input connector is installed at the bottom right side of the front panel.

Depending on the frequency range, different cables W1 are available.

3.2.9.1 Opening Instrument and Removing Cable W1

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (280) towards the front.
- ► Remove 3 countersunk screws (71) at the frame and 4 countersunk screw (71) at the connector mounting plate (70).
- ► Unscrew the cable W1 (295) at the RF attenuator (20).
- ► Unscrew the cable W90 (300) at the pulse power attenuator (56).
- ► Remove the connector mounting plate (70) together with W1 and W90 towards the front.

Note:
The Probe Board (50) and vol./phone board (43) modules are connected to X80, X81 on the motherboard by means of a flat cable.
The USB Board (60) is connected by a cable to the front module controller.

- ► Undo the 4 countersunk screws (350) and remove cable W1 together with mounting plate (330).

3.2.9.2 Installing New Cable and Completing Instrument

- ► Put the mounting plate (330) onto the new cable W1 and fasten it in place using 4 countersunk screws (350), insert the mounting plate (70) into the instrument and screw W1 (295) to attenuator (20) and W90 (300) to pulse power attenuator (56).
- ► Fix 3 countersunk screws (71) in the instrument frame and 4 countersunk screw (71) in the mounting plate (70).
- ► Install the front cover (280).
- ► Mount the 2 front handles (420) again using the 4 screws (430).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Check frequency response according to chapter 1 and correct, if necessary.

3.2.10 Replacing RF INPUT Connector (Testport Adapter) R&S ESU26

(see chapter 5, spare parts list, Item 315, and illustration 1302.6005)

The input connector is at the bottom right of the front panel. Different connectors are used depending on the frequency range of the instrument.

3.2.10.1 Opening Instrument and Removing Testport Adapter

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Remove the 4 screws at the left and right front handles (430) and take off front handles.
- ► Pull off front cover (290) towards the front.
- ► Remove 3 countersunk screws (71) from frame and 4 countersunk screw (71) from mounting plate (70).
- ► Unscrew input cable W1 (316) from attenuator (25).
- ► Unscrew the cable W90 (300) at the pulse power attenuator (56).
- ► Pull out mounting plate (70) together with cable W1 and the Probe Board (50) and vol./phone board (43) modules towards the front.

Note:
The Probe Board (50) and vol./phone board (43) modules are connected to X80, X81 on the motherboard by means of a flat cable.
The USB Board (60) is connected by a cable to the front module controller.

- Remove cable W1 together with mounting plate (340) after undoing 4 countersunk screws (350).
- Unscrew testport adapter (315) from cable W1 (316).

3.2.10.2 Installing Testport Adapter and Completing Instrument

- Screw new testport adapter (315) to cable W1 (316).
- Connect mounting plate (340) to cable W1, fasten it with 4 countersunk screws (350), fit it into the instrument together with mounting plate (70) and screw W1 (316) to the attenuator (25) and W90 (300) to pulse power attenuator (56).
- Fasten mounting plate (70) to instrument frame with 3 countersunk screws (71) and to mounting plate (70) with 4 countersunk screw (71).
- Remount the 2 front handles (420) by means of 4 screws.
- Slide on enclosure (410) and screw on the 4 rear-panel feet (450).
- Connect the AC supply cable, switch on power switch and press the ON key.
- Start selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- Check frequency response as described in Chapter 1 and correct it, if required.

3.2.11 Replacing RF-INPUT (Testport Adapter) R&S ESU40

(see chapter 5, spare parts list, item 320, and illustration 1302.6005)

The input is located at the bottom right of the front panel. The input design will vary depending on the frequency range of the instrument.

3.2.11.1 Opening Instrument and Removing Testport Adapter

- Switch off the instrument, pull the mains plug, unscrew the 4 rear panel feet (450) and remove the enclosure (410) by pulling it toward the rear.
- Unscrew the 4 screws located on the left and right sides of the front handle (430) and remove the front handle.
- Pull off the front cover (292) toward the front.
- Unscrew the 3 countersunk screws (71) on the instrument frame and the 4 countersunk screws (71) on the subassembly plate (70).
- Unscrew the input cable W1 (322) on the attenuator (22).
- Unscrew the cable W90 (300) at the pulse power attenuator (56).
- Pull out the subassembly plate (70) toward the front together with W1 and the Probe Board (50) and the Vol./Phone board (43).

Note:
The Probe Board (50) and vol./phone board (43) modules are connected to X80, X81 on the motherboard by means of a flat cable.
The USB Board (60) is connected by a cable to the front module controller.

- Remove cable W1 after undoing 4 countersunk screws (350) with mounting plate (340).
- Unscrew housing adapter (320) from cable W1 (322).

3.2.11.2 Installing Testport Adapter and Completing Instrument

- Screw the new testport adapter (320) onto cable W1 (322).
- Feed mounting plate (340) to cable W1, fasten into place with 4 countersunk screws (350), insert back into instrument together with subassembly plate (70) and screw back onto attenuator (22) and W90 (300) onto pulse power attenuator (56).
- Fasten subassembly plate (70) via 3 countersunk screws (71) on the device frame and 4 countersunk screws (71) on the subassembly plate (70).
- Put the front cover (292) back on.
- Reassemble 2 front handles (420) using 4 screws.
- Slide enclosure (410) back on and screw on 4 rear panel feet (450).
- Connect power cable, switch on power switch and press ON key.
- Start selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- Check frequency response as described in chapter 1 and correct if necessary.

3.2.12 Replacing Motherboard A10

(see chapter 5, spare parts list, item 511 and illustrations 1302.6005, 1166.1677))
The motherboard is located at the bottom.

- Before removing the motherboard, you must determine the EEPROM entry for the specification version:
  - [**SETUP** : SYSTEM INFO : STATISTICS]

3.2.12.1 Opening Instrument and Removing Motherboard

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on the side frame and remove all cables to the boards.
- Pull out all boards towards the top of the instrument.

Note:
The boards can be disconnected from the motherboard by carefully pressing from the bottom through the motherboard slots.

- ► Remove the power supply (550).
  Undo the 10 screws (560) at the rear of the power supply.
  Pull out the power supply approx. 20 mm towards the rear, slightly tilt it towards the bottom and then pull it out completely.
- ► Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- ► Pull off the front cover (280) towards the front.
- ► Undo 2 countersunk screws (610) in the front frame at the top and 2 screws (610) at the bottom.
- ► Remove the front panel with keyboard and display (601, 621, 631, 641, 650, 660) towards the front.

CAUTION

Note that the cables are still connected to the controller.

- ► Disconnect the cables to the LCD, DC/AC illumination converter, flexible switchfoil and spinwheel and the network connector on the front module controller.

  Note:
  When removing the cables, be careful with the cable connecting the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.
- ► Remove the front module controller (see section "Replacing the Front Module Controller A90")
- ► Remove the screws of all motherboard connectors at the rear panel. Unscrew the bolts (530) at the COM and LPT ports and (540) at the Monitor port. Unscrew the nuts at the Noise Source and Ext. Trig connectors and the bolts at the IEC port.

  Note:
  Do not change the bolts of the Monitor and the LPT or COM ports!
- ► Disconnect the cables at the motherboard (RF attenuator, fan, floppy, Probe Board, rear panel, etc).
- ► Undo seven screws with washers (520) at the lower side of the motherboard (511).
- ► Carefully pull the motherboard (511) towards the front panel (approx. 15 mm) and take it out of the instrument by swiveling down.

3.2.12.2 Installing New Motherboard and Completing Instrument

- ► Reinstall the motherboard in the instrument in the reverse order.

  Note:
  Be careful when installing the motherboard in order not to cause damage to any components.
- ► Make sure to connect the cables according to their labels.
- ► Insert the front module controller, front panel, power supply, boards and cables, top cover, enclosure and rear-panel feet in the reverse order.

- After replacing the attenuator, a cold start is required. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [SETUP : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- Store the serial number of the instrument to the EEPROM:
  - [**SETUP** : SERVICE : ENTER PASSWORD “30473035”], then input serial number of the instrument in HW-Info table (see also chapter 2, section " Adjustment of Module Data").
- Store specification version to the EEPROM on the module:
  - [**SETUP** : SERVICE : ENTER PASSWORD “894129“]
  - [**SETUP** : SERVICE : SERVICE FUNCTION “2.2.21.{value}]
    Example: A value 701 means version 07.01.

3.2.13 Replacing RF Attenuator A40

(see chapter 5, spare parts list, items 20, 22 and 25, and illustration 1302.6005)
The RF attenuator is installed at the bottom behind the RF input connector.

3.2.13.1 Opening Instrument and Removing RF Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Place the instrument onto the left side and unscrew the RF cable at the output of the RF attenuator.
- R&S ESU8: Undo the 2 screws with washers (40) at the instrument frame.

  Note:
  The RF attenuator is then only held via the RF cables at the front.

- R&S ESU26: Undo the 3 screws with washers (28) at the instrument frame.

  Note:
  The RF attenuator is then only held via the RF cables at the front.

- Hold the attenuator and disconnect RF cable W1 an RF cable W91 from the input of the RF attenuator (20, 22, 25).
- Carefully take out the RF attenuator and unscrew the flexible RF cable from the input.
- Disconnect ribbon cable from pulse power attenuator (56) connector X44 on the ESU8 or ribbon cable from motherboard X40 on the R&S ESU26/40.
- Only R&S ESU26/40: Remove RF attenuator (22, 25) by undoing 4 countersunk screws (27) from insulating plate (26).

3.2.13.2 Installing New RF Attenuator and Completing Instrument

- ► Only R&S ESU26/40: fasten new attenuator (22, 25) to insulating plate (26) with 4 countersunk screws (27).
- ► Connect ribbon cable to pulse power attenuator (56) connector X44 on the R&S ESU8 or to motherboard connector X40 on the R&S ESU26/40.
- ► Install the new RF attenuator in the instrument and connect cable W1 and W91 to the input.
  R&S ESU 8: Fasten the attenuator to the instrument frame using the 2 screws with washers (40).
  R&S ESU 26/40: Fasten the attenuator to the instrument frame using the 3 screws with washers (28).
- ► Fasten the RF cable W2 to the RF output of the RF attenuator.
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the mains and switch on the power switch. The instrument is now in the standby mode.
- ► After replacing the attenuator, a cold start is required. See section "Performing a Cold Start".
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Execute frequency response correction FSU-FRQ.EXE.
  The software is located on the Gloris server.
  - – Test setup according to menu item "Schematic" (connect external reference).
  - – Check IEC/IEEE addresses and configuration of instruments.
  - – Press the Autoselect button and perform the measurement with Run.
  - – The frequency correction of the YIG filter is performed under item YIG.
  - – After calibration, the frequency response is corrected over the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.14 Replacing Probe Board ESU A80 and Vol./Phone Board A191

(see chapter 5, spare parts list, Pos. 43, 50 and illustration 1302.6005*)*

The boards are located behind the front-panel connectors, Probe, Headphones and the volume control knob.

3.2.14.1 Opening Instrument and Removing Boards

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take out the enclosure (410) towards the back.
- ► Undo the 4 screws (430) of the front handles on both sides and take off the front handles.

- Pull off the front cover (280) towards the front.
- Pace the instrument onto the left side so that its bottom side is accessible.
- Remove 3 countersunk screws (71) at the frame and 4 countersunk screw (71) at the connector mounting plate (70).
- Unscrew the input cable W1 (295, 316 or 322) at the RF attenuator (20, 22 or 25).
- Unscrew the cable W90 (300) at the pulse power attenuator (56).
- Remove the mounting plate (70) completely with W1 and Probe Board (50) and Vol./Phone board (43) towards the front.

Note:
The Probe Board (50) and vol./phone board (43) modules are connected to X80, X81 on the motherboard by means of a flat cable.
The USB Board (60) is connected by a cable to the front module controller.

- Disconnect the cables of Probe Board (50) and Vol./Phone board (43) from motherboard connectors X80 and X81.
- Disconnect the flat cable of Probe Board (50) from pulse power attenuator (56) connector X43.
- Undo the 3 countersunk screws (55) and remove the Probe Board (50).
- Undo the 2 countersunk screws (46) and remove the Vol./Phone board (43) from the
mounting plate (70).
- Undo the screw with washer (45) and the nut of the volume control at the mounting bracket (44) and remove the Vol./Phone board (43).

3.2.14.2 Installing New Boards and Completing Instrument

- Fasten the new Probe Board (50) to the mounting plate (70) using 3 countersunk screws (55).
- Fasten the new Vol./Phone board (43) to the mounting bracket (44) using the nut of the volume control and 1 screw with washer (45). Mount Vol./Phone board (43) to mounting plate (70) using 2 countersunk screws (46).
- Connect the cables of Probe Board (50) and Vol./Phone board (43) to motherboard connectors X80 and X81.
- Connect the flat cable of Probe Board (50) to pulse power attenuator (56) connector X43.
- Carefully slide the complete mounting plate (70) back into the instrument.

CAUTION

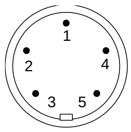
Make sure to route the cables properly.

- Screw RF cable W1 (295, 316 or 322) to the input of the RF attenuator (20, 22 or25) and W90 (300) to the pulse power attenuator (56).
- Mount 3 countersunk screws (71) to the instrument frame and 4 countersunk screw (71) to the mounting plate (70).
- Install the front cover (280).
- Mount the 2 front handles (420) using the 4 screws (430).

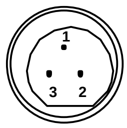
► Mount the enclosure (410) and the 4 rear-panel feet (450).

3.2.14.3 Function Test

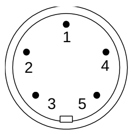
Measure the output voltages at the probe connector (see **Fehler! Verweisquelle konnte nicht gefunden werden.**)



Pin	Signal
1	GND
2	-10 V
3	-
4	+10 V
5	-



Pin	Signal
1	GND
2	-12.6 V
3	+15 V



Pin	Signal
1	GND
2	-10 V
3	-
4	+10 V
5	-

Figure 3-15: Pin assignments of PROBE POWER connectors

► Test the function of headphones connector and volume control. Press the *MKR* key and then the *MARKER DEMOD* softkey*.* Noise can be heard in the loudspeaker, and the volume can be changed using the *VOLUME* knob at the front panel. Connect headphones to the *AF OUTPUT* at the front panel. The loudspeaker is switched off and the noise can be heard in the headphones.

3.2.15 Replacing USB2.0 Board A310

(see chapter 5, spare parts list, Pos. 60 and illustration 1302.6005*)*

The boards are located behind the front-panel.

3.2.15.1 Opening Instrument and Removing Board

► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take out the enclosure (410) towards the back.
► Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
► Pull off the front cover (280) towards the front.
► Pace the instrument onto the left side so that its bottom side is accessible.
► Remove 3 countersunk screws (71) at the frame and 4 countersunk screw (71) at the connector mounting plate (70).

- Unscrew the input cable W1 (295, 316 or 322) at the RF attenuator (20, 22 or 25).
- Unscrew the cable W90 (300) at the pulse power attenuator (56).
- Remove the mounting plate (70) completely with W1 and Probe Board (50),Vol./Phone board (43) and USB Board (60) towards the front.

  Note:
  The Probe Board (50) and Vol./Phone board (43) are connected to X80 and X81 on the motherboard via a ribbon cable and the USB Board (60) is connected to the front module controller (573).

- Disconnect the cable W310 (62) on the USB Board (60).
- Undo the 2 countersunk screws (61) and remove the USB Board (60).

3.2.15.2 Installing New Board and Completing Instrument

- Fasten the new USB Board (60) to the mounting plate (70) using 2 countersunk screws (62).
- Connect the cable W310 (62) to the USB Board (60).
- Carefully slide the complete mounting plate (70) back into the instrument.

CAUTION

Make sure to route the cables properly.

- Screw RF cable W1 (295, 316 or 322) to the input of the RF attenuator (20, 22 or25) and W90 (300) to the pulse power attenuator (56).
- Mount 3 countersunk screws (71) to the instrument frame and 4 countersunk screw (71) to the mounting plate (70).
- Install the front cover (280).
- Mount the 2 front handles (420) using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).

3.2.15.3 Function Test

- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- Connect an USB keyboard to the USB socket on the front of the unit (USB board (60).
- Simultaneously press the CTRL and ESC keys on the keyboard. The Windows XP task bar will appear at the lower edge of the screen.
- Shift the cursor to MAINAPP using the trackball and click. The task bar will disappear.
- Check also the other USB socket on the front.

3.2.16 Replacing RF Converter A100

(see chapter 5, spare parts list, item 100, and illustration 1302.6005)

The board is located in the middle of the instrument .

3.2.16.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) on the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side frame and remove all cables connecting the board.
- ► Pull out board towards the top of the instrument.

Note:
The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.

3.2.16.2 Installing New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labels on the motherboard.

- ► Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable, and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement of the RF converter. See section "Performing a Cold Start".
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Check frequency response according to chapter 1 and correct, if necessary, using the correction software.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.17 Replacing Synthesizer A110

(see chapter 5, spare parts list, item 105 and illustration 1302.6005)

The board is located in the middle of the instrument.

3.2.17.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and pull off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) on the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all connecting cables to the board.
- ► Pull out the board towards the top of the instrument.

Note:
The board can be disconnected from the motherboard connector by carefully pressing through the motherboard slots from the bottom.

3.2.17.2 Installing New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labeling on the motherboard.

- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement of the Synthesizer. See section "Performing a Cold Start".
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Check frequency response according to chapter 1 and correct, if necessary, using the correction software.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.18 Replacing Wideband Detector Unit A140

(see chapter 5, spare parts list, item 11, and illustration 1302.6005)

The board is located in the front part of the instrument.

3.2.18.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.

- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all RF cables to the board.
- ► Pull out the board towards the top of the instrument.

Note:
The module can be disconnected from the motherboard connector by carefully pressing through the motherboard slots from the bottom.

3.2.18.2 Installing New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect all RF cables.

  Note:
  Please observe the labeling on the motherboard.

- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on the power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement of the Wideband Detector Unit. See section "Performing a Cold Start".
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
- ► - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.19 Replacing IF Filter A130

(see chapter 5, spare parts list, item 120, and illustration 1302.6005)

The board is located in the middle of the instrument.

3.2.19.1 Opening Instrument and Removing Board

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- Pull out board towards the top of the instrument.

Note:
The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.

3.2.19.2 Installing New Board and Completing Instrument

- Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labeling on the motherboard.

- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains, switch on the power switch and press the ON key.
- A cold start is required after replacement of the IF Filter. See section "Performing a Cold Start".
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
- - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
  Start total calibration and check results:
- - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- Check frequency accuracy and the calibration source level according to chapter 1 and readjust according to chapter 2, if necessary.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").
- Write calibration data to the EEPROM (see chapter 2, section "Adjustment of Module Data").

3.2.20 Replacing Preselector A150

(see chapter 5, spare parts list, item 95, and illustration 1302.6005)

The board is located in the middle of the instrument.

3.2.20.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) on the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side frame and remove all cables connecting the board.
- ► Pull out board towards the top of the instrument.

Note:
The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.

3.2.20.2 Installing New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labels on the motherboard.

- ► Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable, and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement of the preselector. See section "Performing a Cold Start".
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Check frequency response according to chapter 1 and correct, if necessary, using the correction software.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.21 Replacing Pulse Power Attenuator A42

(see chapter 5, spare parts list, item 56, and illustration 1302.6005)

The board is located on the top right behind the front panel.

3.2.21.1 Opening Instrument and Removing Pulse Power Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Remove the RF Attenuator:
  - Place the instrument onto the left side and unscrew the RF cable at the output of the RF attenuator.
  - R&S ESU8: Undo the 2 screws with washers (40) at the instrument frame.

  Note:
  The RF attenuator is then only held via the RF cables at the front.

  - R&S ESU26: Undo the 3 screws with washers (28) at the instrument frame.

  Note:
  The RF attenuator is then only held via the RF cables at the front.

  - Hold the attenuator and disconnect RF cable W1 and W91 of the RF attenuator (20, 22, 25).
  - Carefully take out the RF attenuator.
- Disconnect RF cable W90 (300) and cable W3 of Pulse Power Attenuator (56).
- Disconnect all flat cables of Pulse Power Attenuator (56).
- Undo the 3 screws with washers (58) at the instrument frame and remove the Attenuator (56) with holder (57).
- Remove RF cable W91 from the Pulse Power Attenuator (56).
- Undo the 4 screws with washers (58) at the PCB and remove the Pulse Power Attenuator (56).

3.2.21.2 Installing New RF Attenuator and Completing Instrument

- Mount the new Pulse Power Attenuator (56) with 4 screws with washers (58) to the holder (57).
- Mount RF cable W91 to the Pulse Power Attenuator (56).
- Connect all flat cables to Pulse Power Attenuator (56).
- Mount the Attenuator (56) with holder (57) back with 3 screws with washers (58) at the instrument frame.
- Connect RF cable W90 (300) and cable W3 to Pulse Power Attenuator (56).
- Mount the RF Attenuator back:
  - Connect the RF cable W1 and W91 of RF attenuator.
  - R&S ESU 8: Fasten the attenuator to the instrument frame using the 2 screws with washers (40).
    R&S ESU 26/40: Fasten the attenuator to the instrument frame using the 3 screws with washers (28).
  - Fasten the RF cable W2 to the RF output of the RF attenuator.
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect the instrument to the mains and switch on the power switch. The instrument is now in the standby mode.
- After replacing the attenuator, a cold start is required. See section "Performing a Cold Start".

- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Execute frequency response correction FSU-FRQ.EXE.
  The software is located on the Gloris server.
  - – Test setup according to menu item "Schematic" (connect external reference).
  - – Check IEC/IEEE addresses and configuration of instruments.
  - – Press the Autoselect button and perform the measurement with Run.
  - – The frequency correction of the YIG filter is performed under item YIG.
  - – After calibration, the frequency response is corrected over the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data")

3.2.22 Replacing 8 GHz Converter Unit A160; R&S ESU8

(see chapter 5, spare parts list, items 130 and illustration 1302.6005)

The board is located in the middle of the instrument.

3.2.22.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- ► Pull out the board towards the top of the instrument.

Note:
The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.

3.2.22.2 Installing New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labeling on the motherboard.

- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).

- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement of the Converter Unit. See section "Performing a Cold Start".

- ➢ After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]

- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the GLORIS server.

  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.

- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.23 Replacing Diplexer A162; R&S ESU8

(see chapter 5, spare parts list, item 2030 and illustration 1130.2544)

The board is located on the 8 GHz Converter Unit.

3.2.23.1 Removing Diplexer on MW Converter 1130.2544

- ► Remove the 8 GHz Converter Unit (130).

  Note:
  See description "Replacing 8 GHz Converter Unit A160; R&S ESU 8".

- ► Disconnect cable W1 from diplexer (2030).
- ► Undo 4 screws with washers (2035) from the bottom of the PCB.
- ► Remove diplexer (2006) perpendicularly to the PCB.

  Note:
  The diplexer is still connected to the PCB with contact pins.

3.2.23.2 Installing Diplexer on MW Converter 1130.2544

- ► Plug in new diplexer (2030) perpendicularly to the PCB.

  Note:
  The diplexer is connected to the PCB with contact pins.

- ► Refasten 4 screws with washers (2035) to the bottom of the PCB.

► Fit cable W1 to diplexer (2030).

3.2.23.3 Completing Instrument and Frequency Response Correction

► Put the 8 GHz Converter Unit (130) back into the instrument.

Note:
See description "Replacing 8 GHz Converter Unit A160; R&S ESU 8".

► Connect the AC supply cable and switch on the instrument.
► After starting the instrument, check the log file for system messages:
- [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
► Start selftest and check the result to ensure that no errors occurred:
- [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
► Start system error correction and check the result to ensure that no errors occurred:
- [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
► Execute frequency response correction software FSU-FRQ.EXE.
The software is on the GLORIS server.

– Test setup according to menu item "Schematic" (connect external reference).
– Check IEC/IEEE addresses and configuration of instruments.
– Press the Autoselect button and perform measurement with Run.
– The frequency correction of the YIG filter is performed under item YIG.
– After calibration, the frequency response is corrected over the entire frequency range.

► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.24 Replacing 8 GHz YIG Unit A161; R&S ESU8

(see chapter 5, spare parts list, items 2005 and 2010, and illustration 1130.2544)

The board is located on the 8 GHz Converter Unit.

Note:
Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.

3.2.24.1 Removing 8 GHz YIG Unit

► Remove the 8 GHz Converter Unit (130).

Note:
See description "Replacing 8 GHz Converter Unit A160; R&S ESU 8".

► Remove the 2 module covers by undoing the screws from the bottom of the module.
► Disconnect cable W1 from the diplexer (2030) and cable W2 from the 8 GHz converter circuit (2000).
► Depending on the YIG unit used, disconnect the cable from the YIG filter at X4.

- Undo 2 countersunk screws (2025).
- Remove the complete YIG unit (2005 or 2010).

  Note:
  YIG unit 1130.2944.02 (2005) is connected to the PCB via contacts. Remove the YIG unit towards the top perpendicularly to the PCB.

- Remove the complete YIG unit (2015 or 2020).

  Note:
  YIG Unit 1130.2944.04 (2015) is connected to the PCB via contacts. Remove the YIG unit towards the top perpendicularly to the PCB.

3.2.24.2 Installing 8 GHz YIG Unit

- Place the new YIG unit (2005 or 2010) on the PCB.

  Note:
  YIG Unit 1130.2944.02 (2015) is connected to the PCB via contacts. Plug the YIG unit into the connector contacts from the top perpendicularly to the PCB.

- Fasten the YIG unit with 2 countersunk screws (2025).
- Screw on cable W1 to the diplexer (2030) and connect cable W2 to the 8 GHz converter circuit (2000).
- Depending on the YIG unit used, connect the cable from the YIG filter at X4.
- Replace the module cover on the top of the Converter Unit (positioning by means of adjusting pins). Turn 8 GHz Converter Unit upside down, place module cover on the bottom side and refasten all screws.

Completing Instrument and Frequency Response Correction

- Place the 8 GHz Converter Unit (130) into the instrument.

  Note:
  See description "Replacing 8 GHz Converter Unit A160; R&S ESU 8".

- Connect the AC supply cable and switch on the instrument.
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the GLORIS server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.

  - After calibration, the frequency response is corrected over the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.25 Replacing 26.5/40 GHz MW Converter Unit A160; R&S ESU 26/40

(see chapter 5, spare parts list, item 140, 150 and illustration 1302.6005)

The board is located in the middle of the instrument.

3.2.25.1 Opening Instrument and Removing Module

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the cover (240) of the instrument to left side and take off.
- ► Place the instrument on its side and remove all RF cables from the module at the bottom of the instrument.
- ► Pull out the module towards the top of the instrument.

Note:
The module can be disconnected from the motherboard connector by carefully pushing it upwards from the bottom through the motherboard slots.

3.2.25.2 Installing New Module and Completing Instrument

- ► Plug the new module into the instrument and reconnect all RF cables.

Note:
Please observe the labeling on the motherboard.

- ► Put the top instrument cover (240) back into place and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the mains, switch on the power switch and press the ON key.
- ► A cold start is required after replacement of the MW Converter Unit. See section "Performing a Cold Start".
- ► After starting the instrument, check if the protocol file is correct:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- ► Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.

– Test setup according to menu item "Schematic" (connect external reference).
– Check IEC/IEEE addresses and configuration of instruments.
– Press the Autoselect button and perform measurement with Run.
– The frequency correction of the YIG filter is performed under item YIG.
– After calibration, the frequency response is corrected over the entire frequency range.

► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.26 Replacing Diplexer A161; R&S ESU 26

(see chapter 5, spare parts list, item 2105 and illustration 1166.2338.22, sheet 1)

The board is located on the 26.5 GHz MW Converter Unit.

3.2.26.1 Removing Diplexer

► Remove *the* 26.5 GHz Converter Unit (140).

Note:
See description "Replacing ≥26.5 GHz MW Converter Unit A160; R&S ESU".

► Disconnect all cables from diplexer (2105).
► Undo 4 screws with washers (2110) from the bottom of the PCB.
► Remove diplexer (2105) perpendicularly to the PCB.

Note:
The diplexer is still connected to the PCB with contact pins.

3.2.26.2 Installing Diplexer

► Plug in new diplexer (2105) perpendicularly to the PCB.

Note:
The diplexer is connected to the PCB with contact pins.

► Refasten 4 screws with washers (2110) to the bottom of the PCB.
► Refasten all cables to the diplexer (2105).

3.2.26.3 Completing Instrument and Frequency Response Correction

► Put the 26.5 GHz MW Converter Unit (140) back into the instrument.

Note:
See description "Replacing ≥26.5 GHz MW Converter A160;

► Connect the AC supply cable and switch on the instrument.
► After starting the instrument, check the log file for system messages:
- [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
► Start selftest and check the result to ensure that no errors occurred:
- [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]

- ► Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- ► Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - – Test setup according to menu item "Schematic" (connect external reference).
  - – Check IEC/IEEE addresses and configuration of instruments.
  - – Press the Autoselect button and perform measurement with Run.
  - – The frequency correction of the YIG filter is performed under item YIG.
  - – After calibration, the frequency response is corrected over the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.27 Replacing YIG Unit A162; R&S ESU 26

(see chapter 5, spare parts list, item 2107 and illustration 1166.2338.22, sheet 1)

The board is located on the 26.5 GHz MW Converter Unit.

Note:
Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.

3.2.27.1 Removing 26.5 GHz YIG Unit

- ► Remove the 26.5 GHz MW Converter Unit (140).

Note:
See description "Replacing ≥26.5 GHz MW Converter Unit A160"

- ► Disconnect cable W1 from the diplexer (2105) and cable W2 from the extension (2125).
- ► Disconnect cable from YIG filter at X4.
- ► Undo 3 cover screws holding the YIG unit (2107) from the bottom of the module.
- ► Undo 2 countersunk screws (2120).
- ► Remove the complete YIG unit (2107).

3.2.27.2 Installing 26.5 GHz YIG Unit

- ► Put the new YIG unit (2107) on the PCB.
- ► Fasten YIG unit with 2 countersunk screws (2120).
- ► Refasten 3 cover screws holding the YIG unit (2107) to the bottom of the module.
- ► Reconnect cable W1 to the diplexer (2105) and cable W2 to the extension (2125).
- ► Connect cable from the YIG filter to X4.

3.2.27.3 Completing Instrument and Frequency Response Correction

- ► Put the 26.5 GHz Converter Unit (140) back into the instrument.

Note:
See description "Replacing ≥26.5 GHz MW Converter Unit A160".

- ▶ Connect the AC supply cable and switch on the instrument.
- ▶ After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ▶ Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- ▶ Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- ▶ Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- ▶ Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.28 Replacing Extender 26.5 GHz A163; R&S ESU 26

(see chapter 5, spare parts list, item 2125 and illustration 1166.2338.22, sheet 1)

The board is located on the 26.5 GHz MW Converter Unit.

3.2.28.1 Removing Extender 26.5 GHz

- ▶ Remove the 26.5 GHz MW Converter Unit (140).

Note:
See description "Replacing the ≥26.5 GHz MW Converter Unit A160".

- ▶ Disconnect all cables from Extender 26 (2125).
- ▶ Undo all a-side cover screws from the bottom side of the module and remove cover.

Note:
The cover on the top (2160) thus comes off.

- ▶ Undo 7 screws with washers (2130) from the Extender 26 (2125) at the bottom side of the module.
  Caution: The Extender 26 (2125) may drop out.
- ▶ Remove the Extender 26 (2125) perpendicularly to the PCB.

Note:
The Extender 26 is still connected to the PCB with contact pins.

- ▶ Disconnect SMA protection cap (2225) from extender (2125).

3.2.28.2 Installing Extender 26.5 GHz

- ► Connect SMA protection cap (2225) to new extender (2125).
- ► Plug in the new Extender 26 (2125) perpendicularly to the PCB.

  Note:
  The Extender 26 is connected to the PCB by means of connector contacts.

- ► Refit 7 screws with washers (2130) to the Extender 26 (2125) at the bottom of the module.
- ► Fit module a-side cover to the bottom side and refit all screws.
- ► Reconnect all cables to the Extender 26 (2125).

3.2.28.3 Completing Instrument and Frequency Response Correction

- ► Put 26.5 GHz MW converter (140) back into the instrument.

  Note:
  See description "Replacing ≥26.5 GHz MW Converter A160."

- ► Connect the AC supply cable and switch on the instrument.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- ► Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- ► Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - – Test setup according to menu item "Schematic" (connect external reference).
  - – Check IEC/IEEE addresses and configuration of instruments.
  - – Press the Autoselect button and perform measurement with Run.
  - – The frequency correction of the YIG filter is performed under item YIG.
  - – After calibration, the frequency response is corrected over the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.29 Replacing Diplexer A161; R&S ESU 40

(see chapter 5, spare parts list, item 3111 and illustration 1130.4982.42, sheet 1)

The board is located on the 40 GHz MW Converter Unit.

3.2.29.1 Removing Diplexer

- ► Remove the 40 GHz Converter Unit (140).

Note:
See description "Replacing ≥26.5 GHz MW Converter Unit A160; R&S ESU"

- ► Disconnect all cables from diplexer (3111).
- ► Undo 4 screws below the diplexer on a-side cover from the bottom side of the module.
- ► Remove diplexer (3111) perpendicularly to the PCB.

Note:
The diplexer is still connected to the PCB with contact pins.

3.2.29.2 Installing Diplexer

- ► Plug in new diplexer (3111) perpendicularly to the PCB.

Note:
The diplexer is connected to the PCB with contact pins.

- ► Refasten 4 screws on a-side cover from the bottom side of the module.
- ► Refasten all cables to the diplexer (2105).

3.2.29.3 Completing Instrument and Frequency Response Correction

- ► Put the 40 GHz MW Converter Unit (150) back into the instrument.

Note:
See description "Replacing ≥26.5 GHz MW Converter A160;

- ► Connect the AC supply cable and switch on the instrument.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- ► Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- ► Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - – Test setup according to menu item "Schematic" (connect external reference).
  - – Check IEC/IEEE addresses and configuration of instruments.
  - – Press the Autoselect button and perform measurement with Run.
  - – The frequency correction of the YIG filter is performed under item YIG.
  - – After calibration, the frequency response is corrected over the entire frequency range.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.30 Replacing YIG Unit A162; R&S ESU 40

(see chapter 5, spare parts list, item 3127 and illustration 1130.4982.42, sheet 1)

The board is located on the 40 GHz MW Converter Unit.

Note:
Only the YIG units (with YIG filter, cable, sheet metal part) are replaced. The interface is thus always the same when using other YIG filters.

3.2.30.1 Removing 40 GHz YIG Unit

- ▶ Remove the 40 GHz MW Converter Unit (140).

  Note:
  See description "Replacing ≥26.5 GHz MW Converter Unit A160"

- ▶ Disconnect **cable W1 from** the diplexer (3111) and cable W2 from the extension (3148).
- ▶ Disconnect cable from YIG filter at X4.
- ▶ Undo 3 cover screws holding the YIG unit (3127) from the bottom of the module.
- ▶ Undo 2 countersunk screws (3140).
- ▶ Remove the complete YIG unit (3127).

3.2.30.2 Installing 40 GHz YIG Unit

- ▶ Put the new YIG unit (3127) on the PCB.
- ▶ Fasten YIG unit with 2 countersunk screws (3140).
- ▶ Refasten 3 cover screws holding the YIG unit (3127) to the bottom of the module.
- ▶ Reconnect cable W1 to the diplexer (3111) and cable W2 to the extension (3148).
- ▶ Connect cable from the YIG filter to X4.

3.2.30.3 Completing Instrument and Frequency Response Correction

- ▶ Put the 40 GHz Converter Unit (150) back into the instrument.

  Note:
  See description "Replacing ≥26.5 GHz MW Converter Unit A160".

- ▶ Connect the AC supply cable and switch on the instrument.
- ▶ After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ▶ Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- ▶ Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- ▶ Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - – Test setup according to menu item "Schematic" (connect external reference).
  - – Check IEC/IEEE addresses and configuration of instruments.
  - – Press the Autoselect button and perform measurement with Run.
  - – The frequency correction of the YIG filter is performed under item YIG.

- After calibration, the frequency response is corrected over the entire frequency range.

► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.31 Replacing Extender 40 GHz A163; R&S ESU 40

(see chapter 5, spare parts list, item 3148 and illustration 1130.4982.42, sheet 1)

The board is located on the 40 GHz MW Converter Unit.

3.2.31.1 Removing Extender 40 GHz

► Remove the 40 GHz MW Converter Unit (150).

Note:
See description "Replacing the ≥26.5 GHz MW Converter Unit A160".

► Disconnect all cables from Extender 40 (3148).

► Undo 6 screws with washers (3160) from the Extender (3148) at the bottom side of the module.

CAUTION!
The Extender (3148) may drop out.

► Remove the Extender (3148) perpendicularly to the PCB.

Note:
The Extender is still connected to the PCB with contact pins.

► Disconnect SMA protection cap (3230) from extender (3148).

3.2.31.2 Installing Extender 40 GHz

► Connect SMA protection cap (3230) to new extender (3148).

► Plug in the new Extender (3148) perpendicularly to the PCB.

Note:
The Extender is connected to the PCB by means of connector contacts.

► Refit 6 screws with washers (3160) to the Extender (3148) at the bottom of the module.

► Reconnect all cables to the Extender (3148).

3.2.31.3 Completing Instrument and Frequency Response Correction

► Put 40 GHz MW Converter (150) back into the instrument.

Note:
See description "Replacing ≥26.5 GHz MW Converter A160."

► Connect the AC supply cable and switch on the instrument.

- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - Test setup according to menu item "Schematic" (connect external reference).
  - Check IEC/IEEE addresses and configuration of instruments.
  - Press the Autoselect button and perform measurement with Run.
  - The frequency correction of the YIG filter is performed under item YIG.
  - After calibration, the frequency response is corrected over the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.32 Replacing the User Port W67

(see chapter 5, spare parts list, item 200, and illustrations 1302.6005).

The cable is at the rear panel.

3.2.32.1 Opening the Instrument and Removing the Cable

- Switch off the instrument and disconnect it from power supply.
- Unscrew 6 screws (180).
- Move rear panel (170) with cables carefully outside.
- Disconnect cable W67 User Port (200) on motherboard X67 and unscrew locking screw (201) with washer (202) and nut (203).

3.2.32.2 Installing the Cable and Completing the Instrument

- Mount supplied cable W67 User Port (200) with locking screw (201), washer (202) and nut (203).
- Connect cable W67 onto motherboard X67.
- Fasten rear panel (170) again with 6 screws (180).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]

3.2.33 Replacing Tracking Generator A170 (Option: B9)

(see chapter 5, spare part list, item 1800, and illustrations 1302.6005 and 1142.9090)

The board is installed in the rear part of the instrument.

3.2.33.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all connecting cables to board at the bottom of the instrument.
- ► Pull out the Tracking Generator Board (1800) towards the top of the instrument.

Note:
The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.

3.2.33.2 Installing New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labeling on the motherboard.

- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► A cold start is required after replacement of the board. See chapter „Performing a cold start".
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Check according to chapter 1, option Tracking Generator –B9.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.34 Replacing Step Attenuator A171 (Option: B12)

(see chapter 5, spare part list, item. 2400, and illustrations 1302.6005 and 1142.9361)

The board is installed in the rear part of the instrument (behind the fan).

3.2.34.1 Opening Instrument and Removing Attenuator

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Place the instrument on its side and remove all connecting cables W41 - X2 and W49 - X1 to tracking attenuator (2400).
- Disconnect flat cable of tracking attenuator (2400) on motherboard connector X270.
- Undo the 3 screws with washers (2420) and remove attenuator with holder.
- Undo the 2 screws M3 (2415) and remove the tracking attenuator (2400).

3.2.34.2 Installing New Attenuator and Completing Instrument

- Mount Tracking Attenuator (2400) with 2 screws M3 (2415) to attenuator holder (2410).
- Insert Tracking Attenuator with attenuator holder into unit and mount 3 screws with washers (2420).
- Connect flat cable of Tracking Attenuator (2400) to motherboard connector X270.
- Connect cable W41 - X2 and W49 – X1 to Tracking Attenuator.
- Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- A cold start is required after replacement of the step attenuator (2400). See chapter „Performing a cold start“.
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- Check according to chapter 1, option Tracking Generator –B9 and Option Attenuator –B12.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.35 Replacing OCXO A200 (Option: B4)

(see chapter 5, spare parts list, item 1100, and illustrations 1302.6005 and 1144.9017)

The board is installed in the front part of the instrument.

3.2.35.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Place the instrument on its side and remove all connecting cables to board at the rear of the instrument.
- ► Pull out the board towards the top of the instrument.

Note:
The board can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.

3.2.35.2 Installing New Module and Completing Instrument

- ► Plug the new board into the instrument and reconnect the cables.

Note:
Please observe the labeling on the motherboard.

- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).
- ► Connect the instrument to the mains, switch on the power switch and press the ON key.
- ► A cold start is required after replacement of the OCXO. See section 3.2.1
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- ► Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- ► Check frequency accuracy according to chapter 1 and readjust according to chapter 2, if necessary.
- ► Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

3.2.36 Replacing External Generator Control A210 (Option: B10)

(see chapter 5, spare parts list, item 1640, and illustrations 1302.6005 and 1129.7317)

The board is installed in the front part of the instrument.

3.2.36.1 Opening Instrument and Removing Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.

- ► Undo the 10 countersunk screws (260) on the top of the instrument and the 3 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- ► Pull out External Generator Control board (1640) with adapterplate (1660) towards the top of the instrument.
- ► Unscrew 4 screws with washer (1665) und remove the External Generator Control board (1640).

3.2.36.2 Installing New Module and Completing Instrument

- ► Mount the new External Generator Control board (1640) with 4 screws (1665) to the adapterplate (1660).
- ► Plug the new board into the instrument.
- ► Replace the instrument cover (240) on the top and fasten in place using 10 countersunk screws (260) and 3 screws with washers (250).
- ► Mount the enclosure (410) and the 4 rear-panel feet (450).

3.2.36.3 Functional Check

- ► Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► For the functional check, connect the generator with ESU via an IEC/IEEE-bus cable (IEC2 interface) and a TTL cable (AUX CONTROL interface). Connect the generator output with the ESU RF Input 1.

NOTICE

Open IEC/IEEE-bus connection to controller.

Activate the generator as follows:

- ► Press PRESET
- ► Set FREQ – CENTER – 100 MHz
- ► Set SPAN 10 MHz
- ► Press NETWORK hotkey
- ► Press EXT SOURCE softkey
- ► Press GENERATOR softkey:
- ► Select generator type
- ► Set IEC/IEEE? to TTL
- ► Set GPIB address to address of generator
- ► Select remote mode
- ► Press FREQUENCY SWEEP softkey:
- ► Set state to ON
- ► Set EXT SRC softkey to ON

R&S ESU carries out a single sweep. The resulting trace is displayed as a horizontal line at –30 dBm.

3.2.37 Replacing Compact Flash Board A381 (Option: B18)

(see chapter 5, spare parts list, item 1500, and illustrations 1302.6005 and 1303.0475)

The board is located on the top right of the front panel.

3.2.37.1 Opening Instrument and Removing Pulse Power Attenuator and Flash Board

- ► Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) towards the back.
- ► Remove the installed Compact Flashdisk with software (1530).
- ► Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- ► Pull off the front cover (280) towards the front.
- ► Pace the instrument onto the left side so that its bottom side is accessible.
- ► Remove 3 countersunk screws (71) at the frame and 4 countersunk screw (71) at the connector mounting plate (70).
- ► Unscrew the input cable W1 (295, 316 or 322) at the RF attenuator (20, 22 or 25).
- ► Unscrew the cable W3 (flexible) and W90 (300) at the pulse power attenuator (56).
- ► Remove the mounting plate (70) completely with W1 and all boards towards the front.
- ► Disconnect all flat cables of Pulse Power Attenuator (56).

- Disconnect RF cable W91 at Pulse Power Attenuator (56).
- Undo the 3 screws with washers (58) at the instrument frame and remove the Pulse Power Attenuator (56) with holder (57) and Compact Flash Board (1500).
- Remove both S-ATA cables from the Compact Flash Board (1500).
- Undo the 4 screws with washers (58) at the PCB and remove the Pulse Power Attenuator (56).
- Undo the 4 screws with washers (1505) at the PCB and remove the Compact Flash Board (1500).

3.2.37.2 Installing New Compact Flash Board and Completing Instrument

- Mount the new Compact Flash Board (1500) with 4 screws with washers (1505) to the holder (57).
- Mount the Pulse Power Attenuator (56) with 4 screws with washers (58) to the holder (57).
- Connect both S-ATA cables to the Compact Flash Board (1500).
- Connect all flat cables to Pulse Power Attenuator (56).
- Mount the Attenuator (56) with Compact Flash Board (1500) and holder (57) back with 3 screws (58) at the instrument frame.
- Connect RF cable W91 to Pulse Power Attenuator (56).
- Move the mounting plate (70) back and mount 3 countersunk screws (71) to the instrument frame and 4 countersunk screw (71) to the mounting plate (70).
- Connect RF cable W90 (300) and cable W3 to Pulse Power Attenuator (56).
- Screw RF cable W1 (295, 316 or 322) to the input of the RF attenuator (20, 22 or25) and W90 (300) to the pulse power attenuator (56).
- Install the front cover (280).
- Mount the 2 front handles (420) using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).
- Mount Compact Flashdisk with software (1530).
- Connect the instrument to the mains and switch on the power switch. The instrument is now in the standby mode.
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start total calibration and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

3.2.38 Replacing preamplifier ESU-B24 (mod 26/40)

(see chapter 5, spare parts list, item 4530 and illustration 1157.2116.00 sheet 1)

The preamplifier is located behind the attenuator.

3.2.38.1 Removing the preamplifier ESU-B24 (mod.26/40)

- Remove the cable W28 from preamplifier (4530/4550) to preselector (95)

- Remove the ribbon cable to motherboard X50
- Undo 4 screws (4612) and slide out the bracket (4611) carefully
- Remove the connection from Attenuator X3 to preamplifier X45,
- Slide out the preamplifier (4530/4550) carefully toward to instrument bottom side, so you can access to K- connector of the cable W2
- Remove the K-connector of the cable W2 (4614) from preamplifier (4530/4550) X46
- Bend the cable W2 carefully toward bottom side and slide out the preamplifier.

3.2.38.2 Installing Preamplifier ESU-B24 (mod.26/40)

- Replace the new preamplifier by inverse procedure of the removal.
- Fasten the preamplifier K-connectors and SMA connector using a torque wrench

3.2.38.3 Completing Instrument and Frequency Response Correction

- Connect the AC supply cable and perform a coldboot.
- After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.

  – Test setup according to menu item "Schematic" (connect external reference).
  – Check IEC/IEEE addresses and configuration of instruments.
  – Press the Autoselect button and perform correction with Run.

3.2.39 Replacing preamplifier ESU-B24 (mod 08)

(see chapter 5, spare parts list, item 4700 and illustration 1305.8921.00 sheet 1)

The preamplifier is located behind the attenuator

3.2.39.1 Removing the preamplifier ESU-B24 (mod.08)

- Remove the ribbon cable connected to motherboard X50
- Remove the cable W2 from preamplifier (4700) to MWC-unit X169
- Remove 2 crews (4811)
- Remove the SMA-SMA (4800) from preamplifier (4700)

3.2.39.2 Installing Preamplifier ESU-B24 (mod.08)

- ► Replace the new preamplifier by inverse procedure of the removal.
- ► Fasten the SMA connector using a torque wrench

3.2.39.3 Completing Instrument and Frequency Response Correction

- ► Connect the AC supply cable and perform a coldboot.
- ► After starting the instrument, check the log file for system messages:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- ► Start selftest and check the result to ensure that no errors occurred:
  - [**SETUP** : SERVICE : SELFTEST], subsequently [SELFTEST RESULT]
- ► Start system error correction and check the result to ensure that no errors occurred:
  - [**CAL** : CAL TOTAL], subsequently [CAL RESULTS]
- ► Execute frequency response correction software FSU-FRQ.EXE.
  The software is on the Gloris server.
  - – Test setup according to menu item "Schematic" (connect external reference).
  - – Check IEC/IEEE addresses and configuration of instruments.
  - – Press the Autoselect button and perform correction with Run

3.3 Troubleshooting

Malfunctions may have simple causes but may also be caused by faulty components.

These troubleshooting instructions can be used to locate error causes down to board level and make the instrument ready for use again by means of board replacement. For troubleshooting and diagnostics, a selftest is available that polls diagnostic voltages of the modules and displays limit value violations.

We recommend shipping the instrument to our experts in the service centers (see address list at the beginning of this manual) for module replacement and further error elimination.

WARNING

Do not plug or unplug boards prior to disconnecting them from the AC supply!
Be careful not to cause short-circuits when measuring voltages!

The following utilities are provided in the R&S ESU for diagnostic purposes:

- Permanent monitoring of levels and frequencies in the instrument
- Selftest
- System error correction

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

3.3.1 Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S-Order No.	Use
1	DC meter		R&S URE	0350.5315.02	Troubleshooting
2	Spectrum analyzer	Frequency range 0 to 7 GHz	R&S FSEB 20	1066.3010.20	Troubleshooting
3	Adapting cable	1m long SMP-to-SMA connection	-	1129.8259.00	Troubleshooting
4	Adapting cable	0.5 m long SMP-to-SMP connection	-	1129.8265.00	Troubleshooting
5	Adapter board	Extension 150 mm high 48-contact, 2 mm spacing	-	1100.3542.02	Troubleshooting

3.3.2 Troubleshooting Switch-on Problems

- **Error: The R&S ESU cannot be switched on.**

Action	Possible error causes and further steps
Check power-on switch on the rear ⇓	Power switch OFF: Switch on power supply.
Check yellow LED (stand-by). ⇓	LED remains dark: Measure voltage at X20.D24 (power supply unit) Rated value: +12 V ± 1 V Voltage o.k.: Keyboard or controller faulty. No voltage: Remove IF filter or OCXO modules. Measure voltage at X20.D24 (power supply unit): Rated value: +12 V ± 1 V Correct voltage: Removed module faulty No voltage: Power supply faulty or short-circuit at 12V standby.
Switch on instrument. Check green LED ⇓	LED remains dark: Measure PWR-ON signal on the power supply X20.B1: < 1V for ON Voltage > 1 V: Flexible switchfoil or controller faulty.
Power supply starts, screen remains dark?	Measure voltages on the motherboard, see "Short-circuit of one or more operating voltages".

- **Error: Short-circuit of one or more operating voltages**

Action	Possible error causes and further steps
At the bottom of the motherboard, check which of the voltages is short-circuited:	One voltage is missing or very low: Remove the respective boards from the instrument one by one and repeat the measurement. If the voltage is supplied, the error is probably located on the module removed. *The power supply switches off all voltages after a short time in the case of a short-circuit. Restart by pressing the Standby/On key.*
Computer, hard disk, EEPROMs : X20.A7 to A10: rated value: +5 V2 Wideband detector unit: X20.A5 and X20.A6: rated value +3 V3	
Analog boards: X130.A10: rated value +12 V X130.A9: rated value +8 V X130.A8: rated value +6 V X130.A12: rated value –12 V	

- **Error: Fan does not work.**

Action	Possible error causes and further steps
Check voltage at connector: X35 pins 1 + 3 : Rated value 7 V	If there is no voltage, the fan is defective: Replace fan. If the voltage is too low, the fan is blocked or the power consumption is too high.

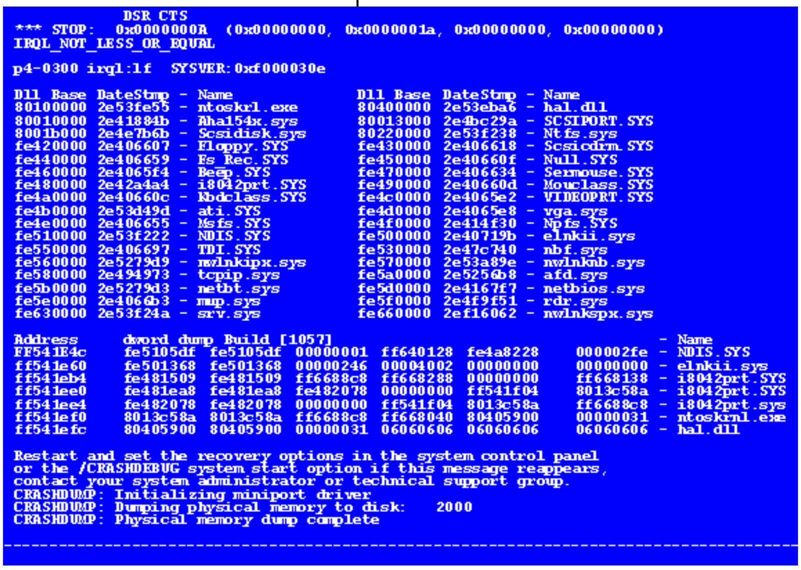
3.3.3 Troubleshooting Problems with Booting

- **Error:The R&S ESU does not start the measurement application.**

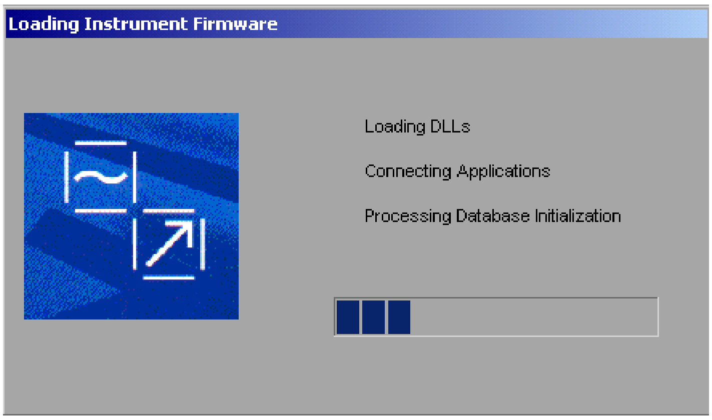
Following switch-on, the R&S ESU first boots the computer BIOS. After successful initialization of the computer, the Windows XP operating system starts up. Subsequently, the test application is loaded as a start-up program. Simultaneously, selftests are performed at various locations and error messages, if any, are output. The messages are disabled with normal operation, but can be enabled for troubleshooting purposes. When troubleshooting, it is advisable to connect a keyboard to the keyboard socket.

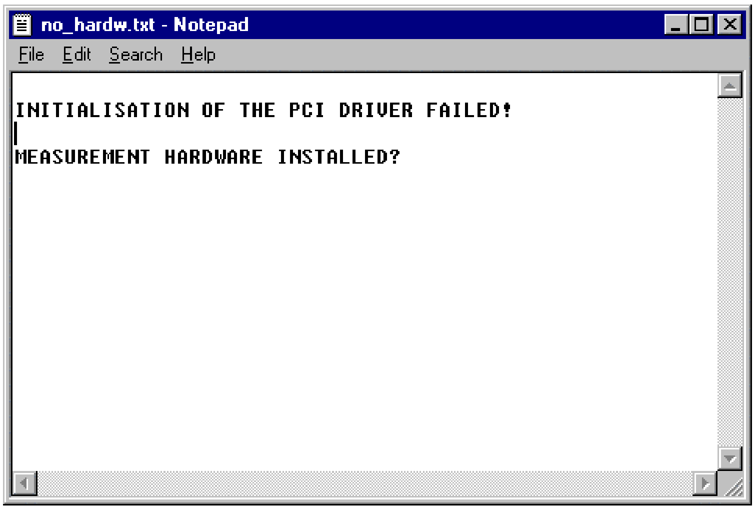
Normal action	Error and error cause
Start the R&S ESU.	
After the R&S ESU is switched on, the following BIOS message is displayed: **Phoenix - AwardBIOS v6.00PG, An Energy Star Ally** **Copyright (C) 1984-2003, Phoenix technologies,LTD.** **R&S ANALYZER BIOS V2.0-17-2** **Main Processor : Intel(R) Celeron(R) M 1.00GHz (100x10.0)** **Memory Frequency for DDR333** **Detecting IDE Drives…** **IDE Channel 2 Master : FUJJITSU MHT2040BH** **IDE Channel 3 Master : None** **02/12/2002-io815E-LPC47B2-6A69REFC2C-00**	
This procedure can also be interrupted using the "PAUSE" key.	
The contents partly depend on the hardware provided: **Please select the operating system to start:** **Analyzer Firmware** **Analyzer Firmware Backup** **Use the up and down arrow keys to move the highlight to your choice.** **Press ENTER to choose.** **Seconds until highlighted choice will be started automatically: 0** **For troubleshooting and advanced startup options for Windows, press F8.**	If the instrument has started correctly so far, there is most probably no fault in the computer; the boot problem presumably results from a defective system file on the hard disk.
The Windows XP start screen will appear in a few seconds.	

Normal action	Error and error cause
	If the operating system on the hard disk has been destroyed and cannot be loaded correctly, Windows XP displays a "bluescreen". This bluescreen contains all essential information about the internal states of the computer which are displayed as follows (by way of example):

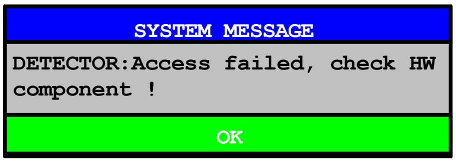


Normal action	Error and error cause
	Windows XP and the instrument firmware must then be updated from the back-up partition (see chapter 4, section "Software Update").
After the operating system is started, the application for the R&S ESU is loaded in a start-up program. The program start is initiated automatically and generates a window that displays information about the start-up procedure.	

Normal action	Error and error cause
	If a "bluescreen" is displayed when loading, a cold start may be necessary. Proceed as follows in this case:
	Cold start (see section "Performing a Cold Start")
	Firmware update from the backup partition if cold start is not successful (see chapter 4).
While booting, the wideband detector unit is identified again.	If the wideband detector board is not identified, the following message is issued:



Normal action	**Error and error cause**
When the program has been loaded, the measurement hardware is initialized first. A timer which is controlled by a 32 MHz clock signal is set on the detector board. This test reveals proper functioning of the detector board and the clock oscillator in the R&S (RF converter).	If there is an error on the detector board or the clock is missing, the following message is displayed:



After passing the function tests, the analog boards are initialized and the correction data EEPROMs are loaded.	In this case, first check the clock generation in the instrument.
The reference is generated on the synthesizer. This 128 MHz reference is necessary for proper functioning of the detector board.	The following measurements are appropriate to check the reference supply:

Measurement:	**Result:**
Synthesizer A100, X114: rated value 128 MHz, 0 dBm ⇓	No signal: replace synthesizer.
Synthesizer A100, X114: rated value 32 MHz, 0 dBm	No signal: replace synthesizer.

If no error occurs with the clock generation, booting can be continued by acknowledging the error message using "OK"

If no error message or any other information on the error source is issued during booting, the error can only be determined by replacing the wideband detector unit or the front-module controller.

3.3.4 Troubleshooting - Loading Module EEPROMs

- **Error: Data of modules cannot be read.**

Normal action	Error and error cause
On booting the instrument, all calibration data required must be written to the RAM of the computer. The calibration data of a module is either read from the EEPROM (in the case of a cold start from EEPROM only) or from the associated binary file. The module information is read from the module EEPROMs in the case of a cold start. Otherwise the binary data is read from the hard disk during starting (e.g. motherb.bin).	
If reading at the desired address is not possible, the software assumes that the module is not available.	For modules that must always be available (e.g. IF filter), an error message will be output:
	Error reading EEPROM of IF Filter
The calibration data are then read from the file pertaining to the module (e.g. motherb.bin).	If the binary data cannot be read out without error, an error message will be output, e.g.:
	Error reading file of IF Filter
If reading at the address of an optional module is not possible, this module is marked as not available in the module array for storage of the module information. If the file pertaining to the non-available module does exist, it is assumed that upon the last successful booting the module was available but has been removed meanwhile. The file with the calibration data of the module is erased. Moreover, the data collected during the last calibration is invalid and only saved as a backup copy on the hard disk.	If reading at the address of a module is possible but the contents of the data block are faulty (e.g. check sum of header block incorrect), the calibration data of the respective module is read from the associated file. The firmware assumes that the module is available. The information read from the file is entered into the array for storage of the module information.
	Error reading EEPROM of IF Filter

Normal action	Error and error cause
Upon successful reading of the module header from the EEPROM, the contents of the module header is compared with the module header of the associated binary file. If the module header can be read from the file and complies with the header read from the EEPROM, the assumption is made that the contents of the module EEPROM have already been mapped in the binary file. The calibration data can thus be written from the file to the RAM.	If, however, the associated file cannot be found or if the module header of the EEPROM differs from that of the file, the total EEPROM contents must be written to the RAM and then saved in the binary file.
	Error finding file of IF Filter
After loading the calibration data from the EEPROMs, the calibration data are loaded from the calibration data files (e.g. DDC settings for various filters). First the relevant calibration data file is written to the calibration data memory.	If an error occurs upon loading the file into the memory, an error message is output:
	Error reading file of DDC Filter
After loading the calibration data from the EEPROMs and files, the data collected during the last calibration is loaded from the ‘rdf_cal.bin’ file into the calibration data memory. This process takes place only if valid calibration data (and the ‘rdf_cal.bin’ file) is available.	If there is no valid calibration data, the status message "UNCAL " is output informing the user that the instrument is uncalibrated.

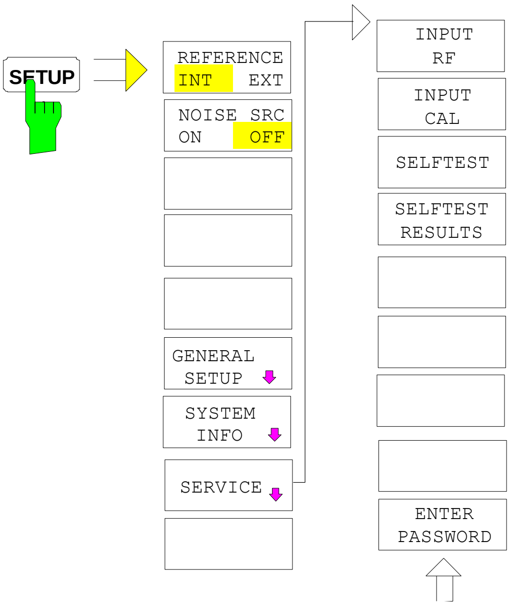
3.3.5 Troubleshooting via Selftest

The selftest is provided for identification of instrument errors and tolerance violations that cannot be corrected by self-calibration of the instrument.
All signal paths are connected and the signal is traced via test points. The selftest checks all possible hardware settings that are used for the self-calibration with regard to a sufficient setting range including reserves.

Service Level 1 - Test Following the Entry of a Password

When entering the password, the test result is recorded in detail and, in case of a fatal error (such as a failure of the operating voltage), the selftest is *not* aborted.

The selftest can be called in the *SETUP - SERVICE* menu:



- ► Enter the password 894129 with *ENTER PASSWORD*.
- ► Initiate the selftest of the instrument modules using the *SELFTEST* softkey.
- ► While the selftest is running, a message box is displayed that shows the current test and test result.
- ► Pressing ENTER ABORT aborts the test run.
- ► All modules are tested one by one and the test result (selftest PASSED or FAILED) is output in the message box

SELFTEST RESULTS

The *SELFTEST RESULTS* softkey calls a complete list of all test results. If an error occurs, a brief description of the failed test, the module concerned, the valid range and the measurement value are displayed.

```
Total Selftest Status: ***FAILED***
Date (dd/mm/yyyy): 10/06/1999 Time: 16:34:47
Runtime: 05:59

Supply voltages detector
test description    min       max       result    state
+6V                  5.88      6.42      6.06     PASSED
+8V                  7.84      8.96      8.56     PASSED
+12V                11.76     12.83     12.42     PASSED
-12V               -11.33    -13.28    -11.85     PASSED
+28V                26.62     29.39     28.34     PASSED
```

If the result is ***FAILED***, look not only for entries marked with FAILED** but also those marked with SKIPPED. These entries indicate that a test item was not carried out, because the conditions had not been met. In this case, an error is present only if the instrument cannot be calibrated.

The selftest with password returns FAILED as the overall status, because the instrument will no longer be able to be calibrated in the near future due to temperature drift or aging.

The selftest without password returns the overall status of PASSED; in this case as well, however, the skipped test items are marked with SKIPPED as an aid for the service technician.

3.3.5.1 Running Selftest and Error Messages

Overview

The calibration source on the IF filter module is used as a signal source for testing the signal path.

1. Measurement of the operating voltages
2. of the power supply
3. regulated operating voltages on the detector and IF filter modules
4. Temperature measurement on the IF filter board
5. Testing the fourfold D/A converter on the detector
6. Synthesizer test
7. Lock test YIG oscillator and LO level test on RF converter
8. Testing of the signal paths on RF converter, IF filter and detector. The preselector is switched off when testing the signal paths.
9. Test of optional modules

All measurements on the analog boards are independent of the gate arrays on the wideband detector unit, since individual A/D converters are provided for them on the analog boards. The interface section in the FPGA of the wideband detector unit must function properly to read these A/D converters. This is always tested when the instrument is switched on.

The signal path via the gate arrays on the wideband detector unit is tested using a known, analog signal at the input of the A/D converter on the wideband detector unit. The analog test signal is provided by the preceding analog tests.

Since the operating voltages are measured first, it is ensured that the selftest can be performed correctly. If an operating voltage not required by the selftest has failed, this is correctly signaled in the error list. If, however, all operating voltages are indicated to be faulty, it may well be assumed that the operating voltage for the selftest has failed or the selftest A/D-converter itself is defective.

Testing Operating Voltages

When an operating voltage fails, the selftest is aborted to avoid subsequent errors. The test is not aborted after entry of the password. All subsequent errors are then listed in the result record. Errors that have occurred irrespective of the voltage failure can then still be detected.
The error message indicates the error source (power supply, IF filter, wideband detector unit) and the voltage that has failed.

Normal action	Error and error cause

Power Supply

The voltages of the power supply and the –6 V regulator (DC/DC converter from –12 V to –6 V on the motherboard) are measured at the board connector by means of the selftest A/D converter on the wideband detector unit.

Channel	Nominal voltage
1	+6 V
2	+8 V
3	+12 V
4	-12 V
5	+28 V
7	-6 V

FATAL ERROR!
Power supply: DC FAIL +6 V.
Selftest aborted.

If error messages occur, the voltages on the motherboard should be checked. The tolerances given in the column "Tolerance range power supply / voltage regulator" apply in this case. If the voltages are within the tolerance limits, the error must be located in the selftest: Replace the wideband detector unit.

Regulated voltages on the boards

Wideband detector unit

Channel	Nominal voltage
6	-5 V

FATAL ERROR!
Detector: DC FAIL -5 V.
Selftest aborted.

If no faults have been found in the preceding tests, the wideband detector unit has to be replaced.

Temperature Measurement on IF Filter

Normal action	Error and error cause

The **temperature** is measured first.

WARNING!
IF FILTER: Operating temperature xx °C -
out of range

If the temperature does not lie within the permissible range of 0° to 70°C, the warning will be output.

Check the temperature data for plausibility. The fan might be defective or the ventilation slots might be covered.

If the indicated temperature data is not plausible, e.g. 120° C when the instrument is cold, the temperature sensor or the selftest may be faulty.

If, in the following, the *first* operating voltage (or all operating voltages after entering the password) is measured incorrectly, the selftest will obviously be defective.

Subsequently the operating voltages are measured.

Channel	Nominal voltage	Expression displayed in the error message
74	- 5 V	UREF-5
77	+2.5 V	UREF+2.5
76	+3.3 V	+3.3 V
73	+5 V	+5 V
72	+10.6 V	+10 V
71	-5 V	-5 V
70	-10,6 V	-10 V
75	+5 V	+5 VR

The IF filter board must always be replaced if an error message occurs that refers to these operating voltages or the temperature (if not plausible).

The voltage of the temperature sensor is used for temperature compensation of the filters. Thus, a faulty temperature sensor may detune the filters such that subsequent errors are likely to occur.

Checking 4-fold D/A Converter on Wideband Detector Unit

Normal action	Error and error cause

Wideband Detector Unit Pretune-DAC Test

The 4-fold D/A-converter on the wideband detector unit is checked.

One D/A converter controls the frequency-dependant IF gain on the IF filter for frequency response correction. The other ones are provided for options (microwave converter, tracking generator).

The first output voltage of the 4-fold D/A converter is measured, thus checking the basic function of the control interface (in DCON gate array), also.

Channel	Nominal voltage
8	666 mV

FATAL ERROR!
Detector: Pretune DAC FAIL - check DCON and pretune DAC
Selftest aborted.

Replace the wideband detector unit

Testing Synthesizer

Normal Action	Error and error cause

Channel	Voltage nominal	Expression displayed in the error message
11	- 5 V	-5 V
01	+5 V	+5 V
21	+7 V	+7 V
60	+12 V	+12 V
41	+28 V	+28 V

here is an error message referring to these operating voltages, the synthesizer is always to be replaced.

Temperature measurement:

The synthesizer accommodates a temperature sensor for the module temperature and one monitoring the heater of the 128 MHz reference oscillator.

Test channel 71

WARNING!
Synthesizer: Temperature out of range

Test channel 51

WARNING!

Synthesizer: Temperature 128 MHz reference range.
In the case of an impermissible temperature, tuning the 128 MHz oscillator to the correct frequency may not be possible since the SC cut crystal used is specified for a temperature of 70 °C.

Reference signals on the synthesizer

The control loops on the synthesizer are checked for the locking status and the set control voltage.

10 MHz OCXO level:

Level detector channel 00.

FATAL ERROR!

10 MHz OCXO defective !

Replace the synthesizer in case of error.

128 / 384 MHz oscillators:

Testing the 128 MHz crystal oscillator and the third LO.

ERROR!
Reference 128 MHz / 3rd LO unlocked !
Reference 128 MHz / 3rd LO out of tuning range !

The instrument may still work properly, but the tuning voltages are almost at the limit or the frequency accuracy is out of tolerance.
Replace/adjust the synthesizer.

Normal action	Error and error cause

Sweep synthesizer:

Testing the tuning voltage at the sweep VCO 600 (595) - 620 MHz

ERROR!

Sweep synthesizer unlocked !

Sweep synthesizer out of tuning range !

If the sweep VCO fails, the YIG oscillator does not lock or it locks at an incorrect frequency and also signals unlock.

Replace synthesizer.

Second local oscillator

Testing the tuning voltage at the 4224 MHz oscillator

FATAL ERROR!

2nd LO tuning voltage out of range !

If the second local oscillator fails, it is possible that the YIG oscillator does not lock or it locks at an incorrect frequency and also signals unlock.

Replace synthesizer

Calibration signal control voltage:

Checking the detector voltage in the level control of the Cal signal

ERROR!

Calibration signal error

If the control voltage is out of tolerance, the level control loop unlocks and the level becomes inaccurate. In the case of a small level error, the selftest of the signal path is possible. However, the level measuring accuracy will be out of tolerance after instrument calibration.

Replace synthesizer.

Testing RF Converter

Normal action	Error and error cause

Channel	Voltage nominal	Expression displayed in the error message
60	+5 V	+5 V
61	2.5 V	DAC Reference
62	+7 V	+7 V
63	+11 V	+11 V
64	+28 V	+28 V

The RF converter is always to be replaced if there is an error message referring to these operating voltages.

Temperature measurement:

The RF Converter accommodates a temperature sensor for the module temperature.

Test channel 67

WARNING!
RF Converter: Temperature out of range

Check air supply and fan for proper functioning.

Test LO level

The level detectors of the second and third LO are read:

Channel	Oscillator	Expression displayed in the error message
3	LO 3	Level 3rd Local
2	LO 2	Level 2nd Local

	In the the voltage is too low, also check the level at the module input in the selftest poll! Setting Center, Zero Span + 10 dBm / 384 MHz at X 101 + 7 dBm / 4224 MHz at X105 If the levels are correct, replace the RF converter. If the levels are not okay (deviation > 3 dB), measure the signals at the synthesizer again and replace the synthesizer, if necessary!

YIG oscillator test:

The YIG oscillator is tuned throughout the entire frequency band. The pretuning (with upper and lower limit) is also tuned with a small offset from the actual frequency. If the current flowing through the YIG coil and set by the PLL reaches one of these limits, the unlock detector will respond. This is a test both for the pretuning values and for functioning of the PLL.

	FATAL ERROR! YIG Oscillator unlocked !
	Replace the RF converter in the case of error.

Test input mixer

The mixer diodes both rectify part of the LO power. The two voltages can be polled via the selftest channels 0 and 1.

If the two voltages are missing or too low, the LO level is presumably missing, which is why an error message appears:	FATAL ERROR! 1st LO level low or 1st mixer defective !
If the two voltages differ (>20 %), the mixer is asymmetric, i.e. one of the two diodes is damaged.	FATAL ERROR! 1st Mixer symmetry out of tolerance !
	In both cases: Replace RF converter

Testing Signal Path via Attenuator

The internal source for the test signal (CAL signal) has already been tested when testing the reference signals. The first and second mixer feature sufficient LO power, i.e. the conversion from the RF to the second IF should therefore work properly.

Normal action	Error and error cause
Signal path via RF attenuator The measurement is made at the second IF using a logarithmic detector on the RF converter. The 0 dBm test signal is measured with the following	

attenuator settings:

RF-Att	Coupling	Test
0	DC	Reference measurement
0	AC	AC/DC switch +-5 dB
5	DC	5-dB attenuator +- 5 dB
10	DC	10-dB attenuator +- 5 dB
20	DC	20-dB attenuator +- 5 dB
40	DC	40-dB attenuator +- 10 dB

If there is **no** measured value within the tolerance range, the error is likely to be located in the subsequent signal path. It is not likely that all attenuator stages and the 0-dB position are faulty; therefore, the following error message appears.

FATAL ERROR!
Input level RF converter out of tolerance !

Before replacing the RF converter, measure the input level at X108 in any case. For this purpose, the input is connected to the Cal source with 0 dBm and 0 dB attenuator DC coupling. The level should lie at 128 MHz and 0 dBm. Otherwise, check level at X125.

If the level is okay, replace the RF converter.

If the signal is not applied at the synthesizer either, replace the synthesizer.

If only individual measurements are out of tolerance, the RF attenuator is defective.

FATAL ERROR!.
RF Attenuator xx dB pad failed !

CAUTION!
Since a faulty RF attenuator causes many subsequent errors to occur with the IF filter test, proper functioning of the attenuator is a must.

Signal Paths on IF Filter Board

Normal action	Error and error cause
Input level of IF filter / calibration amplifier (CAL-Amps 1 + 2)	FATAL ERROR! IF board: IF input level / CALAMP Selftest aborted Possible error causes: • Signal path in preselector interrupted (bypass

relay).

- Signal path interrupted in the RF converter.
- Erroneous EEPROM data in the RF converter leading to incorrect setting of CAL_Amp1. CAL_Amp1 or 2 faulty.

Troubleshooting
Check preselector X155 -> X156 for continuity.
Check the level applied at X132 with 0 dBm mixer level: Nominal –3 dBm, production tolerance ± 3 dB, max. permissible ± 4.5 dB
Replace the RF converter if the deviation exceeds this value.

If the level lies within the tolerance, a defective CAL_Amp may have caused the error. The setting ranges of the CAL_Amps are later tested during the selftest
The selftest is not interrupted after entry of a password. Note whether the result file contains any error messages concerning the CAL_Amps. If there is no CAL_Amp error, the CAL_Amps will be set incorrectly. The EEPROM data in the RF converter are obviously incorrect.

LC filter I and XTAL filter

The level measurement is performed with wide and narrow bandwidths of the LC filter. Subsequently, an additional measurement is performed via the crystal filter. If the LC filter does not work properly, the measurement of the crystal filter is not performed**.**

ERROR!
IF board: LC Filter-1/2 wide
XTAL Filter not tested

ERROR!
IF board: LC Filter-1/2 narrow
XTAL Filter not tested

ERROR!
IF board: XTAL Filter
The IF filter board must be replaced in all cases.

Normal action	Error and error cause
StepGain (IF amplifier) The 10 dB Step Gain (Step Gain Coarse) and the 0.1 dB Step Gain (Step Gain Fine) are tested. The input level is attenuated in steps of 10 dB by the RF attenuator and simultaneously amplified by means of the StepGain by the same amount. The level detector C checks to ±6 dB (user) or ±4 dB (service level 1).	FATAL ERROR! IF board: Step Gain Fine Selftest aborted

	Test with Step Gain Coarse bypassed (0 dB) and Step Gain Fine set to 0 dB. If an error occurs, Step Gain Fine does not work correctly or the signal path is interrupted. Replace the IF filter board.
	ERROR! IF board: Step Gain Coarse
	Testing the amplifier stages.
	ERROR! IF board: Step Gain Fine
	Testing the amplifier stages. **CAUTION!** If the RF attenuator test has already caused an error message, Step Gain cannot be tested and an error message must be ignored! If the RF attenuator test passed without any error, Step Gain is defective. Replace the IF filter board. However, the selftest can be continued since it does not require the IF gain.

Signal Paths on Wideband Detector Unit

Normal action	Error and error cause
Various settings of the wideband detector unit are checked via the normal display function, i.e. FFT mode, digital filters and analog filters. Possible error messages:	
	ERROR! Detector Board: FFT Detector Board: FIR Detector Board: Video

3.3.6 Troubleshooting RF Converter 1

Depending on the kind of error, a few measurements should be performed on the RF converter before the module is replaced:

- IP3 too high
- Signal level too low
- LO feedthrough too high
- Spurious signals

These errors may be caused by a defective input mixer. Since this mixer is directly connected to the input connector, it may be easily destroyed by the user.

A defective mixer can be recognized from a very high display of > -10 dBm at the frequency 0 Hz with 0 dB input attenuation.

Action	Error and error cause
Measure with diode tester at X101: rated value: approx. 0.6 V voltage in the forward and reverse directions with a current of 1 mA.	Different values in both directions, high-impedance or very low-impedance: mixer defective : replace RF converter

- **Signal missing or displayed with incorrect frequency**

If the signal is missing or the instrument signals "LOUNL", the conditioning of the 1st LO is probably not correct. The function of this oscillator requires both the EEPROM data and the reference frequency of the second module.

Action	Error cause/remedy
Measure function of the 1st LO in zero span. check signal at X107: rated value: 4628.4.4 MHz above the current input frequency (between 0 Hz and 3.6 GHz) and the signal level is approx. –5 dBm.	The frequency is considerably higher or lower or the signal is not stable replace RF converter

3.3.7 Troubleshooting MW Converters

The most common error on MW converters is that the displayed signal level on the signal analyzer > 3.6 GHz is too low or missing altogether.

Level ratios on MW converter

Action	Error cause/remedy
Apply a high-frequency signal (f > 3.6 GHz) at the MW converter input with a level of -20 dBm and measure the IF level at the output connector with a spectrum analyzer. The center frequency of the R&S ESU must be set to the frequency of the signal generator, and the span must be set to 0 Hz. If the instrument is operated on an adapter, the LO (connector X102 RF converter) with the R&S ESU 40 -- the 2nd LO (connector X114 synthesizer) must be taken out to the MW converter (connector X167 / X1611). **R&S ESU 8:** - Diplexer input connector: X169 - Output connector: X161 **R&S ESU 26/40:** - Diplexer input connector: X168 - Output connector: X162 Output level at 404.4 MHz: > -20 dBm	If the level is missing or too low, a module is defective on the MW converter. Check levels of the modules on the MW converter unit (see following items). If the measured level is within tolerances, the attenuator or a subsequent module in the signal path is defective.

Level ratios on diplexer

Action	Error cauase/remedy
Apply a high-frequency signal (f > 3.6 GHz) at the diplexer input with a level of -20 dBm and measure the level at the output connector. **R&S ESU 8:** - Diplexer input connector: X169 - Diplexer output connector: X8 **R&S ESU 26:** - Diplexer input connector: X168 - Diplexer output connector: X5 **R&S ESU 40:** - Diplexer input connector: X168 - Diplexer output connector: X7 Output level: >-27 dBm	If the level is missing or too low, replace the diplexer (see "Replacing the Diplexer Module"). If the measured level is within tolerances, one of the subsequent modules on the MW converter is defective.

Level ratios on YIG filter unit

Action	Error cause/remedy
Apply a high-frequency signal (f > 3.6 GHz) at the YIG filter input with a level of -25 dBm and measure at the output connector. Set the R&S ESU to the center frequency of the signal generator and a span of 0 Hz. - Input connector: J1 - Output connector: J2 Output level: >-33 dBm	If the level is missing or too low, replace the diplexer (see "Replacing the YIG Filter Unit Module"). If the measured level is within tolerances, one of the subsequent modules on the MW converter is defective.

Level ratios on RF extension

Action	Error cause/remedy
Apply a high-frequency signal (f > 3.6 GHz) at the RF extension input with a level of -10 dBm and measure at the output connector. Set the R&S ESU to the center frequency of the signal generator and a span of 0 Hz. If the instrument is operated on an adapter, the LO (connector X102 RF converter) must be taken out to the MW converter (connector X167). - R&S ESU Input connector: X1 - Output connector <26.5 GHz: X3 <u>Output level at 404.4 MHz:</u> f = 3.6 GHz to 26.5 GHz: >-26 dBm **R&S ESU 0:** - Input connector: X1 - Output connector: X4 Output level at 404.4 MHz: f = 3.6 GHz to 26.5 GHz: >-26 dBm - Input connector: X1 - Output connector: X5 Output level at 404.4 MHz: f = 29.6 GHz to 42.3 GHz: >-30 dBm Output level at 4.6284 GHz: f = 27 GHz: >-30 dBm f = 45 GHz: >-35 dBm	If the level is missing or too low, replace the diplexer (see "Replacing the RF Extension Module").

3.3.8 Troubleshooting Preselector

Depending on the kind of error a few measurements should be performed on the preselector prior to replacing the module:

- IP3 too high
- Signal level too low

These errors can be caused by a defective relay, PIN diode switch or preselector.

Action	Possible error causes and further steps
In zero span, measure the amplification between X155 and X156 for the different ranges of preselection with and without preamplification. Rated values:	Replace the preselector module in case of large deviations.

<table>
<tr><th>Filter</th><th>Preamp off</th><th>Preamp on</th></tr>
<tr><td>Bypass</td><td>-2 to 0 dB</td><td></td></tr>
<tr><td>9 to 150 kHz</td><td rowspan="9">0 to 6 dB</td><td rowspan="3">20 to 26 dB</td></tr>
<tr><td>150 kHz to 2 MHz</td></tr>
<tr><td>2 to 8 MHz</td></tr>
<tr><td>8 to 30 MHz</td><td rowspan="9">12 to 24 dB</td></tr>
<tr><td>30 to 60 MHz</td></tr>
<tr><td>60 to 150 MHz</td></tr>
<tr><td>150 to 300 MHz</td></tr>
<tr><td>300 to 600 MHz</td></tr>
<tr><td>600 to 1000 MHz</td></tr>
<tr><td>1 to 2 GHz</td><td rowspan="3">0 to 7 dB</td></tr>
<tr><td>2 to 3 GHz</td></tr>
<tr><td>3 to 3.6 GHz</td></tr>
</table>

3.3.9 Troubleshooting - Wideband Detector Unit

The extensive selftest will detect most of the faults that may occur on the wideband detector unit.

Selftests performed

- complete signal path for analog filters, digital filters and FFT
- detectors
- PCI interface, data transfer from and to main processor
- signal processing chain (resampler, wideband DDC, RAM, DSP)
- clock synthesizer
- Pretune DAC

- frequency and time sweep
- supply voltages

Any "failed" in the test results of the detector board indicates a fault in this unit, provided the tests of the preceding boards (RF converter, synthesizer, IF filter) have all been passed. For example, the tests of the detector board signal path rely on a correct IF or video input signal.

Part of the signal path is tested only functionally. Performance testing is restricted from the analog input (IF/Video) via the A/D converter to the correction RAM. For example, a blocked bit (except one of the most significant ones) cannot be detected, as there is no test pattern available from ADC.

If the selftest has been passed but the instrument shows unexpected response in the spectrum display such as spikes, strong noise, pumping noise floor, spurious, stepped curves and so on, some additional tests should be performed to prove that the fault is actually in the detector unit.

To ensure that the detector board receives an error-free signal, a signal generator must be used to substitute the IF/video signal.

3.3.9.1 Test Setup

Connect signal generator (50 Ω output impedance) to X149 of the detector board.

Video Path, Differential Linearity Test

This is a sensitive test for blocked bits.

Signal generator settings

Frequency	1 kHz
Level	-1.7 dBm

R&S ESU settings

Preset	
Zero Span	
Sweep time	300 µs
AMPT	Range Linear
CAL	Cal Corr Off
Trigger	Video

Expected display:

Continuous sinewave-like trace without significant steps

(very small steps are due to noise and pixel resolution)

Why use a linear display? The instrument expects a logarithmic signal at the ADC input. In case of a linear display, the signal is therefore log/lin converted. In the test case, a linear signal is used instead at the ADC input. The log/lin conversion then considerably magnifies differential errors at high levels, yet the whole level range is displayed.

Figure 3-16 shows the trace of an error-free unit.

In the trace shown in Figure 3-16 there is an error at the seventh highest bit (differential error = 1/128 of range). Due to the log/lin conversion the effect is extremely magnified at higher levels.

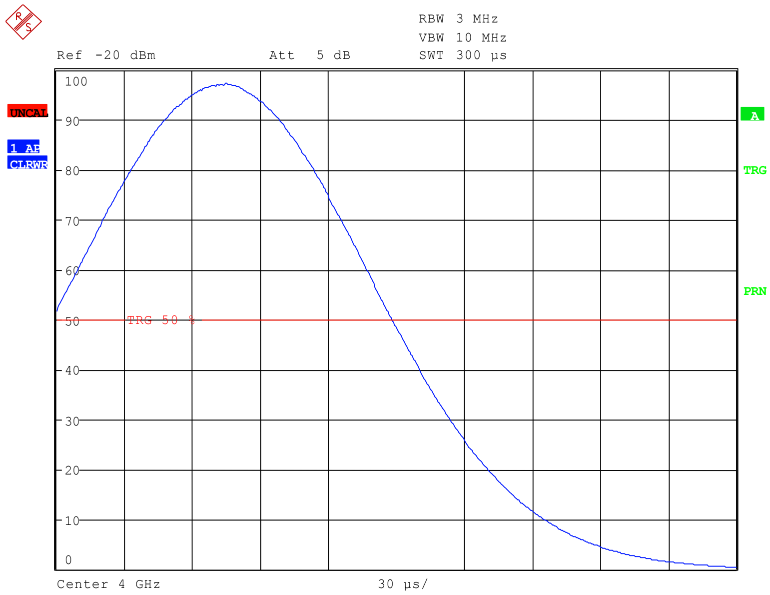


Figure 3-16: Video path differential linearity test, error-free unit

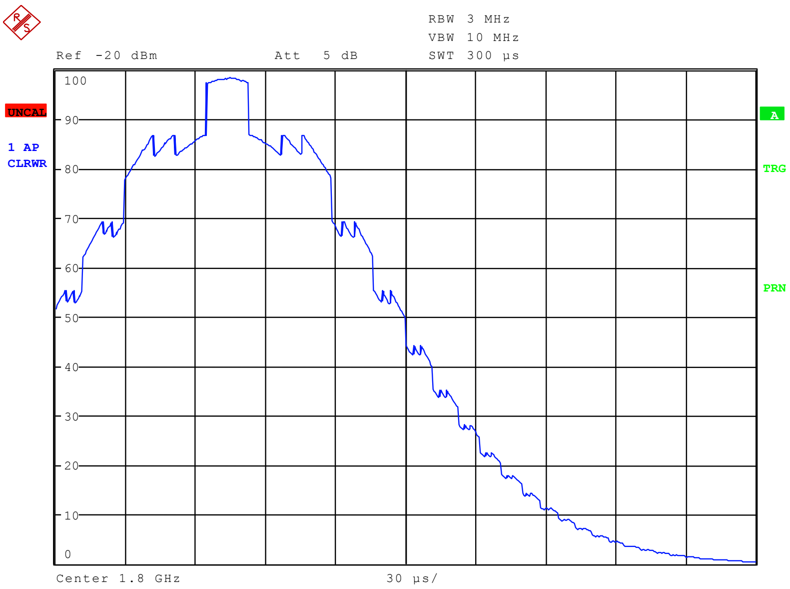


Figure 3-17: Video path differential linearity test, faulty unit (blocked bit).

FFT Path Performance Test

R&S ESU settings

Preset

Span	50 kHz
RBW	100 Hz
Filter Type	FFT
AMPT:	Log Range Manual 120 dB
CAL:	Cal Corr Off

Noise floor

Signal generator setting

Level OFF (50 Ω termination alternatively)

Expected display:

Noise at the bottom line of the display.

Possible errors:

Higher noise (more than 10 dB compared to **Fehler! Verweisquelle konnte nicht gefunden werden.**)

Higher noise in single sweeps (needs some observation time)

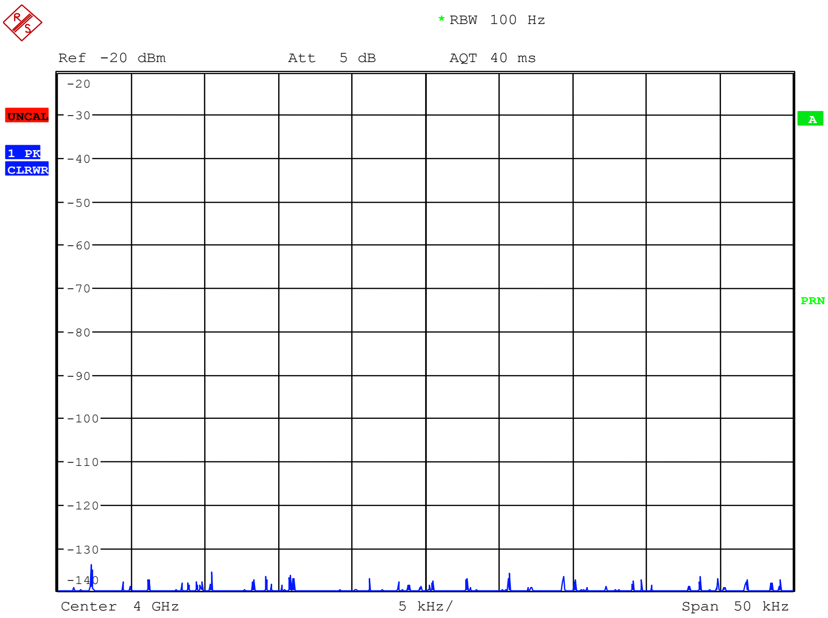


Figure 3-18: FFT test, noise floor, error-free unit

Full Scale Test

Signal generator settings

Frequency 20.4 MHz

Level -2.9 dBm

R&S ESU setting

Marker to peak

Expected display

Spectrum of clean CW signal at center frequency (see **Fehler! Verweisquelle konnte nicht gefunden werden.**), level -20 dBm ±2 dB
(marker readout)

Possible errors:

level out of tolerance

distorted spectrum

spurious

extreme noise

> **Note:**
> *The signal generator sets the limits for spurious and phase noise!*

Fehler! Verweisquelle konnte nicht gefunden werden. is derived from a high-quality signal generator (R&S SMHU).

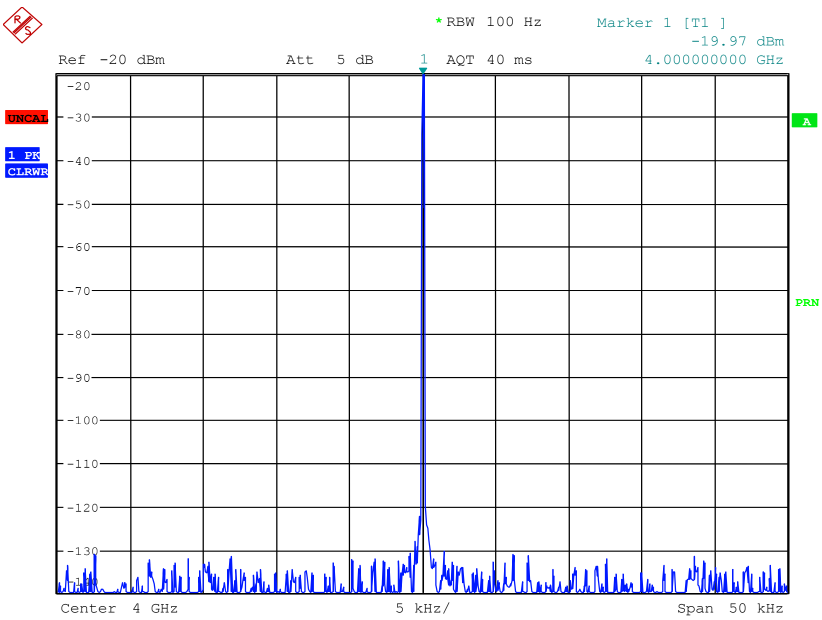


Figure 3-19: Full-scale test, error-free unit

Linearity test

Signal generator settings

Frequency 20.4 MHz

Level -2.9 dBm

R&S ESU settings

Marker to peak, reference fixed

Signal generator settings

Frequency 20.4 MHz

Level -12.9 dBm to –52.9 dBm in 10 dB steps

Delta marker readout

Signal generator	-12.9 dBm	-22.9 dBm	-32.9 dBm	-42.9 dBm	-52.9 dBm
Delta marker	-10 ± 0.5 dB	-20 ± 0.5 dB	-30 ± 0.5 dB	-40 ± 0.5 dB	-50 ± 1 dB

Note:
Use step attenuator if the signal generator's level linearity is worse than 0.2 dB.

Phase noise test

Signal generator setting

Frequency 20.4 MHz

Level -42.9 dBm

Expected display:

Spectrum of clean CW signal at center frequency, level approx. -60 dBm.

The noise level must not be higher than the noise level measured in the noise floor test (see Fig. 3-19).

Presumption: Signal generator phase noise ≤-100 dBc / Hz at >1 kHz offset.

Possible errors:

phase noise higher than thermal noise floor (example: Fig. 3-19).

Distorted spectrum

Spurious

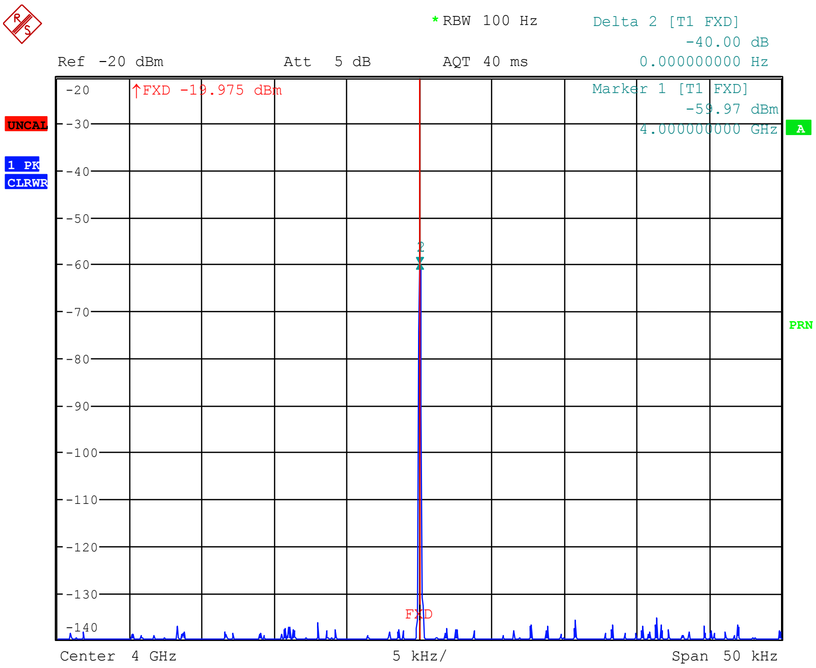


Figure 3-20: Phase noise test, error-free unit

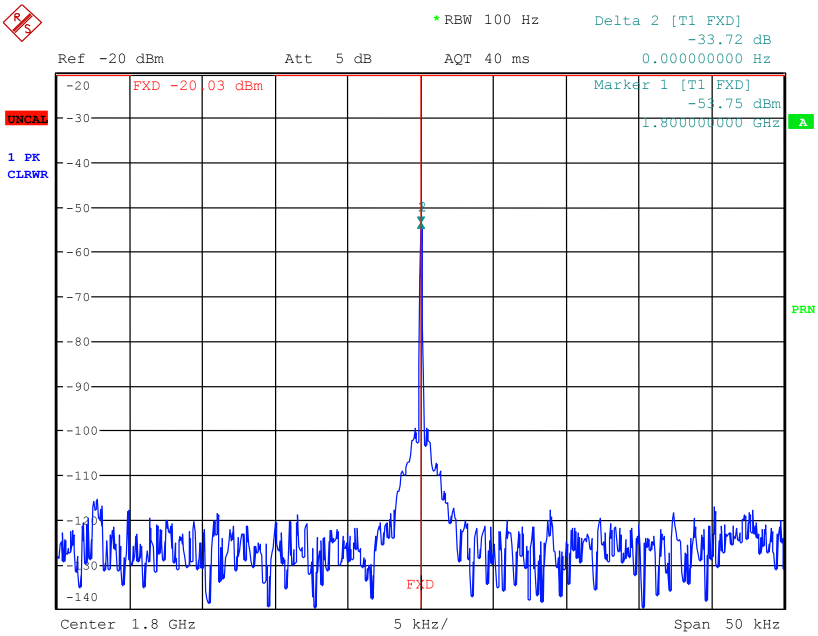


Figure 3-21: Phase noise test, faulty unit (high phase noise)

Testing Signal Path via Pulse Power Attenuator

The internal source for the test signal (CAL signal) has already been tested when testing the reference signals. The first and second mixer feature sufficient LO power, i.e. the conversion from the RF to the second IF and the Signal Path via the attenuator should therefore work properly.

Normal action	Error and error cause

Signal path via RF attenuator
The measurement is made at the second IF using a logarithmic detector on the RF converter. The 0 dBm test signal is measured with the following attenuator settings:

RF-Att	Coupling	Test
0	DC	Reference measurement
0	AC	AC/DC switch +-5 dB
5	DC	5-dB attenuator +- 5 dB
10	DC	10-dB attenuator +- 5 dB
20	DC	20-dB attenuator +- 5 dB
40	DC	40-dB attenuator +- 10 dB

If there is **no** measured value within the tolerance range, the error is likely to be located in the subsequent signal path or in the pulse power attenuator. It is not likely that all RF attenuator stages and the 0-dB position are faulty; therefore, the following error message appears.

FATAL ERROR!
Input level RF converter out of tolerance !

Before replacing the RF converter, measure the input level at X108 in any case. For this purpose, the input is connected to the Cal source with 0 dBm and 0 dB attenuator DC coupling. The level should lie at 128 MHz and 0 dBm. Otherwise, check level at X125.

If the signal is not applied at the synthesizer either, replace the synthesizer.

If the signal is ok check signal at X45, It should lie at 128 MHz and 0 dBm. If there is no signal: replace the pulse power attenuator
Otherwise replace the RF attenuator.

FATAL ERROR!.
RF Attenuator xx dB pad failed !

CAUTION!
Since a faulty RF attenuator causes many subsequent errors to occur with the IF filter test, proper functioning of the attenuator is a must.

4 Software Update / Installing Options

This chapter contains information on software updates, restoring the operating system installation and installing options on the R&S ESU. Additional manuals obtained together with a software/firmware update or with subsequently acquired options can be filed here.

4.1 Installation of New R&S ESU Software

A new firmware version can be installed using the built-in diskette drive. The firmware update kit contains several diskettes.

The installation program is called up in the *SETUP* menu.

SETUP sidemenu:

FIRMWARE UPDATE

The *FIRMWARE UPDATE* softkey starts the installation program and leads the user through the remaining steps of the update

SCPI Command: ---

Performing the update

Insert diskette 1 into the drive.

Call *SETUP* side menu	*[**SETUP**][**NEXT**]*
Start update	[FIRMWARE UPDATE]

RESTORE FIRMWARE

The *RESTORE FIRMW---ARE* softkey restores the previous firmware version

SCPI Command: ---

4.2 Restoring Operating System Installation

If the operating system can no longer be started, it is possible to start the analyzer in the boot menu from the backup partition and to restore the operating system installation.

This function is not available on instruments with option R&S ESU-B18/B20.

Please select the operating system to start:

Analyzer Firmware
Analyzer Firmware Backup

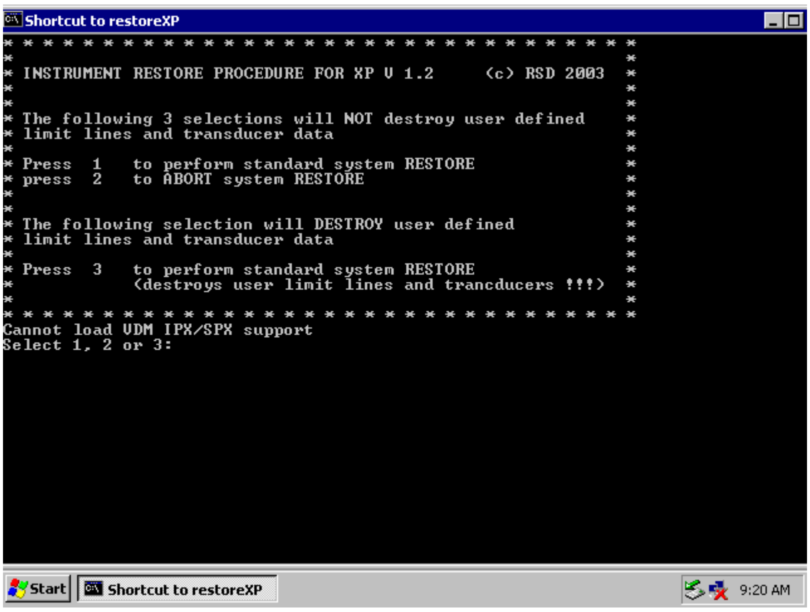
Use the up and down arrow keys to move the highlight to your choice.

Press ENTER to choose.

Seconds until highlighted choice will be started automatically: 5

For troubleshooting and advanced startup options for Windows, press F8.

Use the cursor keys to select the operating system to start within the boot menu (*Analyzer Firmware Backup*) from the backup partition and confirm with ENTER.



After the operating system has been started from the backup partition, a window with various restore functions appears.

The desired function can be started by entering the corresponding number. The operating system files will now be copied from the backup partition to the analyzer partition.

After all files have been copied, the instrument boots and the firmware is installed. A cold start is then performed automatically to detect the analyzer hardware.

4.3 Installing Options

The following options are available with the R&S ESU:

OCXO	R&S FSU-B4	1129.6740.02
Tracking Generator	R&S FSU-B9	1142.8994.02
External Generator Control	R&S FSP-B10	1129.7246.03
Attenuator for Tracking Generator	R&S FSU-B12	1142.9349.02
Removeable Hard Disk	R&S ESU-B18	1302.0400.06
Second Hard Disk for R&S ESU-B18	R&S ESU-B19	1302.0600.06
Low-Noise Preamplifier 08 GHz / 26 GHz 40 GHz / 50 GHz	R&S ESU-B24	1157.2100.08, 26, 40, 50

For retrofitting, please note the mounting instructions enclosed with the options.

These mounting instructions can be inserted at this location in the service manual and will thus be available when needed.

CAUTION

Disconnect the instrument from the mains before opening the casing.
Also pay close attention to the safety instructions at the beginning of this manualEnter

The components used in the instrument are sensitive to electrostatic discharges which is why they are to be handled in accordance with the ESD regulations

When installing hardware options, note the following:

- Switch off the instrument and pull the mains plug.
- Unscrew the 4 rear-panel feet (450) and push the tube (410) backwards and take off.
- After installing the option, replace the tube and screw the rear panel feet back on.

CAUTION

When replacing the tube, be sure not to damage or pull off cables..

- Switch on the R&S ESU (cold start).
- Install additional software, if supplied, according to the instructions enclosed with the option.
- If an adjustment is required for this option, refer to the installation instructions for the option.

5 Documents

5.1 Spare Parts

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

CAUTION

Risk of shock hazard and instrument damage

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.

5.1.1 Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7020.00	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0041.4752.00	GB 2099, GB 1002, 10 A, 250 V approvals CCC	China
DS 0041.6232.00	JIS 8303, 7 A 125 V AC approvls PSE (JET)	Japan
DS 0006.7036.00	Type 498/13 complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0006.7107.00	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0099.1456.00	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight	Europe (except Switzerland)

Spare Part List

Mechanical Drawings

List of R&S ESU parts including spare parts

The R&S ESU is constructed in accordance with R&S design 2000.

Overall dimension: W x H x L, 465,1 x 197,3 x 517

Rackmount: 4E 1/1 T450

Accessories: 19"-Adapter ZZA-411, Stock no. 1096.3283.00

The recommended spare parts are marked with X in the recommended spare parts column.

Table 5-1: List of all R&S ESU parts and spare parts

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
Document 1302.6005.01 (R&S ESU-instrument)					
10	Basic Unit	1166.1677.05	1		
15	Fan	1130.0070.00	1	E1	X
17	Speaker	1129.9332.00	1	B1	X
20	Attenuator R&S ESU8	1137.0599.02	1	A40	X
22	Attenuator R&S ESU40	1046.5130.05	1	A40	X
25	Attenuator R&S ESU26	1046.5130.02	1	A40	X
26	Isolating plate	1129.9690.00	1		
27	DIN965-M2.5X6-A4-PA	1148.3288.00	4		
28	DIN6900-M2.5X6 -A2	1148.3059.00	3		
30	Ribbon cable W105 / W40	1302.6292.00	2	W105 / W40	
40	DIN6900-M2.5X6 -A2	1148.3059.00	2		
43	VOL/PHONES BOARD	1093.7094.02	1	A191	X
44	Holding bracket AF-OUT	1129.9326.00	1		
45	DIN6900-M2.5X6 -A2	1148.3059.00	1		
46	DIN965-M2.5X6-A4-PA	1148.3288.00	2		
48	Rotary knob 13 ACHS-RD4T-GR	0852.1211.00	1		
49	Ring for rotary knob	0852.1228.00	1		
50	PROBE BOARD R&S ESU	1302.7101.02	1S	A80	X
55	DIN965-M2.5X6-A4-PA	1148.3288.00	3		
56	PULSE POWER ATTENUATOR	1302.7047.02	1	A42	X

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
57	Attenuator mount R&S ESU	1302.6092.00	1		
58	Combination screw M2.5x6-A2	1148.3059.00	7		
60	USB 2.0 ADAPTOR	1302.7253.02	1	A310	X
61	965/ISR-M2.5X6-A4-PA	1148.3288.00	2		
70	Subassembly plate R&S ESU	1302.6086.00	1		
71	965/ISR-M2.5X6-A4-PA	1148.3288.00	7		
72	3,5 mm ground spring	1142.8242.00	1		
81	Cover black 30x20 mm	1093.9051.00	1		
82	Adhesive foil 33x68 mm black	1300.0597.00	1		
91	Cover rd 15.9	0009.9200.00	2		
95	PRESELECTOR	1302.7001.02	1	A150	X
96	Bracket MW Converter	1129.9384.00	1		
97	965/ISR-M2.5X6-A4-PA	1148.3288.00	2		
100	RF CONVERTER	1130.4047.02	1	A100	X
105	SYNTHESIZER	1166.2209.02	1	A110	X
111	WIDEBAND DETECTOR UNIT	1130.3086.07	1	A140	X
120	IF-FILTER	1130.2296.03	1	A130	X
130	CONVERTER UNIT(8 GHZ)	1130.2544.02	1	A160	X
135	Angle bracket MW converter	1129.9384.00	1		
136	DIN965-M2.5X6-A4-PA	1148.3288.00	2		
140	MW-CONVERTER UNIT 26	1130.3240.22	1	A160	X
150	MW-CONVERTER UNIT R&S ESU 40	1166.2096.42	1	A160	X
160	Air cover	1129.9355.00	2		
170	Rear panel	1163.0092.00	1		
180	Combination screws M2.5X6-A2	1148.3059.00	6		
182	Cover IQ-Data	1130.0006.00	1		
183	Screw ISR-M2.5X6-A4-PA	1143.5630.00	2		
190	Cover 9-pin SUB-D	1093.8990.00	1		
200	Cover 25-pin SUB-D	1093.9000.00	2		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
201	Locking Screw	0009.6501.00	2		
202	Wave Spring Washer DIN 137-A3	0005.0296.00	2		
203	Nut DIN 934-M3	0016.4398.00	2		
210	Cover round, black	0009.9217.00	5		
220	Cover f. LAN-connector	0852.0467.00	2		
225	Cover f. IEC-BUS	0852.0450.00	1		
230	2xRJ45 coupler jack straight	1093.9122.00	1	X220	
231	LAN cable with spring	1066.1819.00	1	W32	
240	Instrument top cover	1129.9261.00	1		
250	DIN6900-M2.5X6 -A2	1148.3059.00	3		
260	DIN965-M2.5X6-A4-PA	1148.3288.00	10		
280	Printed front panel R&S ESU8	1302.6057.00	1		
290	Printed front panel R&S ESU26	1302.6063.00	1		
292	Printed front panel R&S ESU40	1302.6070.00	1		
295	RF-cable W1 8 GHZ	1302.6405.00	1	W1	X
300	RF cable W90	1302.6263.00	1	W90	
310	Set of cables	1129.9490.09	1		
312	Set of cables	1129.9490.27	1		
313	Set of cables	1129.9490.40	1		
315	TESTPORT ADAPTER	1021.0493.00	1	X1	X
316	RF-CABLE W1 26 GHZ	1302.6357.00	1	W1	X
320	TESTPORT ADAPTER	1036.4702.00	1	X1	X
322	RF-CABLE W1 46 GHZ	1302.6363.00	1	W1	X
330	Assembly plate	1093.4750.00	1		
340	Assembly plate	1093.4772.00	1		
350	DIN965-M2.5X6-A4-PA	1148.3288.00	4		
370	Set of cables	1129.9749.10	1		
380	Set of cables	1129.9749.28			
390	Set of cables	1129.9749.40			
410	Housing 4E1/1T450 R&S ESU	1166.1760.00	1		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
420	Front handle	1096.1480.00	2		
430	Screw M4X14-ISR-PA	1096.4896.00	4		
450	BW2-rear panel foot 50mm	1096.2493.00	4		
455	Label for rear panel foot	1096.2435.00	1		
456	User port label	1302.6105.00	1		
Document 1166.1677.01 (Basic unit) Sheet 2					
501	Instrument frame 2	1155.5576.00	1		
511	MOTHERBOARD	1302.7082.04	1	A10	X
520	DIN6900-M2.5X6 -A2	1148.3059.00	7		
525	DIN965-M2.5X6-A4-PA	1148.3288.00	2		
530	Locking bolt M3	0009.6501.00	4		
540	Locking bolt H=4,5-40	1093.9180.00	2		
550	Power supply unit 230W	1091.2320.00	1	A20	X
560	DIN6900-M2.5X6 -A2	1148.3059.00	10		
573	Front Module Controller 7/3	1091.3104.00	1	A90	X
590	DIN6900-M2.5X6 -A2	1148.3059.00	10		
601	Display unit	1093.4708.08	1	A1	
610	DIN965-M2.5X6-A4-PA	1148.3288.00	4		
621	Keyboard frame	1093.5127.00	1		
631	Flexible switchboard	1093.5133.00	1	A16	X
641	Flexible switchfoil	1093.5140.00	1	A15	X
650	Rotary knob rd 28	0852.1086.00	1		
660	DIN965-M2X6-A4-PA	0041.1599.00	14		
711	SATA harddisk with software R&S ESU	1302.6240.09	1	A60	X
721	SATA data cable	1091.3440.00	1	W29	
722	SATA powercable	1091.3427.00	1	W30	
730	Disk mount	1093.4837.00	1		
740	DIN965-M2.5X6-A4-PA	1148.3288.00	2		
750	DIN965-M3X5-A4-PA	1148.2775.00	4		
760	Cable 4x2 shielded 280 mm length	5500.0213.00	1	W310	
762	Grommet	0062.1146.00	1		

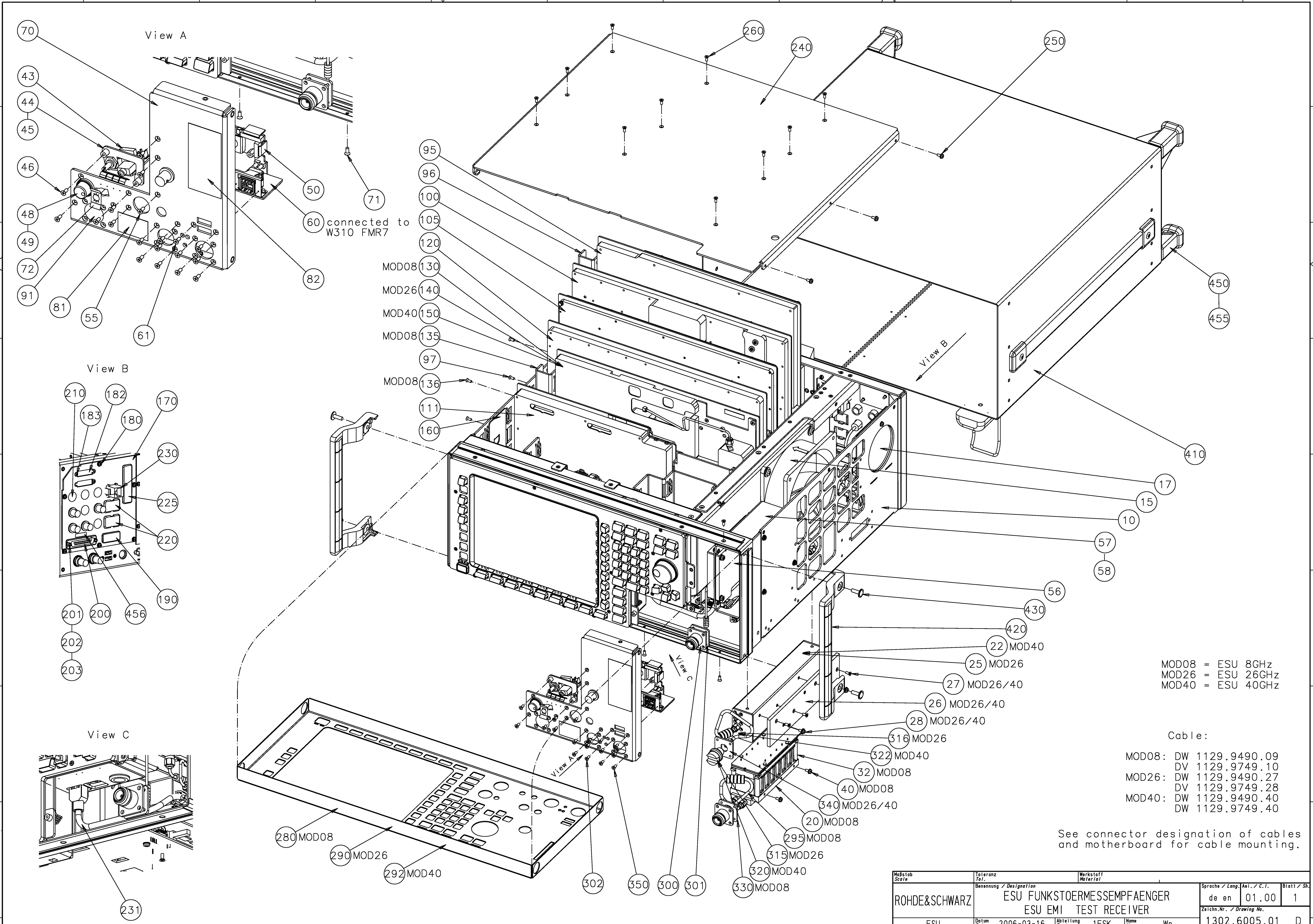
Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
776	Lithiumbatterie CR2032	0858.2049.00	1		
Document 1093.4708.01 Sheet 7 (Display Unit)					
805	Assembly tray	1129.9426.00	1 S		
810	Shielded filter plate	1091.2014.00	1 S		
820	RF spring (177)	1069.3011.00	2 S		
830	RF spring (137)	1069.3105.00	2 S		
840	Plate holder	0852.0844.00	4 S		
850	DIN965-M2X4-A4-PA	1148.3259.00	4 S		
865	Dust sealing	1129.9449.00	1 S		
872	ED STEP UP CONVERTER	1303.3080.02	1 S	T10	X
892	DIN6900-M2.5X6 -A2	1148.3059.00	2 S		
908	CABLE FOR TOSHIBA-FMR7	1303.3239.00	1 S	W100	X
910	Rotary pulse generator	0852.2701.00	1 S	B10	X
923	ND TFT 8.4 SVGA LVDS LED	3583.2145.00	1 S	A70	X
930	DIN6900-M2.5X6 -A2	0071.5040.00	4 S		
932	Spacer	1129.9432.00	4 S		
934	DIN965-M2.5X5-A4-PA	0852.3608.00	4 S		
935	DISPLAY CABLE	1303.3222.00		W101	X
946	Label display connection	1129:9703:00	1 S		
950	DIN6900-M2.5X6 -A2	1148.3059.00	2 S		
954	CABLE W31 LST BOARD - FMR	1307.9425.00	1 S		
960	SPRING	1166.1783.00	1 S		
970	Keyboard frame	1093.5127.00	1 S		
980	Keyboard mat	1093.5133.00	1 S		x
990	Keyboard membrane	1093.5140.00	1 S		x
1000	965/ISR-M2X6-A4-PA	0041.1599.00	1 S		
Document 1144.9017.00 (Option R&S FSU-B4 1144.9000.02)					
1100	OCXO	1093.7871.03	1	A200	X
1120	RF-cable W21	1129.9926.00	1	W21	
Document 1303.0475.00 (Option R&S ESU-B18 1303.0400.06)					

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
1500	COMPACT FLASH BOARD S-ATA	1164.5046.02	1	A381	X
1505	Screw DIN6900/ISR-M2.5X6-A2	1148.3059.00	4		
1530	Flashdisk with software R&S ESU	1303.0417.06	1	A380	X
1550	SATA datacable 420 mm	1091.3456.00	1	W30	X
1560	SATA powercable 440 mm	1091.3433.00	1	W29	X
Document 1129.7317.00 (Option R&S FSP-B10 1129.7246.03)					
1610	IEC-BUS cable W21	1129.7252.00	1	W21	X
1612	DIN125-A3.2-A4	0082.4670.00	2		
1614	DIN137-A3-A2	0005.0296.00	2		
1620	Aux control cable W22	1129.7269.00	1	W22	X
1622	Locking bolt M3	0009.6501.00	2		
1624	DIN137-A3-A2	0005.0296.00	2		
1626	DIN934-M3-A4	0016.4398.00	2		
1640	IEC-BUS Controller	1164.5200.02	1	A210	X
1660	Adapterplate for R&S FSP-B10	1130.0064.00	1		
1665	DIN6500/ISR-M2.5X6-A2	1148.3059.00	4		
Document 1303.0823.00 (Option R&S ESU-B20 1303.0800.06)					
1700	COMPACT FLASH BOARD S-ATA	1164.5046.02	1	A60	X
1725	Flashdisk with software R&S ESU	1303.0417.06	1	A61	X
1730	CF card holder clip	1130.1260.00	1		
1740	Flash disk mount	1303.0817.00	1		
Document 1142.9090.00 (Option FSU-B9 Tracking Generator 1142.8994.02)					
1800	TRACKING GENERATOR	1130.3605.02	1	A170	X
1810	RF-cable W41	1142.9003.00	1	W41	
1820	RF-cable W42 (RF-Con)	1142.9010.00	1	W42	
1830	RF-cable W42 (8GHz)	1142.9026.00	1	W42	
1840	RF-cable W43	1142.9032.00	1	W43	
1850	RF-cable W44	1142.9049.00	1	W44	

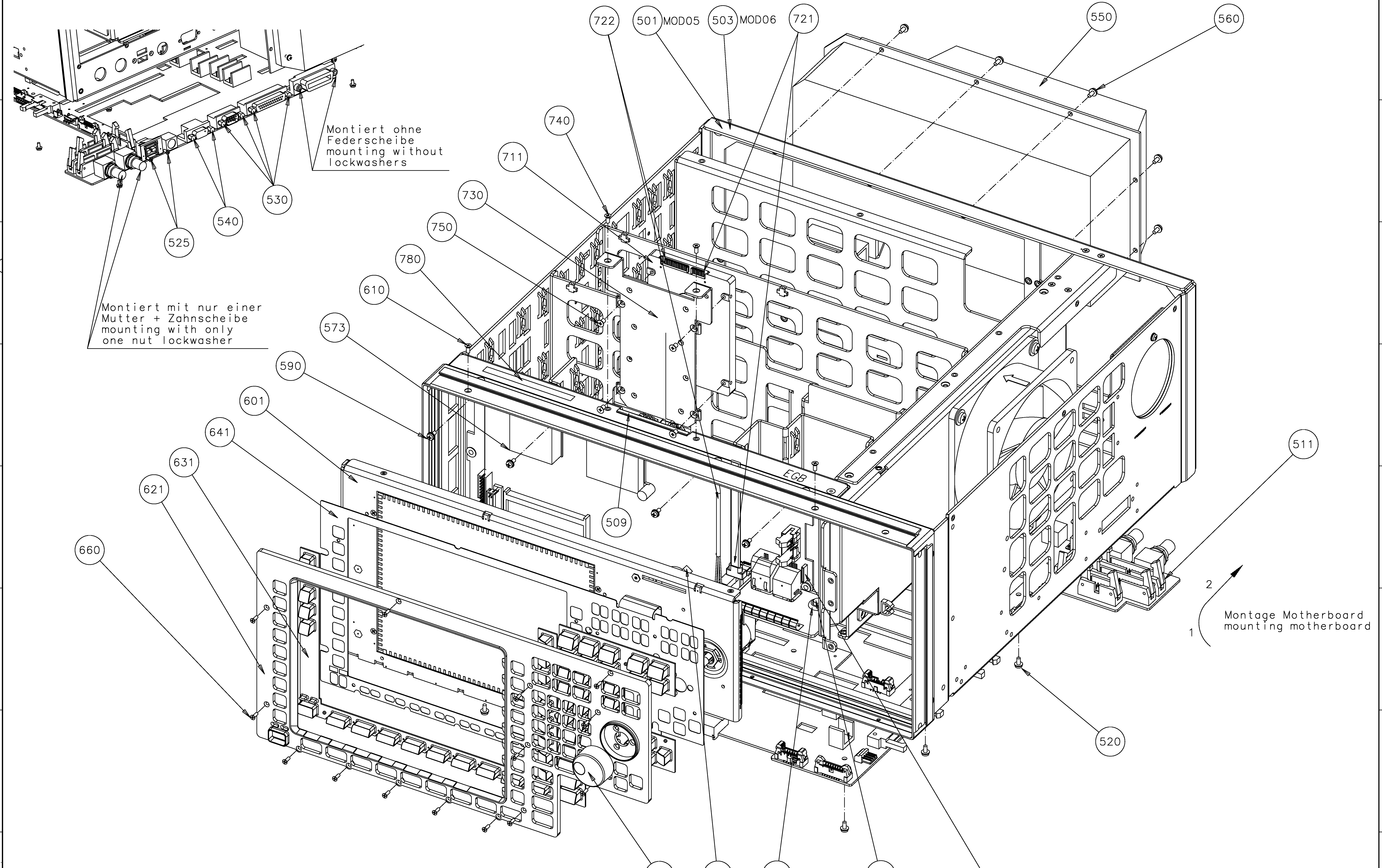
Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
1860	RF cable W45	1142.9055.00	1	W45	
1870	RF cable W46	1142.9061.00	1	W46	
1880	RF-cable W47	1142.9078.00	1	W47	
1890	RF-cable W48	1142.9084.00	1	W48	
1895	Adaptor N-SMA	0343.0257.00	1	X2	X
1900	Mounting plate	1093.4750.00	1		
1910	DIN965-M2.5X6-A4-PA	1148.3288.00	4		
1920	Label FSU-B9 front	1142.9132.00	1		
1930	Label FSU-B9 rear	1142.9126.00	1		
1940	RF cable W26	1142.9161.00	1	W26	
Document 1130.2544.01 (Converter Unit 8 GHz)					
2000	8 GHZ CONVERTER	1130.2550.02	1	A160	
2001	A-side-cover	1130.2580.00	1		
2002	B-side-cover	1130.2573.00	1		
2005	YIG-UNIT 8GHz (MICRO LAMBDA)	1130.2944.02	1	A161	X
2010	YIG-UNIT 8GHz (FILTRONIC)	1130.2944.03	1	A161	X
2025	DIN965-M2.5X6-A4-PA	1148.3288.00	2		
2030	DIPLEXER 8GHZ	1132.6501.02	1	A162	X
2035	DIN6900-M2.5X5 -A2	0071.6830.00	4		
Document 1166.2338.00 (MW Converter Unit 26 GHz)					
2100	26 GHZ CONVERTER	1166.2344.02	1	A160	
2105	DIPLEXER 46	11562.1120.02	1	A161	X
2107	YIG UNIT	1166.1854.25	1	A162	X
2110	DIN6900-M2.5X6 –A2	1148.3059.00	4		
2120	DIN965-M2.5X8-A4-PA	1148.3294.00	2		
2125	EXTENDER 26	1132.8504.03	1	A163	X
2130	DIN6900-M2.5X6 –A2	1148.3059.00	7		
2135	RF-cable W3	1130.3340.00	1	W3	
2140	RF-cable W4	1130.3357.00	1	W4	
2145	RF-cable W5	1130.3363.00	1	W5	
2150	Holder LO cable	1130.3292.00	1		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
2155	DIN6900-M2.5X6 –A2	1148.3059.00	2		
2225	SMA -protection cap	1066.2095.00	1		
Document 1142.9361.00 (Option R&S FSU-B12 Tracking Attenuator 1142.9349.02)					
2400	STEP ATTENUATOR (FSU-B12)	1067.8380.04	1	A171	X
2410	Attenuator mount	1129.9455.00	1		
2415	DIN6900-M3x8-A2	0071.6853.00	2		
2420	DIN6900-M2.5x6-A2	1148.3059.00	3		
2430	RF cable W41	1142.9378.00	1	W41	
2440	RF cable W49	1142.9384.00	1	W49	
2445	Adapter cable	1142.9390.00	1		
Document 1166.2096.01 page 1 (MW-Converter Unit 46/50 GHz)					
3100	50 GHZ CONVERTER	1130.4999.02	1	A160	
3112	DIPLEXER 46	1162.1120.05	1	A161	X
3125	YIG-UNIT 40 GHZ	1130.3963.39	1	A162	X
3140	DIN965-M2.5X8-A4-PA	1148.3294.00	2		
3148	EXTENDER 46	1151.6010.02	1	A163	X
3160	DIN6900/ISR-M2.5X6-A2	1148.3059.00	6		
3170	Clamp LO cable	1130.3292.00	1		
3180	DIN6900-M2.5X6 –A2	1148.3059.00	2		
3190	RF cable W3	1130.3892.00	1	W3	
3200	RF cable W4	1130.3905.00	1	W4	
3210	RF-cable W5	1130.3911.00	1	W5	
3220	RF-cable W6	1130.3928.00	1	W6	
3230	SMA protection cap	1066.2095.00	1		
3240	B-side-cover	1130.3870.00	1		
3250	A-side-cover	1166.2167.00	1		
Document 1157.2116.00 (R&S ESU-B24 Preamplifier 26 GHz / 40GHz)					
4530	Preamplifier unit 26GHz	1157.2080.26			
4550	Preamplifier unit 40GHz	1157.2080.40			
4605	RF cable W28	1305.8950.00		W28	
4610	RF cable W2	1129.9626.00		W2	

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
4614	RF cable W52	1305.8944.00		W52	
Document 1305.8921.00 (R&S ESU-B24 Preamplifier 8 GHz)					
4700	Preamplifier 8GHz	1302.7201.02	1		
4800	SMA/SMA Adaptor	0335.2119.00	1		
4810	RF cable W2	1302.7276.00	1	W2	

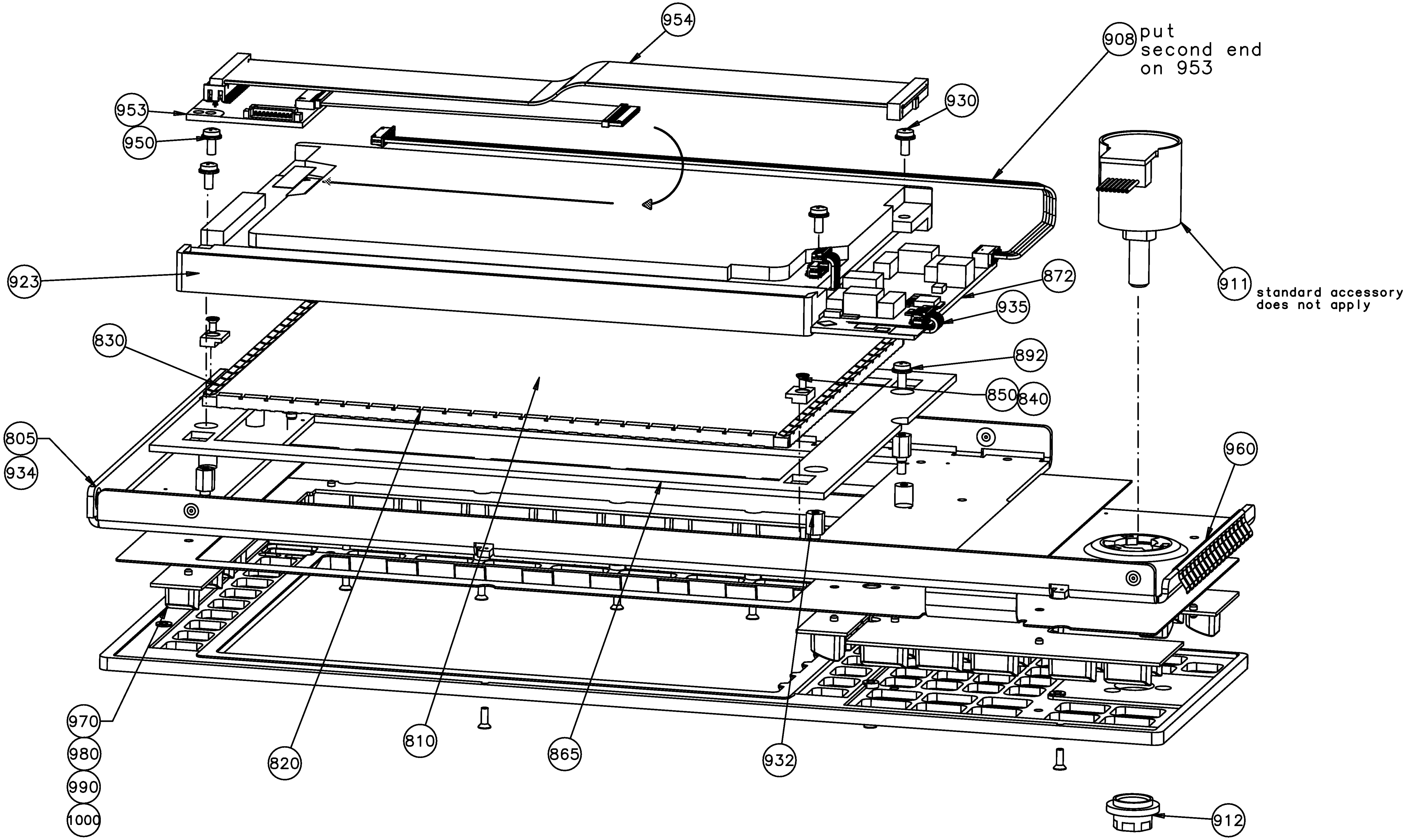


Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: ESU FUNKSTOERMESSEMPFAENGER ESU EMI TEST RECEIVER		Sprache / Lang.: de en; Aei. / C.I.: 01.00; Blatt / Sh.: 1
ESU	Datum / Date: 2006-03-16; Abteilung / Dept.: 1ESK; Name / Name: Wn		Zeichn.Nr. / Drawing No.: 1302.6005.01 D



Variantenerklaerung/Versions
VAR05 = ESU
MOD05 = ESU
VAR06 = FMU
MOD06 = FMU

ROHDE&SCHWARZ	Benennung / Designation: GRUNDEINHEIT Basic Unit	Sprache / Lang.: de en	Ael. / C.I.: 03.00	Blatt / Sh.: 2
Typ / Type: FSU	Datum / Date: 2006-03-16	Abteilung / Dept.: 1ESK	Name: TF	Zeichn.Nr. / Drawing No.: 1166.1677.01 D



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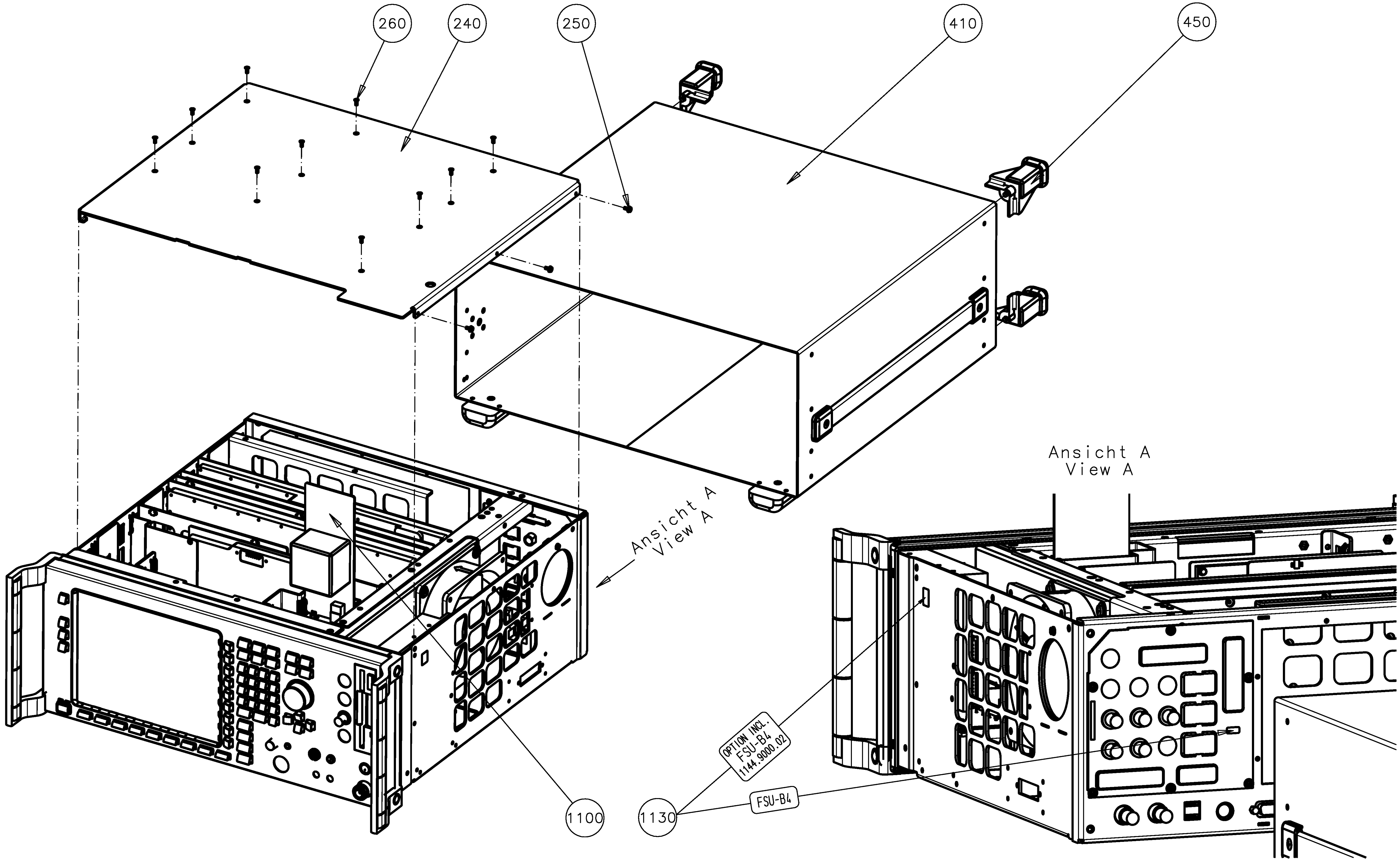
Projektions-methode
Projection Method

MOD 08 = Display Toshiba 084C271F with LED BACK LIGHT

Maßstab / Scale	Toleranz / Tol. ISO2768-m	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: DISPLAYEINHEIT DISPLAY UNIT	Sprache / Lang. de en	Ae. / C.I. 02.00	Blatt / Sh. 7
	Datum / Date 2010-01-12	Abteilung / Dept. MTEK	Name mk	Zeichn.Nr. / Drawing No. 1093.4708.01 D



Projektions-
methode
Projection Method

Kabel nach Beschriftung montieren.
See connector designation of cables
and motherboard for cable mounting.

Maßstab *Scale*	Toleranz *Tol.*		Werkstoff *Material*				
ROHDE&SCHWARZ	Benennung / *Designation* Einbauanweisung FSU-B4 Installation Instruction				Sprache / *Lang.* de en	Aei. / *C.I.* 02.00	Blatt / *Sh.* 1
Typ *Type* FSU-B4					Zeichn.Nr. / *Drawing No.* 1144.9017.00 D		
i.Z. *used in* 1144.9000.01	Datum *Date* 24.11.2000	Abteilung *Dept.* 1ESK	Name *Name* TF				

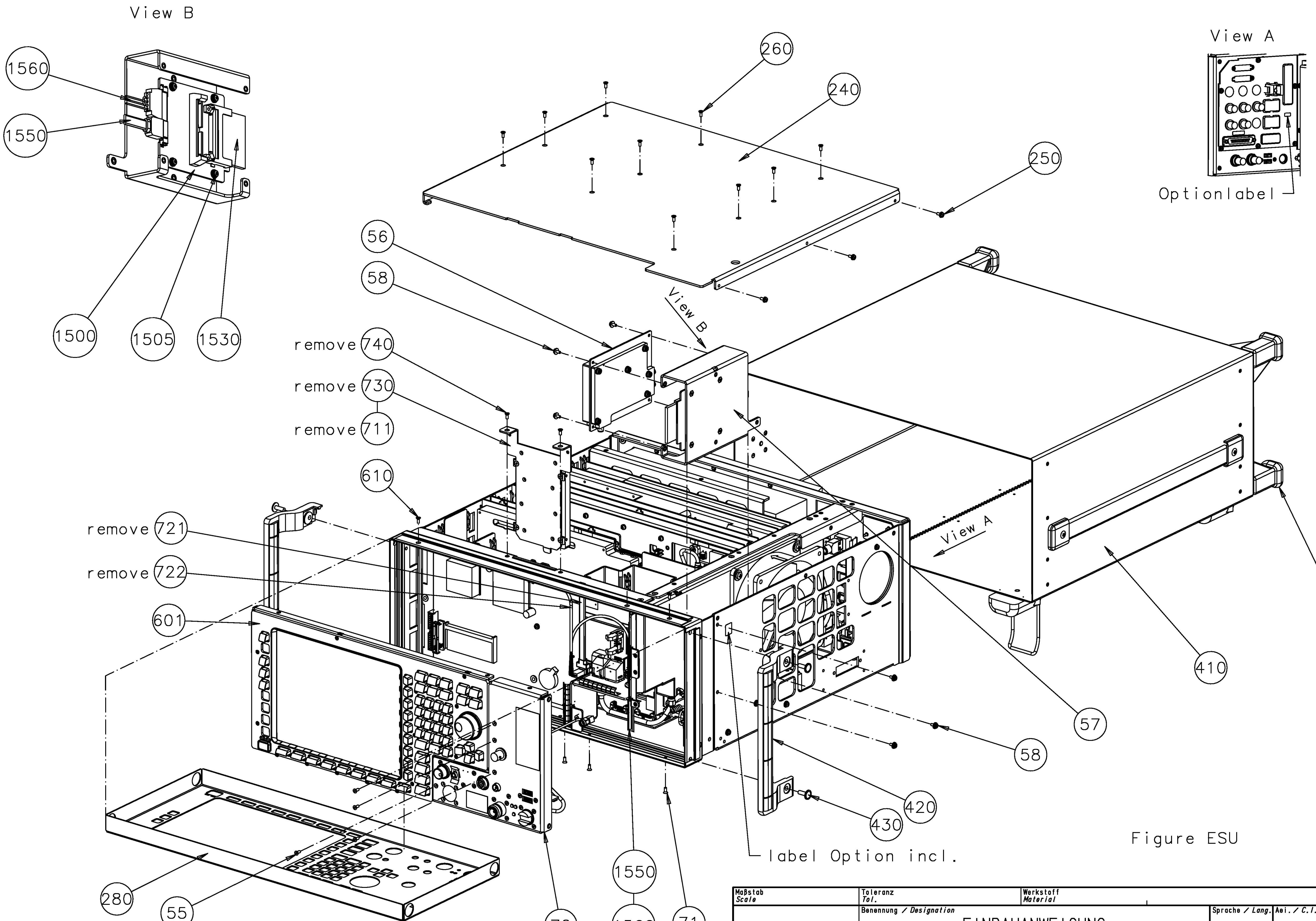
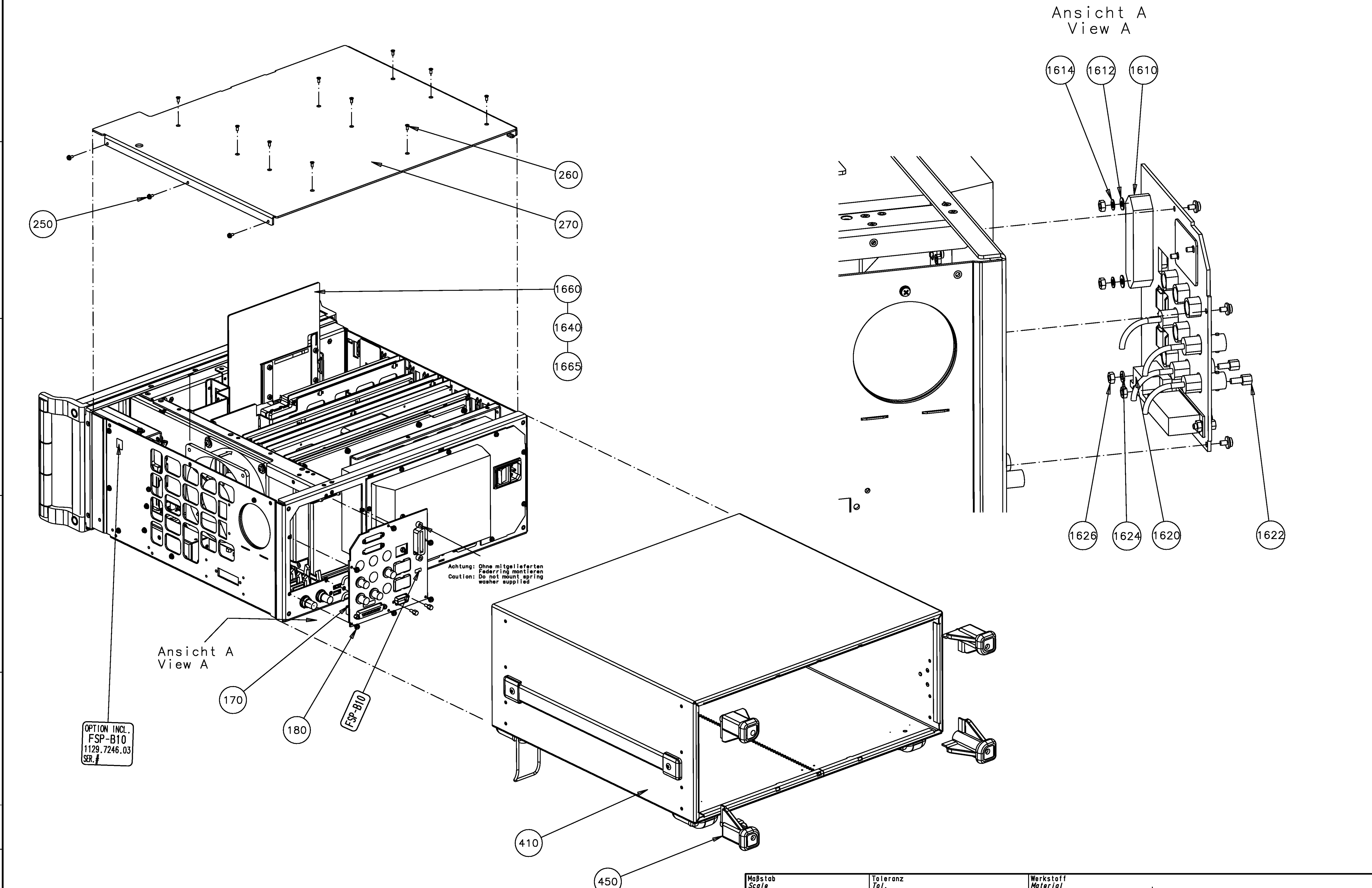


Figure ESU

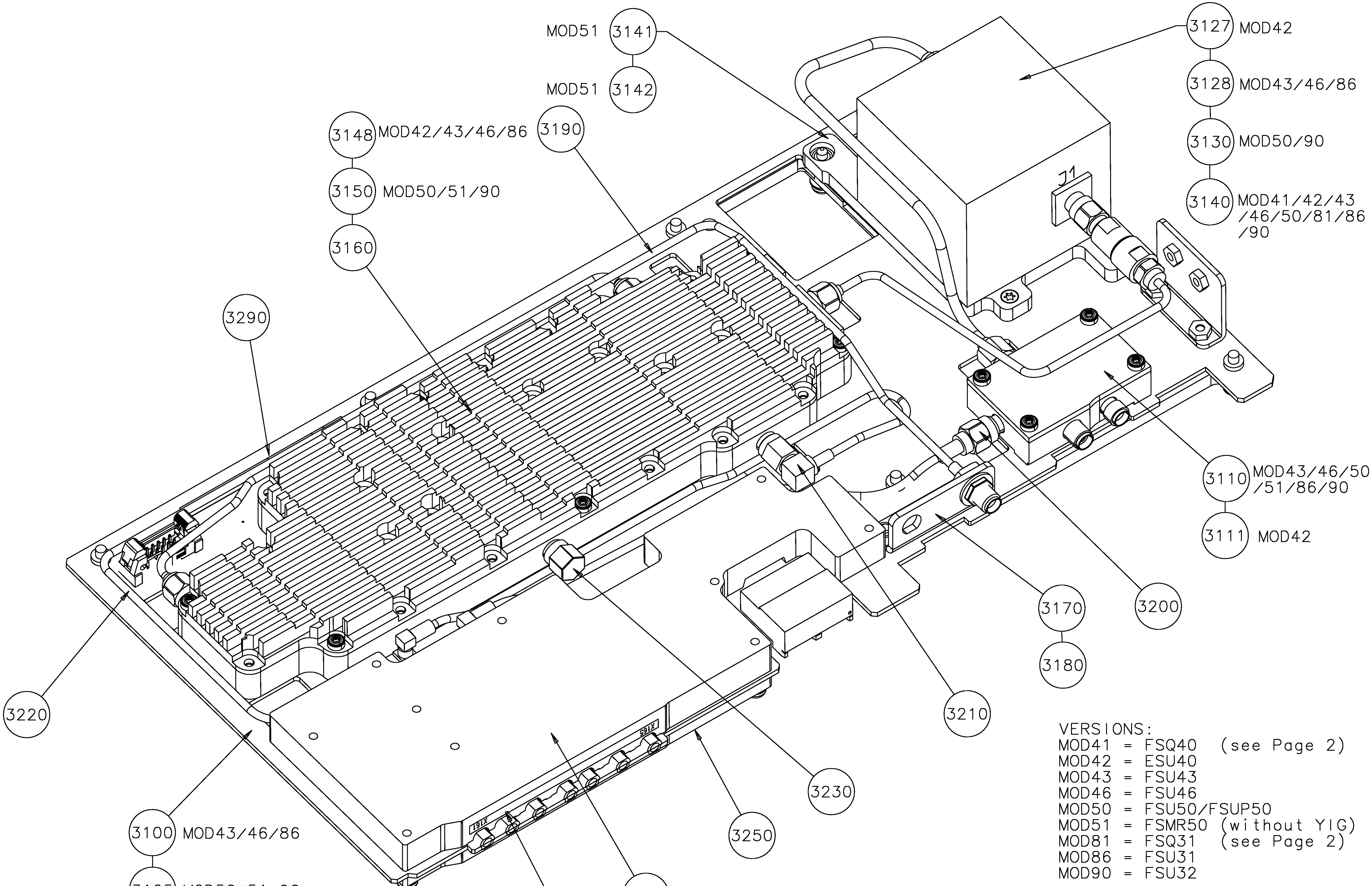
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG ASSEMBLY INSTRUCTION	Sprache / Lang.: de en	Aei. / C.I.: 01.00	Blatt / Sh.: 1
FSU-B18	Datum / Date: 2006-03-31; Abteilung / Dept.: 1ESK; Name / Name: Wn	Zeichn.Nr. / Drawing No.: 1303.0475.00 D		

Projektionsmethode
Projection Method



Projektions-methode
Projection Method

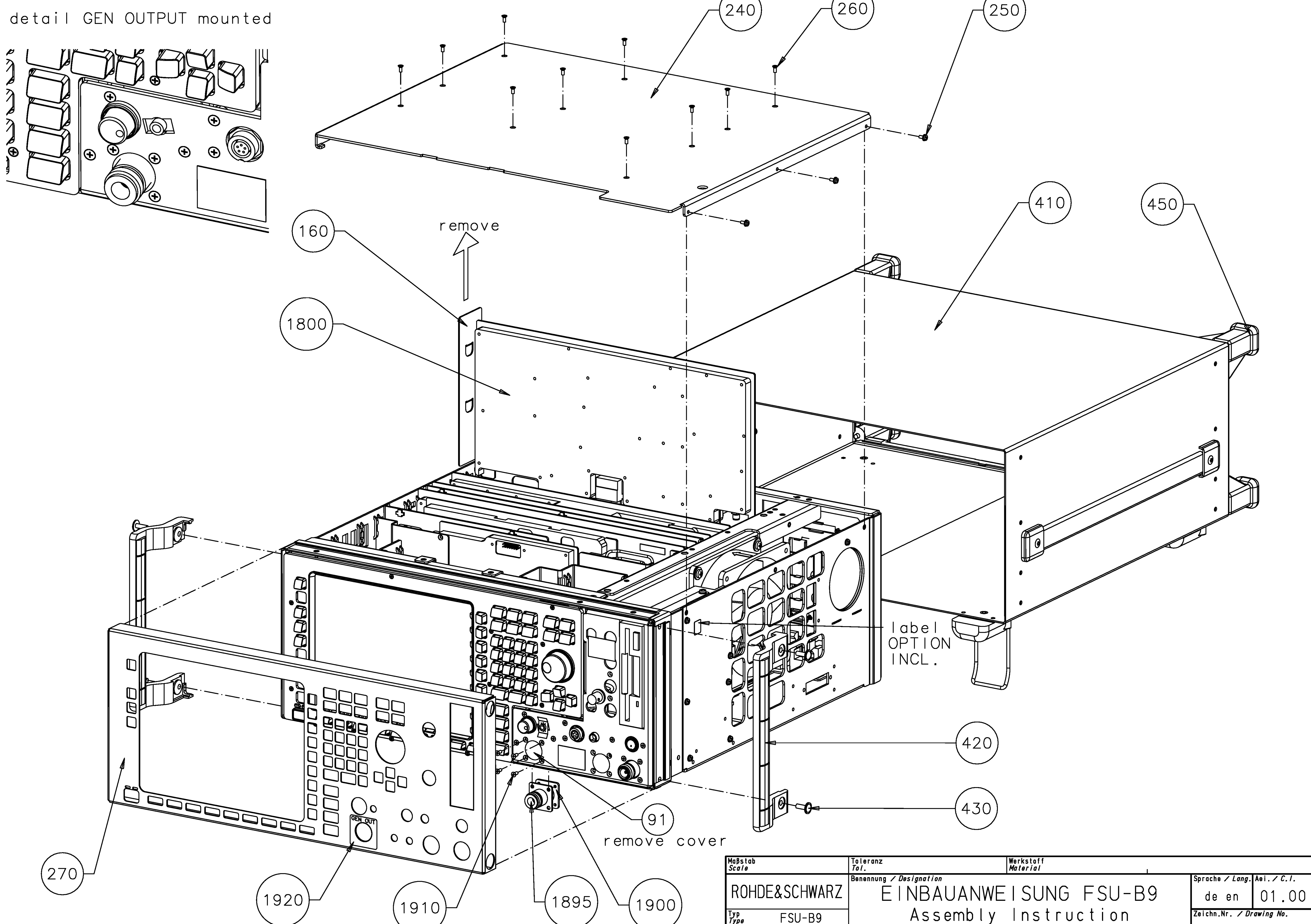
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material				
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSP-B10 INSTALLATION INSTRUCTION			Sprache / Lang.: de en	Aei. / C.I.: 01.00	Blatt / Sh.: 1
FSP-B10	Datum / Date: 2006-03-22	Abteilung / Dept.: 1ESK	Name / Name: Wn	Zeichn.Nr. / Drawing No.: 1129.7317.00 D		



VERSIONS:
MOD41 = FSQ40 (see Page 2)
MOD42 = ESU40
MOD43 = FSU43
MOD46 = FSU46
MOD50 = FSU50/FSUP50
MOD51 = FSMR50 (without YIG)
MOD81 = FSQ31 (see Page 2)
MOD86 = FSU31
MOD90 = FSU32

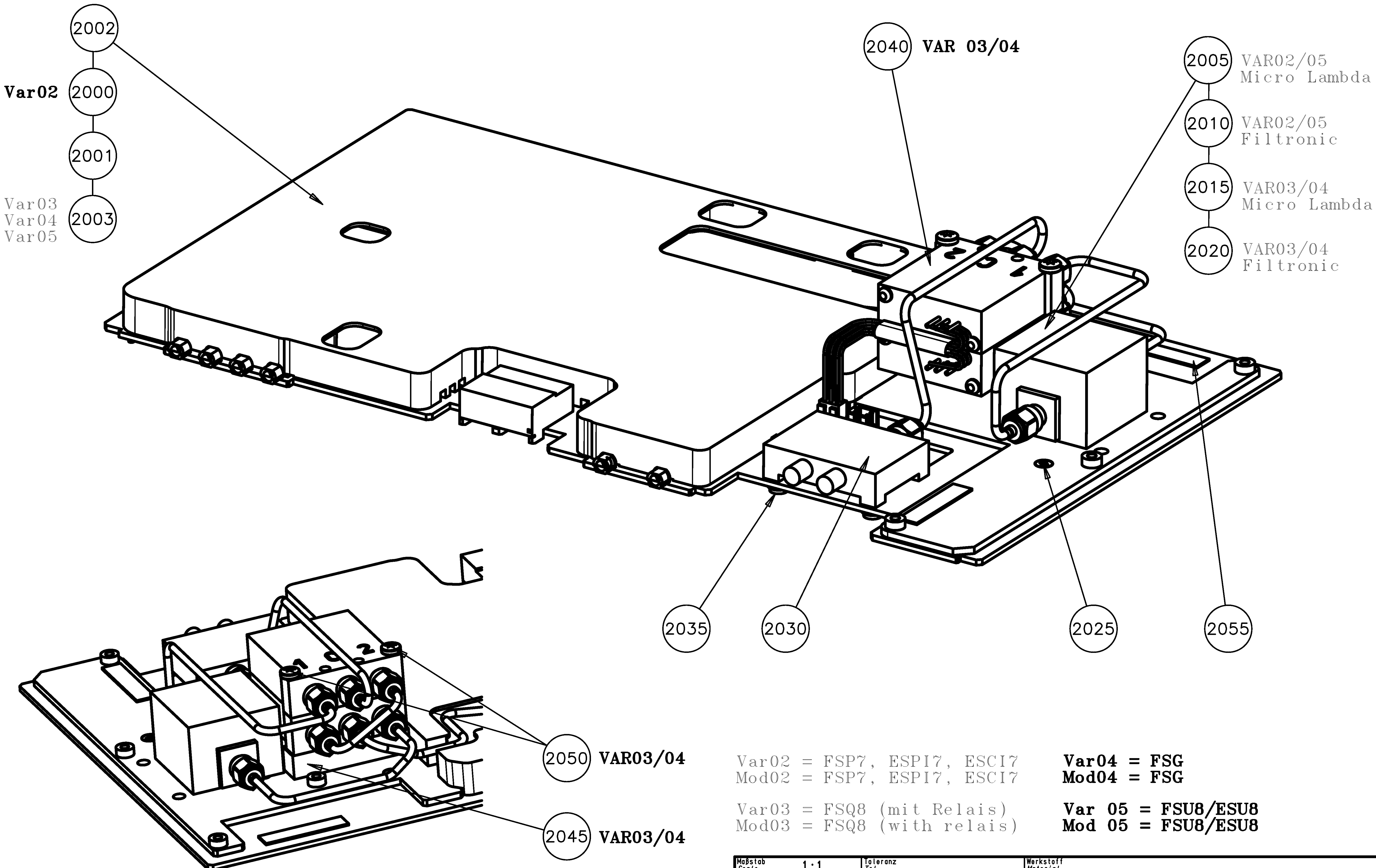
Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 50 / MW-Converter Unit 50	Sprache / Lang.: de en	Aei. / C.I.: 06.00 · Blatt / Sh.: 1
	Datum / Date: 2005-12-02 · Abteilung / Dept.: 1ESK · Name / Name: TF	Zeichn.Nr. / Drawing No.: 1166.2096.01	D

Projektions-methode
Projection Method



Projektions-methode / Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSU-B9 Assembly Instruction	Sprache / Lang.: de en	Aei. / C.I.: 01.00
Typ / Type: FSU-B9		Zeichn.Nr. / Drawing No.: 1142.9090.00 D	Blatt / Sh.: 1
I.Z. used in: 1142.8994.01	Datum / Date: 30.07.2002	Abteilung / Dept.: 1ESK	Name: TF



Var02 = FSP7, ESPI7, ESCI7
Mod02 = FSP7, ESPI7, ESCI7

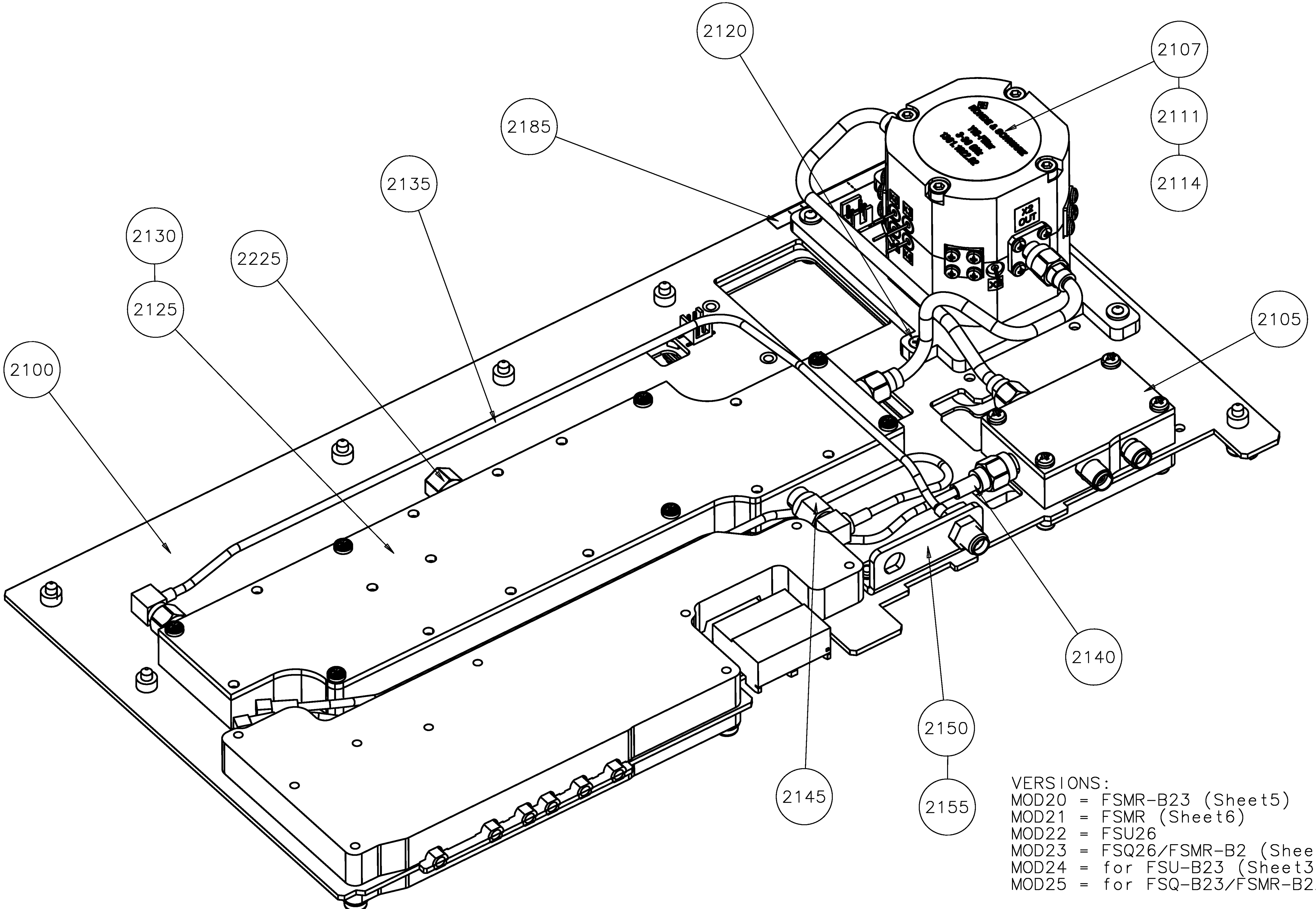
Var03 = FSQ8 (mit Relais)
Mod03 = FSQ8 (with relais)

Var04 = FSG
Mod04 = FSG

Var 05 = FSU8/ESU8
Mod 05 = FSU8/ESU8

Projektions-methode
Projection Method

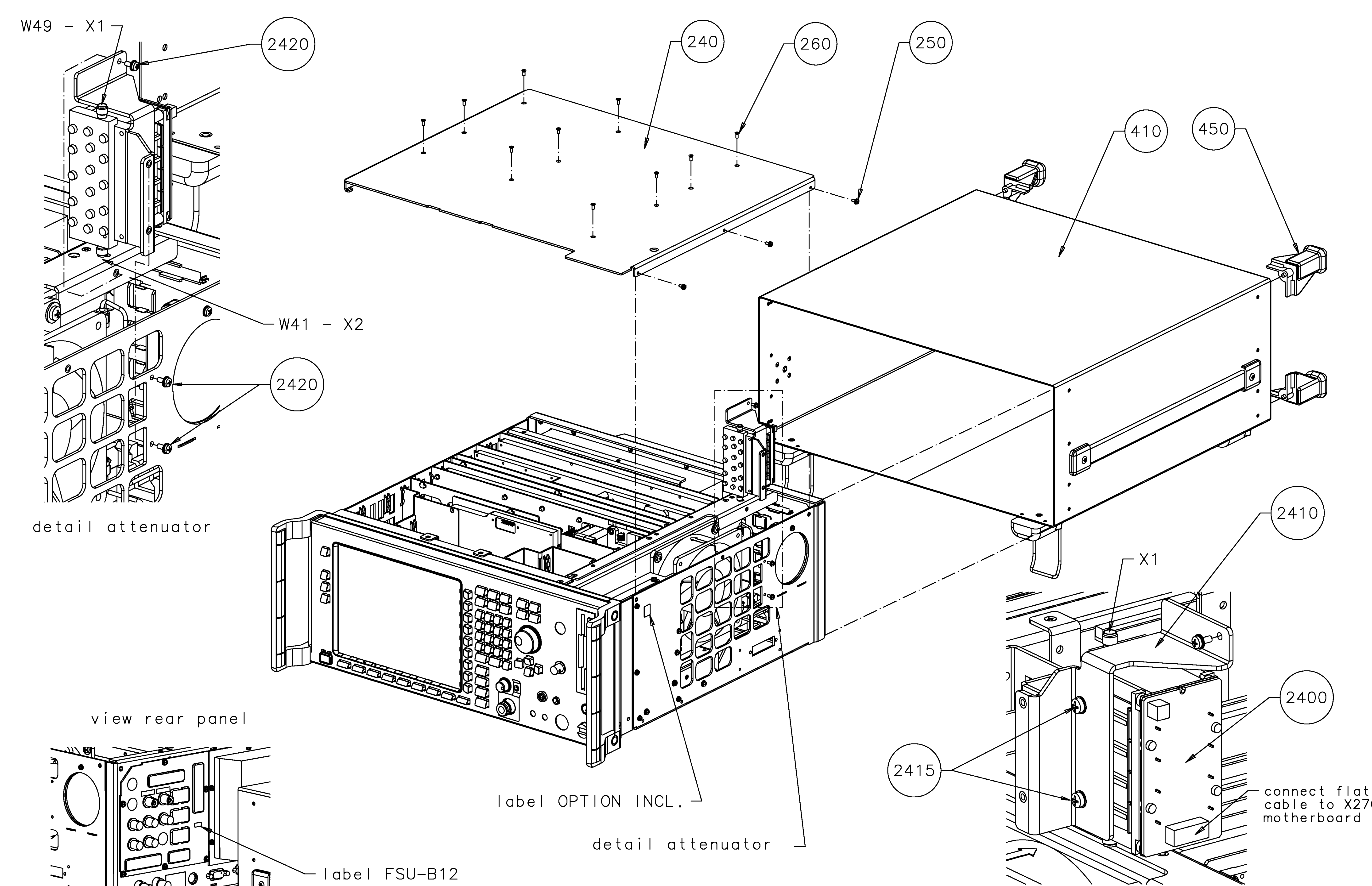
Maßstab / Scale: 1:1	Toleranz / Tol.		Werkstoff / Material				
ROHDE&SCHWARZ	Benennung / Designation: Converter Unit 8GHz				Sprache / Lang.: de en	Aei. / C.I.: 06.00	Blatt / Sh.: 1
Typ / Type: EMU					Zeichn.Nr. / Drawing No.: 1130.2544.01 D		
I.Z. / used in	Datum / Date: 2008-09-26	Abteilung / Dept.: 1ESK	Name / Name: Wn/VL				



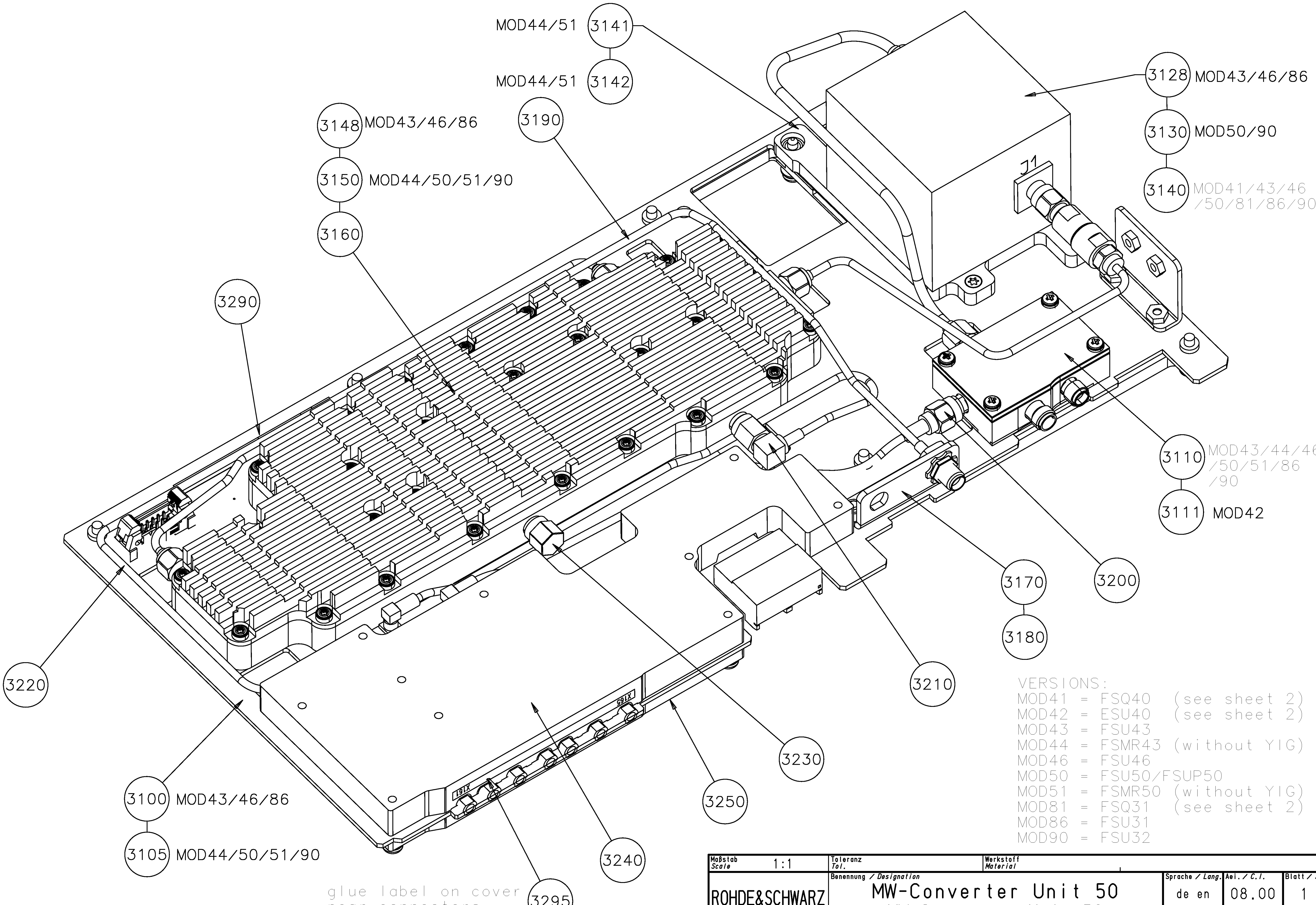
VERSIONS:
MOD20 = FSMR-B23 (Sheet5)
MOD21 = FSMR (Sheet6)
MOD22 = FSU26
MOD23 = FSQ26/FSMR-B2 (Sheet2)
MOD24 = for FSU-B23 (Sheet3)
MOD25 = for FSQ-B23/FSMR-B223 (Sheet4)

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
1:1					
ROHDE&SCHWARZ	Benennung / Designation: MW CONVERTER UNIT 26.5 GHZ / MW CONVERTER UNIT 26.5 GHZ		Sprache / Lang.: de en	Aei. / C.I.: 02.00	Blatt / Sh.: 1
Typ / Type: FSU			Zeichn.Nr. / Drawing No.: 1166.2338.01 D		
i.Z. / used in	Datum / Date: 2006-12-06	Abteilung / Dept.: 1ESK	Name / Name: Wn		

Projektions-methode
Projection Method



Maßstab / Scale	Toleranz / Tol.		Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: Einbauanweisung / Assembly Instruction			Sprache / Lang.: de en	Aei. / C.I.: 01.00	Blatt / Sh.: 1
Typ / Type: FSU-B12				Zeichn.Nr. / Drawing No.: 1142.9361.00 D		
i.Z. / used in 1142.9349.01	Datum / Date: 19.09.2002	Abteilung / Dept.: 1ESK	Name / Name: TF			

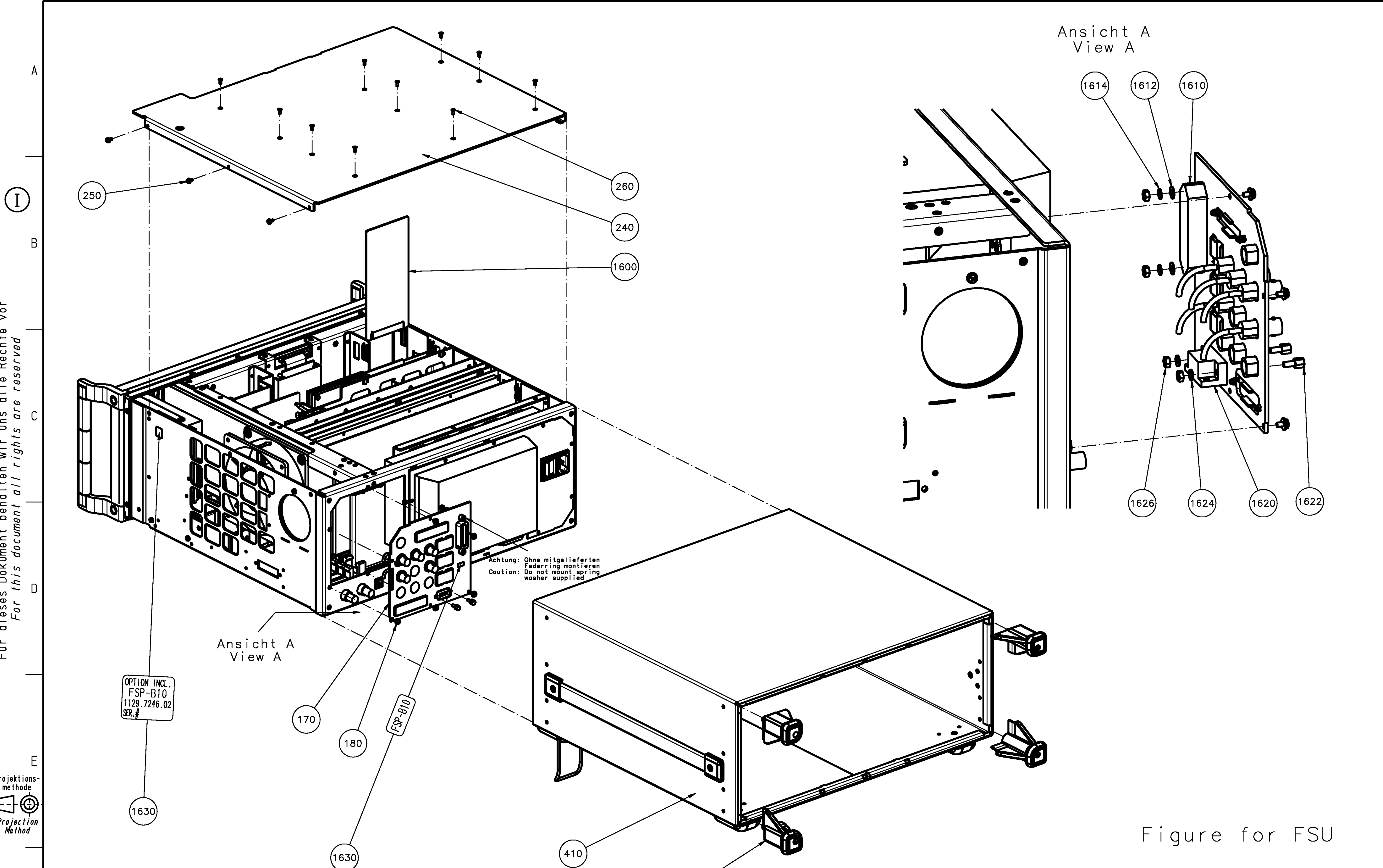


glue label on cover
near connectors

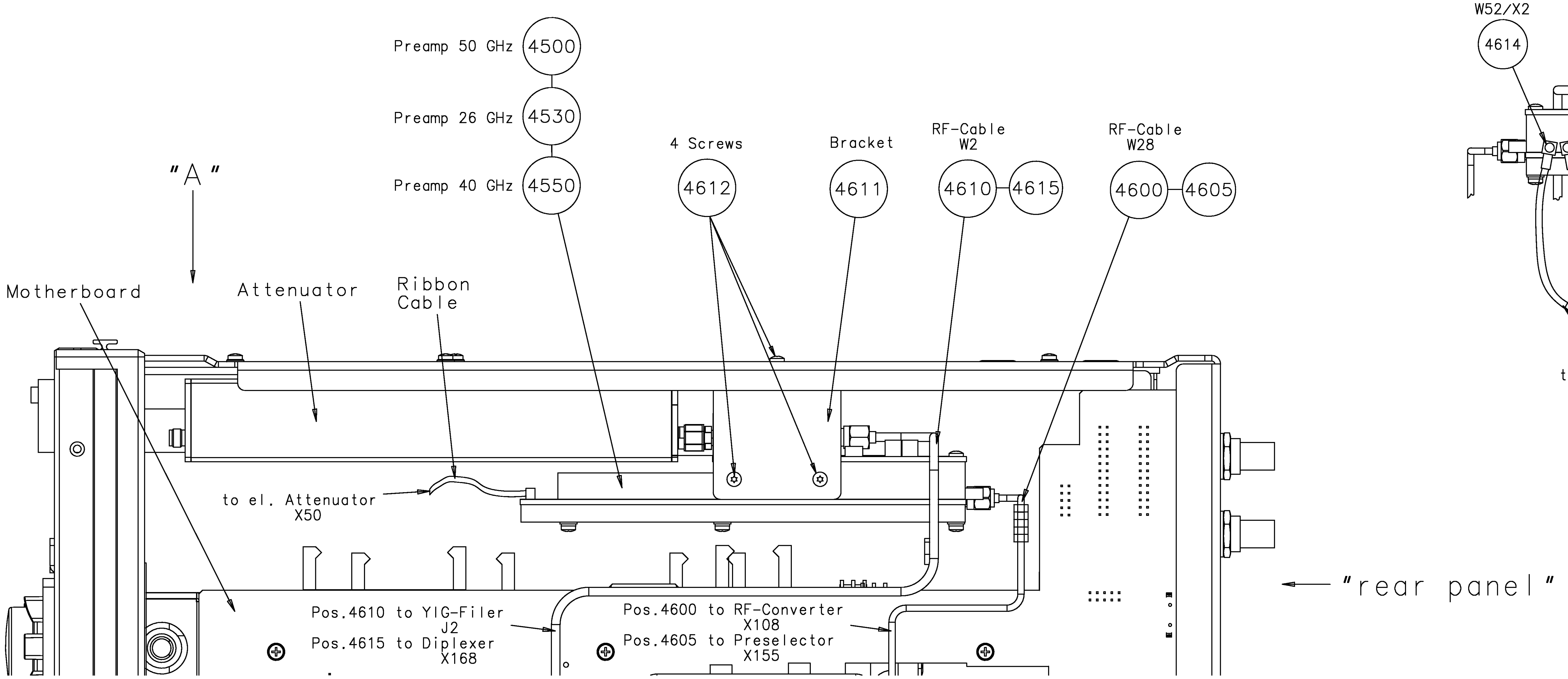
VERSIONS:
MOD41 = FSQ40 (see sheet 2)
MOD42 = ESU40 (see sheet 2)
MOD43 = FSU43
MOD44 = FSMR43 (without YIG)
MOD46 = FSU46
MOD50 = FSU50/FSUP50
MOD51 = FSMR50 (without YIG)
MOD81 = FSQ31 (see sheet 2)
MOD86 = FSU31
MOD90 = FSU32

Maßstab / Scale	1:1	Toleranz / Tol.		Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 50 MW-Converter Unit 50				Sprache / Lang.: de en	Aei. / C.I.: 08.00	Blatt / Sh.: 1
	Datum / Date: 2008-03-04	Abteilung / Dept.: 1ESK	Name: TF		Zeichn.Nr. / Drawing No.: 1166.2096.01		D

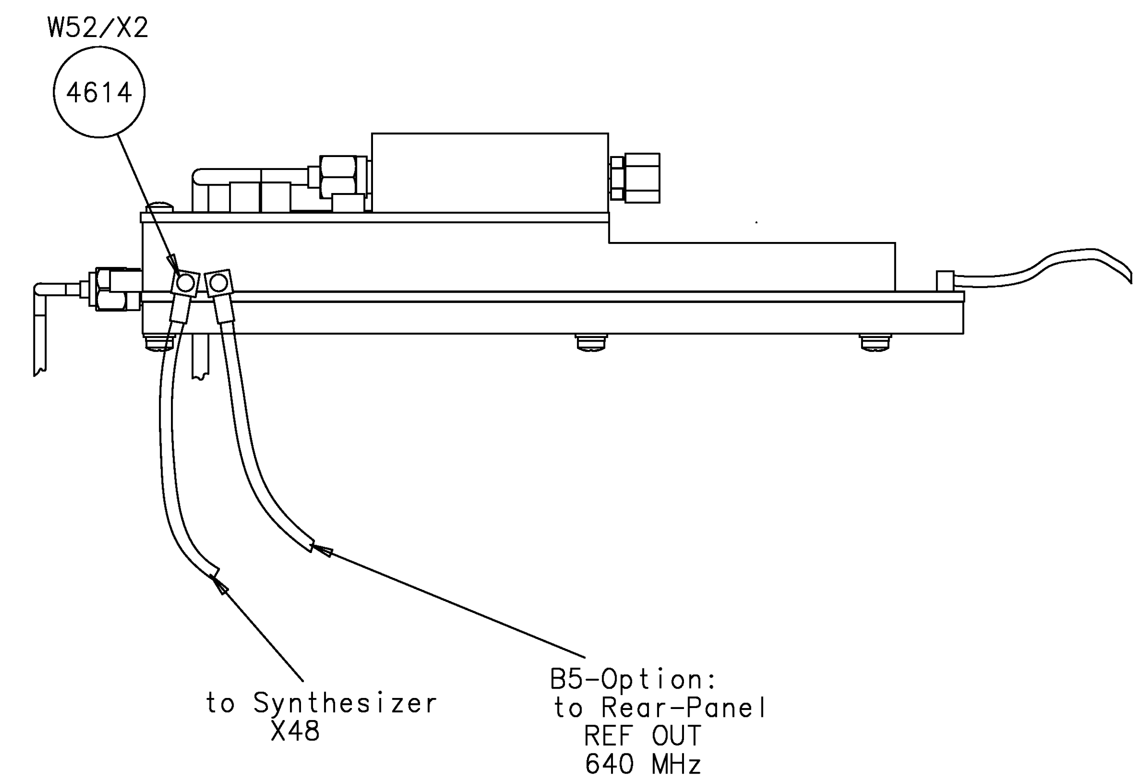
Projektions-methode
Projection Method

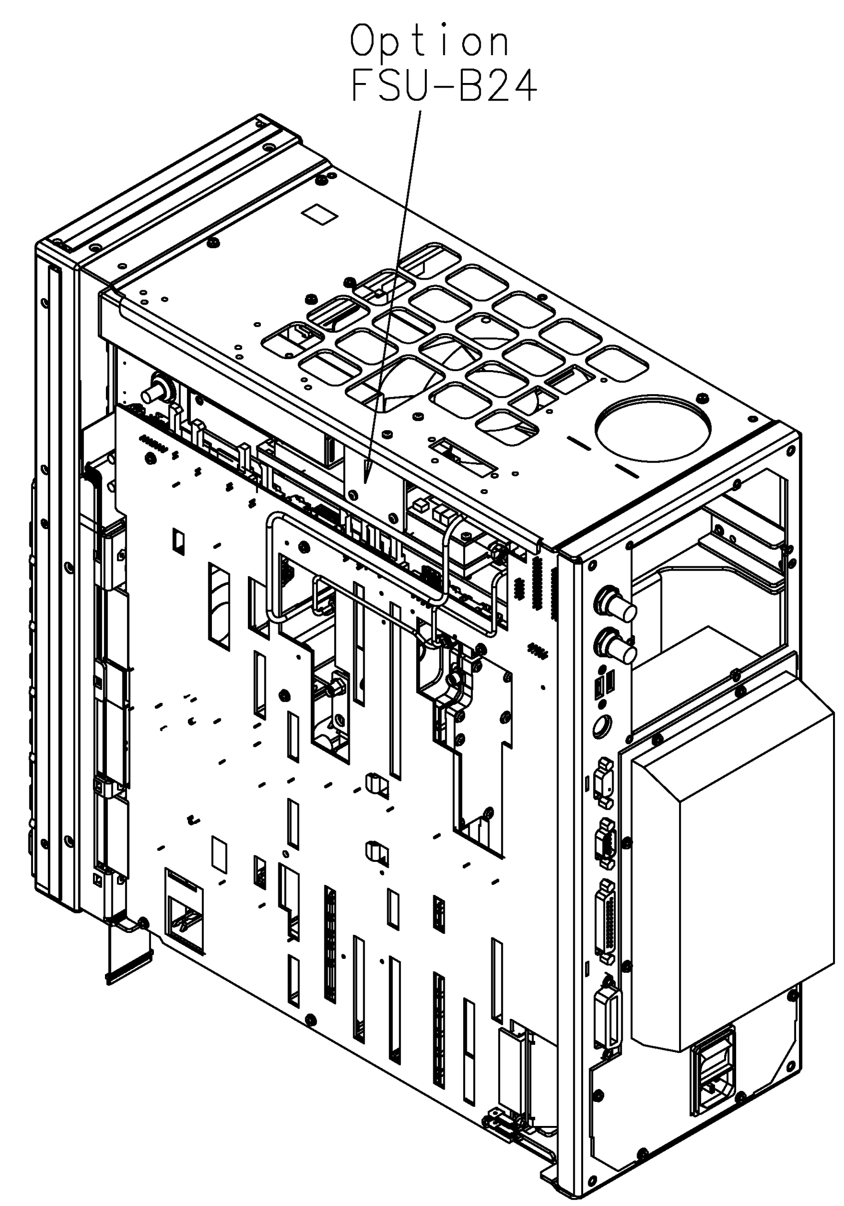


Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSP-B10 INSTALLATION INSTRUCTION		Sprache / Lang.: de en	Aei. / C.I.: 04.00 — Blatt / Sh.: 2
Typ / Type: FSU			Zeichn.Nr. / Drawing No.: 1129.7298.00 D	
i.Z. used in 1129.7246.01	Datum / Date: 29.10.2001	Abteilung / Dept.: 1ESK	Name / Name: Wn	

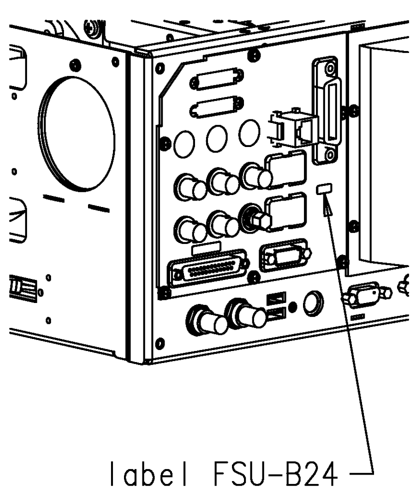


Back View - Option FSU-B24

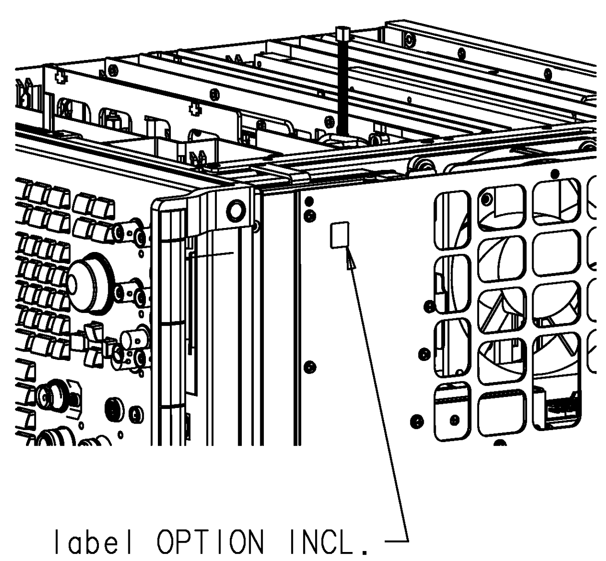




view rear panel



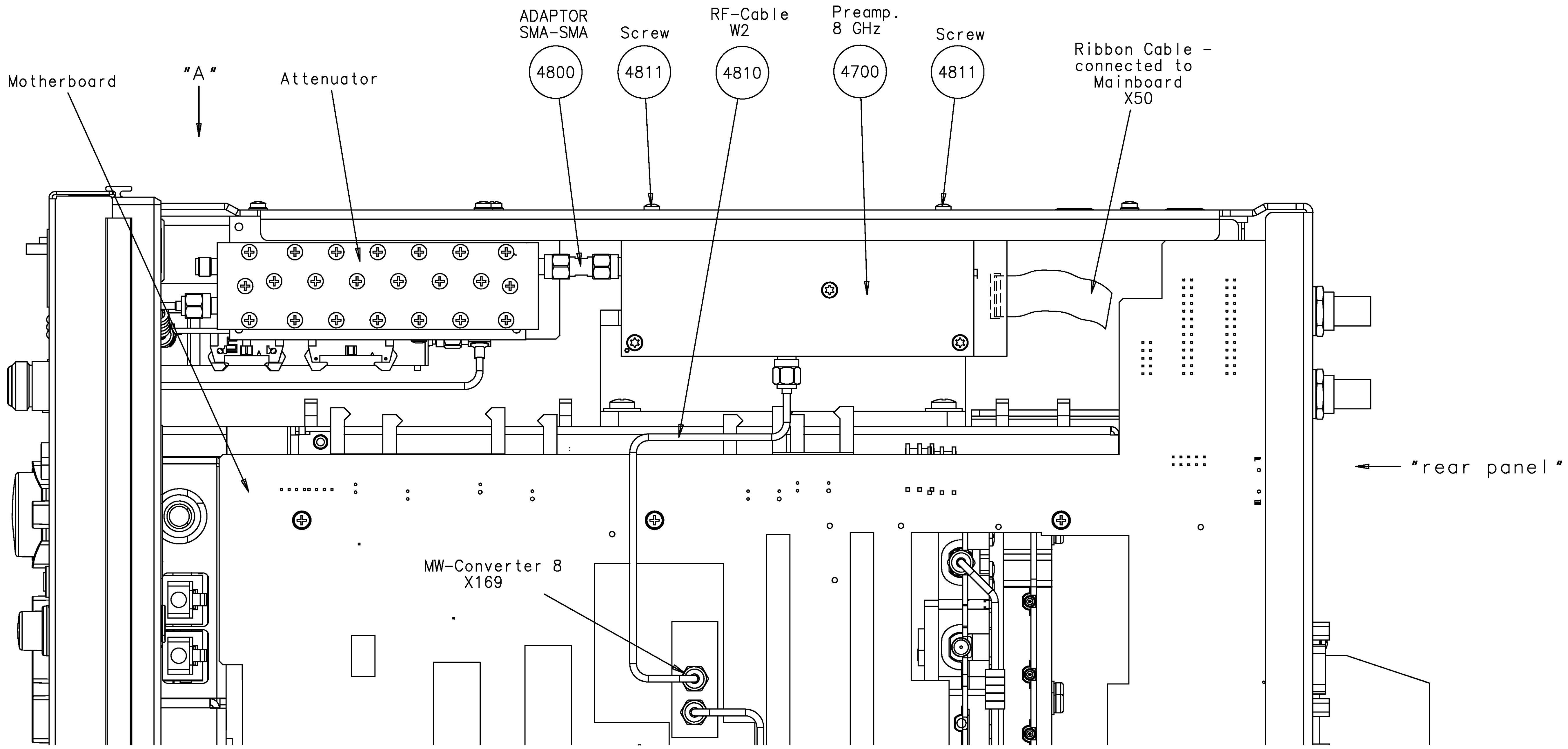
view A



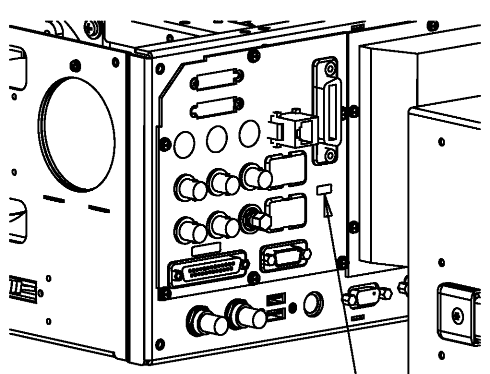
Projektionsmethode
Projection Method

Versions:
MOD26 = Preamplifier 26 GHz
MOD40 = Preamplifier 40 GHz
MOD50 = Preamplifier 50 GHz

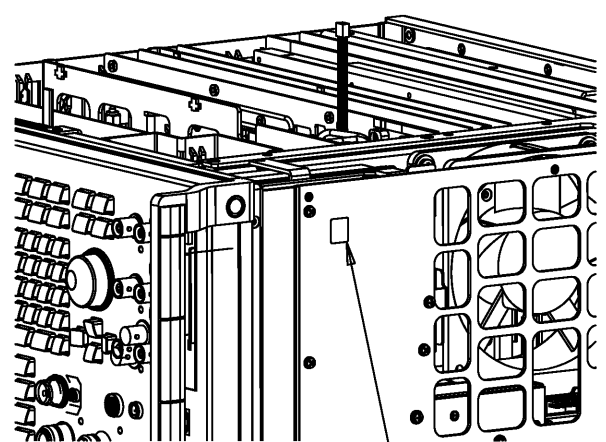
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	Sprache / Lang.	Ael. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation: INSTALL. INSTRUCTION / INSTALL. INSTRUCTION		de en	05.00	1
ESU-B24	Datum / Date: 2007-06-13	Abteilung / Dept.: 1ESK; Name: Wn	Zeichn.Nr. / Drawing No.: 1157.2116.00		D

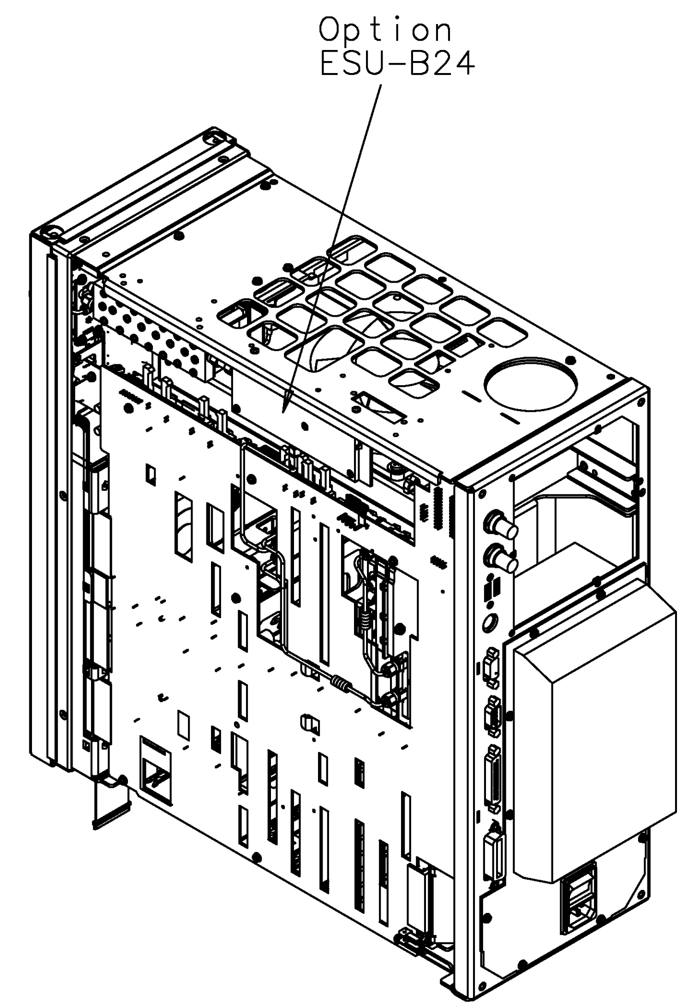


view rear panel



view A



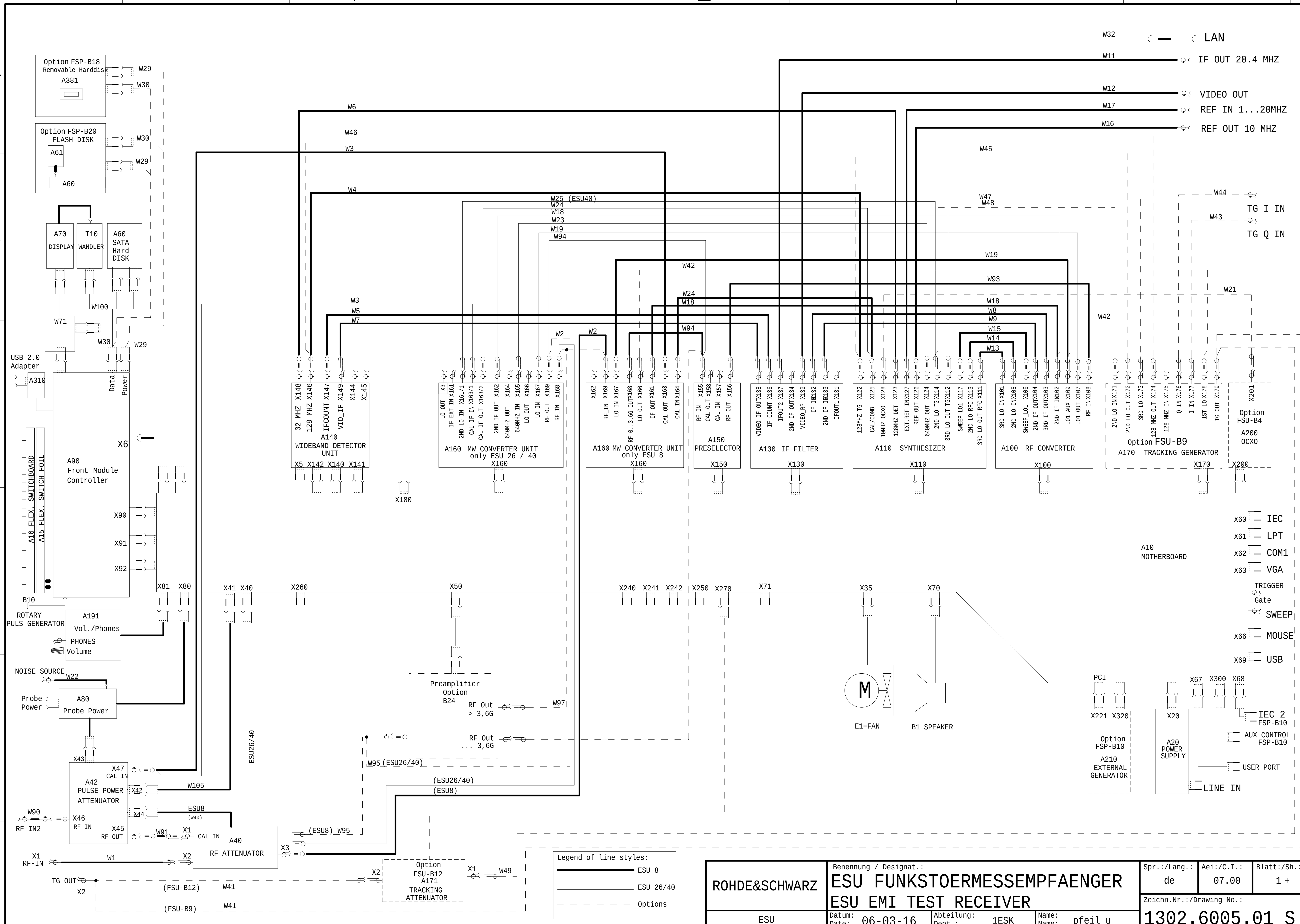


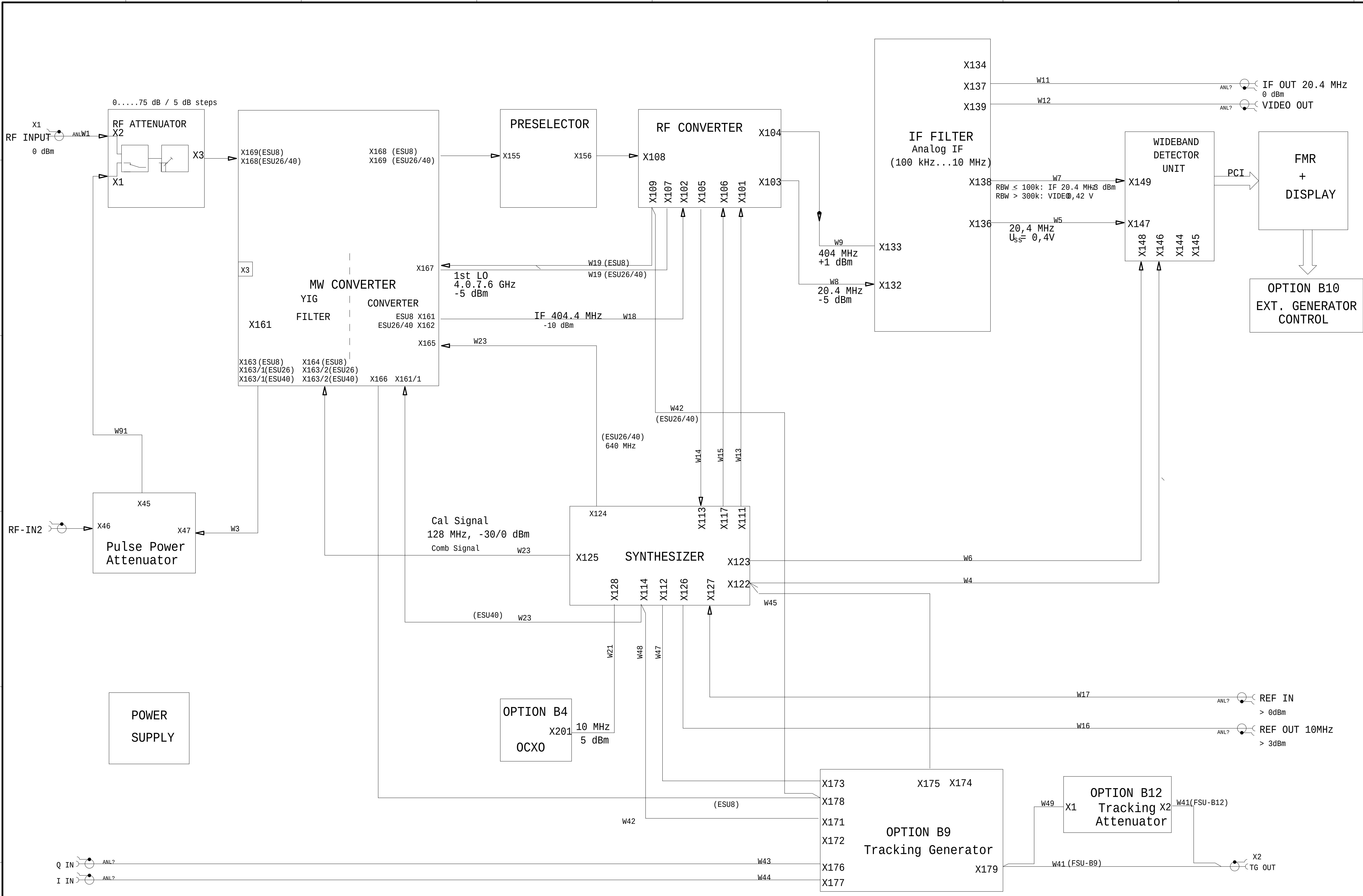
MODEL 08 = Preamplifier 8 GHz

Projektions-methode
Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: INSTALL. INSTRUCTION INSTALL. INSTRUCTION	Sprache / Lang.: de en Ael. / C.I.: 03.00 Blatt / Sh.: 1	Zeichn.Nr. / Drawing No.: 1305.8921.00 D
FSU-B24	Datum / Date: 2007-04-02	Abteilung / Dept.: 1ESK	Name / Name: mi

Block Circuit Diagram


LAN
IF OUT 20.4 MHZ
VIDEO OUT
REF IN 1...20MHZ
REF OUT 10 MHZ
TG I IN
TG Q IN
Option FSP-B18
Removable Harddisk
A381
Option FSP-B20
FLASH DISK
A61
A60
A70
DISPLAY
T10
WANDLER
A60
SATA
Hard
DISK
W71
USB 2.0
Adapter
A310
A90
Front Module
Controller
A16 FLEX. SWITCHBOARD
A15 FLEX. SWITCH FOIL
ROTARY
PULS GENERATOR
A191
Vol./Phones
PHONES
Volume
NOISE SOURCE
Probe
Power
A80
Probe Power
A42
PULSE POWER
ATTENUATOR
RF-IN2
RF-IN
TG OUT
A40
RF ATTENUATOR
Option
FSU-B12
A171
TRACKING
ATTENUATOR
Preamplifier
Option
B24
RF Out
> 3,6G
RF Out
... 3,6G
A140
WIDEBAND DETECTOR
UNIT
A160 MW CONVERTER UNIT
only ESU 26 / 40
A160 MW CONVERTER UNIT
only ESU 8
A150
PRESELECTOR
A130 IF FILTER
A110 SYNTHESIZER
A100 RF CONVERTER
Option FSU-B9
A170 TRACKING GENERATOR
Option
FSU-B4
A200
OCXO
A10
MOTHERBOARD
IEC
LPT
COM1
VGA
TRIGGER
Gate
SWEEP
MOUSE
USB
E1=FAN
B1 SPEAKER
Option
FSP-B10
A210
EXTERNAL
GENERATOR
A20
POWER
SUPPLY
IEC 2
FSP-B10
AUX CONTROL
FSP-B10
USER PORT
LINE IN
Legend of line styles:
ESU 8
ESU 26/40
Options
ROHDE&SCHWARZ
ESU
Benennung / Designat.:
ESU FUNKSTOERMESSEMPFAENGER
ESU EMI TEST RECEIVER
Datum:
Date: 06-03-16
Abteilung:
Dept.: 1ESK
Name:
Name: pfeil_u
Spr.:/Lang.: de
Aei:/C.I.: 07.00
Blatt:/Sh.: 1 +
Zeichn.Nr.:/Drawing No.:
1302.6005.01 S



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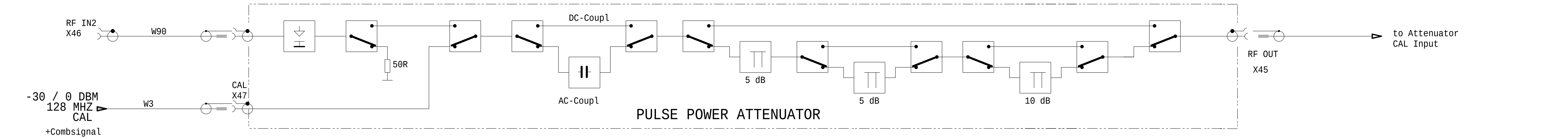
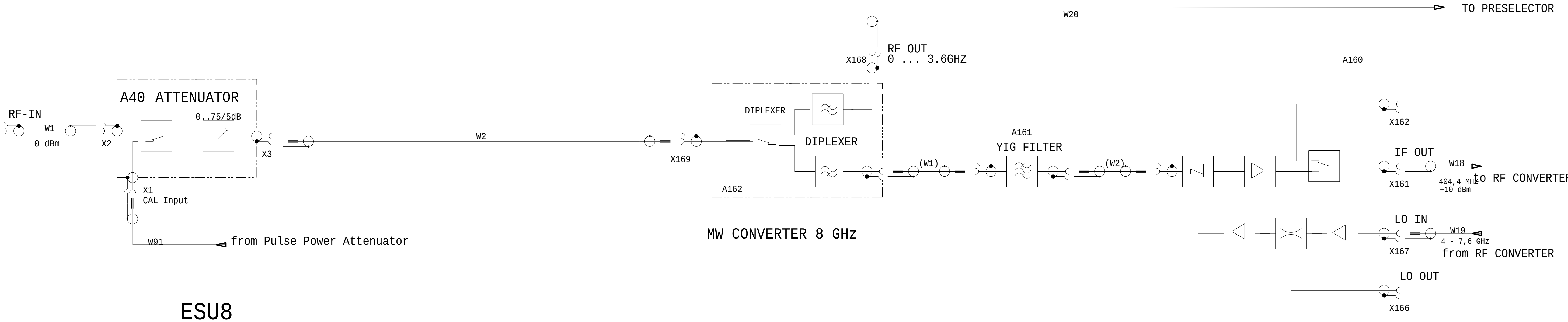
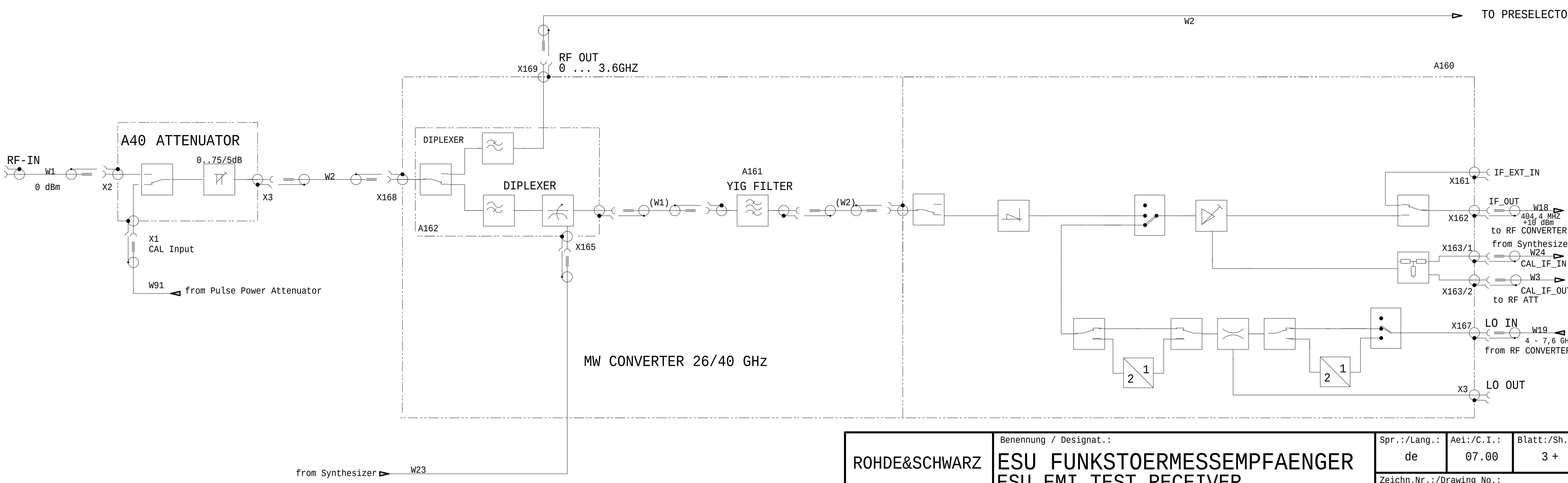
ESU	Datum: / Date: 06-03-16; Abteilung: / Dept.: 1ESK; Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1302.6005.01 S	Blatt:/Sh.: 2 +







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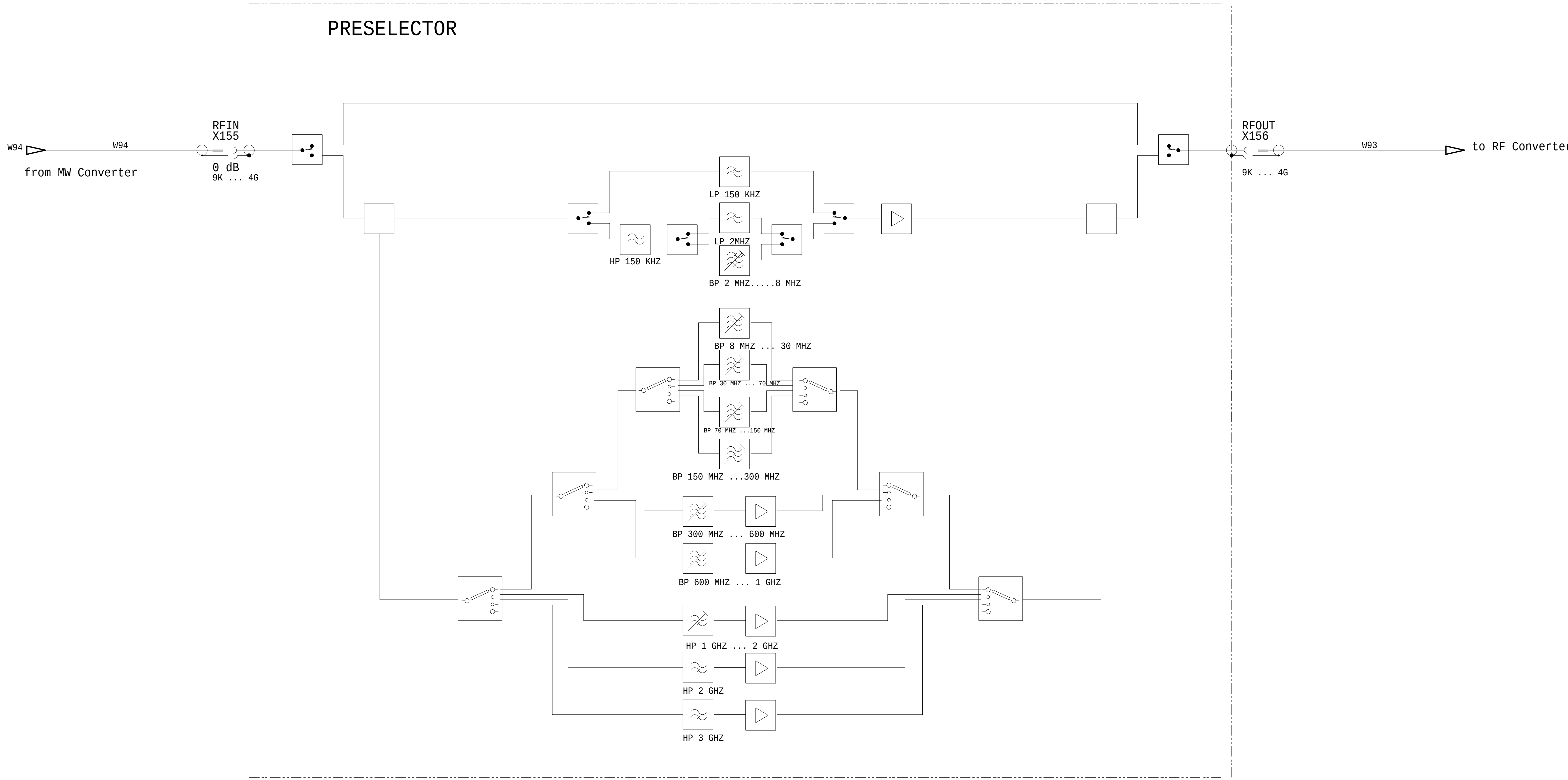

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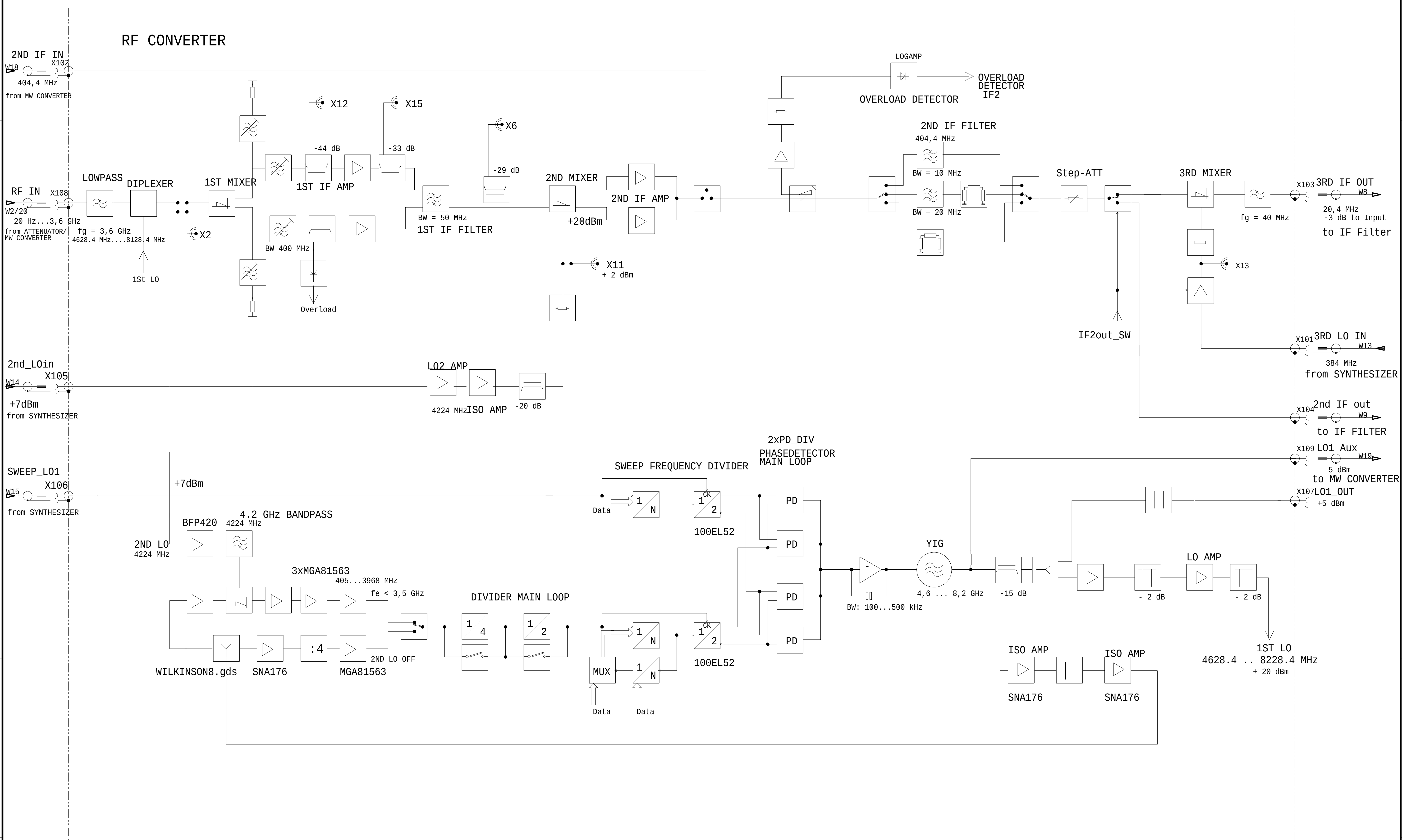

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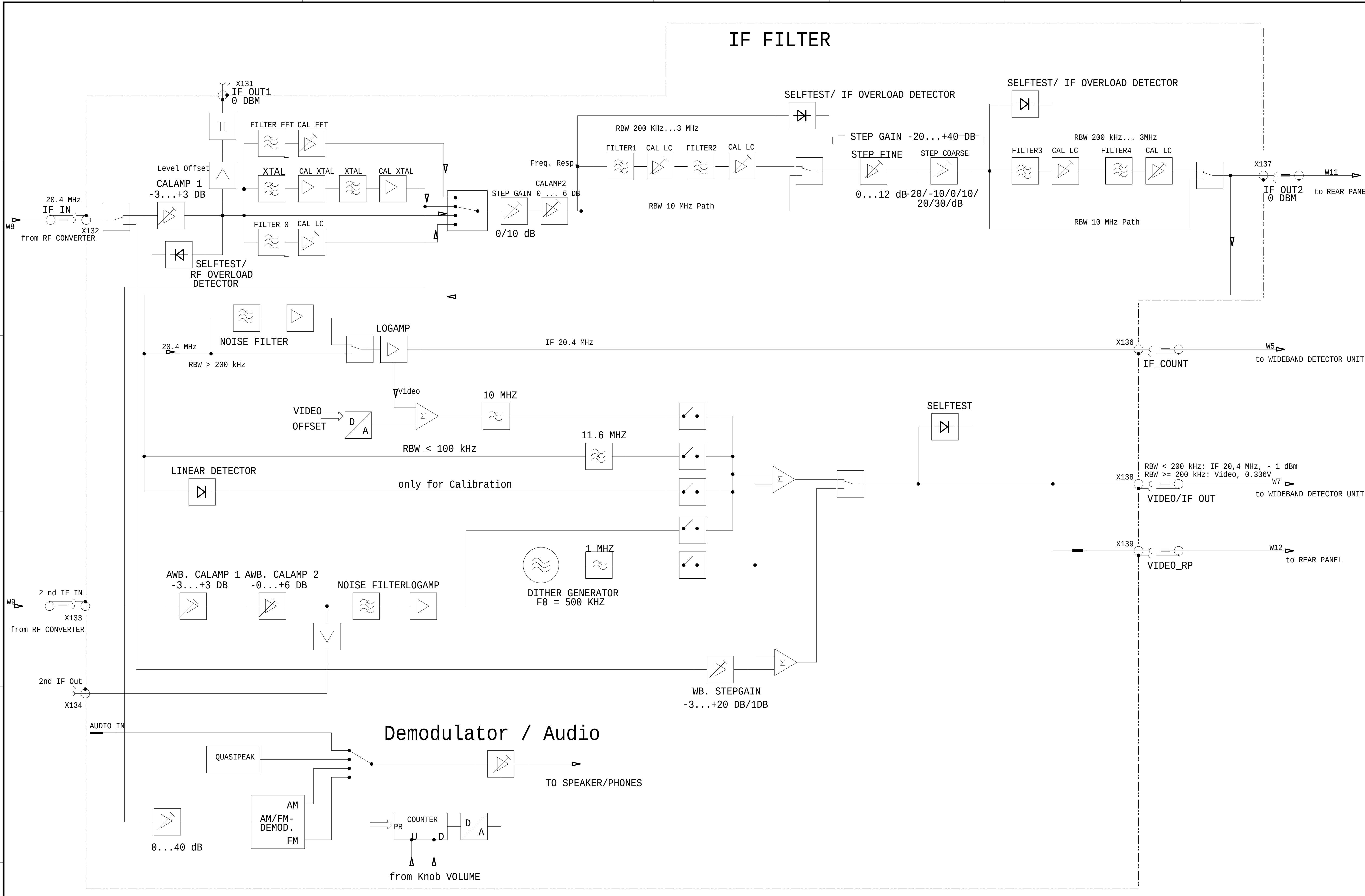
ESU	Datum:/Date: 06-03-16 · Abteilung:/Dept.: 1ESK · Name:/Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1302.6005.01 S		



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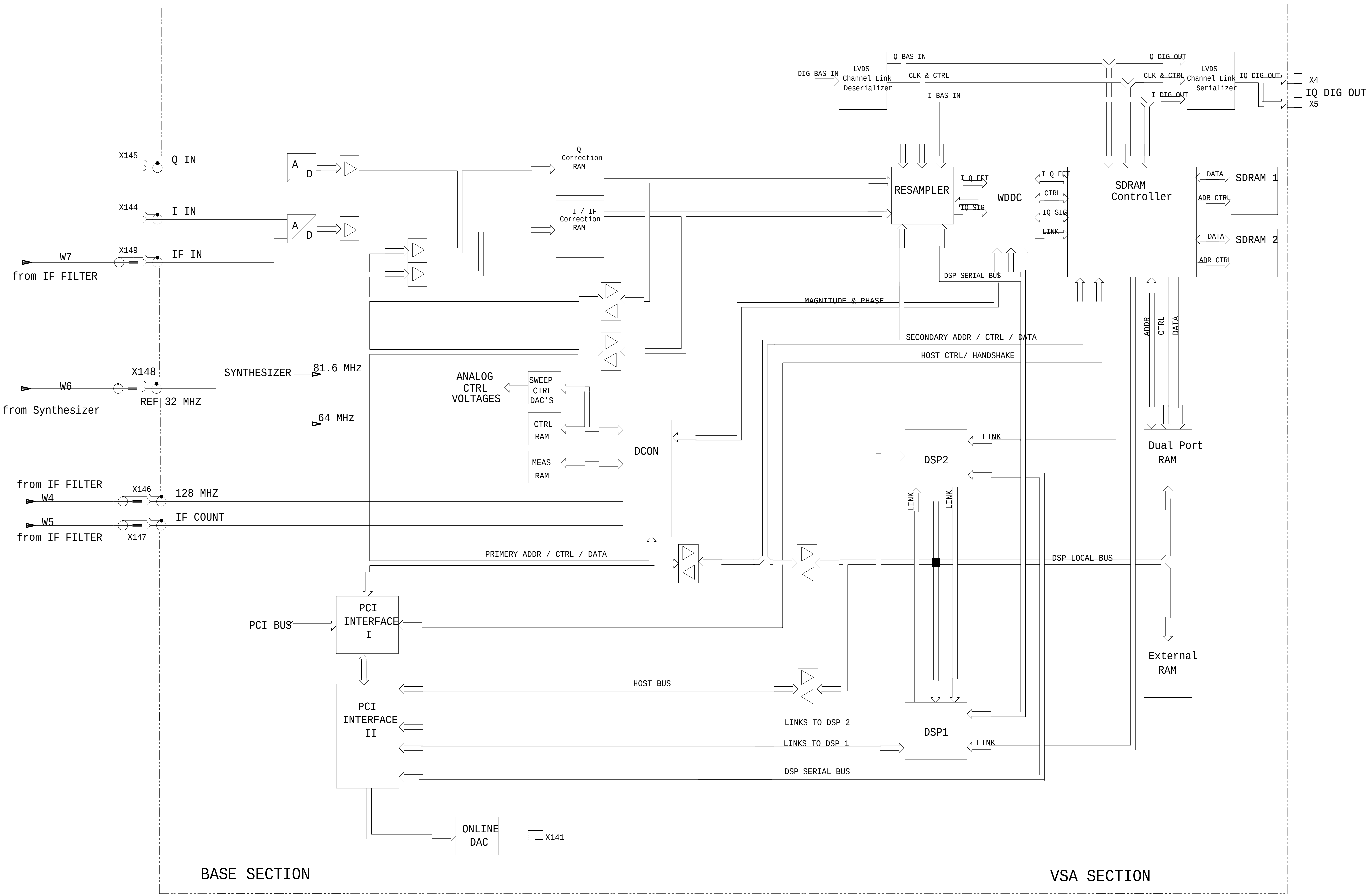
ESU	Datum: Date: 06-03-16 · Abteilung: Dept.: 1ESK · Name: Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1302.6005.01 S		

DETECTOR



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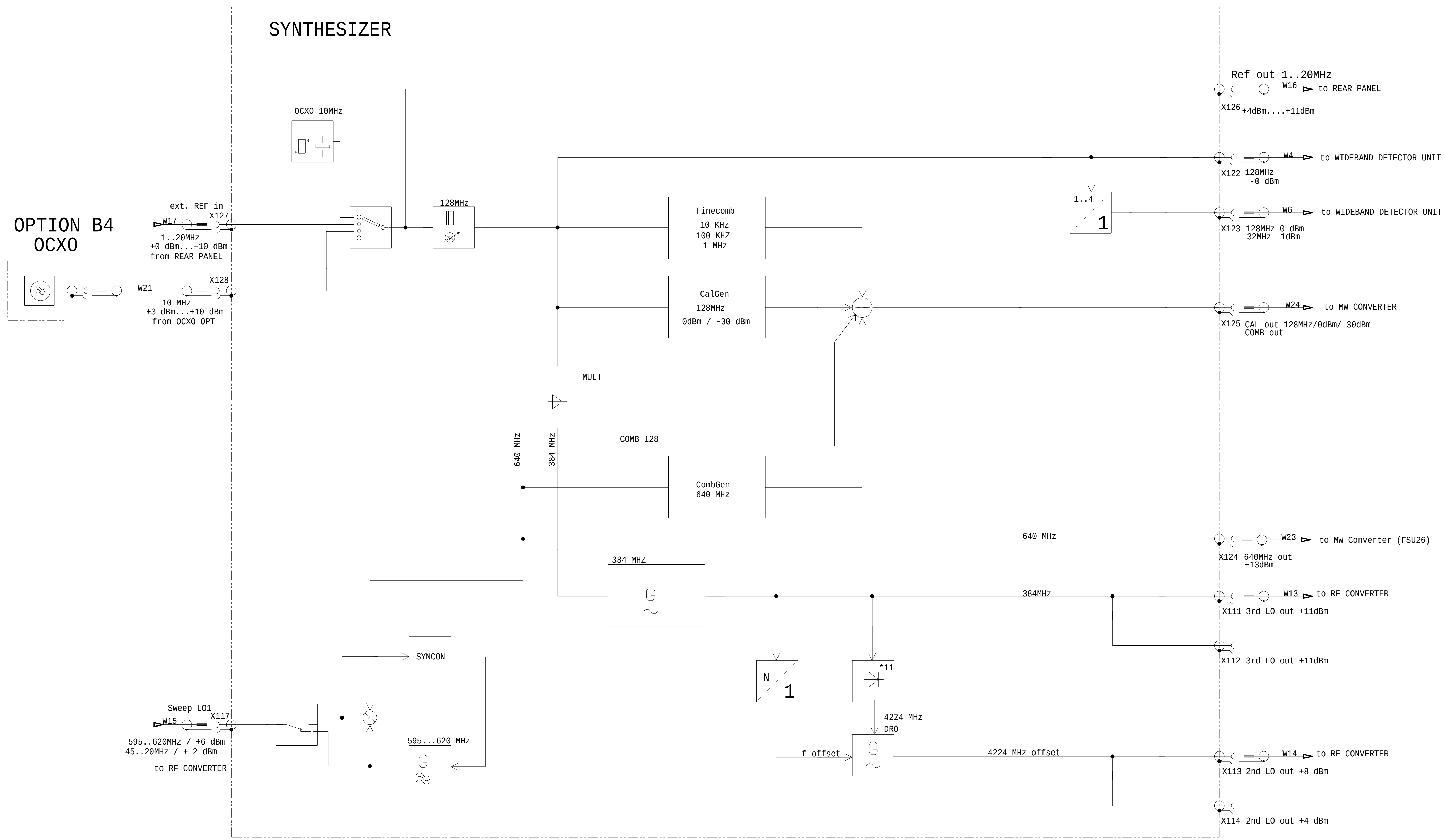
ESU	Datum: Date: 06-03-16 · Abteilung: Dept.: 1ESK · Name: Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1302.6005.01 S		



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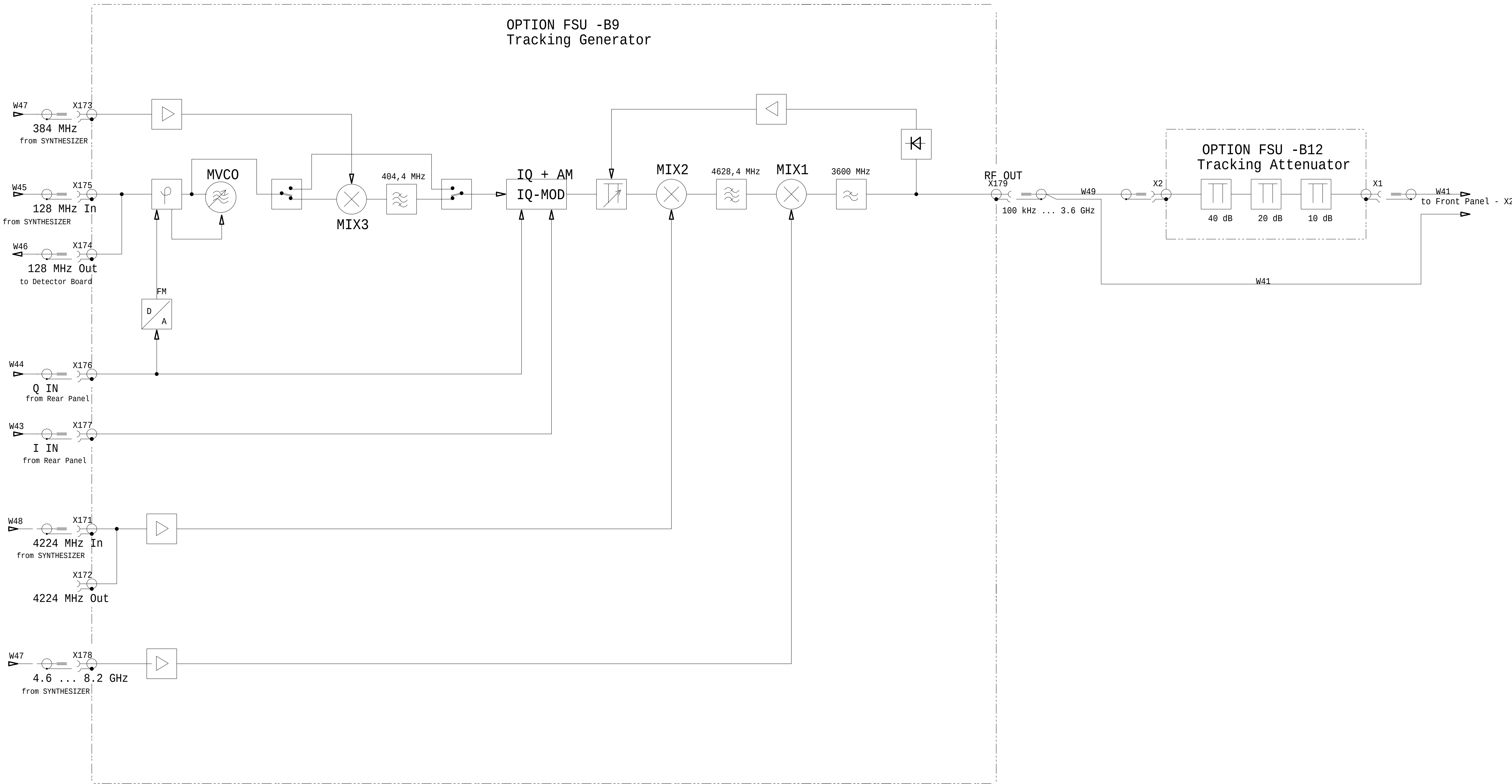

E

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.: ESU FUNKSTOERMESSEMPFAENGER ESU EMI TEST RECEIVER			Spr.:/Lang.: de	Aei:/C.I.: 07.00	Blatt:/Sh.: 9 -
ESU	Datum: Date: 06-03-16	Abteilung: Dept.: 1ESK	Name: Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1302.6005.01 S		