Service Manual Instrument

Spektrum Analyzer

R&S® FSU3
1166.1660.03

R&S® FSU8
1166.1660.08

R&S® FSU26
1166.1660.26

R&S® FSU31
1166.1660.31

R&S® FSU32
1166.1660.32

R&S® FSU43
1166.1660.43

R&S® FSU46
1166.1660.46

R&S® FSU50
1166.1660.50

Printed in the Federal
Republic of Germany

ROHDE & SCHWARZ
Test and Measurement Division

Dear Customer,

throughout this operating manual, the abbreviation FSU is used for your Spectrum Analyzer R&S® FSU.

Tabbed Divider Overview

Index

Index

L

M

N

O

P

R

S

T

V

Before putting the product into operation for the first time, make sure to read the following

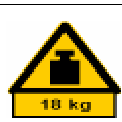
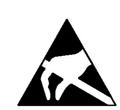
Safety Instructions

Rohde & Schwarz makes every effort to keep the safety standard of its products up to date and to offer its customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance with the relevant safety standards. Compliance with these standards is continuously monitored by our quality assurance system. This product has been designed 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, observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, Rohde & Schwarz 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 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 an intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its operating manual and within its performance limits (see data sheet, documentation, the following safety instructions). Using the products requires technical skills and knowledge of English. It is therefore essential that the products be used exclusively by skilled and specialized staff or thoroughly trained personnel with the required skills. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation.

Symbols and safety labels

							
Observe operating instructions	Weight indication for units >18 kg	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Attention! Electrostatic sensitive devices

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

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 putting the product into operation. It is also absolutely essential to observe the additional safety instructions on personal safety that appear in other parts of the documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by Rohde & Schwarz, including instruments, systems and all accessories.

Tags and their meaning

DANGER	This tag indicates a safety hazard with a high potential of risk for the user that can result in death or serious injuries.
WARNING	This tag indicates a safety hazard with a medium potential of risk for the user that can result in death or serious injuries.
CAUTION	This tag indicates a safety hazard with a low potential of risk for the user that can result in slight or minor injuries.
ATTENTION	This tag indicates the possibility of incorrect use that can cause damage to the product.
NOTE	This tag indicates a situation where the user should pay special attention to operating the product but which does not lead to damage.

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

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
   prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude max. 2000 m.
   Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.
2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.

4. If products/components are mechanically and/or thermically 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, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
5. If handling the product yields 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.
6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.
7. Operating the products requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to handle operating the products; otherwise injuries or material damage may occur. It is the responsibility of the employer to select suitable personnel for operating the products.
8. Prior to switching on the product, it must be ensured 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.
9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.
10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.
12. Never use the product if the power cable is damaged. 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 e.g. tripping over the cable or suffering an electric shock.
13. The product may be operated only from TN/TT supply networks fused with max. 16 A.
14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise this can result in sparks, fire and/or injuries.
15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
16. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.
18. Never remove the cover or part of the housing while you are operating the product. This will expose circuits and components and can lead to injuries, fire or damage to the product.

19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a skilled electrician.
20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.
21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.
22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.
23. Rohde & Schwarz products are not protected against penetration of water, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock or damage to the product, which can also lead to personal injury.
24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.
25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.
26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.
27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries are hazardous waste. Dispose of them only in specially marked containers. Observe local regulations regarding waste disposal. Do not short-circuit batteries or storage batteries.
28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.
29. Please be aware of the weight of the product. Be careful when moving it; otherwise you may injure your back or other parts of your body.
30. 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).
31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.
32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle; the manufacturer assumes no responsibility for accidents or collisions.
33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.

Por favor lea imprescindiblemente antes de la primera puesta en funcionamiento las siguientes informaciones de seguridad

Informaciones de seguridad

Es el principio de Rohde & Schwarz de tener a sus productos siempre al día con los estandards de seguridad y de ofrecer a sus clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. Este producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los estandards técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, deberá el usuario atenerse a todas las informaciones, informaciones de seguridad y notas de alerta. 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 solamente fue elaborado para ser utilizado en la indústria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del maluso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado dentro de las instrucciones del correspondiente manual del uso y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso de los productos hace necesarios conocimientos profundos y el conocimiento del idioma inglés. Por eso se deberá tener en cuenta de exclusivamente autorizar para el uso de los productos a personas péritas o debidamente minuciosamente instruidas con los conocimientos citados. Si fuera necesaria indumentaria de seguridad para el uso de productos de R&S, encontrará la información debida en la documentación del producto en el capítulo correspondiente.

Símbolos y definiciones de seguridad

Ver manual de instrucciones del uso	Informaciones para maquinaria con uns peso de > 18kg	Peligro de golpe de corriente	¡Advertencia! Superficie caliente	Conexión a conductor protector	Conexión a tierra	Conexión a masa conductora	¡Cuidado! Elementos de construción con peligro de carga electroestática

potencia EN MARCHA/PARADA	Indicación Stand-by	Corriente continua DC	Corriente alterna AC	Corriente continua/alterna DC/AC	El aparato está protegido en su totalidad por un aislamiento de doble refuerzo

Tener en cuenta las informaciones de seguridad sirve para tratar de evitar daños y peligros de toda clase. Es necesario de que se lean las siguientes informaciones de seguridad concienzudamente y se tengan en cuenta debidamente antes de la puesta en funcionamiento del producto. También deberán ser tenidas en cuenta las informaciones para la protección de personas que encontrarán en otro capítulo de esta documentación y que también son obligatorias de seguir. En las informaciones de seguridad actuales hemos juntado todos los objetos vendidos por Rohde&Schwarz bajo la denominación de „producto“, entre ellos también aparatos, instalaciones así como toda clase de accesorios.

Palabras de señal y su significado

PELIGRO	Indica un punto de peligro con gran potencial de riesgo para el ususario.Punto de peligro que puede llevar hasta la muerte o graves heridas.
ADVERTENCIA	Indica un punto de peligro con un protencial de riesgo mediano para el usuario. Punto de peligro que puede llevar hasta la muerte o graves heridas .
ATENCIÓN	Indica un punto de peligro con un protencial de riesgo pequeño para el usuario. Punto de peligro que puede llevar hasta heridas leves o pequeñas
CUIDADO	Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
INFORMACIÓN	Indica una situación en la que deberían seguirse las instrucciones en el uso del producto, pero que no consecuentemente deben de llevar a un daño del mismo.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el ámbito de la comunidad económica europea. Pueden existir definiciones diferentes a esta definición. Por eso se debera tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación 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 malinterpretaciones y tener por consecuencia daños en personas u objetos.

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S válido lo que sigue:
   como posición de funcionamiento se define principialmente la posición con el suelo de la caja para abajo , modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar.
   A menos que se especifique otra cosa en la hoja de datos, se aplicará una tolerancia de ±10% sobre el voltaje nominal y de ±5% sobre la frecuencia nominal.
2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal périto autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Despues de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de

seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se producieran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averigurar los motivos de estas reacciones.

4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.

5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberan ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.

6. Ciertos productos, como por ejemplo las instalaciones de radiación HF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario está comprometido a valorar y señalar areas de trabajo en las que se corra un riesgo de exposición a radiaciones aumentadas de riesgo aumentado para evitar riesgos.

7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.

8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del prodcuto.

9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.

10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto ya que puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro, que es controlado su estado técnico de seguridad.

11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (medida del cable de distribución aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en construciones o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

12. No utilice nunca el producto si está dañado el cable eléctrico. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.
13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A.
14. 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. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.
15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.
16. En las mediciones en circuitos de corriente con una tensión de entrada de Ueff > 30 V se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos de la EC950/EN60950.
18. Nunca abra la tapa o parte de ella si el producto está en funcionamiento. Esto pone a descubierto los cables y componentes eléctricos y puede causar heridas, fuego o daños en el producto.
19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efecutadas por un electricista especializado.
20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, deberá la toma de corriente estar protegida de manera que los productos o los usuarios estén suficientemente protegidos.
21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir corto circuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.
22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.
23. Los productos R&S no están protegidos contra el agua si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente o de daños en el producto lo cual también puede llevar al peligro de personas.
24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.
25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.
26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención celulas de Litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Baterías y acumuladores son deshechos problemáticos. Por favor tirenlos en los recipientes especiales para este fín. Por favor tengan en cuenta las prescripciones nacionales de cada país referente al tratamiento de deshechos. Nunca sometan las baterías o acumuladores a un corto circuito.
28. Tengan en consideración de que en caso de un incendio pueden escaparse gases tóxicos del producto, que pueden causar daños a la salud.
29. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.
30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).
31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujecion en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetados de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean tenidas en cuenta. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.
32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo y el fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.
33. Dado el caso de que esté integrado un producto de laser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación. De otra manera pondrá en peligro su salud, ya que el rayo laser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo laser.

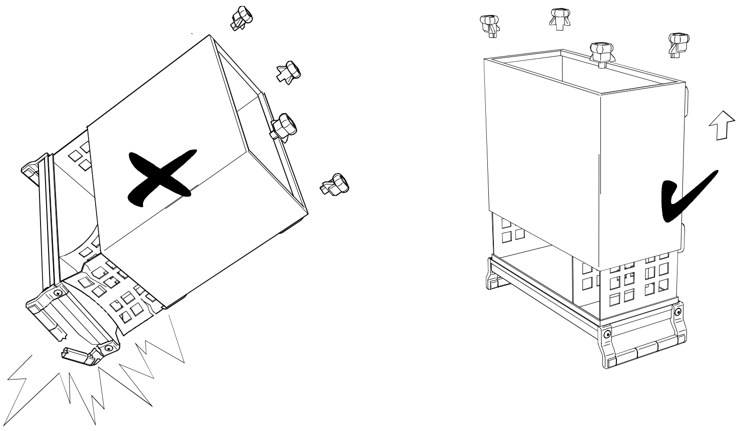
Safety Instructions

WARNING

Danger of injuries

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

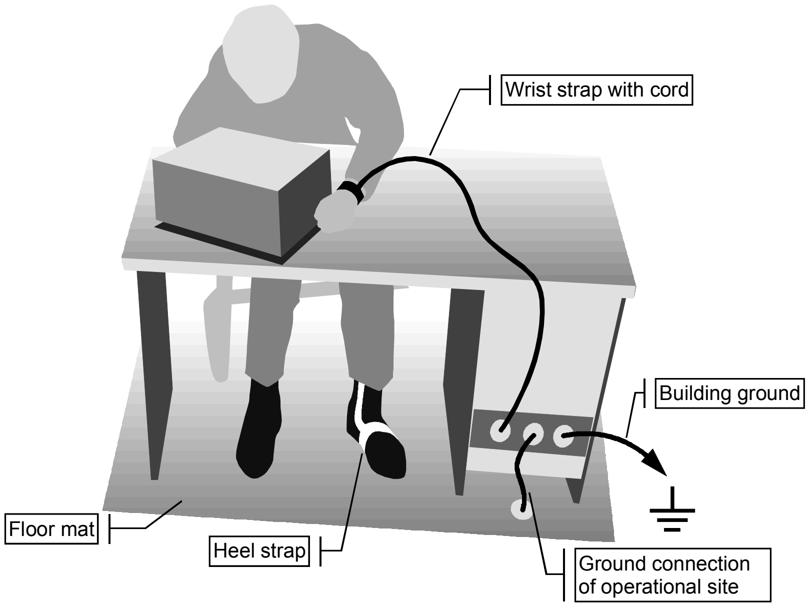
Put the unit onto the front handles, before removing the rear feet and taking off the cabinet. Thus the risk of personal injuries and damages to the unit is avoided.



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

ATTENTION

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*

Spare Parts Express Service

Phone: **+49 89 4129 - 12465**

Fax: **+49 89 4129 - 13306**

E-mail:werner.breidling@rsd.rohde-schwarz.com

In case of urgent spare parts requirements for this Rohde & Schwarz unit, please contact our spare parts express service.

Outside business hours, please leave us a message or send a fax or e-mail. We shall contact you promptly.

Contents of Manuals for R&S FSU

Service Manual - Instrument

The service manual - instrument informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S FSU by the replacement of modules.

The service manual comprises four chapters and an annex (chapter 5) containing the R&S FSU circuit documentation:

Chapter 1 provides all the information necessary to check for compliance with rated specifications. The required test equipment is included, too.

Chapter 2 describes the manual adjustment of the calibration source and of the frequency accuracy as well as the automatic adjustment of individual module data following module replacement.

Chapter 3 describes the design as well as simple measures for repair and fault diagnosis, in particular, the replacement of modules.

Chapter 4 contains information on the extension and modification by installing instrument software and retrofitting options.

Chapter 5 describes the shipping of the instrument and ordering of spare parts and contains spare parts lists and exploded views.

Operating Manual

In the operating manual you will find information about the technical specifications, the controls and connectors on the front and rear panel, necessary steps for putting the instrument into operation, the basic operating concept, manual and remote control.

For introduction typical measurement tasks are explained in detail using the functions of the user interface and program examples.

The operating manual further provides hints on preventive maintenance and fault diagnosis by means of warnings and error messages output by the unit.

Service and Repair

Please contact your Rohde & Schwarz support center or our spare parts express service if you need service or repair of your equipment or to order spare parts and modules.

The list of the Rohde & Schwarz representatives and the address of our spare parts express service are provided at the beginning of this service manual.

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

- Instrument model
- Serial number
- Firmware version
- Detailed error description in case of repair
- Contact partner for checkbacks

Rohde & Schwarz offers the following calibrations:

- Calibration on R&S-type test systems. The calibration documentation meets the requirements of the quality management system ISO 9000.
- Calibration at an R&S calibration center approved by the German Calibration Service (DKD). The calibration documentation consists of the DKD calibration certificate.

Refer to Chapter 5 for a detailed description on shipping of the instrument and ordering of spare parts.

Contents - Chapter 1 "Performance Test"

1 Performance Test

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]*.
- 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**]

Note: *The R&S FSU 31 is tested as R&S FSU 46, the maximum input frequency is limited to 31 GHz. The R&S FSU 32 is tested as R&S FSU 50, the maximum input frequency is limited to 31 GHz.*

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	FSU 3: 10 MHz to 3.6 GHz FSU 8: 10 MHz to 8 GHz FSU 26: 10 MHz to 27 GHz FSU 43/46/50: 10 MHz to 50 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
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 MHz	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	FSU 3: 10 MHz to 3.6GHz FSU 8: 10 MHz to 8 GHz FSU 26: 10 MHz to 26.5 GHz FSU 43/46/50: 10 MHz to 50 GHz	HP 11667B (Agilent) HP 11667C + adapter to K (Agilent)		Frequency response >3.6 GHz; Third-Order Intercept

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
		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 40 GHz to 50 GHz ≤ 0.6 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 22 GHz to 40 GHz ≤ 1.7			
9	50-Ohm termination	FSU 3: 10 MHz to 3.6GHz FSU 8: 10 MHz to 8 GHz FSU 26: 10 MHz to 26.5 GHz FSU 43/46/50: 10 MHz to 50 GHz	R&S RNA Wiltron 28S50 85138A (Agilent)	85138A	Noise display
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 B21: Test LO output power
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	FSU 3: 10 MHz to 3.6GHz FSU 8: 10 MHz to 8 GHz FSU 26: 10 MHz to 26.5 GHz FSU 43/46/50: 10 MHz to 50 GHz -30 to 0 dBm VSWR / cal fact. unc. % 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 40 to 50 GHz 1.5 5	R&S NRV-Z2 R&S NRV-Z2 R&S NRV-Z55 R&S NRV-Z55	HP 8487 A (Agilent)	Frequency response > 3.6 GHz B21: Test LO output power
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 FSU-Z2	Verification Kit Attenuator HP 11812 A (Agilent)	Display Linearity (alternative measurement)

Item	Type of equipment	Specifications recommended	Equipment recommended	Alternative equipment	Use
16	Fixed Attenuator (2 units)	fixed attenuation 10 dB	43KC-10 (Anritsu)	8490D-010 (Agilent)	Third-Order Intercept B21: Test LO output power
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 rejection >35 dB at 580 MHz Filter 3 cut-off >1800 MHz rejection >35 dB at 3600 MHz		HP 0955-0306 HP 0955-0455 HP 0955-0491 (Agilent)	2 nd--order harmonic distortion.
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	FSU 3: 20(50) MHz to 3.6GHz FSU 8: 20 (50) MHz to 8 GHz FSU 26: 20 (50) MHz to 26.5 GHz FSU 43/46/50: 20 (50) MHz to 40 GHz	R&S ZVK	HP 8722C E8363B (Agilent)	VSWR > 20 (50) MHz
24		Not used			
25		Not used			
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)	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	R&S FSU see also item 5	E4404B ESA-E (Agilent)	B9: test of modulation
30	IQ-Base Band Generator	Frequency range up to 10 MHz 2 sinusoidal signals with 90 deg phase difference	AMIQ	Alternative item 26	B9: test of modulation

[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
31	WinIQSIM	PC test program for AMIQ		Alternative item 26	B9: Generation of data for modulation test.
32	Software: Modulation test 100 kHz	Setup files for AMIQ with modulated signal 100 kHz		Alternative item 26	B9: test FM
33	Software modulation test 1 MHz + 90 degrees	AMIQ setup file to generate 2 base band signals of 1 MHz with + 90 deg phase shift between I- and Q- channel		Alternative item 26	B9: test AM; Test of I/Q-modulation with + 90 deg phase shift
34	Software modulation test 1 MHz - 90 degrees	AMIQ setup file to generate 2 base band signals of 1 MHz with - 90 deg phase shift between I- and Q- channel		Alternative item 26	B9: test AM; Test of I/Q-modulation with – 90 deg phase shift
35	PC	Windows, LAN and RSIB SW or GPIB interface		Alternative item 26	frequency response of IQ-path B9,
36	DC-current meter	max. current 50 mA uncertainty +/- 0.01 mA			B21: mixer bias current source

Performance Test FSU

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 FSU must be switched to an internal reference source.

Note: *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 (chapter "Measuring Equipment and Accessories", 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.of the R&S FSU.

R&S FSU 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)

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

B88 option IP2:
For instruments equipped with the RF converter model 06, increased limit values are valid in the range from 800 MHz to 1000 MHz.

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 0.35E-7)

Measurement with Frequency Counter:

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

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

R&S FSU 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

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

Checking Immunity to Interference

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

Frequency range	R&S FSU 3, 8:	10 MHz to 13 GHz
	R&S FSU 26:	10 MHz to 27 GHz
	R&S FSU43:	10 MHz to 43 GHz
	R&S FSU46:	10 MHz to 46 GHz
	R&S FSU 50:	10 MHz to 50 GHz
maximum level	≥ 0 dBm	

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

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

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

1st IF Image Frequency Rejection

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

Additional R&S FSU 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}

2nd IF Image Frequency Rejection

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

Additional R&S FSU 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}

3rd IF Image Frequency Rejection

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

Additional FSU 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}

1st IF Rejection

Additional signal generator settings:	- Frequency 4628.4 MHz
Additional R&S FSU 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}

2nd IF Rejection

Additional signal generator settings:	- Frequency +/- 808.8 MHz see table "performance test report" for explanation of "+/-"
Additional R&S FSU 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}

Checking Nonlinearities

Third-Order Intercept Point

Test equipment:	- 2 signal generators R&S FSU 3: Section "Measurement Equipment", item 2 Frequency range: R&S FSU 3: 10 MHz to 3.6 GHz R&S FSU 8: 10 MHz to 8 GHz R&S FSU 26: 10 MHz to 27 GHz R&S FSU 43/46/50: 10 MHz to 40 GHz - 2 attenuators (Section "Measurement Equipment", item 16) Attenuation a_{ATT} = 10 dB Frequency range: R&S FSU 3: 10 MHz to 3.6 GHz R&S FSU 8: 10 MHz to 8 GHz R&S FSU 26: 10 MHz to 26.5 GHz R&S FSU 43/46/50: 10 MHz to 40 GHz - Power splitter/combiner (Section "Measurement Equipment", item 8) Frequency range: R&S FSU 3: 10 MHz to 3.6 GHz R&S FSU 8: 10 MHz to 8 GHz R&S FSU 26: 10 MHz to 26.5 GHz FSU 43/46/50: 10 MHz to 40 GHz
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 of the R&S FSU.
Signal generator settings: (both generators)	- Frequency: generator 1 $f_{g1} = f_{in} - 50$ kHz generator 2 $f_{g2} = f_{in} + 50$ kHz See tstof performance test report for values of f_{in} ➢ Adjust the output level of the signal generators for an input level at the R&S FSU of –10 dBm. ➢ Switch off the ALC of the generators to reduce the interference between the generators
FSU settings:	- [**PRESET**] - [**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].
Note:	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.

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 lowpass filter with a suitable cut-off frequency (Section "Measurement Equipment", item 13) after the generator.

Test setup:

- Connect RF output of signal generator to the input of the lowpass
- Connect the output of the lowpass to the RF input of the R&S FSU

Note:

If the harmonic suppression of the signal generator is sufficient, the lowpass can be left out.
The RF output of the generator can be connected directly to the RF input of the R&S FSU *in this case.*

Signal generator settings:

- Level: 0 dBm
- Frequency: f_{in}

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

FSU settings:

- [**PRESET**]
- [**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 FSU 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}

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 of the R&S FSU.

Checking the bandwidth switching level accuracy

Reference measurement (RBW 10 kHz)

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

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

Additional FSU setting for RBW = 50 MHz: - [**MKR** ⇒ : SEARCH LIMITS]

Note: *To check the FFT- filter, the resolution bandwidth has to be set manually to FFT mode.*
- [**BW** : BW MODE : FFT]

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´.

Checking Bandwidth

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

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

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.*
Resolution bandwitdths > 10MHz are not avaible for FSU-43

- [**BW** : RES BW MANUAL : **X MHz**] , with X = 5, 10, 20 or 50 MHz

Additional signal generator setting for RBW = 50 MHz:
- Frequency: 999 MHz

Additional R&S FSU setting for RBW = 50 MHz:
- [**FREQ** : CENTER : **999 MHz**]

Measurement:
- [**MKR** ⇒ : PEAK]

The 3 dB bandwidth is displayed by the reading ´BW {bandwidth}´.

Checking the Shape Factor

Note: *To check the shape factor the values of the 3 dB bandwith will be needed. Please check before this measurement.*

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

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

Determine 60-dB-Bandwith
- [**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, 10, 20 or 50 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).

Checking Noise Display

Test equipment: 50 Ω termination (Section "Measurement Equipment", item 7)

Frequency range:

R&S FSU 3:	DC to 3.6 GHz
R&S FSU 8:	DC to 8 GHz
R&S FSU 26:	DC to 26.5 GHz
R&S FSU 43/46/50:	DC to 50 GHz

Test setup:

- ➢ Terminate the RF input of the FSU with 50 Ω

FSU settings:

1. Measurement for $f_n \leq$ 1 kHz:
- [**PRESET**]
- [**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:
- [**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.

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 rFSUlts in a corrected value of –146 dBm in 10 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	> 10kHz
RefLev	-10 dBm	-20 dBm	-30 dBm	-60 dBm	-60 dBm

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 FSU 8:	10 MHz to 8 GHz
	R&S FSU 26:	10 MHz to 27 GHz
	R&S FSU 43:	10 MHz to 43 GHz
	R&S FSU 46:	10 MHz to 46 GHz
	R&S FSU 50:	10 MHz to 50 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 FSU 8:	DC to 8 GHz	
R&S FSU 26:	DC to 26.5 GHz	
R&S FSU 43/46/50:	DC to 50 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 %
	40 to 50 GHz	<5 %
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
	40 to 50 GHz	<1.50

- 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

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

Frequency range:

R&S FSU 8	DC to 8 GHz
R&S FSU 26	DC to 26.5 GHz
R&S FSU 43/46/50	DC to 50 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
	40 to 50 GHz	≤ 0.6 dB
Equivalent output VSWR	3.6 to 8 GHz	≤ 1.3
	8 to 22 GHz	≤ 1.4
	22 to 40 GHz	≤ 1.5
	40 to 50 GHz	≤ 1.7

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 FSU settings:

- [**PRESET**]
- [**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 FSU (level reading of marker 1) reflects the absolute level accuracy of the R&S FSU. It can be calculated as:

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

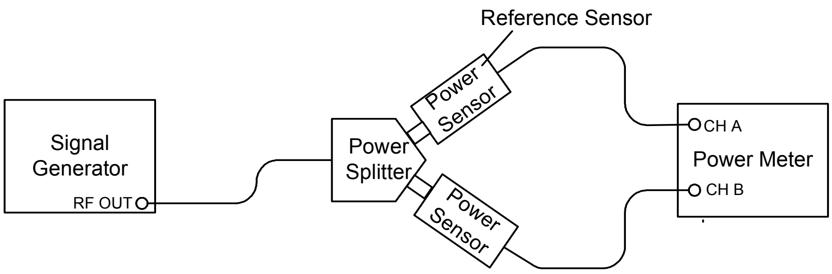
Frequency response < 3.6 GHz

Power splitter calibration

Note: *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 = L_{CHA} / dBm - L_{CHB} / 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 (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	_______

Checking the frequency response

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 of the R&S FSU.

Signal generator settings:

- Level	0 dBm
- Frequency	128 MHz

R&S FSU 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 FSU settings:

Determine signal level $L_{powermeter}$.
Set marker to peak of signal
- [**MKR** ⇒ : PEAK]

➢ Read level indication from R&S FSU (reading of marker 1): L_{FSU}

Power Meter:

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

Evaluation:

➢ Calculate
ΔRef / dB = L_{FSU} / 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 of performance test report for values of f_{fresp}

R&S FSU settings:

- [**FREQ** : CENTER : {f_{fresp}}]
See table of performance test report for values of f_{fresp}

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

➢ Read level indication from R&S FSU (reading of marker 1): L_{FSU}

Power Meter:

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

Evaluation:

➢ The frequency response can be calculated as:

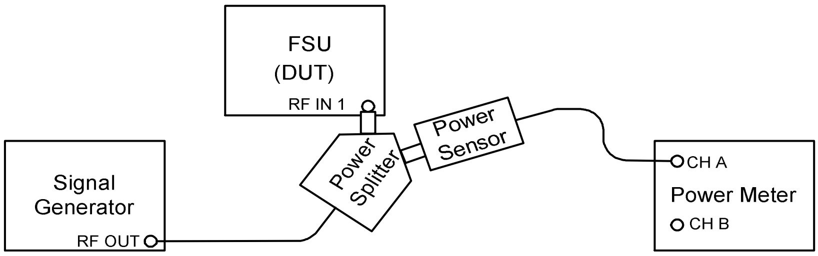
➢ Freq. response / dB = L_{FSU} - $L_{PowerMeter}$ - Imbalance(f_{fresp}) / dB - ΔRef / dB

➢ 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 FSU RF input



- **Important 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 FSU 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 FSU settings:

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

Power Meter:

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

Evaluation:

- Calculate
  ΔRef / dB = L_{FSU} / 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 FSU 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 FSU (reading of marker 1): L_{FSU}

Power Meter:

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

Evaluation:

- The frequency response can be calculated as:
- Freq. response / dB = L_{FSU} - $L_{PowerMeter}$ - ∆Ref / dB
- Take the value of ∆Ref as ascertained before.

Checking the Display Linearity

Test equipment:
- Signal generator (Section "Measurement Equipment", item 3)
  Frequency 5 MHz [1)]
  Maximum level ≥ 10 dBm
- Step attenuator (Section "Measurement Equipment", item 13)
  Frequency 5 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 of the R&S FSU

Signal generator settings:
- Frequency 5 MHz [1)]
- Level +10 dBm

Step attenuator settings: Attenuation 20 dB

R&S FSU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **0 dBm**]
- [**FREQ** :CENTER : **5 MHz**]
- [**SPAN** : **0 Hz**]
- [**TRACE** : DETECTOR : RMS]

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

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

3. Measurement:
- [**BW** : RES BW MANUAL : **20 MHz**]

with RUS FSU-43:
- [**BW** : RES BW MANUAL : **10 MHz**]

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 of performance test report for values of a_{ATT}.

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

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)

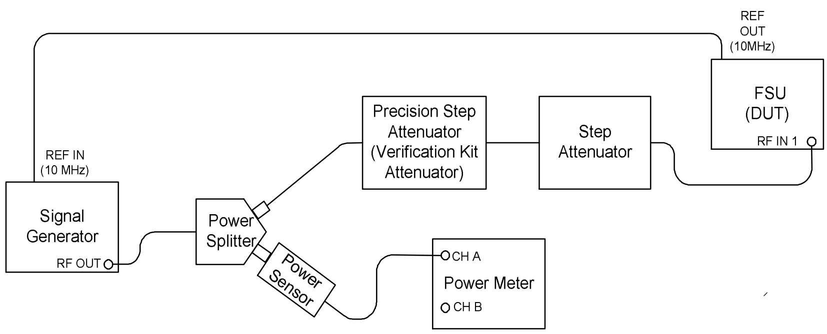
- Power Sensor (Section "Measurement Equipment", item 11)
  Frequency 30 MHz
  Power -15 to +10 dBm

- 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

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

R&S FSU 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 (relativ)		Signal Generator Level Error ∆GEN dB (relativ)
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 FSU 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 R&S FSUI in column 4 (= ∆GEN).
- Read the R&S FSU relative power indication[1]), subtract the appropriate value ∆GEN and add the appropriate value V-Kit-Error [2]).
- Record the R&S FSU in the Performance Test Report, item "Display linearity, RBW 500 Hz".

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

[2]) Refer to charted attenuation accuracy of the Verfication 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.

- Repeat step 2 for the remaining values listed in the table above.
- Record the corrected R&S FSU 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 (relativ)		Signal Generator Level Error ΔGEN dB (relativ)
-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 FSU 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 R&S FSU in column 4 (= ΔGEN).
- Read the R&S FSU relative power indication and subtract both the appropriate value ΔGEN and ΔL. Then add the appropriate value V-Kit-Error.
- Record the R&S FSU in the Performance Test Report, item "Display linearity, RBW 500 Hz".
- Repeat step 4 for the remaining values listed in the table above.

Measurement - RBW 300 kHz

Signal Generator Power dBm	Verification Kit Attenuation dB	Power Meter indication dB (relativ)		Signal Generator Level Error ΔGEN dB (relativ)
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 =	_____
-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 FSU 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 rFSUlt in column 4 (= ΔGEN).
- Read the R&S FSU relative power indication, subtract the appropriate value ΔGEN and add the appropriate value V-Kit-Error.
- Record the rFSUlt in the Performance Test Report, item "Display linearity, RBW 300 kHz".

Repeat step 2 for the remaining values listed in the table above.

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 of the R&S FSU

Signal generator settings:
- Frequency 128,1 MHz
- Level 10 dBm

Step attenuator settings: Attenuation 70 dB

R&S FSU 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 { 80dB - a_{FSU} }
See table below for values of a_{ATT}.

R&S FSU settings:
- [**AMPT** : RF ATTEN MANUAL : { a_{FSU} }]
- [**AMPT** : {-40dBm + a_{FSU} } **dBm**]
- [**MKR** ⇒ : PEAK]

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

Evaluation: The difference between the level of the input signal of the R&S FSU 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_{FSU}	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

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

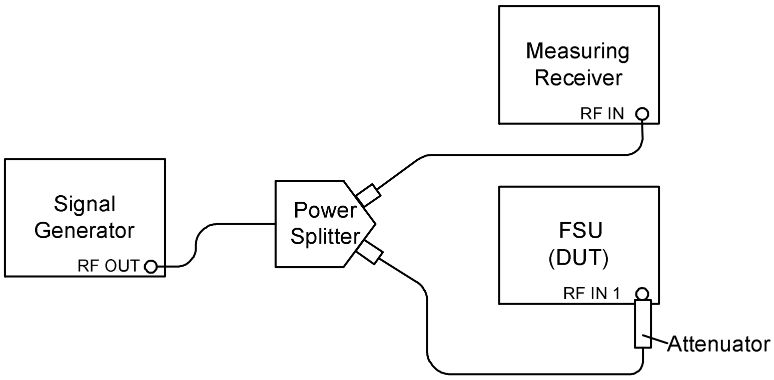
- Power Splitter (Section "Measurement Equipment", item 7)

- 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 FSU 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 FSU RF Attenuation dB	R&S FSU 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 FSU to the first value listed in the table above:

  - [**AMPT** : RF ATTEN MANUAL : **xx dB :** REF LEVEL **xx dBm**]

- Set R&S FSU 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 FSU to the second value listed in the table above.
- Record the difference
  R&S FSU Delta Marker indication[3]) - Measuring Receiver indication in the Performance Test Report.

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

- Repeat step 2 for the remaining values of the table above.

Checking the Reference Level Switching Accuracy

Test principle:	The IF gain of the R&S FSU 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 FSU
Signal generator settings:	- frequency 5 MHz - level -10 dBm
Step attenuator settings:	Attenuation 20 dB
R&S FSU 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 FSU 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 FSU 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:

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

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

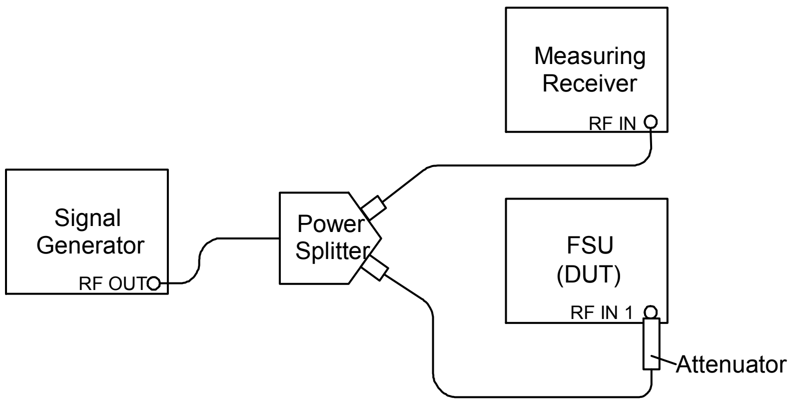
- Power Splitter (Section "Measurement Equipment", item 7)

- 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 FSU 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**]

R&S FSU 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 FSU to the first value listed in the table above.:

  - [**AMPT** : REF LEVEL **xx dBm**]

- Set R&S FSU 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 FSU to the second value listed in the table above.
- Record the difference
  R&S FSU Delta Marker indication[3]) - Measuring Receiver indication in the Performance Test Report.

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

- Repeat step 2 for the remaining values of the table above.

Checking the Phase Noise for Instruments with serial numbers smaller than 200000

Test equipment:

T (section “measuring instruments and accessories”, pos. 30)

Frequency	640 MHz
Level	5 dBm to 9 dBm (on the R&S FSU)
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 RF output of the signal generator to RF input of the FSU
- ➢ The external reference of the two instruments should be disconnected to avoid correlation of the synthesizer phase noise.

Signal generator settings:

- Frequency 639 MHz
- Level 5 dBm

Fine-adjust the frequency of the generator so that the FSU shows exactly 639 MHz .

R&S FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **639 MHz**]
- [**AMPT** : **0 dBm**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : {span}]
- [**Ext Ref** : **INT**]

Depending on offset, see table below for values of span.

- [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
- [**BW** : RBW MANUAL : {RBW}]

Depending on offset, see table below for values of RBW.

- [**TRACE 1** : AVERAGE]
- [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]

➢ Activate phase noise marker

- [**MKR FCTN**: PHASE NOISE]
- [**FREQ** : CENTER : {639 MHz + offset}]
  See table below for values of offset.
- [**AMPT** : {reference level}]
  Depending on offset, see table below for values of reference level.
- [**AMPT** : RF ATTEN MANUAL : {a_{FSU}}]
  Depending on offset, see table below for values of a_{FSU} .

- Set phase noise marker
- [**MKR :** MARKER 2 : {offset}]
  See table below for values of offset.

***Note**: Please make sure not to measure on a spurious signal.*

Evaluation: The phase noise is displayed in the marker field by the reading Delta 2 [T1 PHN].

Note: To avoid correlation during the phase noise measurement, (especially at 100 Hz), the R&S FSU and generator references should not be connected.

Phase noise measurement settings				
Offset	**Span**	**RBW**	**Reference level**	**a_{FSU}**
100 Hz	20 Hz	30 Hz	0 dBm	10 dB
1 kHz	200 Hz	100 Hz	0 dBm	10 dB
10 kHz	2 kHz	300 Hz	0 dBm	10 dB
100 kHz	10 kHz	3 kHz	-10 dBm	0 dB
1 MHz	100 kHz	30 kHz	-30 dBm	0 dB

Note: *To obtain a precise measurement of the phase noise at high offsets, the level used at the R&S FSU input is 10 dB to 30 dB higher than the reference level. To reduce the measurement time, the phase noise is measured with a small span around the frequency offset. This prevents the R&S FSU from being overloaded.*

Testing the phase noise at 639 Mhz or 640 MHz for instruments with serial number larger than 200000

Measuring equipment:

Tester (section “measuring instruments and accessories”, pos. 30)

Frequency	640 MHz
Level	5 dBm to 9 dBm (on the R&S FSU)
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 of the R&S FSU.
- ➢ 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 FSUsettings:

- [**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 FSU:

- [**FREQ** : FREQUENCY OFFSET {f_{dev}}]
- [**FREQ** : CENTER **640** or **639 MHz**]

➢ Continue with R&S FSU 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 +** $\mathbf{f_{Offset}}$**}**]
- [**SPAN** : {Span}]
- [**SWEEP** : SWEEP TIME MANUAL {s_{FSU}}]
- [**BW** : RES BW MANUAL : {RES BW}]
- [**AMPT** : RF ATTEN MANUAL : {a_{FSU}}]
- [**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 FSU and generator references should not be connected.

Setting for phase noise measurement s				
Offset	**Span**	**RES BW / SWEEPTIME**	**Reference level l**	a_{FSU}
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

Notes: *To obtain an accurate phase noise measurement at high offsets, the level at the R&S FSU 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.*

Alternative phase-noise testing at 800 MHz for instruments with a serial number larger than 200000

Measuring equipment:

Alternative measuring at 800 MHz
(Section measuring instruments and accessories pos. 31)
This measurement can be performed , if no FSU with a 640 MHz output is available.

Frequency	800 MHz
Level	5 dBm to 9 dBm (at the R&S FSU)
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 of the R&S FSU.

R&S FSU _settings:

- [**PRESET**]

- Switch to internal reference (INT).
  - [**SETUP** : REFERENCE INT / EXT]
  - [**FREQ** : CENTER : **800 MHz**]
- Correct offset frequency f_{Offset}between REFSYN and FSU with: f
  - [**FREQ** : FREQUENCY OFFSET : {f_{Offset}}]
  - [**FREQ** : CENTER : **800 MHz**]
- Set resolution filter.
  - [**BW** : COUPLING RATIO : RBW/VBW NOISE[10]]
  - [**BW** : RES BW MANUAL : {RES BW}]
  RES BW depends on the offset, refer to the table below.
- Form the average value.
  - [**TRACE** : AVERAGE]
  - [**SWEEP** : SWEEP COUNT : **20** : **ENTER**]

Record reference (carrier).
- [**AMPT** : Make the setting so that the signal is at the reference level]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**SPAN** : {Span}]

- Activate the phase noise marker.
  - [**MKR FCTN**: PHASE NOISE]
  - [**SPAN** : ZERO SPAN]
  - [**FREQ** : CENTER : **{800 MHz + Offset}**]
  - [**SWEEP** : SWEEP TIME MANUAL : {s_{FSU}}]
  - [**TRACE** : DETECTOR RMS]
  - [**AMPT** : {Reference level}]

Depends on the offset, regarding the reference level values, refer to the table below.

- [**AMPT** : RF ATTEN MANUAL : {a_{FSU}}]

Depends on the offset, regarding the values of a, refer to the table below $_{FSU}$.

➢ Set the phase noise marker.
- [**MKR :** MARKER 2 : {Offset}]

Regarding offset values, see the following table.

***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 FSU and generator references should not be connected.*

Setting for phase noise measurement

Offset	Span	RES BW / SWEEP TIME	Reference level	a_{FSU}
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

Note: *To obtain a precise phase noise measurement at high offsets, the level used at the FSU 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.*

Checking the Return Loss at the RF Input

Test equipment:

- Signal generator (Section "Measurement Equipment", item 3)
  Frequency range: 100 kHz to 20 MHz
  Level range: ≥ -10 dBm

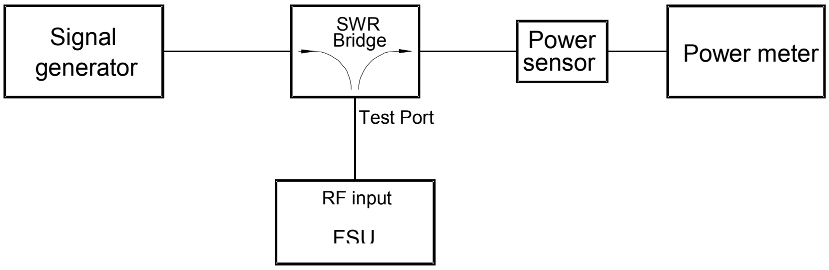
- Power meter (Section "Measurement Equipment", item 10)
- Power sensor (Section "Measurement Equipment", item 21)
  Frequency range 100 kHz to 20 MHz

- 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}.

FSU 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 FSU and connect precision short or open to the cable. Determine reflected power with the power meter and store measured level L_{Ref} as reference. Repeat this procedure for every measurement over the whole frequency range.

Measurement:

R&S FSU 3 / R&S FSU 8:

- Connect the RF input of the R&S FSU to the test port of the SWR bridge.
- Measure reflected power L_r with the power meter. The return loss a_r of the RF input of the FSE can be calculated as:

$a_r = L_{Ref} – L_r$.

The VSWR can be calculated as:

$$s = \frac{10^{0.05a_r} + 1}{10^{0.05a_r} - 1}$$

R&S FSU 26 / 43 / 46 / 50:

- Determine S_{11} of the R&S FSU at the frequencies shown in the performance test report. See operating manual of the network analyzer for detailed information about S_{11} measurement.

Test setup (f_{in} > 20 MHz):

- Connect the test port of the network analyzer to the RF input 1 of the R&S FSU.

Measurement:

- Determine S_{11} of the R&S FSU at the frequencies shown in the performance test report. See operating manual of the network analyzer for detailed information about S_{11} measurement.

Test Procedure Option Tracking Generator B9 with Option Attenuator B12

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 of the R&S FSU.

R&S FSU settings:

- [**PRESET**]
- [**FREQ** : CENTER : **128 MHz**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **300 Hz**]
- [**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.

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 of the R&S FSU.

R&S FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **5 dB**]
- [**AMPT** : **5 dBm**]
- [**AMPT** : RF INPUT DC] not for FSU 46
- [**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.

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 FSU.

R&S FSU settings:

- [**PRESET**]
- [**FREQ : 128 MHz**]
- [**SPAN** : ZERO SPAN]
- [**AMPT** : REF LEVEL : **0 dBm**]
- [**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.

Measurement:

- [**TRACE** : AVERAGE : SWEEP COUNT : **50 ENTER]**

Read off delta marker

Checking Modulation

Checking the I/Q modulator

Test equipment:	- AMIQ (section "Measurement Equipment", item 30-35) or - 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 AMIQ:	➢ Connect the the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer. Ensure that the modulation lines are equal (phase shift). ➢ Connect the spectrum analyzer to the tracking generator output.
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.
AMIQ settings	➢ AMIQ self-adjustment AC voltage I output: U = 0.5 V AC voltage Q output: U = 0.5 V Frequency: 1 MHz Phase (I/Q) = +/-90 degrees (For this purpose, use AMIQ setup files from section "Measurement Equipment", items 22 and 23.)
Generator settings (ADS or 33220A):	➢ 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** : **10 MHz**] - [**AMPT** : REF LEVEL : **10 dBm**]
R&S FSU 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) with AMIQ:

- ➢ Switch on the I and Q channels on the AMIQ.
  Measure the carrier amplitude at 1 GHz and the lateral component amplitudes at 1 GHz + 1 MHz and 1 GHz - 1 MHz.
  Perform this measurement for baseband signals with a phase shift of +90 degrees and –90 degrees between the I and Q channel.

Measuring the impairment (imbalance between the I and Q path) with ADS or 33220A:

- ➢ 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.

Checking the amplitude modulation

Test equipment:

- AMIQ (section "Measurement Equipment", item 30-35)
  or
- 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 AMIQ:

- ➢ Connect the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer.
- ➢ Connect the spectrum analyzer to the tracking generator output.

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.

AMIQ settings:

- ➢ AMIQ self-adjustment
  AC voltage I output: U = 0.5 V
  AC voltage Q output: U = 0 V
  Frequency: 1 MHz
  (For this purpose, use AMIQ setup files from section "Measurement Equipment", item 22)

Generator settings (ADS or 33220A):

- ➢ 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 FSU settings:
- [**PRESET**]
- [**FREQUENCY** : **1 GHz**]
- [**SPAN** : **0 MHz**]
- [**AMPT** : REF LEVEL : **10 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.

Checking the frequency modulation

Test equipment:
- AMIQ (section "Measurement Equipment", item 30-35)

  or
- 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 AMIQ:
- ➢ Connect the I and Q outputs of the AMIQ to the I and Q inputs of the analyzer.
- ➢ Connect the spectrum analyzer to the tracking generator output.

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.

AMIQ settings:
- ➢ AC voltage I output: U = 0 V
  AC voltage Q output: U = 0.5 V
  Frequency: 100 kHz
  (For this purpose, use AMIQ setup files from section "Measuring Equipment", item 21)

Generator settings with ADS or 33220A:
- ➢ 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 : **10 dBm**]

R&S FSU settings:	- [**PRESET**] - [**FREQUENCY** : **1 GHz**] - [**SPAN** : **0 MHz**] - [**AMPT** : REF LEVEL : **10 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.

Performance Test Option Electronic Attenuator B25

Comment: *With R&S FSU 26, 46, 50 the option B25 is implemented in the signal path below 3.6 GHz. Therefore the measurements are done up to 3.6 GHz only.*

Checking Noise Display with Preamplifier (B25)

Test equipment:
50 Ω termination (Section "Measurement Equipment", item 9)
Frequency range:
R&S FSU 3 / 26 / 46 / 50: to 3.6 GHz
R&S FSU 8: to 8 GHz

Test setup:
Terminate the RF input of the FSU with 50 Ω

R&S FSU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**SPAN** : **0 Hz**]
- [**BW** : RES BW MANUAL : **10 Hz**]
- [**BW** : VIDEO BW MANUAL : **1 Hz**]
- [**BW** : SWEEP TIME MANUAL : **0.1 s**]
- [**TRACE 1** : AVERAGE]
- [**TRACE 1** : SWEEP COUNT : **30 ENTER**]
- [**AMPT** : **- 80 dBm**]
- [**SETUP** : PREAMP ON]
- [**FREQ** : CENTER : {f_n}]

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

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

Checking the Level accuracy and the Frequency Response with Preamplifier

Test equipment:

- Signal generator :
  Section "Measurement Equipment", item 2
  Frequency range:
  R&S FSU 3, 26, 43,46, 50: 10 MHz to 3.6 GHz
  R&S FSU 8: 10 MHz to 8 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 FSU 8 50 MHz to 8 GHz
  Power range -30 to 0 dBm
  Cal factor uncertainty 50 to 128 MHz <1.6 %
  3.6 to 8 GHz <2 %
  VSWR 50 to 128 MHz <1.15
  3.6 to 8 GHz <1.15

- 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:
  FSU 8: DC to 8 GHz
  Level imbalance 3.6 to 8 GHz ≤ 0.3 dB
  Equivalent output VSWR 3.6 to 8 GHz ≤ 1.3

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.

B25 with preamplifier

Measurement: Connect the cable to RF input 1 of the R&S FSU

R&S FSU settings:
- [**PRESET**]
- [**SETUP** : PREAMP ON]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : **-10dBm**]
- [**SPAN** : **30kHz**]
- [**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 FSU (level reading of marker 1) reflects the absolute level accuracy of the R&S FSU. It can be calculated as:

Level accuracy$_{128MHz}$ = L_{FSU} - $L_{powermeter}$

B25 with electronic attenuator

R&S FSU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {E_{ATT}} : **dB**]
- [**AMPT** : **-10dBm**]
- [**SPAN** : **30kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

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

See table of performance test report for values of E_{ATT}.

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

Level accuracy$_{128MHz}$ = L_{FSU} - $L_{powermeter}$

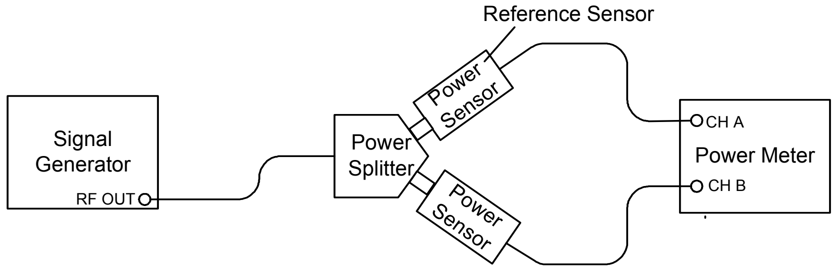
Checking frequency response <3.6 GHz

Power splitter calibration

Note: *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 = L_{CHA} / dBm - L_{CHB} / 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 (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	_______

B25 with 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 FSU.

Signal generator settings:

- level 0 dBm
- frequency 128 MHz

R&S FSU settings

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SETUP** : PREAMP ON]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S FSU settings:

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

Power Meter:

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

Evaluation:

- Calculate
  ΔRef / dB = L_{FSU} / 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 FSU 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 FSU (reading of marker 1): L_{FSU}

Power Meter:

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

Evaluation:

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

B25 with Electronic Attenuator

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 FSU.

Signal generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {E_{ATT}} : **dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

See table of performance test report for values of E_{ATT} .

R&S FSU settings:

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

Power Meter:

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

Evaluation:

- ➢ Calculate
  ΔRef / dB = L_{FSU} / 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 of performance test report for values of f_{fresp}

R&S FSU 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 FSU (reading of marker 1): L_{FSU}

Power Meter:

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

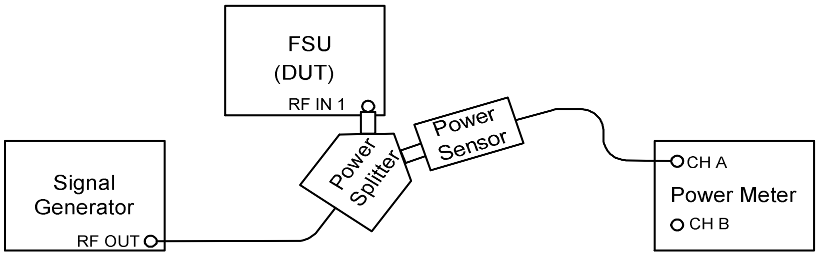
Evaluation:

- The frequency response can be calculated as:
- Freq. response / dB = L_{FSU} - $L_{PowerMeter}$ - 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 FSU RF input 1.



- **Important Note**
  Throughout the remaining steps set the Power Meter Cal Factor as appropriate!

B25 with preamplifier

Reference Measurement

Signal Generator settings:

- Level 0 dBm
- Frequency 128 MHz

R&S FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **30 dB**]
- [**AMPT** : **0 dBm**]
- [**SETUP** : PREAMP ON]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

R&S FSU settings:

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

Power Meter:

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

Evaluation:

- Calculate
  ΔRef / dB = L_{FSU} / 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 FSU 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 FSU (reading of marker 1): L_{FSU}

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

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

B25 with electronic attenuator

Reference Measurement

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

R&S FSU settings:
- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **10 dB**]
- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {E_{ATT}} : **dB**]
- [**AMPT** : **0 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : RES BW MANUAL : **10 kHz**]
- [**TRACE** : DETECTOR : RMS]
- [**FREQ** : CENTER : **128 MHz**]

See table of performance test report for values of E_{ATT} .

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

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

Evaluation:
- Calculate
  ΔRef / dB = L_{FSU} / 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 FSU 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 FSU (reading of marker 1): L_{FSU}

Power Meter:

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

Evaluation:

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

Checking Nonlinearities with Electronic Attenuator

Third-Order Intercept

Test equipment:

- 2 signal generators

  Section "Measurement Equipment", item 2

  Frequency range:
  R&S FSU 3/26/43/46/50: 10 MHz to 3.6 GHz
  R&S FSU 8: 10 MHz to 8 GHz
  Maximum level ≥ 0 dBm
- 2 attenuators (Section "Measurement Equipment", item 16)
  Attenuation aATT = 10 dB

  Frequency range:
  R&S FSU 3/26/43/46/50: 10 MHz to 3.6 GHz
  R&S FSU 8: 10 MHz to 8 GHz

- Power splitter/combiner (Section "Measurement Equipment", item 8)
  Frequency range
  R&S FSU 3/26/43/46/50: 10 MHz to 3.6 GHz
  R&S FSU 8: 10 MHz to 8 GHz

Test setup:

➢ Connect RF outputs of the signal generators via 10 dB attenuators to the inputs of the coupler
➢ Connect output of the coupler to the RF input of the FSU.

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 FSU of –10 dBm.
➢ Switch off the ALC of the generators to reduce the interference between the generators

R&S FSU settings:

- [**PRESET**]
- [**AMPT** : RF ATTEN MANUAL : **0 dB**]
- [**AMPT** : NEXT : ELEC 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 is displayed in the marker field by the reading [TOI].

Note:

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.

Checking the RF Attenuator (with Option B25)

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 of the R&S FSU.

Signal generator settings:

- Frequency 128,1 MHz
- Level 10 dBm

Step attenuator settings: Attenuation 70 dB

R&S FSU 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 { 80dB - a_{FSU} }
See table below for values of a_{ATT}.

, settings:

- [**AMPT** : RF ATTEN MANUAL : {a_{FSU}}]
- [**AMPT** : {-45dBm + a_{FSU} } **dBm**]
- [**MKR** ⇒ : PEAK]

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

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

a_{ATT} in dB	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
a_{FSU} in dB	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
Ref.level in dBm	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25	30

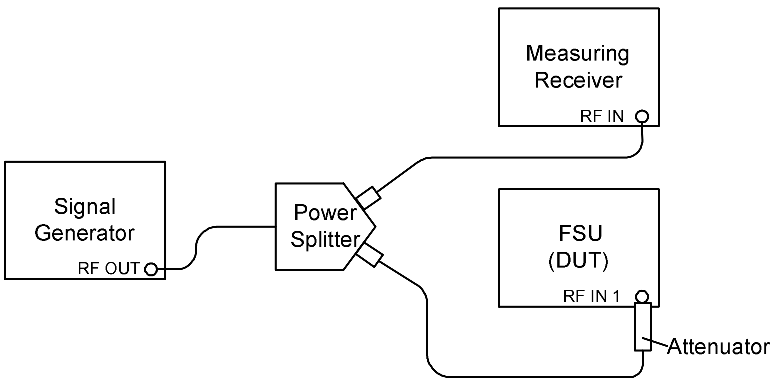
Checking the RF Attenuator Accuracy with option B25 (alternative Measurement)

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 FSU settings:

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

FSU RF Attenuation dB	FSU 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
80	10	+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 FSU to the first value listed in the table above:

  - [**AMPT** : RF ATTEN MANUAL : **xx dB :** REF LEVEL **xx dBm**]

- Set R&S FSU 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 FSU to the second value listed in the table above.
- Record the difference
  R&S FSU Delta Marker indication[3]) - Measuring Receiver indication in the Performance Test Report.

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

- Repeat step 2 for the remaining values of the table above.

Checking the electronic Attenuator accuracy

Test equipment:	- Signal generator (Section "Measurement Equipment", item 3) Frequency 128 MHz Maximum level ≥ 0 dBm - Step attenuator (Section "Measurement Equipment", item 13) Frequency 128 MHz Attenuation 0 to 40 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 of the R&S FSU
Signal generator settings:	- Frequency 128 MHz - Level 0 dBm
Step attenuator settings:	attenuation 40 dB
R&S FSU settings:	- [**PRESET**] - [**FREQ** : CENTER : **128 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** : **- 30 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 { 40dB - a_{FSU} } See table below for values of a_{ATT}.
R&S FSU settings:	- [**AMPT** : NEXT : ELEC ATTEN MANUAL : {a_{FSU}}] - [**AMPT** : {-30dBm + a_{FSU} } **dBm**] - [**MKR** ⇒ : PEAK] See table below for values of a_{FSU} , a_{ATT} and reference level.
Evaluation:	The difference between the level of the input signal of the FSU and the reference (at 10 dB RF-Attenuation) is displayed in the marker field by the reading ´Delta [T1 FXD]´.

a_{ATT}	40 dB	35 dB	20 dB	25 dB	20 dB	15 dB	10 dB
a_{FSU}	0 dB	5 dB	10 dB	15 dB	20 dB	25 dB	30 dB
Reference level	-30 dBm	-25 dBm	-20 dBm	-15 dBm	-10 dBm	-5 dBm	0 dBm

Checking the electronic Attenuator Accuracy with option B25 (alternative Measurement)

Test equipment:

- Signal Generator (Section "Measurement Equipment", item 4)
  Frequency 128 MHz
  Level range -62 to +8 dBm

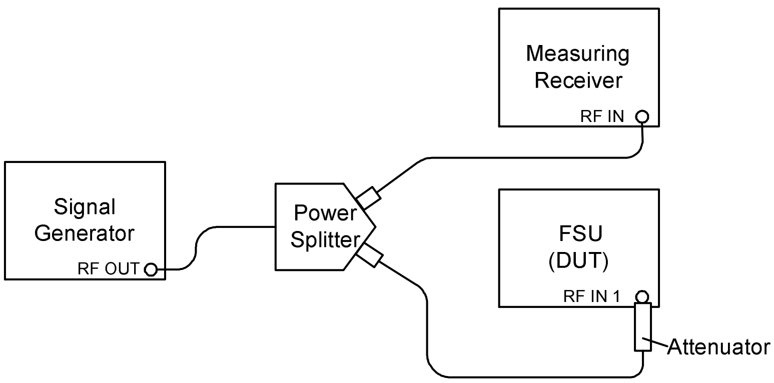
- Power Splitter (Section "Measurement Equipment", item 7)

- 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 FSU 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**]

R&S FSU RF elec. attenuation dB	R&S FSU Ref Level dBm	Signal Generator Power dBm
10	-60	-52
15	-55	-47
20	-50	-42
25	-45	-37
30	-40	-32
35	-35	-27
40	-30	-22

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 FSU to the first value listed in the table above:

- [**AMPT** :NEXT:ELEC ATTEN MANUAL: **xx dB :** REF LEVEL **xx dBm**]

- Set R&S FSU 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 FSU to the second value listed in the table above.
- Record the difference
  R&S FSU Delta Marker indication[3]) - Measuring Receiver indication in the Performance Test Report.

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

- Repeat step 2 for the remaining values of the table above.

Performance Test Option External Mixing B21

Checking LO-level

Measurement equipment:	- Power sensor (section "Measurement Equipment", item 12) Frequency range 7.0 MHz to 15.5 GHz Max. input power P_{max} = +23 dBm RSS ≤ 2.5% referred to measured power Impedance Z = 50 Ω - Power Meter (Section "Measurement Equipment", item 10) - Fixed attenuator with 10 dB (Section "Measurement Equipment" item 16)
Power meter settings:	- Connect power sensor to the power meter and execute function ´ZERO´ when there is no signal applied to the power sensor.
R&S FSU settings:	- [**PRESET**] - [**FREQ** : EXTERNAL MIXER : SELECT BAND] - Table settings: Band: USER Harmonic # 20 - [**FREQUENCY SPAN** : ZERO SPAN] - [**FREQUENCY CENTER** : {f_c}] f_c see table
Power meter settings:	- Connect power sensor via fixed attenuator to the output ‘LO_{out} / IF_{in}’
Measurement:	- Determine level of the LO-signal LLO,meas.To achive higher accuracy it is recommended to compensate the frequency response of the power sensor
Evaluation:	The level of the LO-signal can be determined as: $L_{LO} = L_{LO,meas} + 10$ dB

Checking the Input LO_{out} / IF_{in} (2-Port-Mixers)

Measurement equipment:	- Generator (section "Measurement Equipment", item 2 or 3) frequency f = 404.4 MHz output power P = - 20 dBm
R&S FSU settings:	- [**PRESET**] - [**FREQ** : EXTERNAL MIXER : SELECT BAND] - Table settings: Band: USER Ports 2 Bias 0 mA AVG Conv Loss 20 dB Switch off LO with service function: - [**SETUP :** SERVICE : ENTER PASSWORT **894129**] - [**SETUP :** SERVICE FUNCTION: **2.18.1.2**] - [**AMPT** REF LEVEL **0 dBm**]
Test setup:	➢ Connect the generator to the connector LO_{out} / IF_{in}; Input level P = – 20 dBm +/- 0,1 dB
Evaluation:	- [**MKR->** : PEAK]

Checking the Input IF_{in} (3-Port-Mixers)

Measurement equipment:	- Generator (section "Measurement Equipment", item 2 or 3) frequency f = 404.4 MHz output level P = - 20 dBm
R&S FSU settings:	- [**PRESET**] - [**FREQ** : EXTERNAL MIXER : SELECT BAND] - Table settings: Band: USER Ports 3 Bias 0 mA AVG Conv Loss 20 dB ➢ Switch off LO with service function: - [**SETUP :** SERVICE : ENTER PASSWORT **894129**] - [**SETUP :** SERVICE FUNCTION : **2.18.1.2**] - [**AMPT** : REF LEVEL **0 dBm**]
Test setup:	➢ Connect the generator to the connector IF_{in}. Input level P = – 20 dBm +/- 0,1 dB
Evaluation:	- [**MKR->** : PEAK]

Checking the bias supply

Measurement equipment:	- DC-current meter (section "Measurement Equipment", item 36)
R&S FSU settings:	- [**PRESET**] - [**FREQ** : EXTERNAL MIXER] ➢ Switch off LO with service function: - [**SETUP :** SERVICE : ENTER PASSWORT **894129]** - [**SETUP :** SERVICE FUNCTION : **2.18.1.2**] - [**FREQ** : EXTERNAL MIXER : SELECT BAND] - Table settings: Band: USER Bias{I_{bias}}: - 10 mA, 0 mA, + 10 mA
Test setup:	➢ Connect the DC current meter between cable conductor and ground of LOout / IFin
Evaluation:	- Read out current

Performance Test Option - B23

Comment: The option B23 is implemented in the signal path above 3.6 GHz and is only avaible for the model FSU-26. Therefore the measurements are done between 3.6 GHz and 26.5 GHz..

Checking Noise Display with Preamplifier (B23)

Test equipment:	50-Ω termination (Section "Measurement Equipment", item 9) frequency range: R&S FSU 26 3.6 to 26.5 GHz
Test setup:	➢ terminate the RF input of the R&S FSU with 50 Ω
R&S FSU settings:	- [**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 : **5 ENTER**] ➢ - [**FREQ** : CENTER : {f_n}] ➢ - [**MEAS** : Time Dom Power : **Mean**] ➢ - [**AMPT** : **- 80 dBm**] ➢ - [**SETUP** : PREAMP ON] ➢ - [**FREQ** : CENTER : {f_n}]
Measurement:	➢ set marker to peak - [**MKR** ⇒ : PEAK] ➢
Evaluation	➢ 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

Checking the Level accuracy and the Frequency Response with Preamplifier (B23)

Test equipment:

- Signal Generator (Section "Measurement Equipment", item 2)

Frequency range:		
R&S FSU 26	10 MHz to 26.5 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 12)

Frequency range:		
R&S FSU 26	50 MHz to 26.5 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 26.5 GHz	<1.35

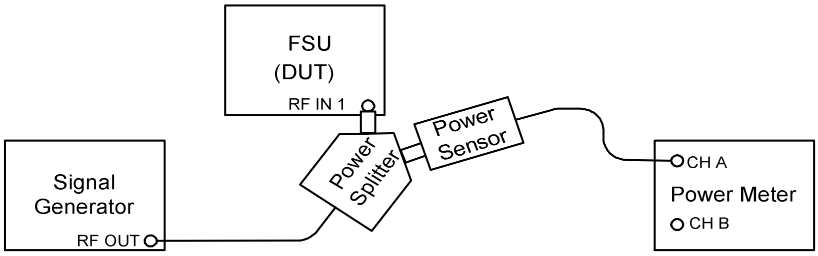
- 6 dB Power Splitter (Section "Measurement Equipment", item 8)

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

Measuring the frequency response

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 FSU RF input 1.



➢ **Important 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 FSU 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 FSU settings:

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

➢ Read level indication from R&S FSU (reading of marker 1): L_{FSU}

Power Meter:

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

Evaluation:

➢ Calculate
ΔRef / dB = L_{FSU} / 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 FSU 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 FSU (reading of marker 1): L_{FSU}

Power Meter:

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

Evaluation:

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

This page is left blank intentionally

Performance Test Report R&S FSU

Table 1-1 Performance Test report

ROHDE & SCHWARZ Performance Test Report Spectrum Analyzer R&S FSU Version 06-05-11
Model (R&S FSU 3 / R&S FSU 8 / R&S FSU 26 / R&S FSU 43/ R&S FSU 46 / R&S FSU 50): Order number: 1166.1660.03 / 1166.1660.08 / 1166.1660.26 / 1166.1660.43 / 1166.1660.46 / 1166.1660.50: Serial number: Test person: Date: Signature:

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency accuracy Reference oscillator	Page 1.6					
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 1.8					
11 MHz		90	________	-	dB	
100 MHz		90	________	-	dB	
1701 MHz		90	________	-	dB	
3001 MHz		90	________	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Image frequency rejection 2^{nd} IF, f_{in}	Page 1.8					
f_{in} + 808.8 MHz						
***) f_{in} – 808.8 MHz**						
R&S FSU:						
100 MHz		90	________	-	dB	
R&S FSU 8/26/43/46/50:						
3700 MHz		70	________	-	dB	
5000 MHz		70	________	-	dB	
7999 MHz		70	________	-	dB	
R&S **FSU 26/43/46/50:**						
26000 MHz *)		70	________	-	dB	
FSU 46 / 50:						
35000 MHz		70	________	-	dB	
Image frequency rejection 3rd IF, f_{in}	Page 1.8					
R&S FSU						
100 MHz		90	________	-	dB	
R&S **FSU 8/26/43/46/50:**						
4500 MHz		70	________	-	dB	
R&S FSU:						
2000 MHz		70	________	-	dB	
1st IF rejection f_{in}	Page 1.9					
11 MHz		90	________	-	dB	
100 MHz		90	________	-	dB	
1701 MHz		90	________	-	dB	
2990 MHz		90	________	-	dB	
2^{nd} IF rejection f_{in}	Page 1.9					
R&S FSU:						
100 MHz		90	________	-	dB	
FSU 8/26/43/46/50:						
4500 MHz		70	________	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd-order intercept point, f_{in}	Page 1.10					
R&S FSU 3/8:						
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	
R&S FSU 8:						
4001 MHz		18	________	-	dBm	
5001 MHz		18	________	-	dBm	
7999 MHz		18	________	-	dBm	
R&S FSU 26/43/ 46/ 50						
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 FSU 43/ 46 / 50:						
32000 MHz		12	________	-	dBm	
38000 MHz		12	________	-	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
2nd-order harmonic distortion, f_{in} :	Page 1.10					
28 MHz		35	________	-	dBm	
106 MHz		35	________	-	dBm	
261 MHz		45	________	-	dBm	
640 MHz		45	________	-	dBm	
1000 MHz		45	________	-	dBm	
1700 MHz		35	________	-	dBm	
with option 88 additional:						
900 MHz		55	________	-	dBm	
IF bandwidth switch. level accuracy	Page 1.12					
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		-0.2	________	+0.2	dB	
20 MHz		-0.5	________	+0.5	dB	
50 MHz		-0.5	________	+0.5	dB	
FFT Bandwidth level accuracy	Page 1.12					
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	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
IF bandwidth Bandwidth:	Page 1.13					
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	with RFC
20 MHz *		14	________	22	MHz	1130.1990
50 MHz *		35	________	55	MHz	with RFC
20 MHz *		16	________	24	MHz	1130.1990
50 MHz *		40	________	60	MHz	
* not with FSU-43						
IF Bandwidths Shape factor:	Page 1.13					
100 Hz		-	________	6	-	
1 kHz		-	________	6	-	
10 kHz		-	________	6	-	
100 kHz		-	________	6	-	
300 kHz		-	________	12	-	
1 MHz		-	________	12	-	
3 MHz		-	________	7	-	
10 MHz		-	________	7	-	
Noise Display f_{noise}:	Page 1.14					
20 Hz		-	________	-80	dBm	
90 Hz		-	________	-100	dBm	
900 Hz		-	________	-110	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 10Hz: **R&S FSU 3 / 8:**	Page 1.14					
9 kHz		-	________	–120	dBm	
95 kHz		-	________	–120	dBm	
999 kHz		-	________	–130	dBm	
9.99 MHz		-	________	–145	dBm	
19.99 MHz		-	________	–145	dBm	
49.99 MHz		-	________	–145	dBm	
99.99 MHz		-	________	–145	dBm	
199.9 MHz		-	________	–145	dBm	
499.9 MHz		-	________	–145	dBm	
999.9 MHz		-	________	–145	dBm	
1499 MHz		-	________	–145	dBm	
1999 MHz		-	________	–145	dBm	
2499 MHz		-	________	–143	dBm	
2999 MHz		-	________	–143	dBm	
3599 MHz		-	________	–143	dBm	
Noise Display normalized to 10Hz: **R&S FSU 8:**	Page 1.14					
3999 MHz		-	________	–142	dBm	
4499 MHz		-	________	–142	dBm	
4999 MHz		-	________	–142	dBm	
5499 MHz		-	________	–142	dBm	
5999 MHz		-	________	–142	dBm	
6499 MHz		-	________	–142	dBm	
6999 MHz		-	________	–142	dBm	
7499 MHz		-	________	–140	dBm	
7999 MHz		-	________	–140	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display normalized to 10 Hz:	Page 1.14					
FSU 26 / 43 / 46 / 50:						
9 kHz		-	________	–120	dBm	
95 kHz		-	________	–120	dBm	
999 kHz		-	________	–130	dBm	
9.99 MHz		-	________	–142	dBm	
19.99 MHz		-	________	–142	dBm	
49.99 MHz		-	________	–142	dBm	
99.99 MHz		-	________	–142	dBm	
199.9 MHz		-	________	–142	dBm	
499.9 MHz		-	________	–142	dBm	
999.9 MHz		-	________	–142	dBm	
1499 MHz		-	________	–142	dBm	
1999 MHz		-	________	–142	dBm	
2499 MHz		-	________	–140	dBm	
2999 MHz		-	________	–140	dBm	
3599 MHz		-	________	–140	dBm	
FSU 26:						
3601 MHz		-	________	–142	dBm	
6999 MHz		-	________	–142	dBm	
9999 MHz		-	________	–140	dBm	
12999 MHz		-	________	–140	dBm	
17999 MHz		-	________	–138	dBm	
21999 MHz		-	________	–137	dBm	
26499 MHz		-	________	–135	dBm	
FSU 43/ 46 / 50:						
3601 MHz		-	________	–140	dBm	
6999 MHz		-	________	–140	dBm	
9999 MHz		-	________	–140	dBm	
12999 MHz		-	________	–140	dBm	
17999 MHz		-	________	–138	dBm	
21999 MHz		-	________	–137	dBm	
26499 MHz		-	________	–135	dBm	
FSU 43/ 46:						
26799 MHz		-	________	–128	dBm	
30999 MHz		-	________	–128	dBm	
34999 MHz		-	________	–128	dBm	
38999 MHz		-	________	–130	dBm	
42999 MHz		-	________	–123	dBm	
45999 MHz*		-	________	–123	dBm	
* not with FSU-43						

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S FSU 50:						
26799 MHz		-	________	–128	dBm	
30999 MHz		-	________	–128	dBm	
34999 MHz		-	________	–123	dBm	
38999 MHz		-	________	–123	dBm	
42999 MHz		-	________	–123	dBm	
45999 MHz		-	________	–123	dBm	
47499 MHz		-	________	–118	dBm	
49999 MHz		-	________	–118	dBm	
Level accuracy at 128 MHz. –30 dBm	Page 1.15	-0.2	________	+0.2	dB	
Frequency response RF Attenuation 10 dB DC coupling	Page 1.15					
R&S FSU:						
f_{fresp}						
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		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
FSU 8/26/43/46/50:						
f_{resp}						
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	
7990 MHz		-2	________	+2	dB	
Frequency response RF attenuation 10 dB DC coupling	Page 1.15					
R&S FSU 26/43/46/50						
f_{resp}						
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		-2.5	________	+2.5	dB	
24000 MHz		-2.5	________	+2.5	dB	
25000 MHz		-2.5	________	+2.5	dB	
26000 MHz		-2.5	________	+2.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S FSU 43 / 46 / 50:						
f_{resp}						
27000 MHz		-2.5	________	+2.5	dB	
28000 MHz		-2.5	________	+2.5	dB	
29000 MHz		-2.5	________	+2.5	dB	
30000 MHz		-2.5	________	+2.5	dB	
31000 MHz		-2.5	________	+2.5	dB	
32000 MHz		-2.5	________	+2.5	dB	
33000 MHz		-2.5	________	+2.5	dB	
34000 MHz		-2.5	________	+2.5	dB	
35000 MHz		-2.5	________	+2.5	dB	
36000 MHz		-2.5	________	+2.5	dB	
37000 MHz		-2.5	________	+2.5	dB	
38000 MHz		-2.5	________	+2.5	dB	
39000 MHz		-2.5	________	+2.5	dB	
40000 MHz		-2.5	________	+2.5	dB	
41000 MHz		-2.5	________	+2.5	dB	
42000 MHz		-2.5	________	+2.5	dB	
42999 MHz		-2.5	________	+2.5	dB	
44000 MHz *		-2.5	________	+2.5	dB	
45000 MHz *		-2.5	________	+2.5	dB	
45999 MHz *		-2.5	________	+2.5	dB	
R&S FSU 50						
47000 MHz		-2.5	________	+2.5	dB	
48000 MHz		-2.5	________	+2.5	dB	
49000 MHz		-2.5	________	+2.5	dB	
49999 MHz		-2.5	________	+2.5	dB	
* not with FSU-43						

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response	Page 1.15					
RF attenuation 10 dB						
AC coupling						
Not with						
R&S FSU 43/46/50						
f_{fresp}		-0.3	________	+0.3	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	
500 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz						
Frequency response	Page 1.15					
RF attenuation 5 dB						
DC coupling						
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	
500 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 20 dB DC coupling	Page 1.15					
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	
500 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	
Frequency response RF attenuation 40 dB DC coupling	Page 1.15					
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	
500 MHz		-0.3	________	+0.3	dB	
1000 MHz		-0.3	________	+0.3	dB	
1500 MHz		-0.3	________	+0.3	dB	
2000 MHz		-0.3	________	+0.3	dB	
2500 MHz		-0.3	________	+0.3	dB	
3000 MHz		-0.3	________	+0.3	dB	
3599 MHz		-0.3	________	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 500 Hz	Page 1.23					
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	
Display linearity RBW 300 kHz	Page 1.23					
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	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Display linearity RBW 20 MHz *	Page 1.23					
a_{ATT} :						
10 dB		9.5	________	10.5	dB	
15 dB		4.5	________	5.5	dB	
20 dB		-	reference	-	-	
25 dB		-5.5	________	-4.5	dB	
30 dB		– 10.5	________	-9.5	dB	
35 dB		-15.5	________	-14.5	dB	
40 dB		-20.5	________	-19.5	dB	
45 dB		-25.5	________	-24.5	dB	
50 dB		-30.5	________	-29.5	dB	
55 dB		-35.5	________	-34.5	dB	
60 dB		-40.5	________	-39.5	dB	
* RBW=10MHz für FSU-43						
Attenuator accuracy	Page 1.29					
a_{ATT} :						
0 dB		-9.8	________	-10.2	dB	
5 dB		-4.8	________	-5.2	dB	
10 dB		-	reference	-	-	
20 dB		+9.8	________	+10.2	dB	
40 dB		+29.8	________	+30.2	dB	
Reference level switching accuracy	Page 1.32					
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
Phase noise for instruments with serial numbers smaller than 200000 Offset frequency: 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	Page 1.34	- - - - -	________ ________ ________ ________ ________	-90 -112 -120 -120 -138	dBc (1Hz) dBc (1Hz) dBc (1Hz) dBc (1Hz) dBc (1Hz)	
Phase noise at 640 MHz for instruments with serial number larger than 200000 Offset: 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	Page 1.38	- - - - -	________ ________ ________ ________ ________	-98 -116 -128 -128 -140	dBc (1Hz) dBc (1Hz) dBc (1Hz) dBc (1Hz) dBc (1Hz)	
Phase noise testing at 800 MHz for instruments with a serial number larger than 200000 Offset: 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	Page 1.40	- - - - -	________ ________ ________ ________ ________	-98 -116 -128 -128 -140	dBc (1Hz) dBc (1Hz) dBc (1Hz) dBc (1Hz) dBc (1Hz)	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Return Loss RF input RF att 10 dB / DC f_{in}	Page 1.42					
FSU 3, FSU 8:						
10 MHz		14	________	-	dB	
250 MHz		14	________	-	dB	
500 MHz		14	________	-	dB	
750 MHz		14	________	-	dB	
1000 MHz		14	________	-	dB	
1250 MHz		14	________	-	dB	
1500 MHz		14	________	-	dB	
1750 MHz		14	________	-	dB	
2000 MHz		14	________	-	dB	
2250 MHz		14	________	-	dB	
2500 MHz		14	________	-	dB	
2750 MHz		14	________	-	dB	
3000 MHz		14	________	-	dB	
3250 MHz		14	________	-	dB	
3500 MHz		14	________	-	dB	
FSU 8:						
3750 MHz		9,5	________	-	dB	
4000 MHz		9,5	________	-	dB	
4250 MHz		9,5	________	-	dB	
4500 MHz		9,5	________	-	dB	
4750 MHz		9,5	________	-	dB	
5000 MHz		9,5	________	-	dB	
5500 MHz		9,5	________	-	dB	
6000 MHz		9,5	________	-	dB	
6500 MHz		9,5	________	-	dB	
7000 MHz		9,5	________	-	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
FSU 26 / 43 / 46 / 50:						
10 MHz		20	________	-	dB	
250 MHz		20	________	-	dB	
500 MHz		20	________	-	dB	
750 MHz		20	________	-	dB	
1000 MHz		20	________	-	dB	
1250 MHz		20	________	-	dB	
1500 MHz		20	________	-	dB	
1750 MHz		20	________	-	dB	
2000 MHz		20	________	-	dB	
2250 MHz		20	________	-	dB	
2500 MHz		20	________	-	dB	
2750 MHz		20	________	-	dB	
3000 MHz		20	________	-	dB	
3250 MHz		20	________	-	dB	
3500 MHz		20	________	-	dB	
4000 MHz		14	________	-	dB	
6000 MHz		14	________	-	dB	
8000 MHz		14	________	-	dB	
10000 MHz		14	________	-	dB	
12000 MHz		14	________	-	dB	
14000 MHz		14	________	-	dB	
16000 MHz		14	________	-	dB	
18000 MHz		9,5	________	-	dB	
20000 MHz		9,5	________	-	dB	
22000 MHz		9,5	________	-	dB	
24000 MHz		9,5	________	-	dB	
26000 MHz		9,5	________	-	dB	
FSU 43 / 46 / 50:						
28000 MHz		7,5	________	-	dB	
30000 MHz		7,5	________	-	dB	
32000 MHz		7,5	________	-	dB	
34000 MHz		7,5	________	-	dB	
36000 MHz		7,5	________	-	dB	
38000 MHz		7,5	________	-	dB	
40000 MHz		7,5	________	-	dB	

Performance Test Report Option FSU-B9

Table 1-2: Performance Test Report Option B9, B12

ROHDE & SCHWARZ	Performance Test Report	Option B9	Version 11.05.06
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 1.44					
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 1.45					
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 1.49					
reference level		- 1	________	+ 1	dBm	
isolation		-	________	- 100	dBc	
Checking modulation Tracking generator I/Q modulation +90 ° output level:	Page 1.47					
Signal 1001 MHz		- 3	________	+ 3	dBm	
residual carrier		-	________	- 30	dBc	
sideband 999 MHz		-	________	- 30	dBc	
I/Q modulation -90 ° output level:						
Signal 999 MHz		- 3	________	+ 3	dBm	
residual carrier		-	________	- 30	dBc	
sideband 1001 MHz		-	________	- 30	dBc	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Checking Modulation Tracking generator AM modulation	Page 1.48					
Carrier level		- 3	________	+ 3	dBm	
Sgnl spacing 1001 MHz		- 8	________	- 4	dBc	
Signal spacing 999 MHz		- 8	________	- 4	dBc	
Checking modulation Tracking generator FM modulation	Page 1.49					
Carrier level		- 5	________	+ 1	dBm	
Sgnl spcng 1000.1 MHz		- 5	________	- 3	dBc	
Sgnl spcng 999.9 MHz		- 5	________	- 3	dBc	

Performance Test Report Option B25

Table 1-3: Performance Test Report Option B25

ROHDE & SCHWARZ	Performance Test Report	Option B25	Version 06-05-11
Serial number: Test person: Date: Signature:			

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display with Preamplifier (B25) **R&S FSU**: f_{noise}:	Page 1.51					
10.99 MHz		-	________	-152 / -150*)	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		-	________	-150	dBm	
2999 MHz		-	________	-150	dBm	
3599 MHz		-	________	-150	dBm	
				*) -150 for FSU, 46, 50		
Noise Display with Preamplifier (B25) **R&S FSU 8:** f_{noise}	Page 1.51					
3601 MHz		-	________	-147	dBm	
3999 MHz		-	________	-147	dBm	
4499 MHz		-	________	-147	dBm	
4999 MHz		-	________	-147	dBm	
5499 MHz		-	________	-147	dBm	
5999 MHz		-	________	-147	dBm	
6499 MHz		-	________	-147	dBm	
6999 MHz		-	________	-147	dBm	
7999 MHz		-	________	-147	dBm	
Level accuracy with Preamplifier (B25) at 128 MHz, -30 dBm	Page 1.52	-0.3	________	+0.3	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with preamplifier (B25)	Page 1.52					
R&S FSU: f_{fresp}						
10 MHz		-1	________	+1	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	
2990 MHz		-0.6	________	+0.6	dB	
3590 MHz		-0.6	________	+0.6	dB	
Frequency Response with preamplifier (B25)	Page 1.52					
R&S FSU 8: f_{fresp}						
3610 MHz		-2	________	+2	dB	
4000 MHz		-2	________	+2	dB	
4500 MHz		-2	________	+2	dB	
5000 MHz		-2	________	+2	dB	
5500 MHz		-2	________	+2	dB	
6000 MHz		-2	________	+2	dB	
6500 MHz		-2	________	+2	dB	
6990 MHz		-2	________	+2	dB	
7990 MHz		-2	________	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 1.57					
E_{ATT} = 5 dB						
FSU: f_{fresp}						
10 MHz		-1	________	+1	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	
2990 MHz		-0.6	________	+0.6	dB	
3590 MHz		-0.6	________	+0.6	dB	
Frequency Response elec. attenuator (B25)	Page 1.57					
E_{ATT} = 5 dB						
FSU 8: f_{fresp}						
3610 MHz		-2	________	+2	dB	
4000 MHz		-2	________	+2	dB	
4500 MHz		-2	________	+2	dB	
5000 MHz		-2	________	+2	dB	
5500 MHz		-2	________	+2	dB	
6000 MHz		-2	________	+2	dB	
6500 MHz		-2	________	+2	dB	
6990 MHz		-2	________	+2	dB	
7990 MHz		-2	________	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 1.57					
E_{ATT} = 10 dB						
FSU: f_{fresp}						
10 MHz		-1	________	+1	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	
2990 MHz		-0.6	________	+0.6	dB	
3590 MHz		-0.6	________	+0.6	dB	
Frequency Response elec. attenuator (B25)	Page 1.57					
E_{ATT} = 10 dB						
FSU 8: f_{fresp}						
3610 MHz		-2	________	+2	dB	
4000 MHz		-2	________	+2	dB	
4500 MHz		-2	________	+2	dB	
5000 MHz		-2	________	+2	dB	
5500 MHz		-2	________	+2	dB	
6000 MHz		-2	________	+2	dB	
6500 MHz		-2	________	+2	dB	
6990 MHz		-2	________	+2	dB	
7990 MHz		-2	________	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency Response elec. attenuator (B25)	Page 1.57					
E_{ATT} = 15 dB						
FSU: f_{fresp}						
10 MHz		-1	________	+1	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	
2990 MHz		-0.6	________	+0.6	dB	
3590 MHz		-0.6	________	+0.6	dB	
Frequency Response elec. attenuator (B25)	Page 1.57					
E_{ATT} = 15 dB						
FSU 8: f_{fresp}						
3610 MHz		-2	________	+2	dB	
4000 MHz		-2	________	+2	dB	
4500 MHz		-2	________	+2	dB	
5000 MHz		-2	________	+2	dB	
5500 MHz		-2	________	+2	dB	
6000 MHz		-2	________	+2	dB	
6500 MHz		-2	________	+2	dB	
6990 MHz		-2	________	+2	dB	
7990 MHz		-2	________	+2	dB	

Characteristic	included in	Min. value	Actual value	Max. value	Unit	Tolerance
3rd-order intercept point with elec. att., f_{in}	Page 1.62					
FSU:						
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	
FSU 8:						
3610 MHz		18	________	-	dBm	
5000 MHz		18	________	-	dBm	
7990 MHz		18	________	-	dBm	
Attenuator accuracy, a_{ATT} :	Page 1.63					
0 dB		-9.8	________	-10.2	dB	
5 dB		-4.8	________	-5.2	dB	
10 dB		-	reference	-	-	
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	
45 dB		+34.8	________	+35.2	dB	
50 dB		+39.8	________	+40.2	dB	
55 dB		+44.8	________	+45.2	dB	
60 dB		+49.8	________	+50.2	dB	
65 dB		+54.8	________	+55.2	dB	
70 dB		+59.8	________	+60.2	dB	
75 dB		+64.8	________	+65.2	dB	
Electronic Attenuator accuracy ., a_{ATT}	Page 1.64					
0 dB		-0.2	________	+0.2	dB	
5 dB		+4.8	________	+5.2	dB	
10 dB		+9.8	________	+10.2	dB	
15 dB		+14.8	________	+15.2	dB	
20 dB		+19.8	________	+20.2	dB	
25 dB		+24.8	________	+25.2	dB	
30 dB		+29.8	________	+30.2	dB	

Performance Test Report Option FSU-B21

Table 1-5: Performance Test Report Option B21

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
LO-level	Page 1.50					
fc						
140,5 GHz		14,5	________	16,5	dBm	
150,5 GHz		14,5	________	16,5	dBm	
160,5 GHz		14,5	________	16,5	dBm	
170,5 GHz		14,5	________	16,5	dBm	
180,5 GHz		14,5	________	16,5	dBm	
190,5 GHz		14,5	________	16,5	dBm	
200,5 GHz		14,5	________	16,5	dBm	
210,5 GHz		14,5	________	16,5	dBm	
220,5 GHz		14,5	________	16,5	dBm	
230,5 GHz		14,5	________	16,5	dBm	
240,5 GHz		14,5	________	16,5	dBm	
250,5 GHz		14,5	________	16,5	dBm	
260,5 GHz		14,5	________	16,5	dBm	
270,5 GHz		14,5	________	16,5	dBm	
280,5 GHz		14,5	________	16,5	dBm	
290,5 GHz		14,5	________	16,5	dBm	
300,5 GHz		14,5	________	16,5	dBm	
309,5 GHz		14,5	________	16,5	dBm	
level display 2-port-mixer	Page 1.51	- 1	________	+ 1	dBm	
level display 3-port-mixer	Page 1.51	- 1	________	+ 1	dBm	
bias current	Page 1.52	- 12,0	________	- 8,0	mA	
		- 1,0	________	+ 1,0	mA	
		+ 8,0	________	+ 12,0	mA	

Performance Test Report Option B23

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Noise Display with Preamplifier (B23)	Page 1.51					
FSU **26** f_{noise}						
3601 MHz		-	________	-152	dBm	
3999 MHz		-	________	-152	dBm	
4499 MHz		-	________	-152	dBm	
4999 MHz		-	________	-152	dBm	
5499 MHz		-	________	-152	dBm	
5999 MHz		-	________	-152	dBm	
6499 MHz		-	________	-152	dBm	
6999 MHz		-	________	-152	dBm	
7999 MHz		-	________	-152	dBm	
8999 MHz			________	-149	dBm	
9999 MHz			________	-149	dBm	
10999 MHz			________	-149	dBm	
11999 MHz			________	-149	dBm	
12999 MHz			________	-149	dBm	
13999 MHz			________	-147	dBm	
14999 MHz			________	-147	dBm	
15999 MHz			________	-147	dBm	
16999 MHz			________	-147	dBm	
17999 MHz			________	-147	dBm	
18999 MHz			________	-144	dBm	
19999 MHz			________	-144	dBm	
20999 MHz			________	-144	dBm	
21999 MHz			________	-144	dBm	
22999 MHz			________	-140	dBm	
23999 MHz			________	-140	dBm	
24999 MHz			________	-140	dBm	
25999 MHz			________	-140	dBm	
26499 MHz			________	-140	dBm	
			________	-140	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response with Preamplifier (B23)	Page 1.52					
FSU **26:** f_{fresp}						
3610 MHz		-2	________	+2	dB	
4000 MHz		-2	________	+2	dB	
4500 MHz		-2	________	+2	dB	
5000 MHz		-2	________	+2	dB	
5500 MHz		-2	________	+2	dB	
6000 MHz		-2	________	+2	dB	
6500 MHz		-2	________	+2	dB	
7000 MHz		-2	________	+2	dB	
8000 MHz		-2	________	+2	dB	
9000 MHz		-2.5	________	+2.5	dB	
10000 MHz		-2.5	________	+2.5	dB	
11000 MHz		-2.5	________	+2.5	dB	
12000 MHz		-2.5	________	+2.5	dB	
13000 MHz		-2.5	________	+2.5	dB	
14000 MHz		-2.5	________	+2.5	dB	
15000 MHz		-2.5	________	+2.5	dB	
16000 MHz		-2.5	________	+2.5	dB	
17000 MHz		-2.5	________	+2.5	dB	
18000 MHz		-2.5	________	+2.5	dB	
19000 MHz		-2.5	________	+2.5	dB	
20000 MHz		-2.5	________	+2.5	dB	
21000 MHz		-2.5	________	+2.5	dB	
22000 MHz		-2.5	________	+2.5	dB	
23000 MHz		-3.0	________	+3.0	dB	
24000 MHz		-3.0	________	+3.0	dB	
25000 MHz		-3.0	________	+3.0	dB	
26000 MHz		-3.0	________	+3.0	dB	
26490 MHz		-3.0	________	+3.0	dB	

Contents - Chapter 2 "Adjustment"

This page is left blank intentionally.

2 Adjustment

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 FSU permits the following manual adjustments:

- Adjustment of the 10 MHz reference oscillator which determines the frequency accuracy of the R&S FSU
- Adjustment of the 128 MHz calibration source which determines the level accuracy of the R&S FSU
- Adjustment of the 50 MHz power reference

The adjustment permits the data integrity of the instrument to be maintained and restored.

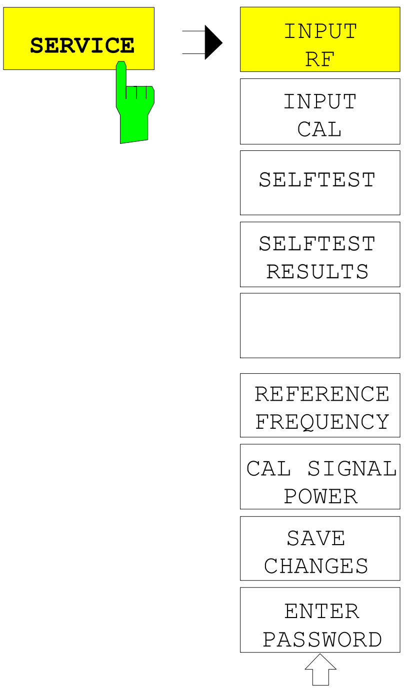
Manual adjustments must be performed at an ambient temperature of between +20 °C and +30 °C after the instrument has warmed up.

After the adjustment and an internal total calibration has been performed, the R&S FSU is ready for use and offers full data integrity.

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

Entering Password

SETUP SERVICE submenu:

The *ENTER PASSWORD* softkey allows the entry of a password.

The R&S FSU 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".

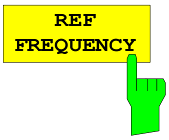
IEC/IEEE-bus command: `SYST:PASS "<Password>"`

Adjustment Functions

Caution:

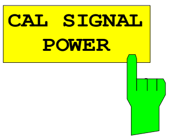
The realignment should be carried out by qualified personnel since any change considerably influences the measurement accuracy of the instrument. This is the reason why the softkeys REF FREQUENCY, CAL SIGNAL POWER and SAVE CHANGES can only be accessed after entering a password.

SETUP SERVICE submenu:



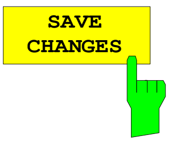
The *REF FREQUENCY* softkey opens the data input for the adjustment of the reference frequency. Values can be selected between 0 and 255 (without option R&S FSU-B4 OCXO) or between 0 to 4095 (with option R&S FSU-B4 OXCO). They modify the setting of the associated D/A converter. The setting is first stored in the volatile memory. The *SAVE CHANGES* softkey is used to store the setting permanently in nonvolatile memory.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN 155`



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.

IEC/IEEE-bus command: --



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.

IEC/IEEE-bus command: `SENS:ROSC:INT:TUN:SAV`

Manual Adjustment

This section explains the measuring instruments and auxiliary means required when manually adjusting the R&S FSU the appropriate preparations of the instrument as well as the individual adjustments.

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.
- Inputs for setting the R&S FSU 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**]

Measuring Equipment and Accessories

Table 2-1 Measuring equipment and accessories for manually adjusting the FSU

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 Power Reference

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 $P_{max} \geq 1$ µW
  meter noise ≤ 20 pW
  RSS $\leq 0.8\%$ 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 of the R&S *FSU*.

Overall calibration of the R&S *FSU*:

- [**PRESET**]
- [**CAL** : CAL TOTAL]

R&S *FSU* 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.

Caution:

The following realignment changes the level of the internal calibration source. Since this adjustment influences the level measurement accuracy of the R&S FSU it is strongly recommended that this adjustment be performed only if the level is not within the tolerance. .

R&S FSU 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`.

Adjusting Frequency Accuracy

Preparation: The measurement can be performed either with a signal generator at connector RF INPUT (front of the R&S FSU) at 1 GHz or at connector EXT REF OUT (rear of the R&S FSU) at 10 MHz using a frequency counter.
To be adjusted, the R&S FSU 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.*

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:
➢ Connect the RF output of the signal generator to RF input of the R&S FSU

R&S FSU 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 FSU 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 FSU (rear panel).

R&S FSU 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

Note: *Before the following measurement, the R&S FSU 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:

Important Note !

The following adjustment changes the frequency of the internal reference source. Since this adjustment influences the frequency accuracy of the R&S FSU, it is strongly recommended that this adjustment be performed only if the frequency is not within the tolerance.

R&S FSU 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 FSU) at 1 GHz or at connector EXT REF OUT (rear of the R&S FSU) at 10 MHz using a frequency counter.
To be adjusted, the R&S FSU 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.*

Adjusting Power Reference

Test equipment:

- Power meter (Section "Measuring Equipment", item 3)
- Power sensor (Section "Measuring Equipment", item 4)

Test setup:

Connect the power sensor to the power reference output of the R&S FSU.

R&S FSU settings:

Execute function ‘zero’ if there is no signal on the power sensor.
Switch on power reference:
- [**PRESET** : POWER MTR: POWER REF ON]

Measurement:

Read out level value at the power meter display.

Adjustment:

Enter the service password "30473035)
Read out actual measurement settings via service function:

DAC raw setting:	3.0.2.20700.9
DAC fine adjustment:	3.0.2.20700.13

Calculate the difference between measured and required (1mW) level and the new measurement settings (raw setting 0,8 µW/Bit, fine adjustment 7 nW/Bit). Set the DAC’s via sevice function

DAC raw setting:	2.35.4.1.value 1
DAC fine adjustment :	2.35.4.3.value 2

Verify level and repeat steps if necessary.

Required level 1 mW ± 0,001 mW (±0,0043 dB)

Write calculated values to RAM via:
3.0.3.20700.9.value 1
3.0.3.20700.13.value 2

Save values to EEPROM via:
3.35.1

Boot R&S FSU (switch off and on device).

Adjustment of Module Data

All boards of the R&S FSU 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 FSU. The existing calibration data (results from the latest total calibration) are deleted and the instruments displays UNCAL. Thus, the R&S FSU 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 FSU: - [**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 FSU: - [**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.

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".

Contents - Chapter 3 "Repair"

Figures

Tables

3 Repair

This chapter describes the design of the R&S FSU, 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.

Instrument Design and Function Description

A detailed schematic of the R&S FSU 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.

Block Diagram

See also chapter 5 illustrations for a detailed block diagram.

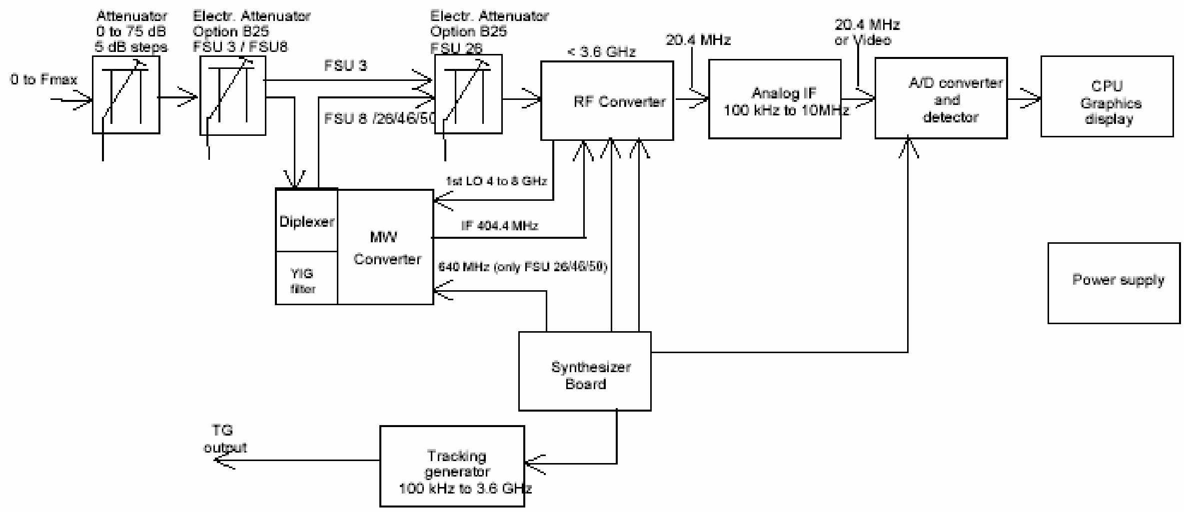


Fig. 3-1 Block diagram of instrument

Description of Block Diagram

The R&S FSU is a triple-conversion superhet receiver (double-conversion for receive frequencies >3.6 GHz) for the frequency range 20 Hz to 3.6 GHz, 8 GHz,, 26,5, 46 or 50 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. In instruments with option R&S FSU-B25 (electronic attenuator), this module follows in the signal path. In 3.6 GHz models, the attenuator is followed by the RF converter; in the high-frequency models, a diplexer is connected in between. The high-frequency signal component >3.6 GHz is routed to the microwave converter module following the diplexer. 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.

Attenuator

The RF signal passes from the input connector via the input switch to the attenuator, which can be set. The input signal is applied to the switch as well as a 128 MHz signal, which has a close-tolerance level of -30 dBm for calibration purposes or 0 dBm for the selftest of the instrument. Different attenuators are used: the 8 GHz attenuator in the R&S FSU3 and R&S FSU8, and the microwave attenuators up to 26 GHz or 46 GHz. All attenuators switch in steps of 5 dB and have maximum total attenuation of 75 dB; the 8 and 26 GHz 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 FSU26; models > 26 GHz are permanently DC-coupled.

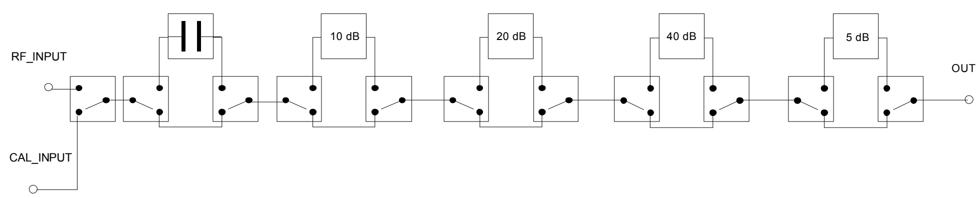


Fig. 3-2 Input attenuator

Electronic Attenuator (Option R&S FSU-B25)

The electronic attenuator is inserted in the signal path after the attenuator. It consists of a mechanical 5 dB attenuator pad, an electronic input attenuator, which can be switched from 0 to 30 dB in steps of 5 dB, and a switchable 20 dB preamplifier to reduce the noise figure of the R&S FSU.

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.

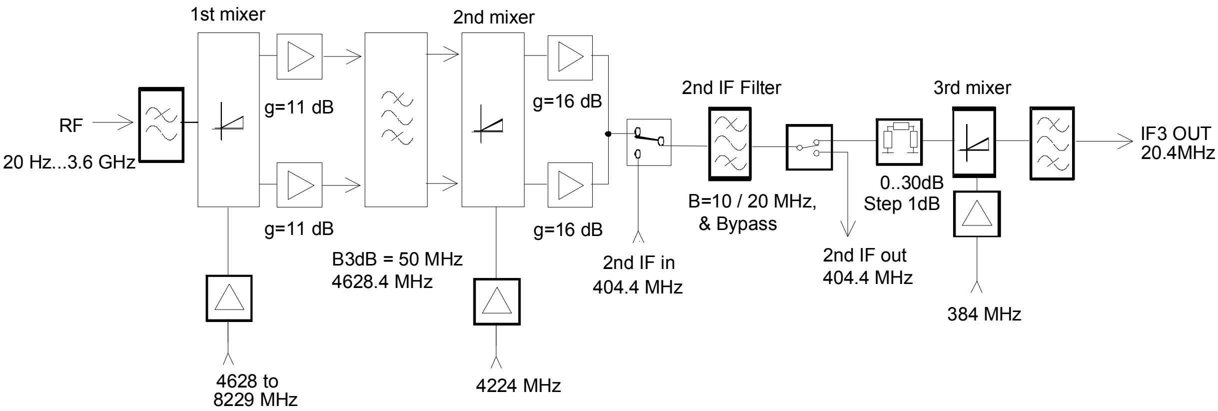


Fig. 3-3 Conversion of the RF to the third IF from 20 Hz to 3.6 GHz

RF to IF Conversion for Frequencies > 3.6 GHz - MW Converter

The high-frequency models of the R&S (frequency range > 3.6 GHz) also comprise a microwave converter board. 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 like in the R&S . Signals above 3.6 GHz are taken via the YIG filter to the mixer, where they are directly converted to the 2nd IF of 404.4 MHz. In the range >26 GHz, the signals are converted to the 404.4 MHz IF in two stages. The YIG filter can be bypassed by means of a relay.

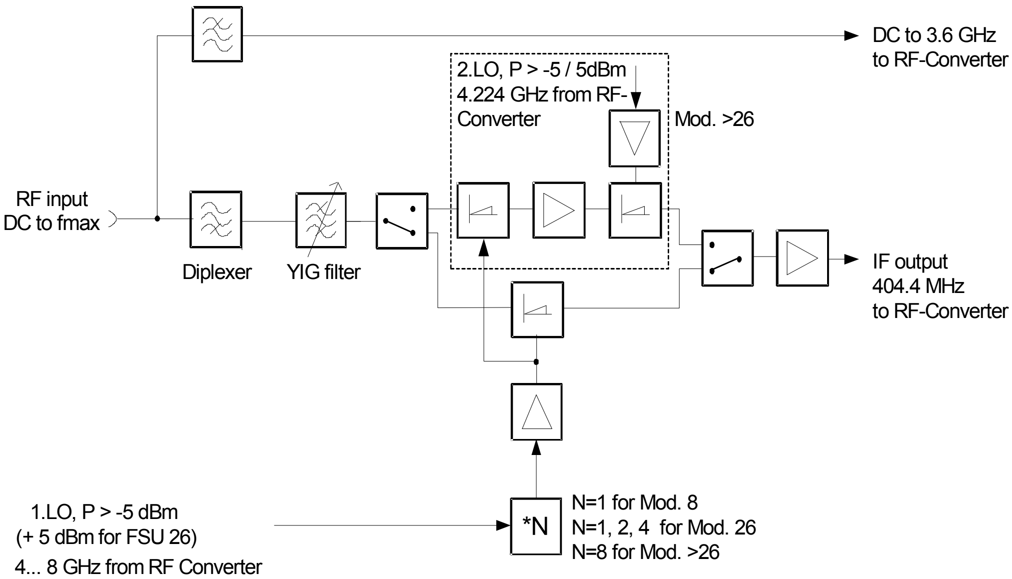


Fig. 3-4 Conversion of the RF to the IF from 3.6 GHz

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 FSU26 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.

IF Filter Module

The RF converter is followed by the analog IF filter module:

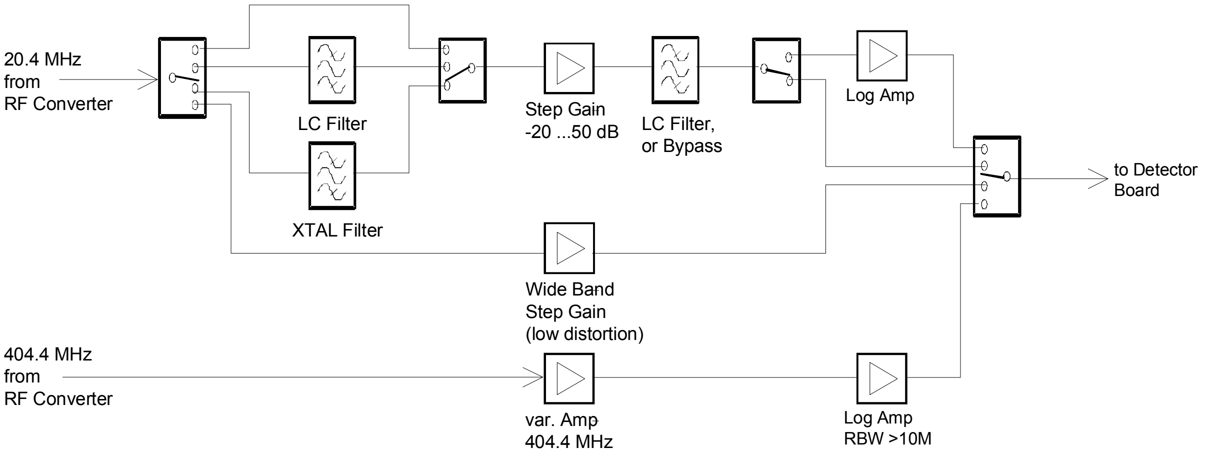


Fig. 3-5 IF filter

The R&S FSU offers resolution bandwidths from 1 Hz to 20 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 IF; a logarithmic amplification to 404.4 MHz is performed.
The tunable 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 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.

The R&S FSU 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 FSU stops the frequency sweep for a selectable period of time and demodulates the input signal. The volume is set using the rotary knob 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.

Processing of Measured Data - Detector Board

The sections below explain the signal and data paths required for result processing in the various operating modes:

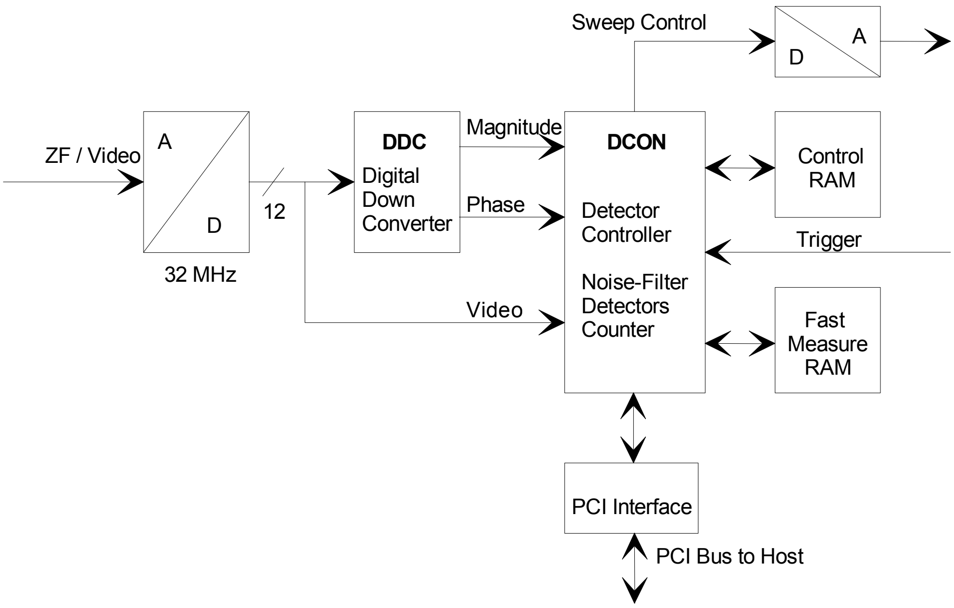


Fig. 3-6 Processing of measured data

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 DDC (digital down converter). The IF filter module provides an IF signal pre-filtered at 20.4 MHz. The DDC 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 DDC. The DDC first mixes the input IF into the baseband using an NCO; then the obtained I/Q signal is filtered in a HDF (**h**igh **d**ecimation **f**ilter) and FIR stage (**f**inite **i**mpulse **r**esponse). The I/Q output data is then stored by the DDC in the I/Q RAM. With data logging completed, the I/Q data from the I/Q RAM is transferred to the host via DDC and PCI interface FPGA. The host then performs the FFT for this sweep section.

Video Bandwidths (VBW)

The video filters of the FSU can be adjusted between 1 Hz and 10 MHz in steps of 1/2/3/5. They are designed as a digital lowpass 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 FSU 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.

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.

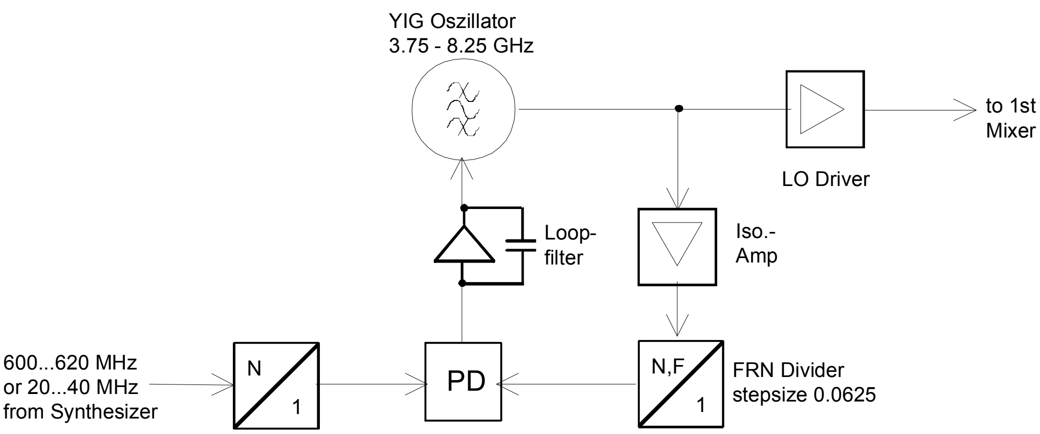


Fig. 3-7 Synchronization of 1st local oscillator

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.

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.

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 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).

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.

OCXO Reference (Option R&S FSU-B4)

The R&S FSU 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.

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 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.

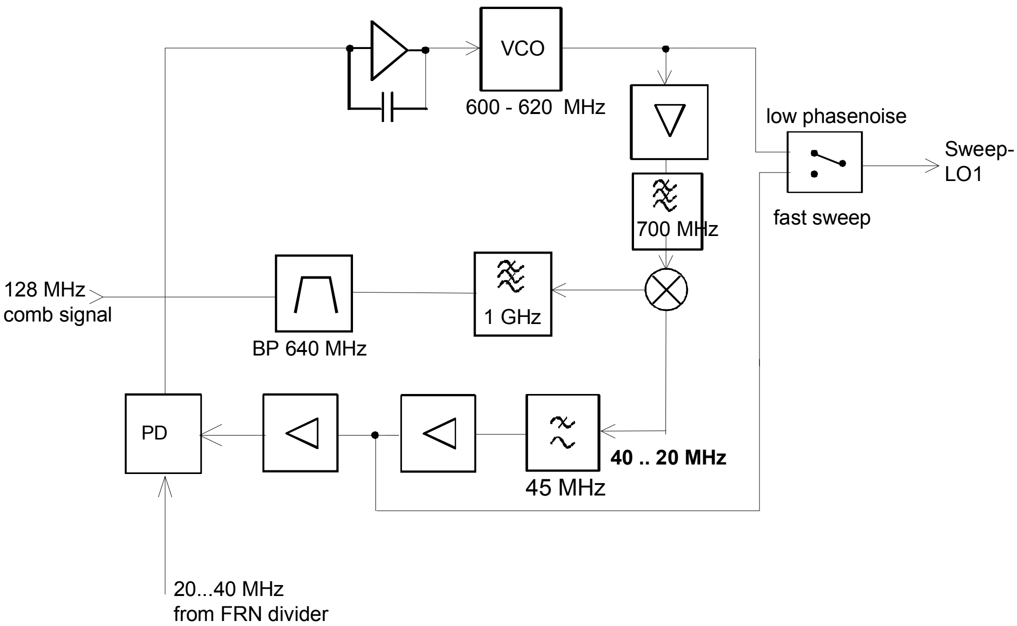


Fig. 3-8 Sweep synthesizer

Front Panel

The front panel consists of a mounting plate that accommodates the LCD, the keyboard mat with the membrane and the rotary knob. The case panel incorporates the front-module controller.

LCD
The color 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 cold cathode tube for illumination. The high voltage required for this purpose is generated in an extra DC/AC 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 (ISA bus), lithium battery, IEC/IEEE-bus controller, two serial interfaces (COM1/2), a parallel interface (LPT), LCD graphics controller, external VGA monitor graphics interface (monitor) and an external keyboard connection (keyboard 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 a ribbon cable.

Power Supply Module

The power supply module provides all currents necessary for operating the FSU. 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!).*

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 / Keyboard

The probe / keyboard PCB is located at the front of the instrument frame and accommodates the external interfaces KEYBOARD (PS/2) and PROBE POWER connector. 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 FSU 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 FSU 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 FSU-B10)

The external generator control option permits a number of commercially available generators to be operated as tracking generators on the R&S FSU. The generator is controlled via the – optional – second IEC bus interface of the R&S FSU (= 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 FSU.

If the option R&S FSU-B20 is used, a flash disk can be substituted for the hard disk in the instrument. The compact flash board contains two connectors for compact flash cards of type 1 and one connector for a link to the IDE interface of the front module processor.

External Mixer Port (Option R&S FSU-B21)

The external mixer port option enables the R&S FSU (model 26 or later) to be operated with external mixers to extend the frequency range. The option consists of a module that provides the LO output (7 GHz to 15.2 GHz) and an IF input (404.4 MHz) for the external mixer.

Preamplifier 26.5 GHz (Option R&S FSU-B23)

A connectible preamplifier can be used to improve the noise figure of the R&S FSU26 above 3.6 GHz. The preamplifier is integrated in the microconverter module and is thus only available directly from the factory.

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.

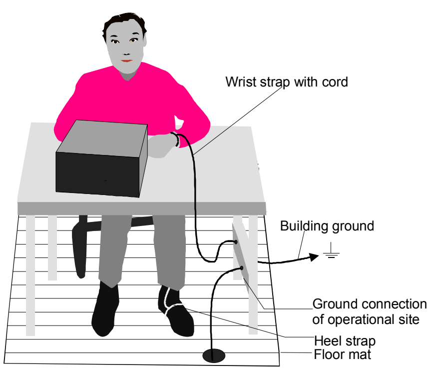
Note: *The numbers indicated in brackets refer to the item position in the list of mechanical parts in chapter 5.*

These items correspond to the item numbers in the illustrations for board replacement (see also chapter 5):

1166.1660 (R&S FSU Basic Model, items 1-455),
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).
1162.9921 (option R&S FSU-B28, items 1360-1380)
1144.9300 (option R&S FSU-B25, items 1400-1460)
1145.0259 (option R&S FSU-B18, items 1500-1560)
1129.7298 (option R&S FSU-B10. items 1600-1630)
1155:1612 (option R&S FSU-B20, items 1700-1730)
1142.9090 (option R&S FSU-B9, items 1800-1960)
1130.2544 (8 GHz MW Converter, items 2000-2035)
1130.3240 (≥26.5 GHz MW Converter, items 2100-2165)
1157.0907 (option R&S FSU-B23, items 2106)
1142.9361.00 (option R&S FSU-B12, items 2400-2445)
1157.1090 (option FSU-B21, Pos. 2900-2960)

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

Caution!



- *Please observe the safety instructions at the beginning of this manual and on the CD-ROM.*
- *Disconnect the instrument from the mains before opening the case.*
- *Protect the replacement site against electrostatic discharge to avoid damage to electronic components of the modules.*
- *The following two methods of ESD protection may be used together or separately:*

  - Wrist strap with cord to ground connection

  - Conductive floor mat and heel strap combination

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.

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/AC-converter			
Keyboard membrane or mat			
Front cover			
Floppy disk drive	Check of directories		
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 with B72 additional I/Q frequency response	Cold boot
Key probe and vol./phone	Voltage / keyboard / volume		
RF Converter	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response with B72 additional I/Q frequency response	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 R&S FSU-B10	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot
LAN interface B16			
Removable HD B18			
Flash Disk -B20	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot FW update
Electr. Attenuator -B25	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
External Generator Control -B10	SYSTEM MESSAGES/ SELFTEST / CAL		
Tracking Generator -B9	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Attenuator for Generator -B12	SYSTEM MESSAGES/ SELFTEST / CAL		
External Mixer -B21	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
Preamplifier 26.5 GHz -B23	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	
Trigger Port B28	SYSTEM MESSAGES/ SELFTEST / CAL		

Replacing Front Module Controller A90

(see chapter 5, spare parts list, item 571 and illustrations 1155.5001 and 1166.1677)
The front module controller is mounted behind the front panel.

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 (270) toward 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 (600, 621, 631, 641, 650, 660) toward 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/AC illumination converter, keyboard membrane, rotary knob and, if required, 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.*

Removing Front Module Controller

- Undo the 10 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: *The front module controller is tightly inserted on the motherboard.*
  It can be pulled off toward the front using the slots at the bottom of the mounting plate.
  Carefully push the board toward the front step by step using a flat, blunt tool.

Caution:

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!

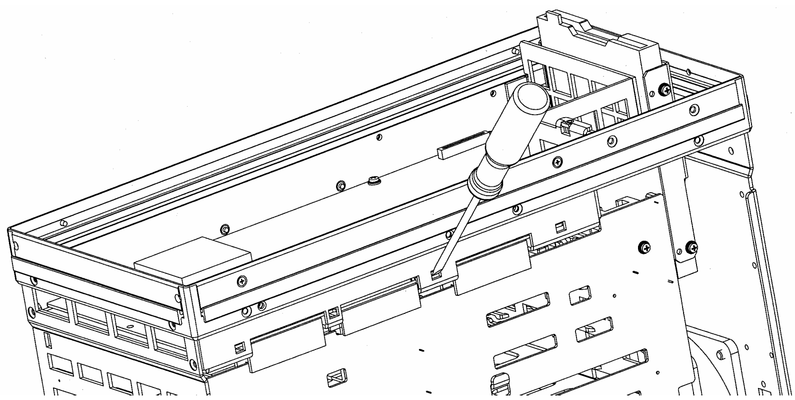


Fig. 3-9 Removing the front module controller

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 10 screws with washers (590).

  Caution: *Short-circuits might occur between controller components, lines and screws (590) on the FMR6, 1091.2520.00. Place an insulating mat underneath!*

- Carefully plug the cable connectors to the controller board, taking care not to reverse the polarities.

Front Module Controller Typ FMR6

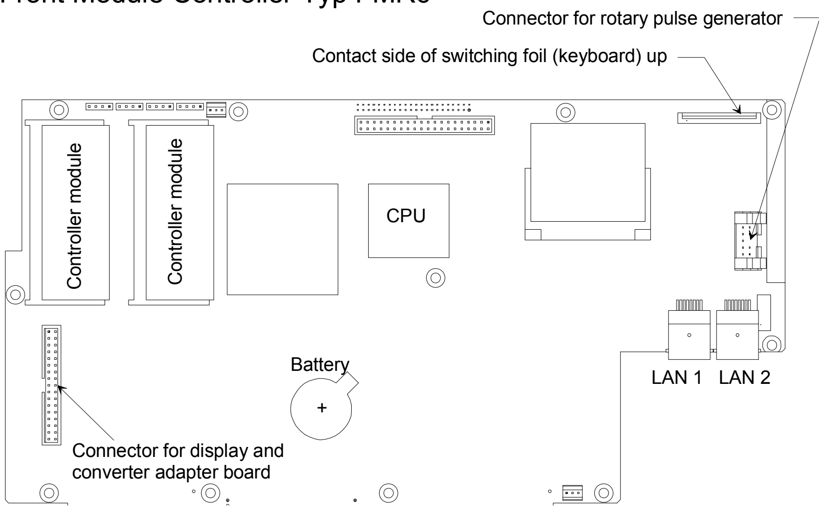


Fig. 3-10 Position of connectors on front module controller

- Rotate the front panel into the R&S FSU 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 (270).
- 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 FSU and wait until the first beep. Press the FILE key. The BIOS update starts.
- When programming the flash EEPROM, the R&S FSU must not be switched off.
- Follow the message indicated in the display, then switch the R&S FSU 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]

Replacing Lithium Battery on Front Module Controller

(see chapter 5, spare parts list, item 776 and illustrations 1166.1660 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 FMR6).

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

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 (270) toward 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) toward the front and rotate it to the top of the instrument.

Caution!
Note that the connecting cables are still connected to the controller.

- Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and rotary knob and, if required, network connector from the front module controller.

  Note: *When removing the connecting cables, be careful with the cable to the keyboard. It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.*

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*

Front Module Controller Typ FMR6

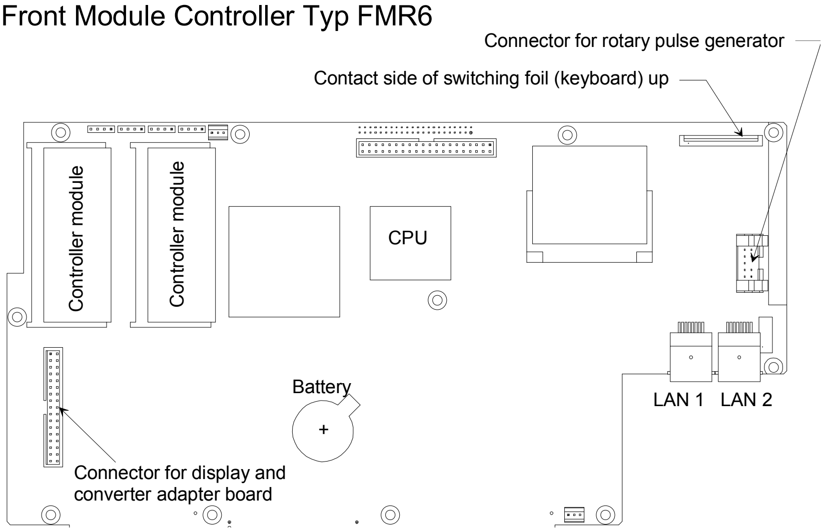


Fig. 3-11 Position of lithium battery on front module controller

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 FSU 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 (270).

➢ Mount the 2 front handles (420) again using the 4 screws (430).

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]

Replacing Hard Disk A60

(see chapter 5, spare parts list, item 710, and illustrations 1166.1660 and 1166.1677)

The hard disk is located between the front module and the boards.
The spare part contains the complete software.

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) toward the rear.
- 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 ribbon cable (720) at the hard disk.
- Undo the 2 countersunk screws (740) on the hard disk mounting plate (730).
- Take the hard disk (710) with the mounting plate (730) out of the R&S FSU.
- Undo the 4 countersunk screws (750), remove the hard disk and mount a new hard disk to the mounting plate (730).

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 ribbon cable (720) 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 "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 results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

Replacing LCD and DC/AC Converter in Front Module

(see chapter 5, spare parts list, items 601, 921 and 871, and illustrations 1166.1660, 1166.1677, 1093.4708)

The LCD is accommodated on the mounting plate together with the associated DC/AC converter. It is connected to the front module controller via cables, which can also be replaced individually. For replacement, proceed as follows:

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 (270) toward 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) toward 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/AC illumination converter, keyboard membrane and rotary knob and, if required, 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.

Removing DC/AC Converter

- Pull off the connecting cable from the display (921) to the DC/AC converter (871).
- Disconnect cable (905) to DC/AC converter (871).
- Remove the DC/AC converter (871) after undoing the 2 screws (892).

Removing LCD

- Unscrew 2 screws with washers (946) and unplug the display cable (945).
- Undo the 4 screws with washers (930) and remove the display (921).

Installing New LCD and/or DC/AC Converter and Putting into Operation

- To insert the new LCD and/or DC/AC converter, proceed in the reverse order, connect all cables in the correct position and tighten all screws (drawing 1093.4708).
- When replacing the display (921) or display cable (945), affix a new adhesive label (946) for cable safety.
- 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.

Front Module Controller Typ FMR6

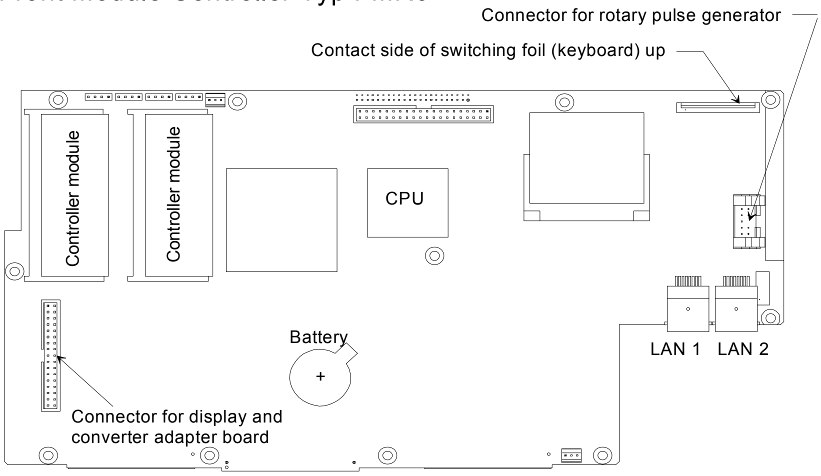


Fig. 3-12 Position of connectors on front module controller

- 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 (270).
- 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.

Replacing Keyboard Membrane or Mat on Front Module

(see chapter 5, spare parts list items 631 and 641, and illustrations 1166.1660, 1166.1677)

The keyboard membrane is the contact film for the rubber keys (mat) behind the front cover and the keyboard frame.

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 (270) toward 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) toward 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, keyboard membrane and rotary knob and, if required, 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.*

Removing Membrane

- Place the front panel onto a clean surface with the keys pointing upwards.
- Pull off the knob (650) of the rotary knob.
- Undo the 10 countersunk screws (660) and remove the keyboard frame (621).
- The keyboard membrane (641) as well as the mat (631) can now be replaced.

Installing New Membrane and Completing Instrument

- Insert the new mat (631) into the keyboard frame (621) from the back.

  Note: *The pins of the mat must be inserted into the holes at the keyboard frame.*

- Position the new keyboard membrane (641) on the back of the mat (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 mat 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 mat 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.

Front Module Controller Typ FMR6

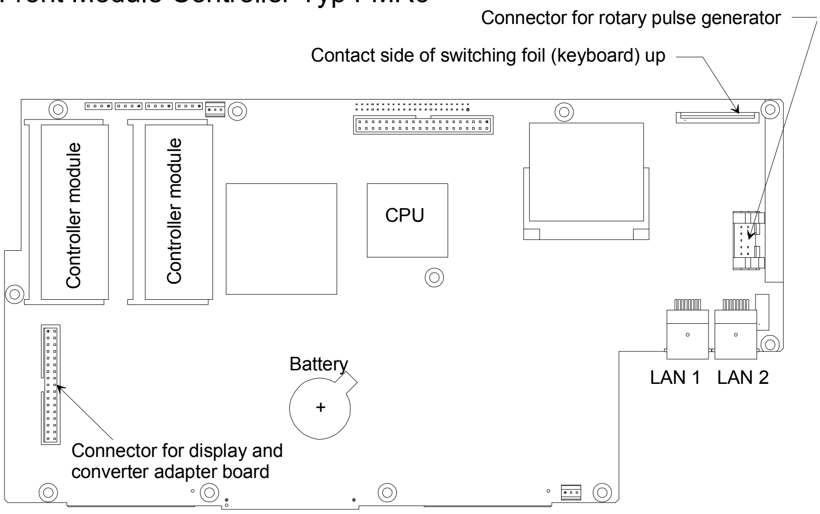


Fig. 3-13 Position of connectors on front module controller

- Rotate the front panel back into the R&S FSU and fasten it in the front frame using 4 countersunk screws (610).

Caution!
Make sure to route the cables properly.

- Install the front cover (270).
- 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.

Replacing Front Cover on Front Module

(see chapter 5, spare parts list, items 270/280/290/292, and illustration *1166.1660*)

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 (270) toward 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.

Replacing Floppy Disk Drive A30

(see chapter 5, spare parts list, item 670, and illustrations 1166.1660, 1166.1677)

Opening Instrument and Removing Floppy Disk Drive

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) toward the rear.
- 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 3 screws (700) at the fan side of the R&S FSU and carefully pull out the floppy disk drive (670) with the floppy mounting plate (680) pointing toward the top.

  Note: *The cable is still connected to the motherboard.*
- Disconnect the cable at the floppy disk drive.

Installing New Floppy Disk Drive and Completing Instrument

- Undo the 3 screws with washers (700) and remove the floppy disk from the mounting plate (680) and mount a new disk drive (670) to the floppy mounting plate (680).
- Connect the cable (690) to the disk drive (note the contact side of the cable).
- Insert the floppy mounting plate (680) and fasten it to the fan side using 2 screws with washers (700).

  Note: *Please mount the floppy disk drive in the middle of the front-panel breakout.*
- Replace the instrument cover (240) on the top and fasten it in place using 10 countersunk screws (260) and 3 screws with washers (250).
- Push the enclosure (410) onto the instrument and mount the 4 rear-panel feet (450).
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.

Function Test

- The instrument boots and the firmware starts.
- Insert a 3 ½" disk with any files.
- Press the FILE key, then the FILE MANAGER and EDIT PATH softkeys.
- Enter "a" and ":" and confirm with the Enter key.
- The directory structure of the inserted disk must be displayed on the screen.

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.

Removing Power Supply

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) toward the rear.
- Undo the 10 screws (560) at the rear of the power supply.
- Pull out the power supply approx. 20 mm toward the rear, slightly tilt it toward the bottom and then pull it out completely.

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 results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

Replacing Fan

(see chapter 5, spare parts list, item 15, and illustration 1166.1660)

The fan is installed at the right side of the frame.

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) toward the rear.
- 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) .

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.

Replacing RF Input Connector (Cable W1) R&S FSU3/8

(see chapter 5, spare parts list, item 295, and illustration 1166.1660)

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.

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) toward the rear.
- Undo the 4 screws (430) on the front handles on both sides and take off the front handles.
- Pull off the front cover (270) toward the front.
- Remove 3 countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (61).
- Unscrew the cable W1 (295) to 7 GHz or W1 (315) to 30 GHz at the RF attenuator (20) or (30).
- Remove the connector mounting plate (61) together with W1 and the probe/key module (50) toward the front.

  ***Note**: The probe/key module (50) is connected by a ribbon cable to the motherboard X80.*
- Undo the 4 countersunk screws (350) and remove cable W1 together with mounting plate (330) or (340).

Installing New Cable and Completing Instrument

- Put the mounting plate (330) or (340) onto the new cable W1 and fasten it in place using 4 countersunk screws (350), insert the mounting plate (61) into the instrument and screw it to attenuator (20) or (30).
- Fix 3 countersunk screws (70) in the instrument frame and 1 countersunk screw (70) in the mounting plate (61).
- Install the front cover (270).
- 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.

Replacing RF INPUT Connector (Testport Adapter) R&S FSU26

(see chapter 5, spare parts list, Item 315, and illustration 1166.1660)

The input connector is at the bottom right of the front panel. Different connectors are used depending on the frequency range of the instrument.

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) toward the rear.
- Remove the 4 screws at the left and right front handles (430) and take off front handles.
- Pull off front cover (290) toward the front.
- Remove 3 countersunk screws (70) from frame and 1 countersunk screw (70) from mounting plate (61).
- Unscrew input cable W1 (316) from attenuator (25).
- Pull out mounting plate (61) together with cable W1 and the probe/key (50) and vol./phone board (43) modules toward the front.

  ***Note**: The probe/key (50) and vol./phone board (43) modules are connected to X80, X81 on the motherboard by means of a flat cable.*

- Remove cable W1 together with mounting plate (340) after undoing 4 countersunk screws (350).
- Unscrew testport adapter (315) from cable W1 (316).

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 (61) and screw it to the attenuator (21).
- Fasten mounting plate (61) to instrument frame with 3 countersunk screws (70) and to mounting plate (61) with 1 countersunk screw (70).
- 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.

Replacing ´RF-INPUT´ (Testport Adapter) R&S FSU>26

(see chapter 5, spare parts list, item 320, and illustration 1166.1660)

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.

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 (70) on the instrument frame and the 4 countersunk screws (70) on the subassembly plate (61).
- Unscrew the input cable W1 (322) on the attenuator (22).
- Pull out the subassembly plate (61) toward the front together with W1 and the Probe/Key board (50) and the Vol./Phone board (43).

  ***Note**: The Probe/Key board (50) and* Vol./Phone board (43) *are plugged into the motherboard X80, X81 via a flat cable.*

- Remove cable W1 after undoing 4 countersunk screws (350) with mounting plate (340).
- Unscrew housing adapter (320) from cable W1 (322).

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 (61) and screw back onto attenuator (25).
- Fasten subassembly plate (61) via 3 countersunk screws (70) on the device frame and 4 countersunk screws (70) on the subassembly plate (61).
- 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.

Replacing Motherboard A10

(see chapter 5, spare parts list, item 510 and illustrations 1166.1660, 1166.1677)

The motherboard is located at the bottom.

Before removing the motherboard, you must determine the EEPROM entry for the specification version:

- [**SETUP** : SERVICE : ENTER PASSWORD „30473035“]
- [**SETUP** : SERVICE : SERVICE FUNCTION „3.0.2.12200.21“], shows the value 1 (hexadecimal value).
- [**SETUP** : SERVICE : SERVICE FUNCTION „3.0.2.12200.22“], shows the value 2 (hexadecimal value).
- Write down the values.

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) toward the rear.

➢ 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 toward 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 toward the rear, slightly tilt it toward 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 (270) toward 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) toward the front.

Caution:
Note that the cables are still connected to the controller.

➢ Disconnect the cables to the LCD, DC/AC illumination converter, keyboard membrane and rotary knob and, if required, 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/key, rear panel, etc).
- Undo seven screws with washers (520) at the lower side of the motherboard (510 or 511).
- Carefully pull the motherboard (510 or 511) toward the front panel (approx. 15 mm) and take it out of the instrument by swiveling down.

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.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- 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:
  - First convert the determined hexadecimal values into decimal values.
  - [**SETUP** : SERVICE : ENTER PASSWORD „30473035“]
  - [**SETUP** : SERVICE : SERVICE FUNCTION „3.0.3.12200.21.Wert 1“]
  - [**SETUP** : SERVICE : SERVICE FUNCTION „3.0.3.12200.22.Wert 2“]
  - [**SETUP** : SERVICE : SERVICE FUNCTION „3.2.1“]

Replacing RF Attenuator A40

(see chapter 5, spare parts list, items 20 and 25, and illustration 1166.1660)

The RF attenuator is installed at the bottom behind the RF input connector.

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) toward the rear.
- Place the instrument onto the left side and unscrew the RF cable or the diplexer (150) at the output of the RF attenuator.
- FSU3/8: 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.*
- FSU26: 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 (295) on the R&S FSU3/8, cable W1 (316) or cable W1 (322) on the R&S FSU26 from the input of the RF attenuator.
- Carefully take out the RF attenuator and unscrew the flexible RF cable from the input.
- Disconnect ribbon cable from motherboard connector X41 on the R&S FSU3/8 or at X40 on the R&S FSU26.
- Only R&S FSU26: Remove RF attenuator (25) by undoing 4 countersunk screws (27) from insulating plate (26).

Installing New RF Attenuator and Completing Instrument

- Only R&S FSU26: fasten new attenuator (25) to insulating plate (26) with 4 countersunk screws (27).
- Connect ribbon cable to motherboard connector X41 on the R&S FSU3/8 or to X40 on the R&S FSU26.
- Connect the flexible RF cable to the input of new RF attenuator (see label on cable).
- Install the new RF attenuator in the instrument and connect cable W1 to the input.
- R&S FSU3/8: Fasten the attenuator to the instrument frame using the 2 screws with washers (40).
  R&S FSU26: Fasten the attenuator to the instrument frame using the 3 screws with washers (28).
- Fasten the RF cable 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 R&S 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").

Replacing Key/Probe Module A80 and Vol./Phone Board A191

(see chapter 5, spare parts list, Pos. 43, 50 and illustration 1166.1660*)*

The boards are located behind the front-panel connectors Keyboard, Probe, Headphones and the volume control knob.

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) toward the rear.
- Undo the 4 screws (430) of the front handles on both sides and take off the front handles.
- Pull off the front cover (270) toward the front.
- Remove volume control knob (48).
- Pace the instrument onto the left side so that its bottom side is accessible.
- Remove 3 countersunk screws (70) at the frame and 1 countersunk screw (70) at the connector mounting plate (61).
- Unscrew the input cable W1 (295) or (315) at the RF attenuator (20) or (30).
- Remove the mounting plate (61) completely with W1 and Probe/Key board (50) and optional Vol./Phone board (1040) toward the front.

  ***Note**: The Probe/Key (50) and Vol./Phone (43) boards are connected to X80 and X81 on the motherboard via a ribbon cable.*
- Disconnect the cables of the 2 boards from motherboard connectors X80 and X81.
- Undo the 3 countersunk screws (55) and remove the Probe/Key board (50).
- Undo the 3 countersunk screws (46) and remove the Vol./Phone board (43) from the mounting plate (61).
- 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).

Installing New Boards and Completing Instrument

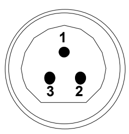
- Fasten the new Probe/Key board (50) to the mounting plate (61) using 4 countersunk screws (55).
- Fasten the new Vol./Phone board (43) to the mounting bracket (44) using the nut of the volume control and 1 screw with washer (45). Mount Vol./Phone board (43) to mounting plate (61) using 2 countersunk screws (46).
- Connect the cables of the 2 boards to motherboard connectors X80 and X81.
- Carefully slide the complete mounting plate (61) back into the instrument.

> ***Caution***
> *Make sure to route the cables properly.*

- Screw RF cable W1 (295) or (315) to the input of the RF attenuator (20) or (30).
- Mount 3 countersunk screws (70) to the instrument frame and 1 countersunk screw (70) to the mounting plate (61).
- Install the front cover (270).
- Mount the volume control knob (48).
- Mount the 2 front handles (420) using the 4 screws (430).
- Mount the enclosure (410) and the 4 rear-panel feet (450).

Function Test

- Connect an appropriate keyboard to the keyboard socket.
- Connect the instrument to the AC supply, switch on the power switch and press the ON key.
- 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.
- Measure the output voltages at the probe connector (see Fig. 3-14).



Pin	Signal
1	GND
2	-12.6 V
3	+15 V

Fig. 3-14 Pin assignments of PROBE POWER connector

- 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.

Replacing RF Frontend A100

(see chapter 5, spare parts list, item 100, and illustration 1166.1660)

The board is located in the middle of the instrument .

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) toward the rear.
- 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 toward 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.*

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.
- As of firmware version 1.6x, 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").

Replacing Synthesizer A110

(see chapter 5, spare parts list,, Pos. 105 and illustration 1166.1660)

The board is located in the middle of the instrument.

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) toward the rear.
- 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 toward 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.*

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.
- As of firmware version 1.6x, 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").

Replacing Detector A140

(see chapter 5, spare parts list, item 110, and illustration 1166.1660)

The board is located in the front part of the instrument.

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) toward the rear.
- 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 toward 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.*

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.
- As of firmware version 1.6x, 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]
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing IF Filter A130

(see chapter 5, spare parts list, item 120, and illustration 1166.1660)

The board is located in the middle of the instrument.

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) toward the rear.
- 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 toward 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.*

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.
- As of firmware version 1.6x, 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").

Replacing 8 GHz Converter Unit A160; R&S FSU8

(see chapter 5, spare parts list, items 130 to 140, and illustration 1166.1660)
(see chapter 5, spare parts list, items 130 to 140, and illustration 1155.5001)

The board is located in the middle of the instrument.

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) toward the rear.
- 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 toward 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.*

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.
- As of firmware version 1.6x, 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]
- Execute frequency response correction software R&S 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").

Replacing Diplexer A162; R&S FSU8

(see chapter 5, spare parts list, item 2030 and illustration 1130.2544)

The board is located on the 8 GHz Converter Unit.

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 FSU8".
- 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.

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).

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; FSU8".
- Connect the AC supply cable and switch on the instrument.
- 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 R&S 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").

Replacing 8 GHz YIG Unit A161; R&S FSU8

(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.*

Removing 8 GHz YIG Unit

- Remove the 8 GHz Converter Unit (130).
  Note: See description "Replacing 8 GHz Converter Unit A160; R&S FSU8".
- 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 toward the top perpendicularly to the PCB.*

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 FSU8".
- Connect the AC supply cable and switch on the instrument..
- 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 R&S 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").

Replacing ≥26.5 GHz MW Converter Unit A160; R&S FSU ≥26

(see chapter 5, spare parts list, item 140, 150 and illustration 1166.1660)

The board is located in the middle of the instrument.

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) toward the rear.
- 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 toward 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.*

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.
- As of firmware version 1.6x, 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 R&S 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").

Replacing Diplexer A161; R&S FSU ≥26

(see chapter 5, spare parts list, item 2105 and illustration 1130.3240, sheet 1)

The board is located on the ≥26.5 GHz MW Converter Unit.

Removing Diplexer

- Remove the ≥26.5 GHz Converter Unit (140 150).
  Note: *See description "Replacing ≥26.5 GHz MW Converter Unit A160; R&S "*
- 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.*

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).

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 Unit A160*"; connect AC supply cable and switch on the instrument.
- 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 R&S 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").

Replacing ≥26.5 GHz YIG Unit 162; R&S FSU ≥26

(see chapter 5, spare parts list, item 2530 and illustration 1130.3840)

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.*

Removing ≥ 26.5 GHz YIG Unit

- Remove the ≥26.5 GHz MW Converter Unit (140, 150).
  Note: See description "Replacing ≥26.5 GHz MW Converter Unit A160"
- Disconnect cable W1 from the diplexer (2105) and cable W2 from the relay unit (2170).
- Disconnect cable from YIG filter at X4.
- Undo 3 cover screws holding the YIG unit (2115) from the bottom of the module.
- Undo 2 countersunk screws (2120).
- Remove the complete YIG unit (2115 or 2117).

Installing ≥ 26.5 GHz YIG Unit

- Put the new YIG unit (2115 or 2117) on the PCB.
- Fasten YIG unit with 2 countersunk screws (2120).
- Refasten 3 cover screws holding the YIG unit (2115 or 2117) to the bottom of the module.
- Reconnect cable W1 to the diplexer (2105) and cable W2 to the relay unit (2170).
- Connect cable from the YIG filter to X4.

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.
- 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 R&S 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").

Replacing Extender ≥ 26,5 GHz A163; R&S FSU, 26/46/50

(see chapter 5, spare parts list, item 2125 and illustration 1130.3240)

The board is located on the ≥26.5 GHz MW Converter Unit.

Removing Extender ≥ 26,5 GHz

- Remove the ≥26.5 GHz MW Converter Unit (140, 150).
  Note: See description "Replacing the ≥26.5 GHz MW Converter Unit A160".
- Disconnect all cables from Extender 26 (2125).
- Undo all cover screws from the bottom side of the module and remove cover (2165).
  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.

Installing ≥ 26,5 GHz YIG Unit

- 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 the module cover (2160) onto the top of the ≥26.5 GHz MW Converter Unit (positioning by means of adjusting pins). Turn the ≥26.5 GHz MW Converter Unit upside down, fit module cover (2165) to the bottom side and refit all screws.
- Reconnect all cables to the Extender 26 (2125).

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.
- 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 R&S 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").

Replacing Tracking Generator A170 (Option: B9)

(see chapter 5, spare parts list, item. 1800, and illustrations 1129.9003 and 1142.9090)

The board is installed in the rear part of the instrument.

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) toward the rear.
- 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 board toward 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.*

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.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. 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").

Replacing Generator Attenuator A171 (Option: B12)

(see chapter 5, spare parts list, item. 2400, and illustrations 1129.9003 and 1142.9361)

The board is installed in the rear part of the instrument (behind the fan).

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) toward the rear.
- 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).

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.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. 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").

Replacing OCXO A200 (Option: B4)

(see chapter 5, spare parts list, item 1100, and illustrations 1155.5001 and 1144.9017)

The board is installed in the front part of the instrument.

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) toward the rear.
- 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 toward 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.*

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.
  As of firmware version 1.6x, a cold start is required after replacement of the OCXO. 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 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").

Replacing Combo Drive A381 (Option: B18)

(see chapter 5, spare parts list, item 1500, and illustrations 1155.5001 and 1145.0259)

The board is located on the top right of the front panel.

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) toward the rear.
- 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.
- Disconnect floppy power (691) and floppy data (1550) cables from combo drive (1500).
- Disconnect 44-contact flat cable from front module processor (570 or 571), remove cable tie and disconnect cable from combo drive (1500).
- Undo 3 screws with washers (700) and carefully take combo drive (1500) out of the instrument toward the top.
- Remove combo drive (1500) from holder (1505) by undoing 3 screws with washers (1506).

Installing New Module and Completing Instrument

- Fit new combo drive (1500) to holder (1505) using 3 screws with washers (1506).
- Carefully insert combo drive (1500) with flat cable into the instrument and fasten it to frame using 3 screws with washers (700).
- Route 44-contact flat cable from combo drive (1500) to front module processor (570 or 571) via cable ties and connect it. Lock cable ties.
- Reinstall floppy power (691) and floppy data (1550) cables to combo drive (1500).
- Place top cover on instrument (240) and fasten it with 10 countersunk screws (260) and 3 screws with washers (250).
- Push enclosure (410) back in place and fasten 4 rear-panel feet (450) by means of screws.
- Connect power cable, switch on power switch and press ON key.
- 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 results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

Replacing Flash Memory Cards A61, A62 (Option: B20)

(see chapter 5, spare parts list, item 1700 and illustrations 1129.9003 and 1155.1612)

The flash cards are located in the instrument between the processor and the modules. The spare parts are supplied with pre-installed software.

Note: *The flash memory cards can only be replaced in pairs. The spare part no. 1155.1641 includes 2 flash cards with pre-installed software.*

Opening Instrument and Replacing Flash Memory Cards

- Switch off the instrument, pull the mains plug, unscrew the 4 rear-panel feet (450) and take off the enclosure (410) toward the rear.
- 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.
- Disconnect flat cable (720) from flash board (1700).
- Undo 2 countersunk screws (740) from flash board holder (730).
- Remove flash board (1700) with holder (730).
- Open clamps (1730) and remove flash memory cards (1710).

Installing New Flash Memory Cards and Putting Instrument into Operation

- Plug in new flash memory cards (1710) as indicated by the labeling and lock clamp (1730).
- Plug flash board (1700) and holder (730) into instrument and fix it with 2 countersunk screws (740).
- Refit flat cable (720) to flash board (1700).
- Place top cover on instrument (240) and fix it back with 10 countersunk screws (260) and 3 screws with washers (250).
- Push enclosure (410) back in place and fix 4 rear-panel feet (450) by means of screws.
- Connect power cable and switch on power switch. The instrument is in the standby mode.
- A cold start is required after replacing the flash memory cards. Switch on with the ON key and press the decimal point key at the same time until the computer outputs a beep.
- After starting the instrument check if the protocol file is correct:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check if the result is correct:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]

Replacing External Generator Control A210 (Option: B10)

(see chapter 5, spare parts list, item 1600, and illustrations 1155.5001 and 1129.7298)

The board is installed in the front part of the instrument .

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) toward the rear.
- Undo the 2 countersunk screws (260) on the top of the instrument and the 2 screws with washers (250) at the fan side, lift the instrument cover (240) and remove it by swinging it to the left.
- Pull out the board toward the top of the instrument.

Installing New Module and Completing Instrument

- 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).
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a Cold Start“.
- After starting the instrument, check the log file for system messages:
  - [SETUP **:** SYSTEM INFO : SYSTEM MESSAGES **]**

Replacing Detector Module A140 (Option B73)

(see chapter 5, spare parts list, item 5100, and illustration 1166.1660)

The module is at the front of the instrument.

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) toward the rear.

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 module at the bottom of the instrument and at the top of instrument, if necessary.

Pull out the module toward the top of the instrument.

***Note**:* *The module can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing New Module and Completing Instrument

- Plug new module 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 power switch. The instrument is now in the standby mode.

A cold start is required after replacement of the detector (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]
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing External Mixer Board A180 (Option B21)

(see chapter 5, spare parts list, item 2900, and illustrations 1166.1660 and 1157.1110)

The board is installed in the center part of the instrument.

Opening Instrument and Removing Board

- Switch off instrument, disconnect from mains, unscrew 4 rear panel feet (450) and pull off enclosure (410) toward rear.
- Remove the instrument cover toward the top (240) after undoing the 10 countersunk screws (260) on the cover top and the 3 countersunk screws (250) on the fan side and then swinging it toward the left.
- Undo RF cable W39 at the top of the external mixer board.
- Place the instrument on its side and remove all RF cables to the board at the bottom of the instrument.
- Pull the board out toward the bottom of the instrument.
  Do not damage RF cable W39 on the top!

  ***Note**: The board can be loosened from the motherboard connector by carefully applying pressure from the bottom through the motherboard slots.*

Installing Board and Completing Instrument

- Insert new board into instrument and reconnect all RF cables.

  Note: *Do not forget RF cable W39 at the top of the board.*
  Note the labeling on the motherboard.

- Place the instrument cover on the top (240) and screw it back on with ten countersunk screws (260) and 3 screws with washers (250).
- Slide on the enclosure (410) and screw on the 4 rear panel feet (450).
- After the external mixer board is replaced, a cold start must be performed.
  See section "3".
- Plug in the power cable, switch on the power switch and press the ON key.
- After starting the instrument, check the log file for any errors:
  - [**SETUP :** SYSTEM INFO : SYSTEM MESSAGES]
- Start the selftest and check results:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start the system error correction and check results:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- Check characteristics as defined in chapter 1,Test Sequence for Option External Mixer B21.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing Diplexer Board with Preamplifier A161; (Option B23)

(see chapter 5, spare parts list, item 2106 and illustration 1130.3240.01 sheet 3)

The board is installed on the ≥ 26.5 GHz MW Converter Unit.

Removing Diplexer

- Remove the ≥26.5 GHz MW Converter Unit (140).
  Note*: See description "Replacing* ≥26.5 GHz *MW Converter Unit A160; R&S FSU26"*
- Undo all cables on the diplexer (2106).
- Unscrew 4 screws with washers (2110) at the bottom of the PCB.
- Remove the diplexer (2106) perpendicularly to the PCB.
  Note: *The diplexer is still connected to the PCB with contact pins.*

Installing Diplexer

- Plug in the new diplexer (2106) perpendicularly to the PCB.
  Note: *The diplexer is connected to the PCB with contact pins.*
- Screw on 4 screws with washers (2110) at the bottom of the PCB.
- Screw on all cables to the diplexer (2106).

Completing Instrument and Correcting Frequency Response

- Plug the ≥26.5 GHz MW converter unit (140) back into instrument.
  Note: *See description "Replacing ≥ 26.5 GHz MW Converter Unit A160; R&S FSU"*
- Connect the AC supply cable and switch on the instrument.
- 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]
- Run the "FSU-FRQ.EXE" frequency response software program.
  The software is located on the GLORIS server.
  - Test setup in accordance with menu item "Schematic" (connect external reference). Check IEC addresses and configurations of the instruments.
  - Press the Autoselect button and perform measurement with Run.
  - Select YIG to perform the frequency correction of the YIG filter.
  - After calibration, the frequency response is corrected for the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing the Electronic Attenuator A50 (Option B25)

(see chapter 5, spare parts list, item 1400, and illustrations 1166.1660 and 1144.9300)

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) toward the rear.
- Place instrument on its side and remove RF cables on both sides of the electronic attenuator (1400).
- Undo 4 screws with washers (1460) from the trough.
- Carefully remove electronic attenuator (1400).
- Connect flat cable (1410) to electronic attenuator (1400).

Installing Module and Completing Instrument

- Refit flat cable (1410) to new electronic attenuator (1400).
- Carefully reassemble new electronic attenuator (1400) and screw it to trough using 4 screws with washers (1460).
- Refit RF cables to both sides of electronic attenuator (1400).
- Push enclosure (410) back in place and fix 4 rear-panel feet (450) by means of screws.
- Connect AC supply cable and switch on power switch. The instrument is now in the standby mode.
- As of firmware version 1.6x, a cold start is required after replacement of the RF converter. See chapter „Performing a Cold Start“.
- After starting the instrument check if the protocol file is correct:
  - [**SETUP** : SYSTEM INFO : SYSTEM MESSAGES]
- Start selftest and check if the result is correct:
  - [**SETUP** : SERVICE : SELFTEST], then [SELFTEST RESULT]
- Start system error correction and check if the result is correct:
  - [**CAL** : CAL TOTAL], then [CAL RESULTS]
- Run the "FSU-FRQ.EXE" frequency response software program.
  The software is located on the GLORIS server.
  - Test setup in accordance with menu item "Schematic" (connect external reference). Check IEC addresses and configurations of the instruments.
  - Press the Autoselect button and perform measurement with Run.
  - Select YIG to perform the frequency correction of the YIG filter.
  - After calibration, the frequency response is corrected for the entire frequency range.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing FM Demodulator Module A290 (Option B27)

(see chapter 5, spare parts list, item 3500, and illustrations 1166.1660 and 1157.2016)

The module is in the middle section of the instrument.

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) toward the rear.

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 module at the bottom of the instrument.

Pull out the module toward the top of the instrument.

***Note**: The module can be disconnected from the motherboard connector by carefully pressing from the bottom through the motherboard slots.*

Installing New Module and Completing Instrument

- Plug new module 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, switch on power switch and press the ON key.

A cold start is required after replacement of the detector (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 module functioning as described in chapter 1.
- Create backup of the EEPROM data (see chapter 2, section "Adjustment of Module Data").

Replacing the Trigger Ports W67 (Option B28)

see chapter 5, spare parts list, item 1360, and illustrations 1166.1660 and 1162.9921).

The cable is at the rear panel.

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 Trigger Port (1360) on motherboard and move on the rear panel.

Installing the Cable and Completing the Instrument

- Mount supplied cable W67 Trigger Port (1360) spring (1370) and nuts (1375).
- 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]

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 FSU for diagnostic purposes:

- Permanent monitoring of levels and frequencies in the instrument
- Selftest
- System error correction

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

Measuring Equipment and Accessories

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S-Order No.	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	0.5m 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

Troubleshooting Switch-on Problems

- **Error: The R&S FSU 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 ± 1V 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 ± 1V 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 > 1V: Keyboard membrane 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: 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	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. ***Note:*** *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.*

- **Error: Fan does not work.**

Action	Possible error causes and further steps
Check voltage at connector: X35 pins 1 + 3 : Rated value 7V	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.

Troubleshooting Problems with Booting

- **Error: The R&S FSU does not start the measurement application.**

Following switch-on, the R&S FSU 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 FSU. After the R&S FSU is switched on, the following BIOS message is displayed: **Award Modular BIOS v6.00PG, An Energy Star Ally** **Copyright (C) 1984-2000, Award Software, Inc.** **R&S ANALYZER BIOS V2.0-17-2** **02/12/2002-io815E-LPC47B2-6A69REFC2C-00** After the first beep, the computer starts the hardware test and the following message is briefly displayed at the lower edge of the screen: **, ESC to skip Memory test...** The test results are usually not displayed. If errors occur during the boot procedure, these messages may indicate defects. ➢ The messages can be made visible by pressing the "DISP" key following the beep. The keystroke is acknowledged by a second beep. Then, all messages are displayed.	
Award Modular BIOS v6.00PG, An Energy Star Ally **Copyright (C) 1984-2000, Award Software, Inc.** **R&S ANALYZER BIOS V2.0-17-2** **Main Processor : Intel Pentium III 700 MHz (100x7.0)** **Memory Testing: 261120K OK + 1024 Shared Memory** ***(= result of memory test)*** **02/12/2002-io815E-LPC47B2-6A69REFC2C-00** The memory test yields the memory capacity of the front module controller. The basic version of FMR6 provides 256 Mbyte. BIOS then starts to check the controller hardware. All PCBs found are displayed.	If no result of the memory test is indicated, the memory is defective.

Normal action	Error and error cause
➢ This procedure may be interrupted using the "PAUSE" key on the connected external keyboard, any other key continues the program execution.	

```
Award Modular BIOS v6.00PG, An Energy Star Ally
Copyright (C) 1984-2000, Award Software, Inc.

R&S ANALYZER BIOS V2.0-17-2

Main Processor : Intel Pentium III 700 MHz (100x7.0)
Memory Testing: 261120K OK + 1024 Shared
Memory

  Primary Memory Clock is 100 MHz
  Primary Master : IBM-DJSA-205 JS100AB0A
            (depending on installed hard disk))
  Primary Slave    : None
  Secondary Master : None
  Secondary Slave  : None

02/12/2002-io815E-LPC47B2-6A69REFC2C-00
```

If this hard disk entry is missing, the hard disk may be faulty

SETUP is then displayed.

➢ This procedure can also be interrupted using the "PAUSE" key.

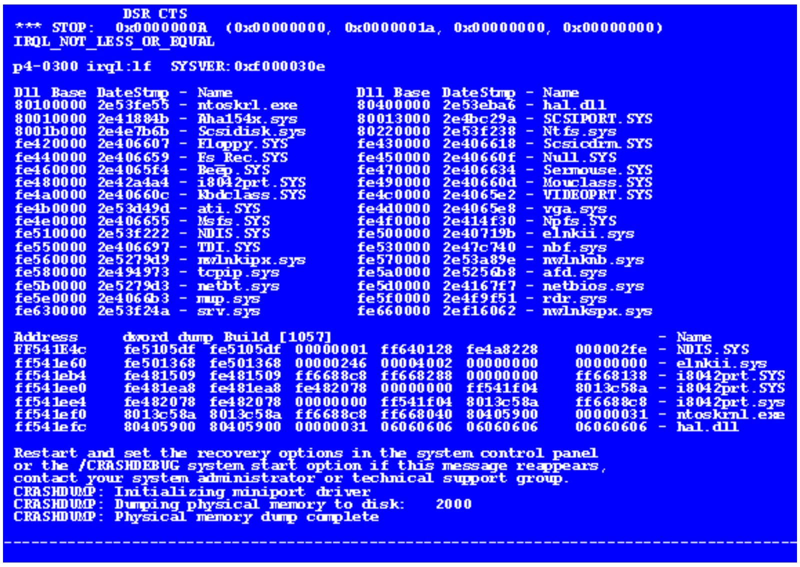
The contents partly depend on the hardware provided:

```
Award Software Inc.
System Configurations

  CPU Type          : Intel Pentium III      Base Memory        : 640K
  Co-processor      : Installed              Extended Memory    : 260096K
  CPU Clock         : 700 MHz                Cache Memory       : 256

  Diskette Drive  A : 1.44M, 3.5 in.         Display Type       : EGA/VGA
  Diskette Drive  B : None                   Serial Port(s)     : 3F8
  Hard Disk Drive C : LBA, ATA 66, 5001MB    Parallel Port(s)   : 378
  Hard Disk Drive D : None                   EDO DRAM at Row(s) : None
                                             SDRAM at Row(s)    : 2 3
                                             Display Cache Size : None

 PCI device listing.....
```

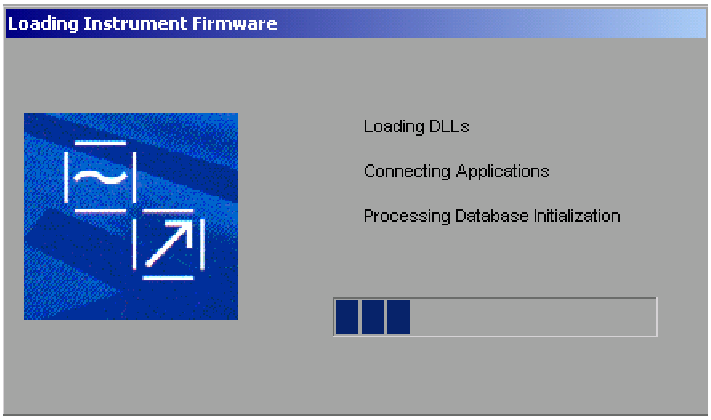
Bus No.	Device No.	Funct No.	Vendor /	Device ID	Class	Device Class	IRQ
0	2	0	8086	1132	0300	Display Cntrlr	10
0	31	1	8086	244B	0101	IDE Cntrlr	14
0	31	2	8086	2442	0C03	Serial Bus Cntrlr	11
0	31	3	8086	2443	0C05	SMBus Cntrlr	NA
0	31	4	8086	2444	0C03	Serial Bus Cntrlr	9
1	8	0	8086	2449	0200	Network Cntrlr	11
1	13	0	162F	1212	FF00	Unknown PCI Device	11

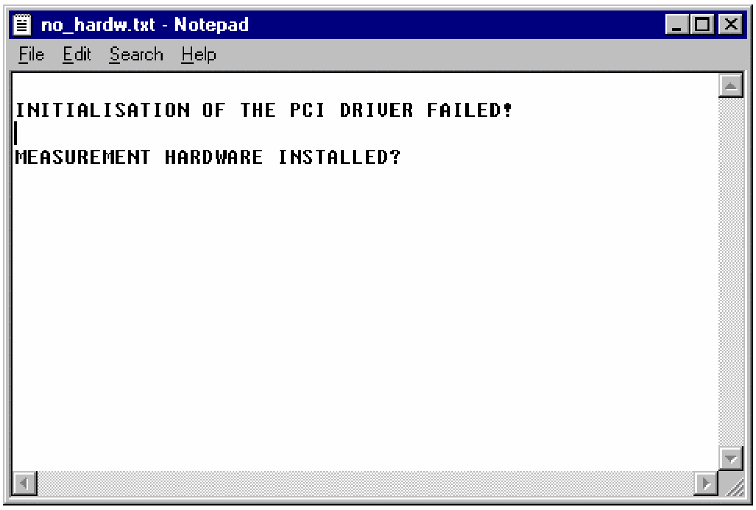
Normal action	Error and error cause
The PCI hardware test is displayed in the lower half of the screen. All modules found during the test are displayed with their names and PCI device IDs. The Device Class column lists the types of PCI devices. The wideband detector unit of the R&S FSU is indicated as "Unknown PCI Device".	If the line "Unknown PCI Device" is missing, the wideband detector unit has not been identified and the measuring application cannot be started. If the remaining PCI devices have all been identified, the wideband detector unit will probably contain the error, which is why the board must then be replaced.
After this test, the BIOS has been loaded and the operating system is started.	The message "No System Disk or Disk error ..." at this point indicates that the contents of the hard disk are not correct. Replace the hard disk.
After successful installation of Windows NT, the following selection menu is displayed: **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):



	Windows XP and the instrument firmware must then be updated from the backup partition (see chapter 4, section "Software Update").
Before the operating system is started, the application for the R&S **FSU** 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 FSU (RF converter).	If there is an error on the detector board or the clock is missing, the following message is displayed:

SYSTEM MESSAGE

DETECTOR:Access failed, check HW component !

OK

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.

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

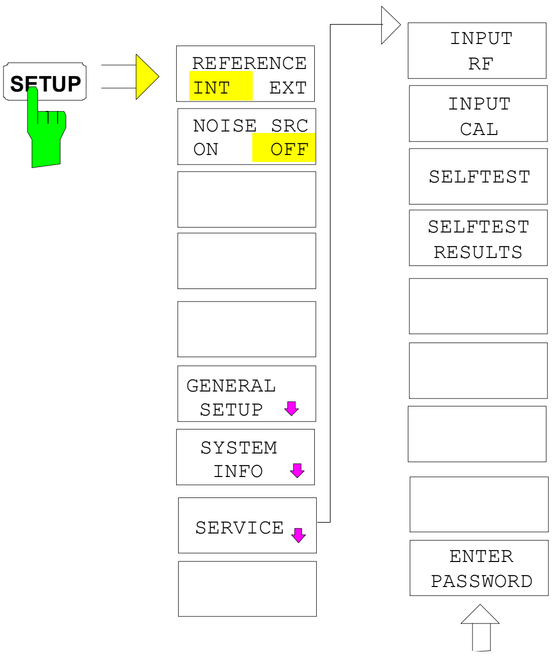
Normal action	Error and error cause
Upon successful reading of the module header from the EEPROM, the contents of the module header is compared with the module header of the associated binary file. If the module header can be read from the file and complies with the header read from the EEPROM, the assumption 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.

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

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.

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

   of the power supply
   regulated operating voltages on the detector and IF filter modules
2. Temperature measurement on the IF filter board
3. Testing the fourfold D/A converter on the detector
4. Synthesizer test
5. Lock test YIG oscillator and LO level test on RF converter
6. Testing of the signal paths on RF converter, IF filter and detector
7. 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 +6V.
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 -5V.
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.
Subsequently the operating voltages are measured.	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.

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

➢ If there 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

- If 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 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 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. ***Attention:*** *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
Signal path	

All switchable signal paths will be checked for compliance with a level tolerance of ±10%.
These are:
I channel, high
I channel, low
Q channel, high
Q channel, low
In each of these four paths, the 0 dB range, the two -5/-10 dB attenuators and the three +5/+10/+15 dB amplifiers are checked.
An additional measurement is performed in the I and Q paths with the filter switched on.

If an error is detected in the 0 dB range, all other amplifier/attenuator stages and the filter are not checked as they would inevitably produce a FAILED.

See under SELFTEST RESULTS:
baseband board: signal path tests

I/Q path high/low x dB	FAILED
and / or	
I/Q path filter	FAILED

Possible error sources:
Switch or amplifier on the baseband input 2 board.
Special case: I/Q path high, 0 dB, FAILED
If this error occurs, all other tests in the respective channel are skipped. The cause may also be a defective cable to the wideband detector board: W57 (I channel) or W58 (Q channel). First check the cables or replace them for a test. If the cables are OK, replace the baseband input 2 board.

Other components

Dither
The peak-peak voltage of each channel (I and Q) is measured first with and then without dither signal (internal noise only).

DC offset DAC
Function and setting range of the two DACs are checked.
(The DACs are required to compensate for the I/Q offset.)

Pulse source
Check level of pulse source.
(The pulse source is required to determine the frequency response correction.)

See under SELFTEST RESULTS:
baseband board: components

I/Q path dither	FAILED
and / or	
I/Q DC offset DAC	FAILED
and / or	
pulse source	FAILED

Possible error sources:
Failure of components (dither, DC offset, DAC,

pulse source) on the baseband input 2 board.

I/Q path noise	FAILED

Possible error sources:

Strong noise on the baseband input 2 board (e.g. because the amplifier is defective) or on the wideband detector module (e.g. stuck bit).
Troubleshooting:

- Disconnect cables from X144 and X145 on the wideband detector board and terminate the inputs X144 and X145 with 50 Ω or short-circuit them. Repeat selftest, with password, so that the test is not interrupted.
- Observe only the measured I/Q path noise:
  If a PASSED is obtained → replace the baseband input 2.
  If a FAILED is obtained → replace the wideband detector board.

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

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 FSU 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) and -- with the FSU 46 -- the 2nd LO (connector X114 synthesizer) must be taken out to the MW converter (connector X167 / X1611). **R&S FSU 8:** - Diplexer input connector: X169 - Output connector: X161 **R&S FSU 26/40:** **26/46/50:** - 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 cause/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. **FSU 8:** - Diplexer input connector: X169 - Diplexer output connector: X8 **R&S FSU 26:** - Diplexer input connector: X168 - Diplexer output connector: X5 **R&S FSU 40:** **46/50:** - 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 FSU** 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 FSU 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 FSU- 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 FSU 46/50:** - Input connector: X1 - Output connector: X4 Output level at 404.4 MHz: f = 3.6 GHz to 26.5 GHz: >-26dBm - 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").

Contents - Chapter 4 "Software Update/Installing Options"

This page is left blank intentionally.

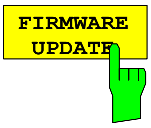
4 Software Update / Installing Options

This chapter contains information on software updates, restoring the operating system installation and installing options on the R&SFSU. Additional manuals obtained together with a software/firmware update or with subsequently acquired options can be filed here.

Installation of New R&S FSU 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:

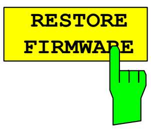


The *FIRMWARE UPDATE* softkey starts the installation program and leads the user through the remaining steps of the update

IE/IEEE-bus command: --

Performing the update:

Insert diskette 1 into the drive.
Call *SETUP* side menu *[**SETUP**][**NEXT**]*
Start update *[FIRMWARE UPDATE]*



The *RESTORE FIRMWARE* softkey restores the previous firmware version

IEC/IEEE-bus command: --

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.

Please select the operating system to start:

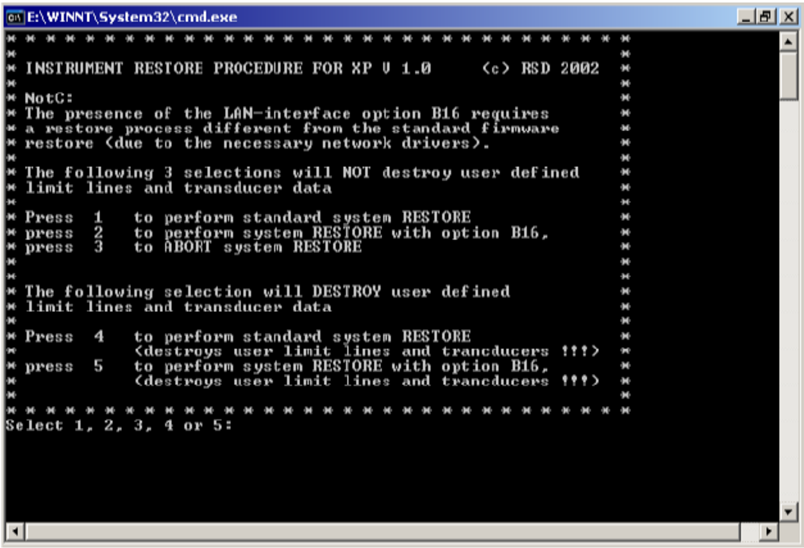
Analyzer Firmware
Analyzer Firmware Backup

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.

Installing Options

The following options are available with the R&S FSU:

OCXO	R&S FSU-B4	1129.6740.02
Tracking Generator	R&S FSU-B9	1142.8994.02
Attenuator for Tracking Generator	R&S FSU-B12	1142.8994.02
Removeable Hard Disk	R&S FSU-B18	1145.0242.05
RF Preamplifier 3.6 GHz to 26 GHz	R&S FSU-B23	1157.0907.05
Electronic Attenuator	R&S FSU-B25	1129.7746.02
Trigger Port	R&S FSU-B28	1162.9915.02
Option Preselector for FSU 26	R&S FSU-B2	1157.1903.26

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 manual.

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 FSU (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.

Contents - Chapter 5 "Documents"

Figures

Tables

This page is left blank intentionally.

5 Documents

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

Shipping of Instrument and Ordering of Spare Parts

Please contact your Rohde & Schwarz support center or our spare parts express service if you need service or repair of your equipment or to order spare parts and modules.

The list of the Rohde & Schwarz representatives and the address of our spare parts express service are provided at the beginning of this service manual.

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

- Instrument model
- Stock No.
- Serial number
- Firmware version
- Detailed error description in case of repair
- Contact partner for checkbacks

Shipping of Instrument

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

➢ Repack the instrument as it was originally packed when transporting or shipping. The two protective caps for the front and rear panels prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

➢ If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

Shipping of a Module

When shipping a module, then, also be also careful to provide for sufficient mechanical and antistatical protection

➢ Ship the module in a sturdy, padded box.

➢ Wrap the board into antistatic foil.
If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the enclosed 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 replacement parts promptly and correctly we need the following indications:

- Stock number (see component lists in this chapter)
- Designation
- Component number according to component list
- Number of pieces
- Instrument type the replacement part belongs to
- Stock No.
- Contact person for possible questions

The stock numbers necessary for ordering replacement parts and modules as well as power cables can be found further down.

Refurbished Modules

Refurbished modules are an economic alternative for original modules. It should be kept 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.

To find out which refurbished modules are available, please refer to your Rohde & Schwarz representative (or to the central service division, Rohde & Schwarz Munich).

Taking back Defective Replaced Modules

Defective modules of the replacement program which can be repaired are taken back within **3 months** after delivery of the replaced module. A repurchasing value is credited.

Excluded are parts which can not be repaired, e.g. PCBs that are burnt, broken or damaged by repair attempts, incomplete modules, parts which are heavily damaged mechanically.

The defective parts must be sent back with a **returned accompanying document** containing the following information:

- Stock number, serial number and designation of the dismounted part,
- **Precise** description of the error,
- Stock number, serial number and designation of the instrument the part was dismounted from,
- Date of dismounting,
- Name of the technician who exchanged the part.

A returned accompanying document is provided with each replacement module.

Spare Parts

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

Important Note!

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

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

Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013.00	BS1363: 1967' complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
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)

This page is left blank intentionally.

Spare Part List

Mechanical Drawings

This page is left blank intentionally.

List of parts including spare parts

The R&S FSU is constructed in accordance with R&S design 2000.

Overall dimension: W x H x L, 426,7 x 176,5 x 517

Rackmount: 4E 1/1 T450

Accessories: 19"-Adapter ZZA-411, Stock no. 1096.3283.00

Note: *The recommended spare parts are marked x in the like column.*

Table 5-2 List of all R&S FSU part and spare parts

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
Document 1166.1660.01 (R&S FSU-instrument)					
10	Basic Unit	1166.1677.02	1 S		
15	Fan	1130. 0070.00	1 S	E1	x
17	Speaker	1129.9332.00	1 S	B1	x
20	Attenuator R&S FSU3/8	1137.0599.02	1 S	A40	x
22	Attenuator R&S FSU40	1046.5130.03	1 S	A40	x
23	Attenuator R&S FSU50	1046.5130.04	1 S	A40	x
25	Attenuator R&S FSU26	1046.5130.02	1 S	A40	x
26	Insolating plate	1129.9690.00	1 S		
27	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
28	DIN6900-M2,5X6 -A2	1148.3059.00	3 S		
30	Ribbon cable W40	1130.2515.00	1 S	W40	
40	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
43	VOL/PHONES BOARD	1093.7094.02	1 S	A191	x
44	HOLDING BRACKET AF-OUT	1129.9326.00	1 S		
45	DIN6900-M2,5X6 -A2	1148.3059.00	1 S		
46	DIN965-M2,5X6-A4-PA	148.3288.00	2 S		
48	Rotary knob 13 ACHS-RD4T-GR	0852.1211.00	1 S		
49	Ring for rotary knob	0852.1228.00	1 S		
50	KEY-PROBE	1130.2996.02	1S	A80	x
55	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
61	Subassembly plate II	1155.5553.00	1 S		
65	Power Sense Interface	1166.3270.00	1 S		x
70	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
72	3,5 MM GROUND SPRING	1142.8242.00	1 S		
90	Cover RD15,9	0009.9200.00	1 S		
91	Cover RD15,9	0009.9200.00	2 S		
100	RF CONVERTER	1130.4047.02	1 S	A100	x
105	SYNTHESIZER	1166.2209.02	1 S	A110	x
111	DETECTOR BOARD 1	1130.2196.06	1 S	A140	x
120	IF-FILTER	1130.2296.03	1 S	A130	x
130	CONVERTER UNIT(8 GHZ)	1130.2544.03	1 S	A160	x
135	Angle bracket MW converter	1129.9384.00	1 S		
136	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
140	MW-CONVERTER UNIT 26.5 GHz	1130.3240.22	1 S	A160	x
148	MW-CONVERTER UNIT 43 GHz	1166.2096.43	1 S	A160	x
150	MW-CONVERTER UNIT 46 GHz	1130.3840.46	1 S	A160	x
151	MW-CONVERTER UNIT R&S FSU31	1166.2096.86	1 S	A160	x
152	MW-CONVERTER UNIT 50 GHz	1166.2096.50	1 S	A160	x
153	MW-CONVERTER UNIT R&S FSU32	1166.2096.90	1 S	A160	x
160	Air cover	1129.9355.00	2 S		
161	Air cover	1129.9355.00	1 S		
170	Rear panel	1163.0092.00	1 S		
180	DIN6900-M2,5X6 -A2	1148.3059.00	6 S		
182	Cover I/Q DATA	1130.0006.00	1 S		
183	DIN7985-M2.5x6-A4-PA	1143.5630.00	2 S		
190	Cover 9-pin SUB-D	1093.8990.00	1 S		
200	Cover 25-pin SUB-D	1093.9000.00	2 S		
210	Cover RD11,1/9,9	0009.9217.00	5 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
212	Cover RD11,1/9,9	0009.9217.00	1 S		
220	Cover f. LAN-connector	0852.0467.00	2 S		
225	Cover f. IEC-BUS	0852.0450.00	1 S		
230	ADAPTER	1093.9122.00	1 S		
231	CABLE 2xRJ45	1066.1819.00	1 S		
240	Instrument top cover	1129.9261.00	1 S		
250	DIN6900-M2,5X6 -A2	1148.3059.00	3 S		
260	DIN965-M2,5X6-A4-PA	1148.3288.00	10 S		
270	Printed front panel R&S FSU3	1166.1690.00	1 S		
280	Printed front panel R&S FSU8	1166.1702.00	1 S		
285	Printed front panel R&S FSU43	1166.2467.00	1 S		
290	Printed front panelR&S FSU26	1166.1719.00	1 S		
291	Printed front panel R&S FSU31	1166.1825.00	1 S		
292	Printed front panel R&S FSU46	1129.9232.00	1 S		
293	Printed front panel R&S FSU50	1166.1790.00	1 S		
294	Printed front panel R&S FSU32	1166.1831.00	1 S		
295	RF-cable W1 8GHZ	1129.9503.00	1 S	W1	x
315	TESTPORT GEH. ADAPTER	1021.0493.00	1 S	X1	x
316	RF-CABLE W1 26.5GHZ	1129.9555.00	1 S	W1	x
320	TESTPORT GEH. ADAPTER	1036.4702.00	1 S	X1	x
322	RF-CABLE W1 46GHZ	1129.9590.00	1 S	W1	x
330	Assembly plate	1093.4750.00	1 S		
340	Assembly plate	1093.4772.00	1 S		
350	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
410	BW2-HOUSING 4E1/1T450 R&S FSU	1166.1760.00	1 S		
420	BW 2 - front handle 4U	1096.1480.00	2 S		
430	Screw M4X14	1096.4909.00	4 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
450	BW2-rear panel foot 50MM	1096.2493.00	4 S		
455	BW2-foil f. rear panel foot	1096.2435.00	1 S		
Document 1166.1677.01 (Basic unit)					
501	Instrument frame 2	1155.5576.00	1 S		
513	MOTHERBOARD	1166.3528.02	1 S	A10	x
520	DIN6900-M2,5X6 -A2	1148.3059.00	7 S		
525	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
530	Locking bolt M3	0009.6501.00	4 S		
540	Locking bolt H=4,5-40	1093.9180.00	2 S		
550	Power supply unit 230W	1091.2320.00	1 S	A20	x
560	DIN6900-M2,5X6 -A2	1148.3059.00	10 S		
572	FMR 6/1+	1091.2814.00	1 S	A90	x
590	DIN6900-M2,5X6 -A2	0071.5040.00	10 S		
601	Display unit	1093.4708.05	1 S		
610	DIN965-M2,5X6-A4-PA	1148.3059.00	4 S		
621	Keyboard frame	1093.5127.00	1 S		
631	Keyboard mat	1093.5133.00	1 S	A16	x
641	Keyboard membrane	1093.5140.00	1 S	A15	x
650	Rotary knob RD28 ACHS-RD6	0852.1086.00	1 S		
660	DIN965-M2X6-A4-PA	0041.1599.00	10 S		
670	3,5" FLOPPY DRIVE STD.	0048.4935.00	1 S	A30	x
680	Floppy bracket	1129.9161.00	1 S		
690	W300 CABLE FLOPPY DATA	1129.9726.00	1 S	W300	
691	CABLE FLOPPY POWER	1129.9732.00	1 S	W301	
700	DIN6900-M2,5X6 -A2	1148.3059.00	3 S		
702	DIN6900-M3,0X6 -A2	0041.1682.00	3 S		
710	Harddisk with software FSU	1164.4579.04	1 S	A60	x
720	Ribbon cable	1093.5156.00	1 S	W29	
730	Disk bracket	1093.4837.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
740	DIN965-M2,5X6-A4-PA	0852.3614.00	2 S		
750	DIN965-M3X5-A4-PA	0396.8023.00	4 S		
776	LITHIUM-BATTERIE CR2032	0858.2049.00	1 S		
Document 1093.4708.01 Sheet 4 (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		
871	VNR-08C351-INVERTER	0048.8760.00	1 S	T10	x
892	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
907	Cable L=310	1091.2650.00	1 S	W100	x
910	Spin wheel	0852.2701.00	1 S	B10	x
915	Screw for plastic material 1.8x4,4	1066.2066.00	3 S		
921	TFT DISPLAY 8.4 INCH 800x600x3	0048.8599.00	1 S	A70	x
930	DIN6900-M2,5X6 -A2	0071.5040.00	4 S		
932	Space	1129.9432.00	4 S		
934	DIN965-M2,5X5-A4-PA	0852.3608.00	4 S		
946	LABEL FOR DISPLAY CABLE	1129:9703:00	1 S		
948	Display cable TOSHIBA FMR6	1091.2666.00	1 S	W70	x
949	Display connector TOSHIBA FMR6	1091.2637.00	1 S	W71	x
950	DIN6900-M2,5X6 -A2	1148.3059.00	2 S		
960	Slip on spring	1166.1783.00	1 S		
Document 1144.9017.00 (Option R&S FSU-B4 1144.9000.02)					
1100	OCXO	1093.7871.03	1 S	A200	x
1120	RF-cable W21	1129.9926.00	1 S	W21	
Document 1162.9921.00 (Option R&S FSU-B28 1162.9915.02)					
1360	USER-PORT CABLE W67	1142.8094.00	1 S	W67	x

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
1365	Locking bolt M3	0009.6501.00	2 S		
1370	DIN137-A3-A2	0005.0296.00	2 S		
1375	DIN934-M3-A4	0016.4398.00	2 S		
1380	Adhesive shield	1162.9938.00	1 S		
Document 1144.9300.00 (Option R&S FSU-B25 1144.9298.02)					
1400	ATTENUATOR (PARTLY ELECTRICAL)	1137.0724.02	1 S	A50	x
1410	Ribbon cable 10 POL	1129.7823.00	1 S		
1420	RF-CABLE W 27	1144.9330.00	1 S		
1425	RF-CABLE W27 (26,5 GHz)	1144.9323.00	1 S		
1430	RF-CABLE W28 (RF-CON)	1144.9346.00	1 S		
1440	RF-CABLE W28 (MW-CON)	1144.9352.00	1 S		
1460	DIN6900-M2,5X8 -A2	0071.5705.00	4 S		
Document 1145.0259.00 (Option R&S FSU-B18 1145.0242.04)					
1500	MULTI-PURPOSE DRIVE (FLOPPY, PCMCIA)	1080.4140.03	1 S	A381	x
1505	HOLDER FOR MULTI-PURPOSE DRIVE	1129.9484.00	1S		
1506	DIN6900-M3,0X6 -A2	0071.6847.00	3 S		
1510	PCMCIA HARDDISK WITH SOFTWARE	1145.0407.04	1 S	A380	x
1550	CABLE W300 FLOPPY DATA	1145.0265.00	1 S	W300	
1575	CABLE CLAMP	0099.7825.00	2 S		
1576	CABLE CLAMP	0627.2116.00	2 S		
Documnet 1129.7298.00 Page 2 (Option R&S FSP-B10 1129.7246.04)					
1600	EXT. GEN. CONTROL	1093.8590.02	1 S	A210	x
1610	IEC-BUS Cable W21	1129.7252.00	1 S	W21	x
1612	DIN125-A3,2-A4	0082.4670.00	2 S		
1614	DIN137-A3-A2	0005.0296.00	2 S		
1620	Aux control cable W22	1129.7269.00	1 S	W22	x
1622	Locking bolt M3	0009.6501.00	2 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
1624	DIN137-A3-A2	0005.0296.00	2 S		
1626	DIN934-M3-A4	0016.4398.00	2 S		
Document 1155.1612.00 (Option R&S FSU-B20 1155.1606.04)					
1700	COMPACT FLASH BOARD	1164.5181.02	1 S	A60	x
1715	FLASH MEMORY CARDS WITH SOFTWARE	1155.1735.08	1 S	A61/A62	x
1730	CARD HOLDER	1130.1260.00	2 S		
1740	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
Document 1142.9090.00 (Option R&S FSU-B9 Tracking Generator 1142.8994.02)					
1800	Tracking Generator	1130.3605.02	1 S	A170	x
1810	RF-CABLE W41	1142.9003.00	1 S	W41	
1820	RF-CABLE W42 (RF-Con)	1142.9010.00	1 S	W42	
1830	RF-CABLE W42 (8GHz)	1142.9026.00	1 S	W42	
1840	RF-CABLE W43	1142.9032.00	1 S	W43	
1850	RF-CABLE W44	1142.9049.00	1 S	W44	
1860	RF-CABLE W45	1142.9055.00	1 S	W45	
1870	RF-CABLE W46	1142.9061.00	1 S	W46	
1880	RF-CABLE W47	1142.9078.00	1 S	W47	
1890	RF-CABLE W48	1142.9084.00	1 S	W48	
1895	ADAPTOR	0343.0257.00	1 S	X2	x
1900	MOUNTING PLATE	1093.4750.00	1 S		
1910	DIN965-M2,5X6-A4-PA	1148.3288.00	4 S		
1920	LABEL FSU-B9 FRONT	1142.9132.00	1 S		
1930	LABEL FSU-B9 REAR	1142.9126.00	1 S		
Document 1130.2544.01 (Converter Unit 8GHz)					
2000	8 GHZ CONVERTER	1130.2550.02	1 S	A160	x
2005	YIG-UNIT 8GHz (MICRO LAMBDA)	1130.2944.02	1 S	A161	x
2010	YIG-UNIT 8GHz (FILTRONIC)	1130.2944.03	1 S	A161	x
2025	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
2030	DIPLEXER 8GHZ	1132.6501.02	1 S	A162	x
2035	DIN6900-M2,5X5 -A2	0071.6830.00	4 S		
Document 1130.3240.01 page 2 (MW-Converter Unit 26.5 GHz)					
Document 1130.3240.01 page 4 (OPTION FSU-B23 PREAMP 26.5 GHz 1157.0907.02)					
2100	26 GHz CONVERTER	1130.3257.02	1 S	A160	x
2105	DIPLEXER26	1151.3010.02	1 S	A161	x
2106	DIPLEXER 26 (OPTION B23)	1151.5520.23	1 S	A161	x
2107	YIG UNIT (MICRO LAMBDA)	1166.1852.22	1 S	A162	x
2109	YIG UNIT (MICRO LAMBDA)	1130.3311.24	1 S	A162	x
2110	DIN6900-M2,5X6 –A2	1148.3059.00	4 S		
2111	YIG UNIT (FILTRONIC)	1130.3492.22	1 S	A162	x
2113	YIG UNIT (FILTRONIC)	1130.3492.24	1 S	A162	x
2114	YIG UNIT (MICRO LAMBDA)	1130.3311.22	1 S	A162	x
2115	YIG UNIT (MICRO LAMBDA)	1130.3311.24	1 S	A162	x
2118	YIG UNIT (FILTRONIC)	1130.3492.28	1 S	A162	x
2119	YIG UNIT (MICRO LAMBDA)	1130.3311.28	1 S	A162	x
2120	DIN965-M2,5X6-A4-PA	1148.3288.00	2 S		
2125	EXTENDER 26	1132.8504.02	1 S	A163	x
2130	DIN6900-M2,5X6 –A2	1148.3059.00	7 S		
2135	RF-CABLE W3	1130.3340.00	1 S		
2140	RF-CABLE W4	1130.3357.00	1 S		
2142	RF-CABLE W4	1157.0971.00	1 S		
2145	RF-CABLE W5	1130.3363.00	1 S		
2150	HOLDER LO CABLE	1130.3292.00	1 S		
2155	DIN6900-M2,5X6 –A2	1148.3059.00	2 S		
2160	Cover B side	1130.3270.00	1 S		
2225	ABSCHLUSSKAPPE SMA	1066.2095.00	1 S		
Document 1142.9361.00 (Option R&S FSU-B12 Tracking Attenuator 1142.9349.02)					
2400	STEP ATTENUATOR (R&S FSU-B12)	1067.8380.04	1 S	A171	x

Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
2400	ATTENUATOR HOLDER	1129.9455.00	1 S		
2415	DIN6900-M3x8-A2	0071.6853.00	2 S		
2420	DIN6900-M2,5x6-A2	1148.3059.00	3 S		
2430	RF CABLE W41	1142.9378.00	1 S	W41	
2440	RF CABLE W49	1142.9384.00	1 S	W49	
2445	ADAPTER CABLE	1142.9390.00	1 S		
Document 1157.1110.00 (Option FSU-B21 1157.1090.02)					
2900	EXT MIXER	1157.1126.02	1 S	A180	x
2910	RF-CABLE W36	1157.1178.00	1 S	W36	x
2920	RF-CABLE W37	1157.1184.00	1 S	W37	x
2930	RF-CABLE W38	1157.1190.00	1 S	W38	
2940	RF-CABLE W39	1157.1203.00	1 S	W39	
2942	RF-CABLE W39	1157.1232.00	1 S	W39	
2950	HOLDER EXT MIXER	1157.1103.00	1 S		
2960	DIN965-M2,5X6-A4-PA	1148.3288.00	2		
Document 1166.2096.01 page 1 (MW-Converter Unit 43/46/50 GHz)					
3100	50 GHz Converter	1166.2109.02	1 S	A160	X
3105	50 GHz Converter	1166.2109.03	1 S	A160	X
3110	Diplexer	1162.1120.04	1 S	A161	X
3120	DIN6900/ISR-M2,5X6-A2	1148.3059.00	4 S		
3128	YIG-Unit 46GHz	1130.3963.46	1 S	A162	X
3130	YIG-Unit 50GHz	1130.3963.50	1 S	A162	X
3140	DIN965-M2,5X8-A4-PA	1148.3294.00	2 S		
3148	EXTENDER 46	1151.6010.02	1 S	A163	X
3150	EXTENDER 50	1162.2885.02	1 S	A163	X
3160	DIN6900/ISR-M2,5X6-A2	1148.3059.00	6 S		
3170	CLAMP LO-KABEL	1130.3292.00	1 S		
3180	DIN6900-M2,5X6 –A2	1148.3059.00	2 S		

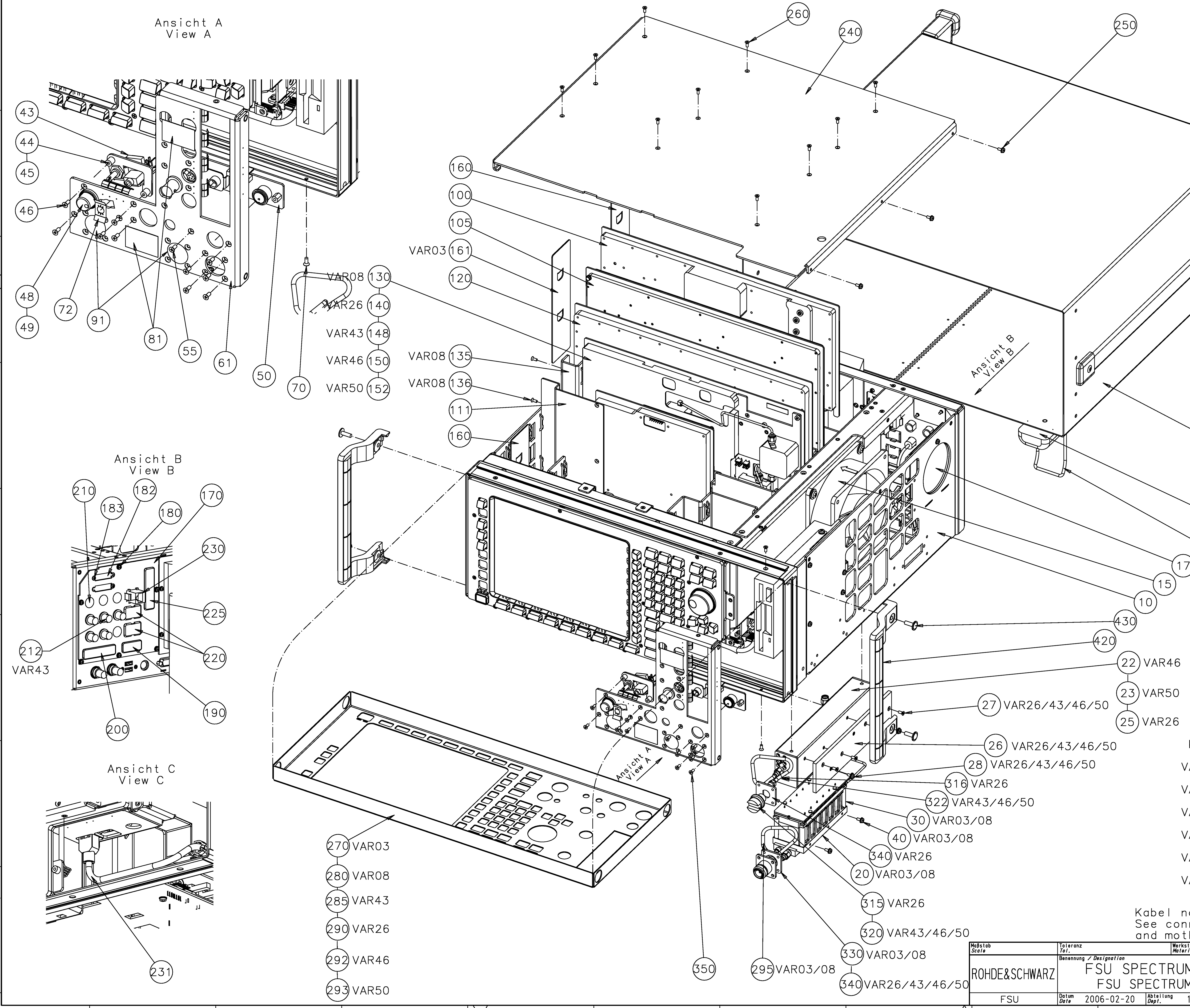
Position	Designation	Stock No.	Number	Electrical designation	Recommended Spare Parts
3190	RF-CABLE W3	1130.3892.00	1 S		
3200	RF-CABLE W4	1130.3905.00	1 S		
3210	RF-CABLE W5	1130.3911.00	1 S		
3220	RF-CABLE W6	1130.3928.00	1 S		
3230	SMA	1066.2095.00	1 S		
3240	B-SIDE-COVER	1130.3870.00	1 S		
3250	A-SIDE-COVER	1166.2167.00	1 S		
3295	LABEL MW-CONVERTER	1130.3940.00	1 S		
Document 1157.2016.00 (Option R&S FSU-B27 1157.2000.02)					
3500	FM DEMODULATOR ANALOG	1166.2015.00	1 S	A290	x
3510	RF CABLE W67	1157.2022.00	1 S	W67	
3520	RF CABLE W68	1157.2039.00	1 S	W68	
3530	Label Rear panal R&S FSU-B27	1157.2068.00	1 S		
3550	RF CABLE W11	1129.9832.00	1 S	W11	
Option R&S FSU-B73 1169.5696.03					
5100	WIDEBAND DETECTOR UNIT	1130.3086.05	1 S	A140	x

ROHDE&SCHWARZ

Block Circuit Diagram

ROHDE&SCHWARZ

Block Circuit Diagram



VAR03/MOD03 = FSU 3,6GHz
VAR08/MOD08 = FSU 8GHz
VAR26/MOD26 = FSU 26,5GHz
VAR43/MOD43 = FSU 43GHz
VAR46/MOD46 = FSU 46GHz
VAR50/MOD50 = FSU 50GHz

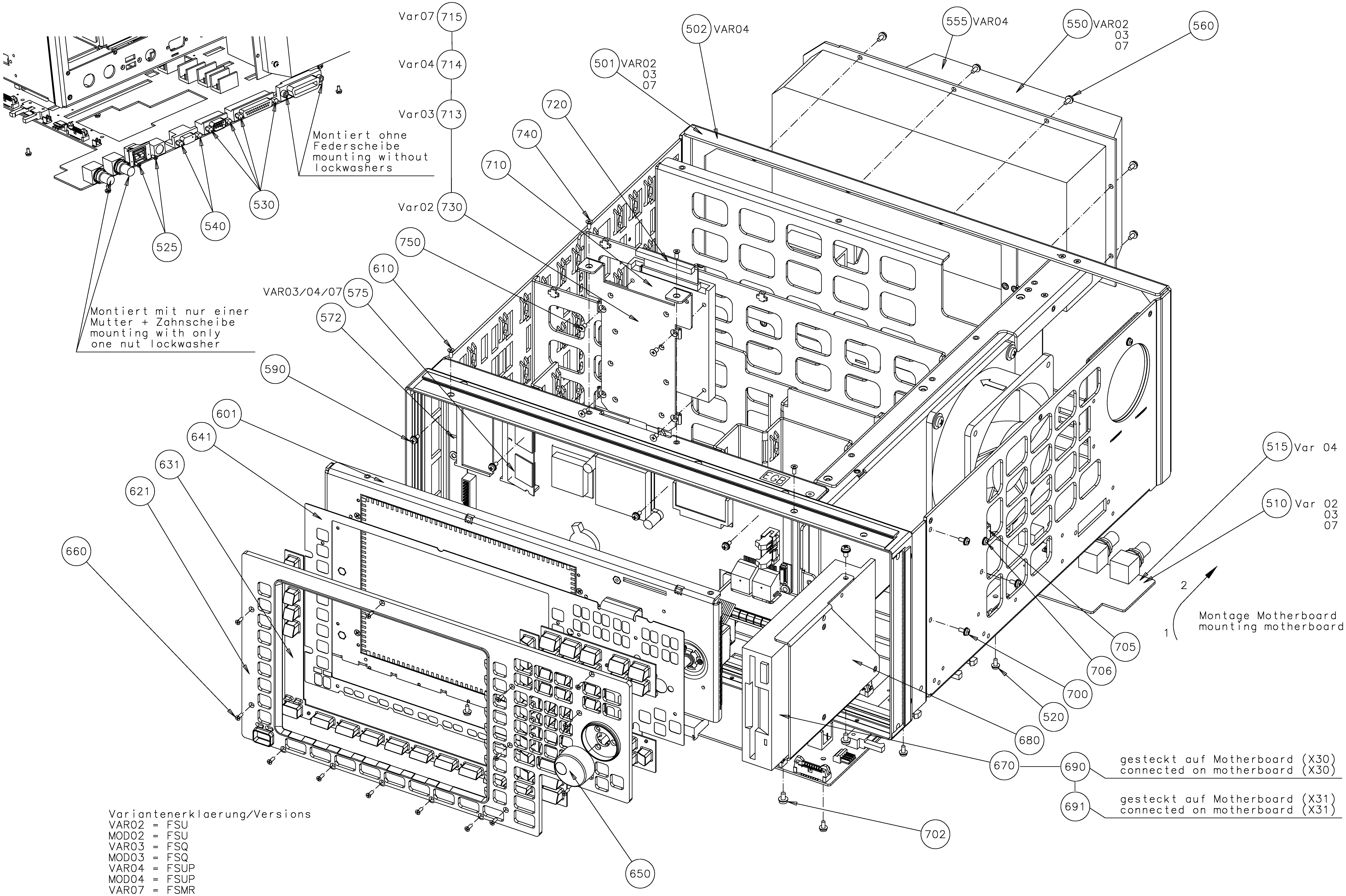
Kabel/Cable:

VAR03/MOD03:	DW 1129.9490.03
	DV 1129.9749.03
VAR08/MOD08:	DW 1129.9490.08
	DV 1129.9749.08
VAR26/MOD26:	DW 1129.9490.26
	DV 1129.9749.26
VAR43/MOD43:	DW 1129.9490.46
	DV 1129.9749.43
VAR46/MOD46:	DW 1129.9490.46
	DV 1129.9749.46
VAR50/MOD50:	DW 1129.9490.46
	DV 1129.9749.46

Kabel nach Beschriftung montieren.
See connector designation of cables and motherboard for cable mounting.

Projektions-methode / *Projection Method*

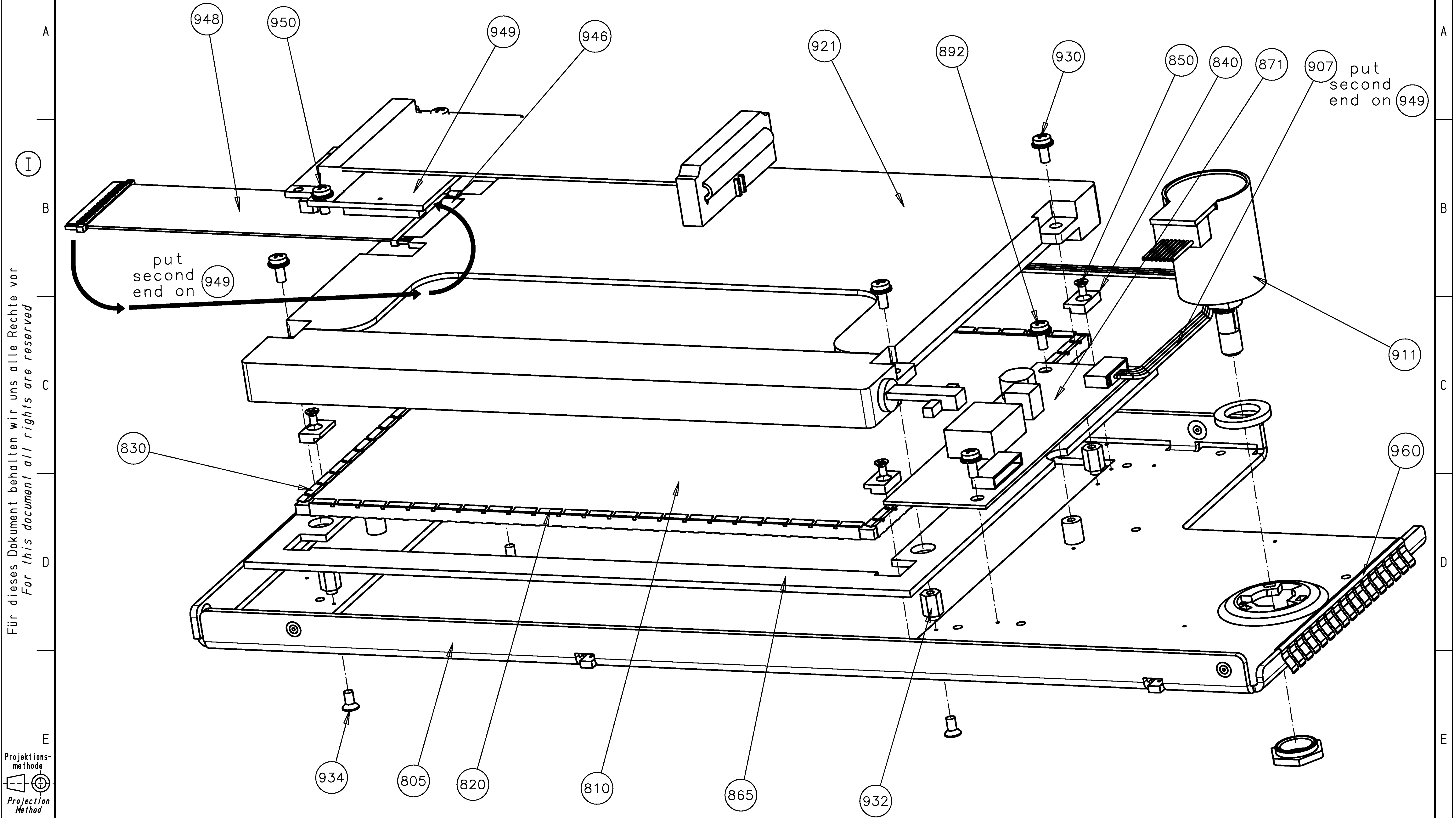
Maßstab / *Scale*	Toleranz / *Tol.*	Werkstoff / *Material*	
ROHDE&SCHWARZ	Benennung / *Designation*: FSU SPECTRUM ANALYZER / FSU SPECTRUM ANALYZER	Sprache / *Lang.*: de en; Änd. / *C.I.*: 04.00; Blatt / *Sh.*: 1	
FSU	Datum / *Date*: 2006-02-20; Abteilung / *Dept.*: 1ESK; Name / *Name*: TF	Zeichn.Nr. / *Drawing No.*: 1166.1660.01 D	



Variantenerklaerung/Versions
VAR02 = FSU
MOD02 = FSU
VAR03 = FSQ
MOD03 = FSQ
VAR04 = FSUP
MOD04 = FSUP
VAR07 = FSMR
MOD07 = FSMR

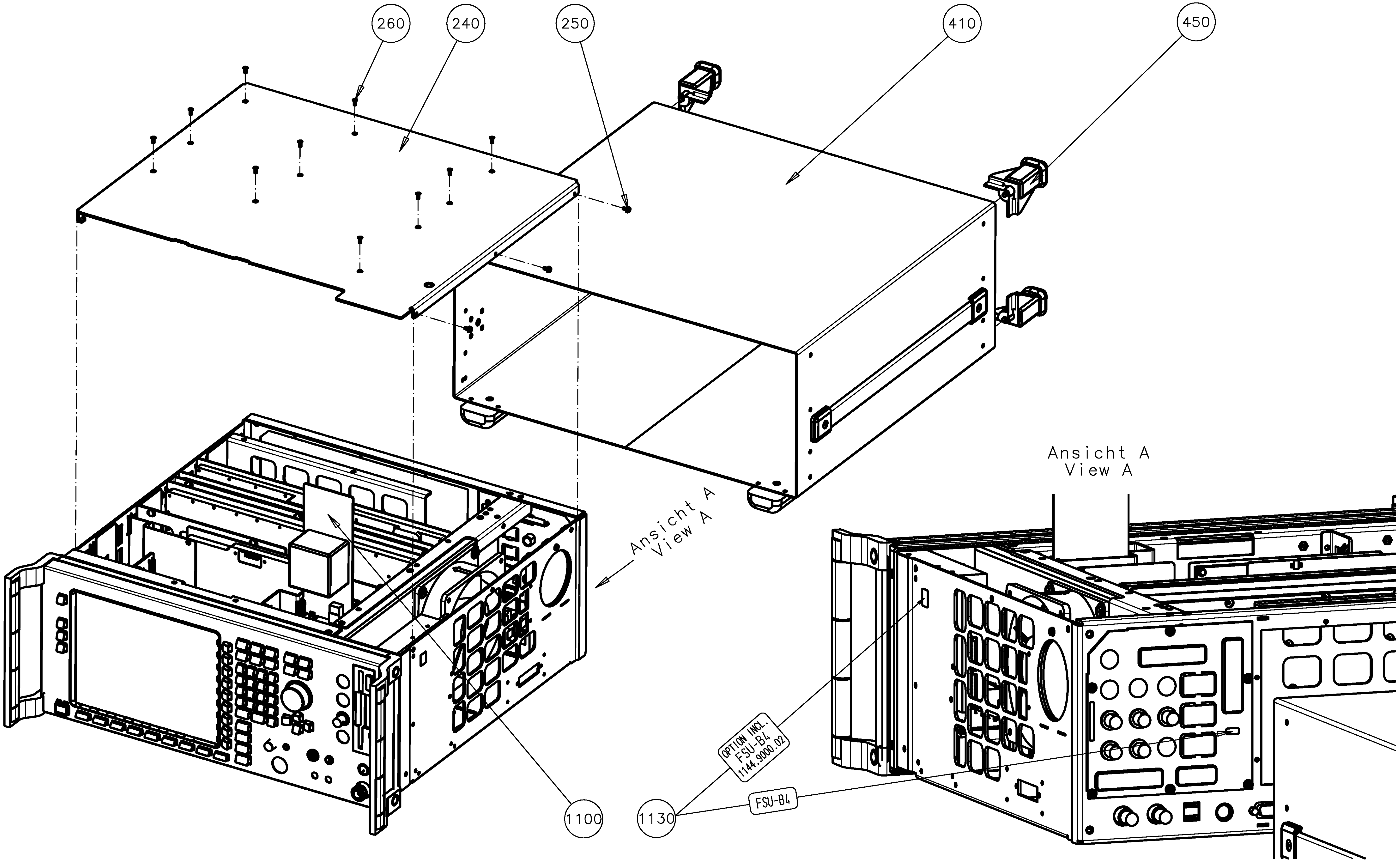
Projektionsmethode / Projection Method

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	Sprache / Lang.	Änd. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation: GRUNDEINHEIT Basic Unit		de en	05.00	1
Typ / Type: FSU			Zeichn.Nr. / Drawing No.: 1166.1677.01 D		
I.Z. / used in	Datum / Date: 2005-12-22	Abteilung / Dept.: 1ESK	Name: TF/PA		



MOD 05 = Display Toshiba LTM 08C351 for FSU/FSQ with FMR6

Maßstab / Scale: 1:1	Toleranz / Tol.		Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: DISPLAYEINHEIT DISPLAY UNIT			Sprache / Lang.: de en	Aei. / C.I.: 10.00	Blatt / Sh.: 4
Typ / Type				Zeichn.Nr. / Drawing No.: 1093.4708.01 D		
I.Z. used in 1129.9090.01	Datum / Date: 24.11.2003	Abteilung / Dept.: 1ESK	Name: Wn			



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: TF		

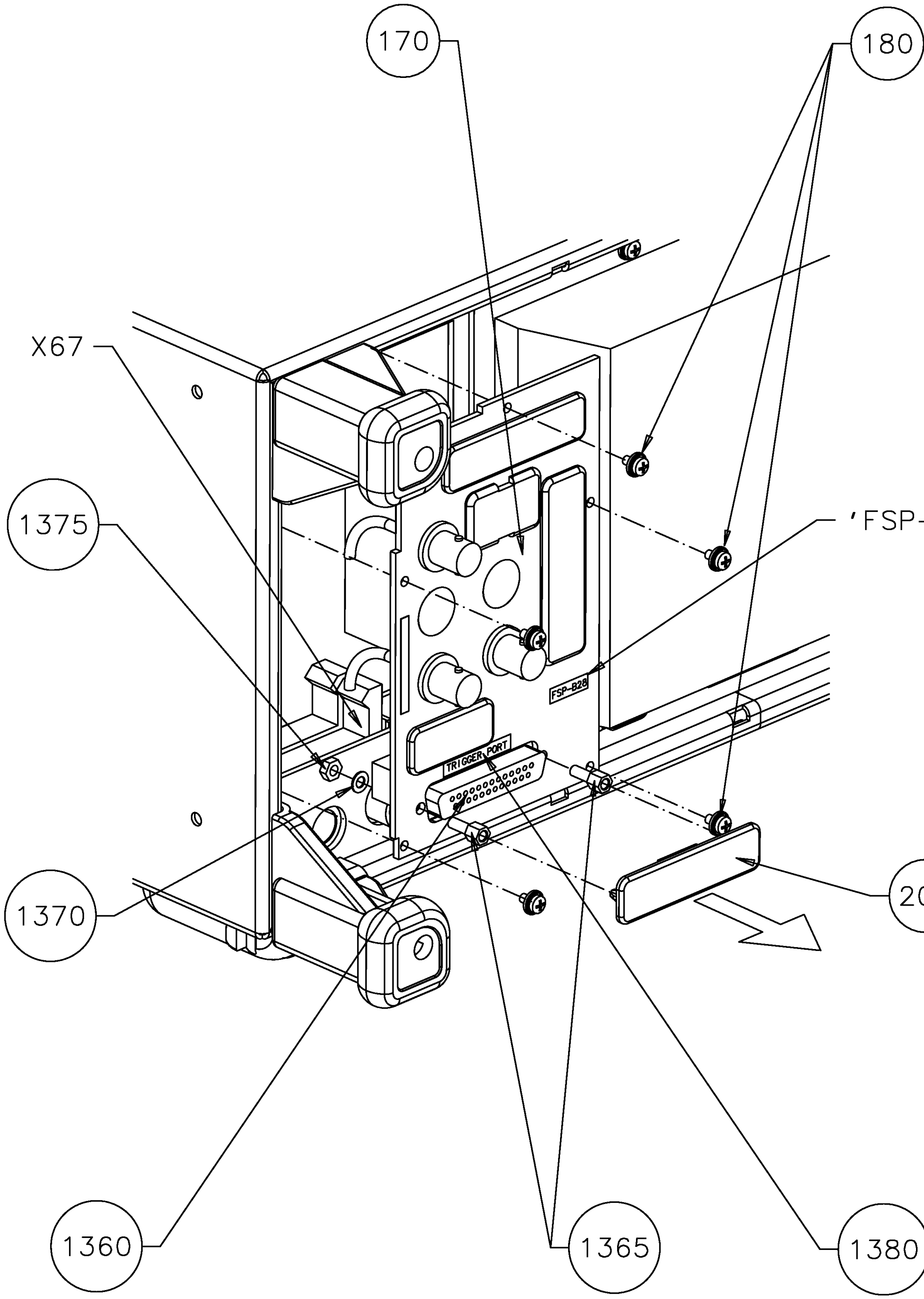
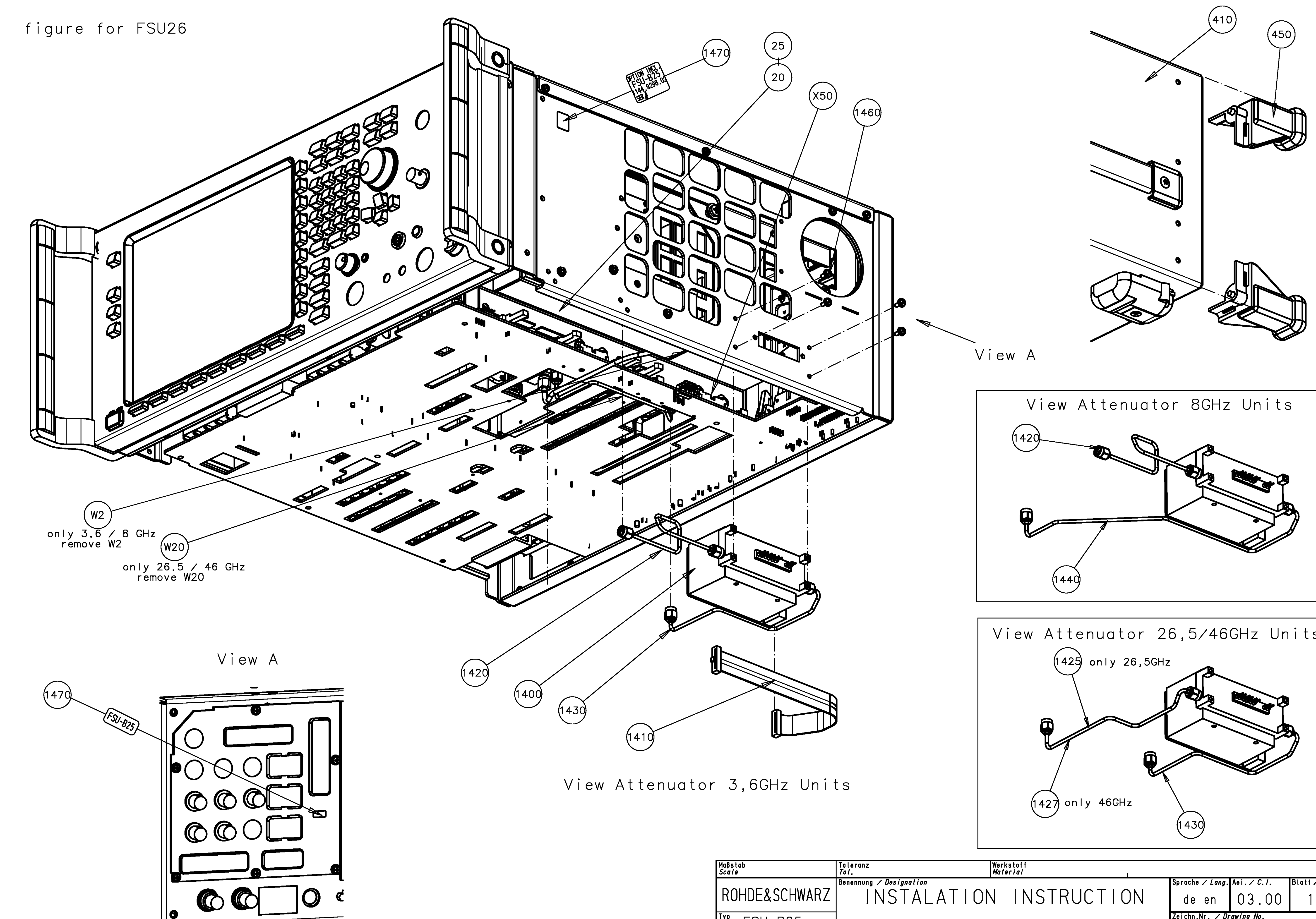


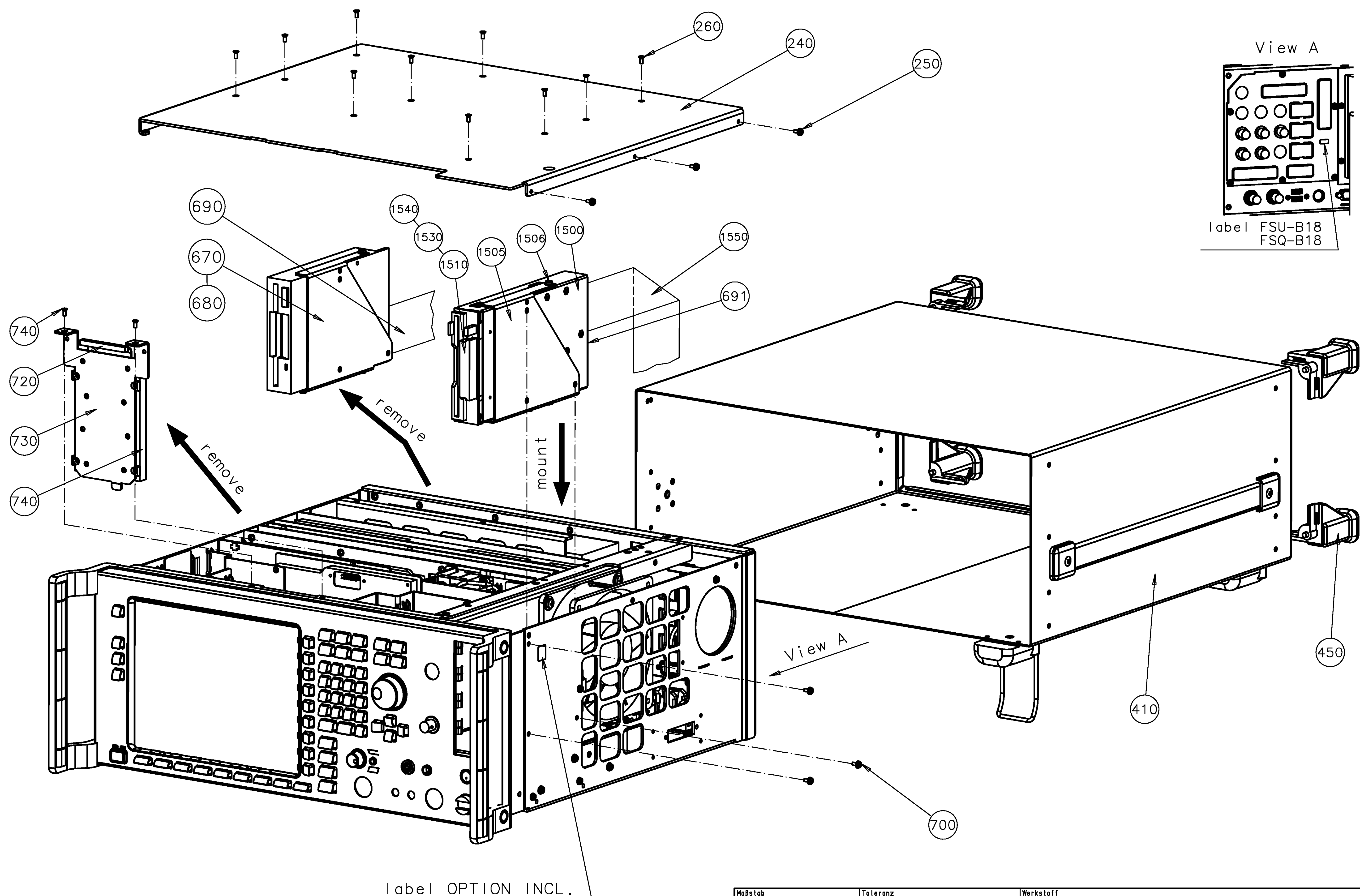
figure for FSP

Projektions-methode / Projection Method

Maßstab / *Scale*	Toleranz / *Tol.*		Werkstoff / *Material*			
ROHDE&SCHWARZ	Benennung / *Designation*: Einbauanweisung -B28 / Assembly Instruction			Sprache / *Lang.*: de en	Aei. / *C.I.*: 01.00	Blatt / *Sh.*: 1
Typ / *Type*: FSP-B28				Zeichn.Nr. / *Drawing No.*: 1162.9921.00 D		
I.Z. / *used in*: 1162.9915.02	Datum / *Date*: 18.07.2002	Abteilung / *Dept.*: 1ESK	Name / *Name*: TF			

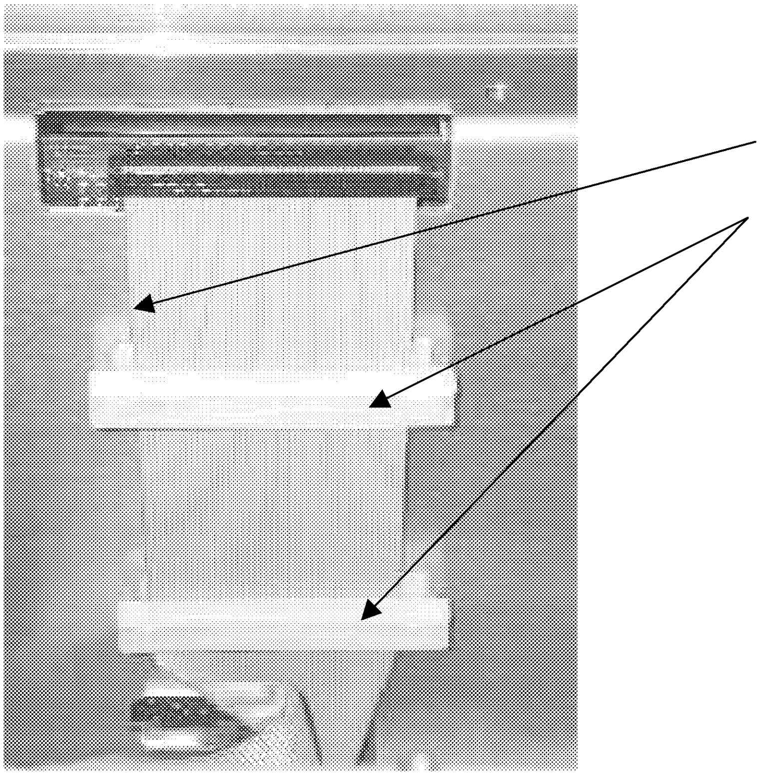


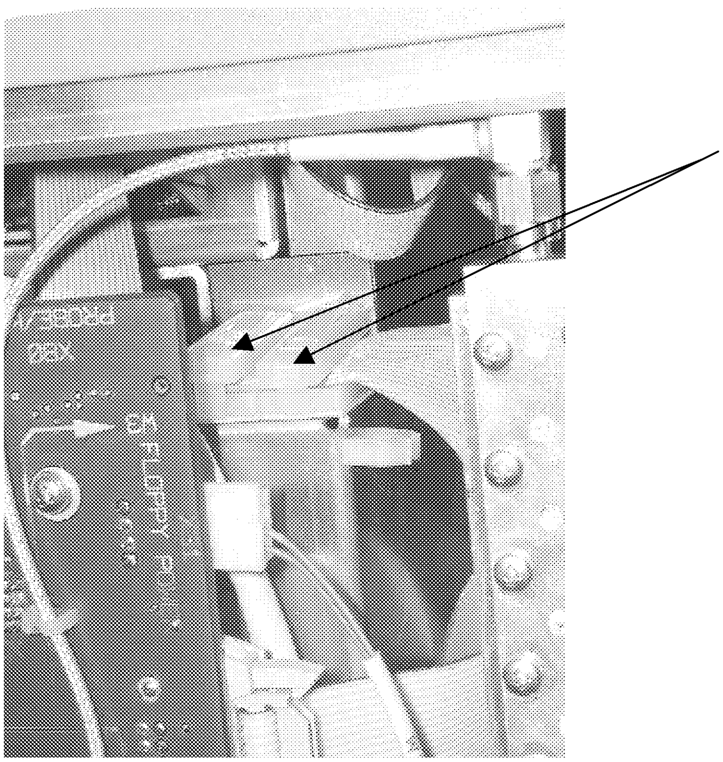
Maßstab / Scale	Toleranz / Tol.		Werkstoff / Material				
ROHDE&SCHWARZ	Benennung / Designation: INSTALATION INSTRUCTION				Sprache / Lang.: de en	Aei. / C.I.: 03.00	Blatt / Sh.: 1
Typ / Type: FSU-B25					Zeichn.Nr. / Drawing No.: 1144.9300.00 D		
I.Z. / used in: 1144.9298.01	Datum / Date: 19.02.2003	Abteilung / Dept.: 1ESK	Name / Name: Wn				



Projektionsmethode / Projection Method

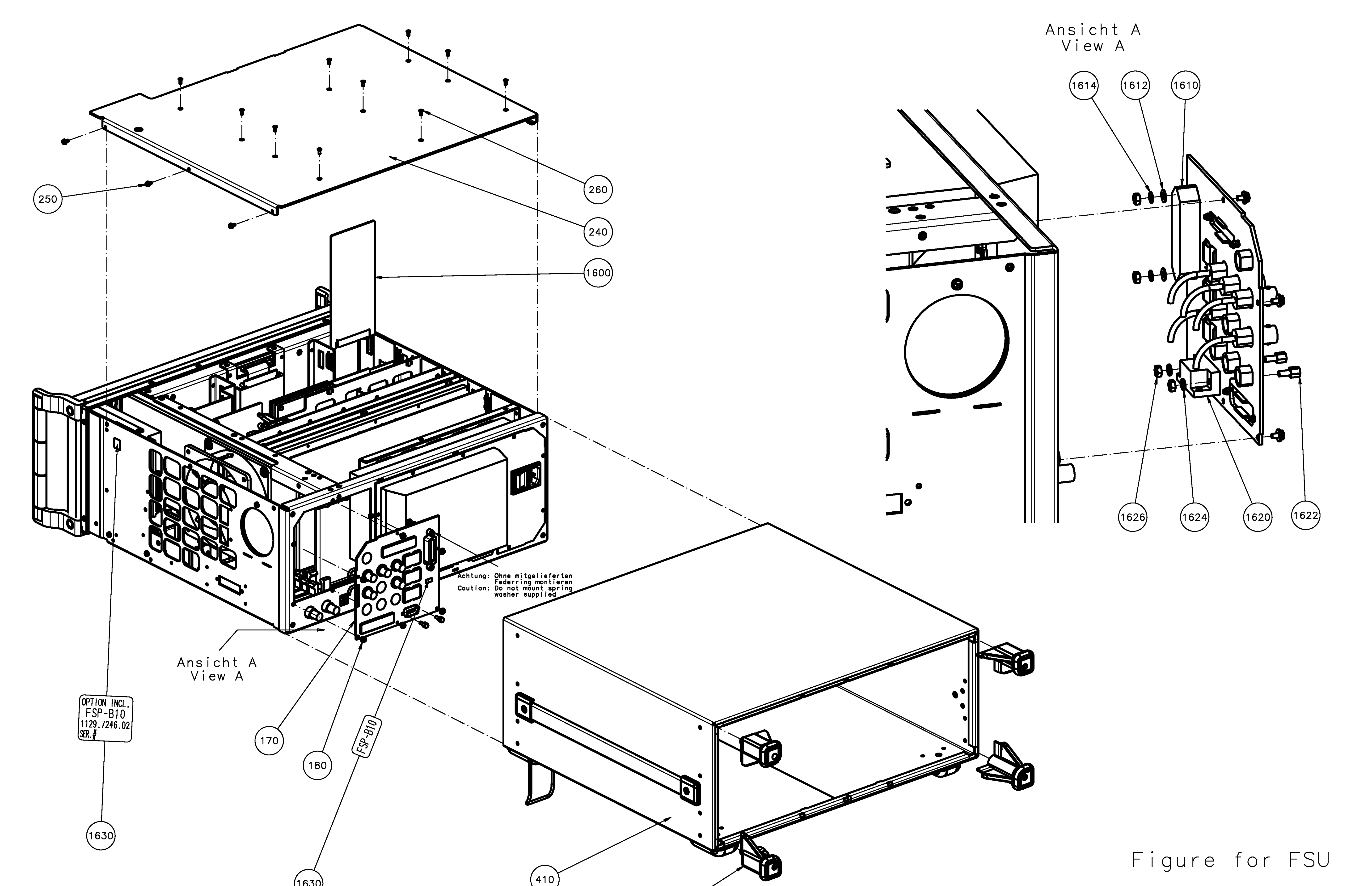
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: Assembly Instruction / Assembly Instruction		Sprache / Lang.: de en	Aei. / C.I.: 02.00 · Blatt / Sh.: 1
FSU-B18	Datum / Date: 16.10.2003	Abteilung / Dept.: 1ESK · Name / Name: Wn	Zeichn.Nr. / Drawing No.: 1145.0259.00 D	





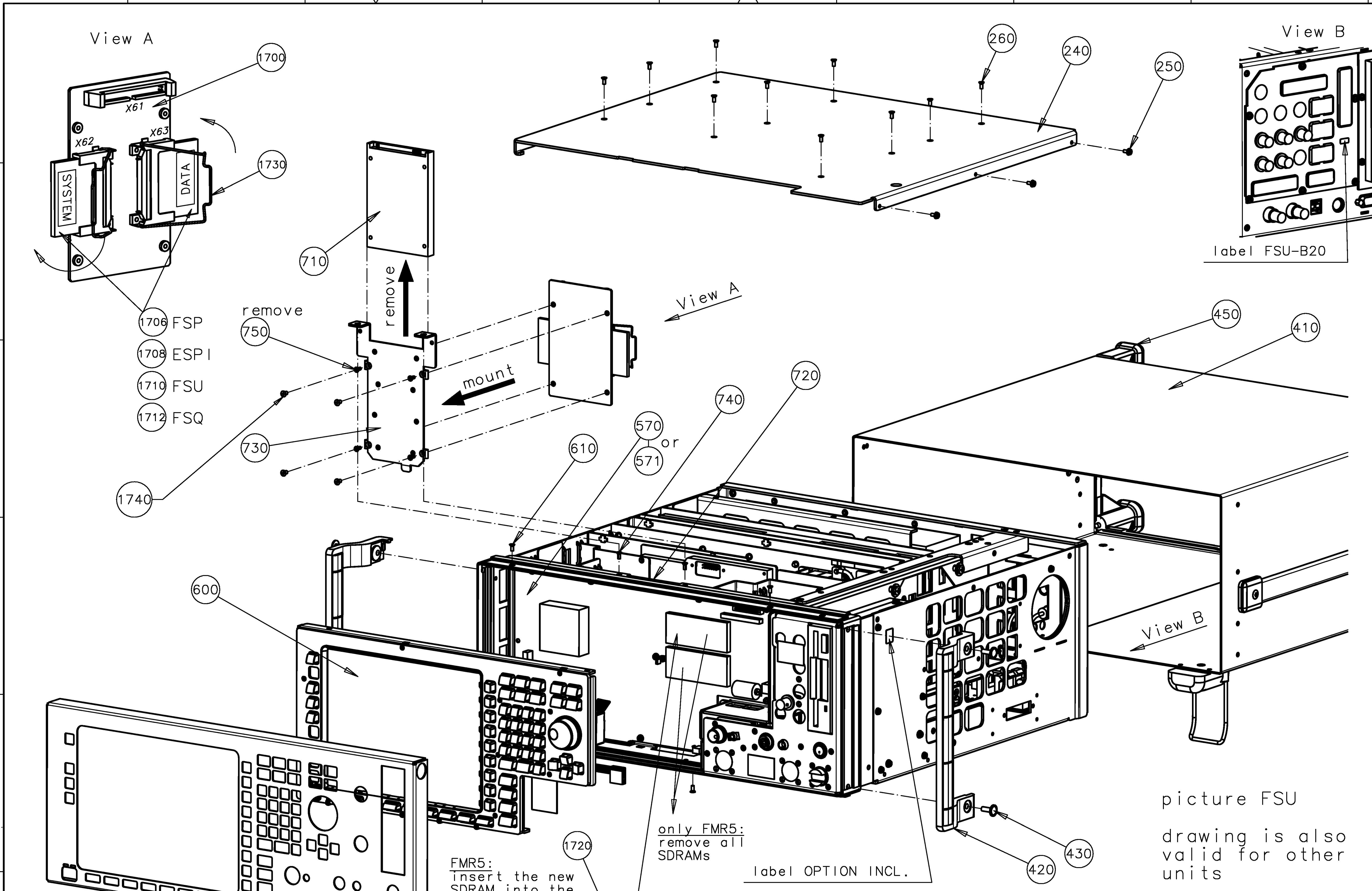
Maßstab: / *Scale:*	Toleranz: / *Tol.:*	Rauht.: /*Roughn.:*	Kanten: / *Edges:*	Werkstoff: / *Material:*	Werknormen: / *Company Standards:*

ROHDE&SCHWARZ	Benennung: / *Designation:* Assembly Instruction			Sprache: / *Lang.:* de en	Aei: / *C.I.:* 01.00	Blatt: / *Sh.:* 2
Typ: / *Type:* FSU-B18	Datum: / *Date:* 11.02.02	Abteilung: / *Dept.:* 1ESK	Name: / *Name:* TF	Zeichn. Nr.: / *Drawing Nr.:* 1145.0259.00 D		
1. Z.: / *used in:*						

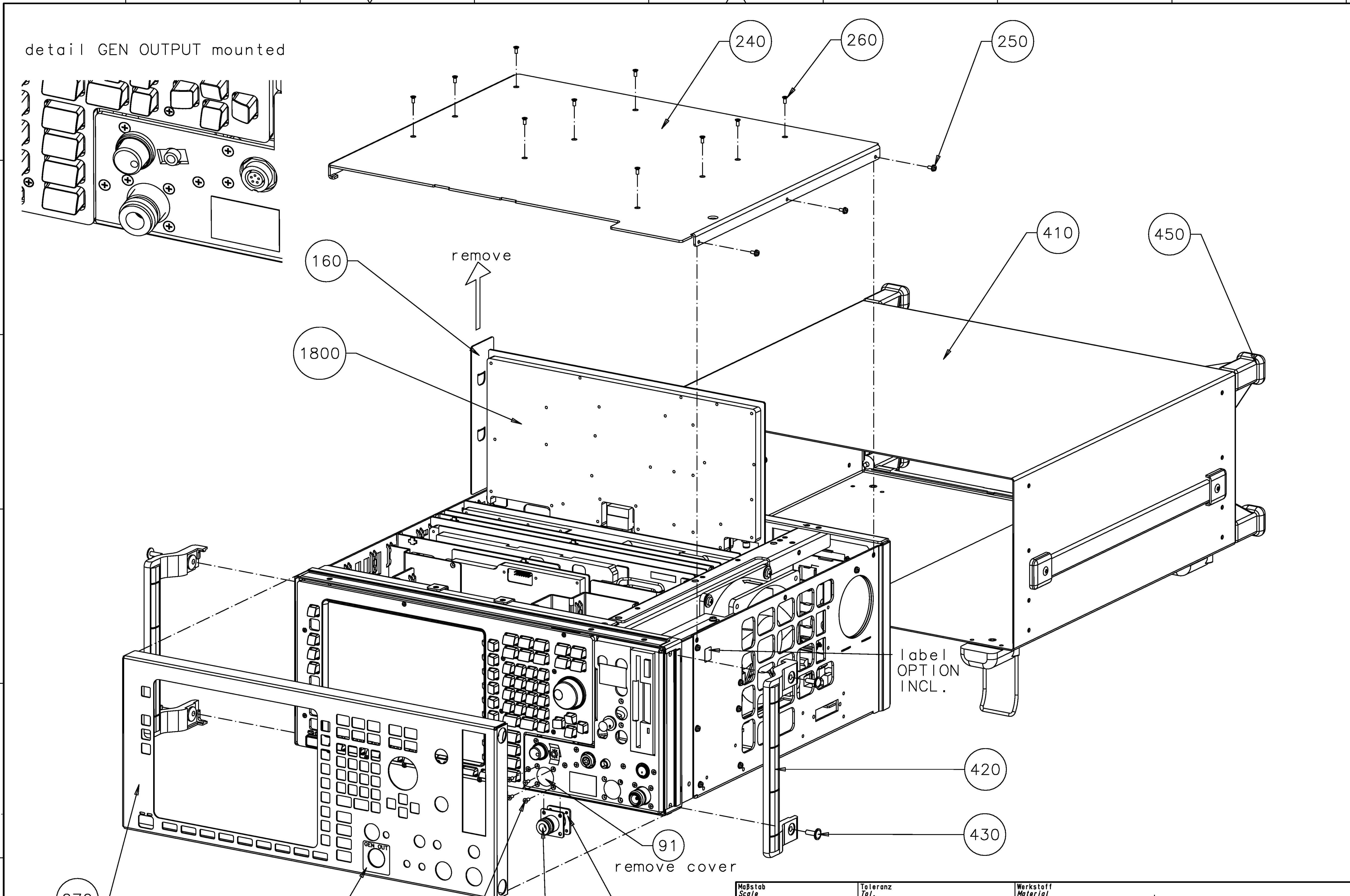


Projektionsmethode
Projection Method

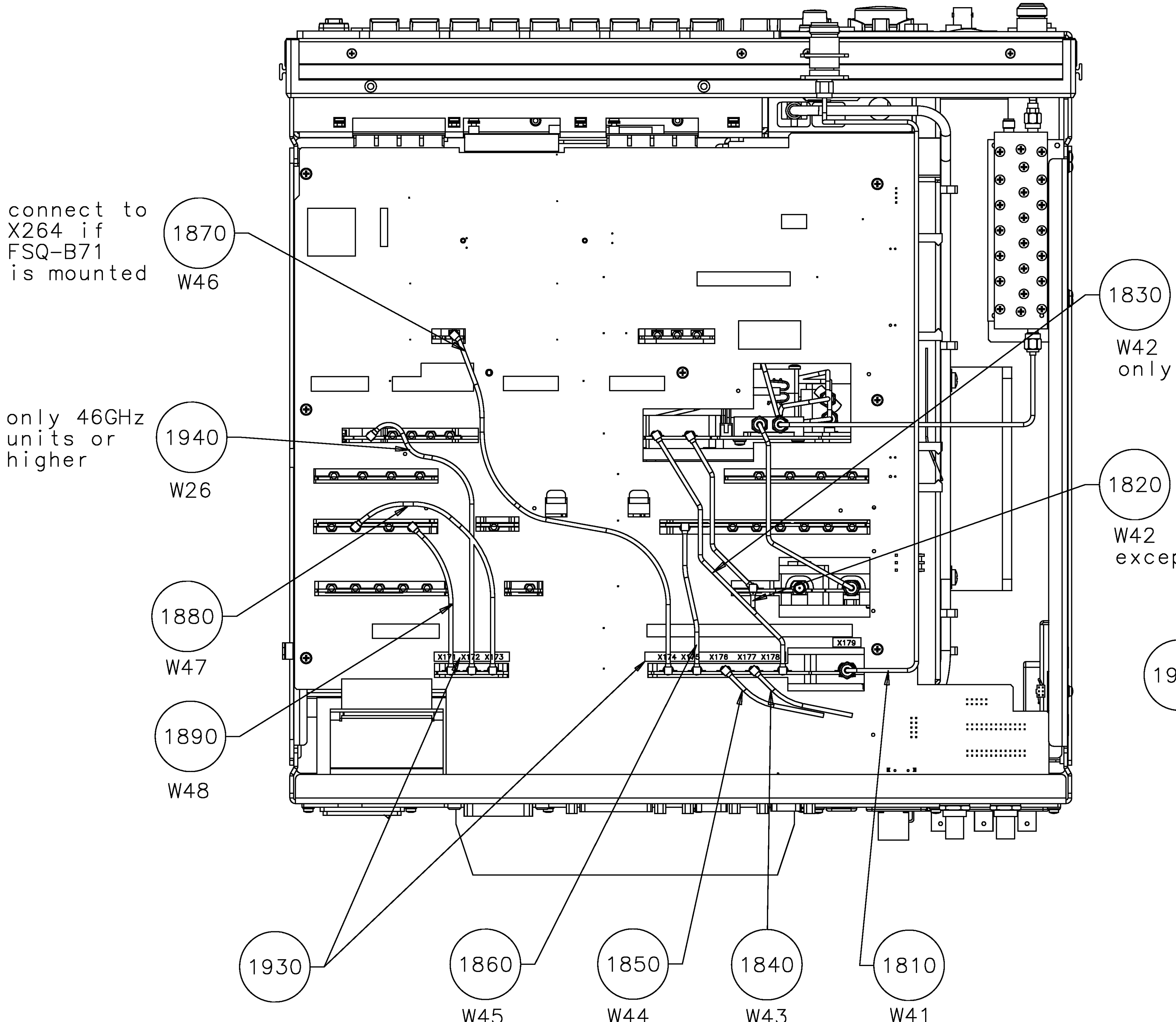
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSP-B10 INSTALLATION INSTRUCTION	Sprache / Lang.: de en	Aei. / C.I.: 04.00	Blatt / Sh.: 2
Typ / Type: FSU		Zeichn.Nr. / Drawing No.: 1129.7298.00 D		
i.Z. / used in: 1129.7246.01	Datum / Date: 29.10.2001	Abteilung / Dept.: 1ESK	Name / Name: Wn	

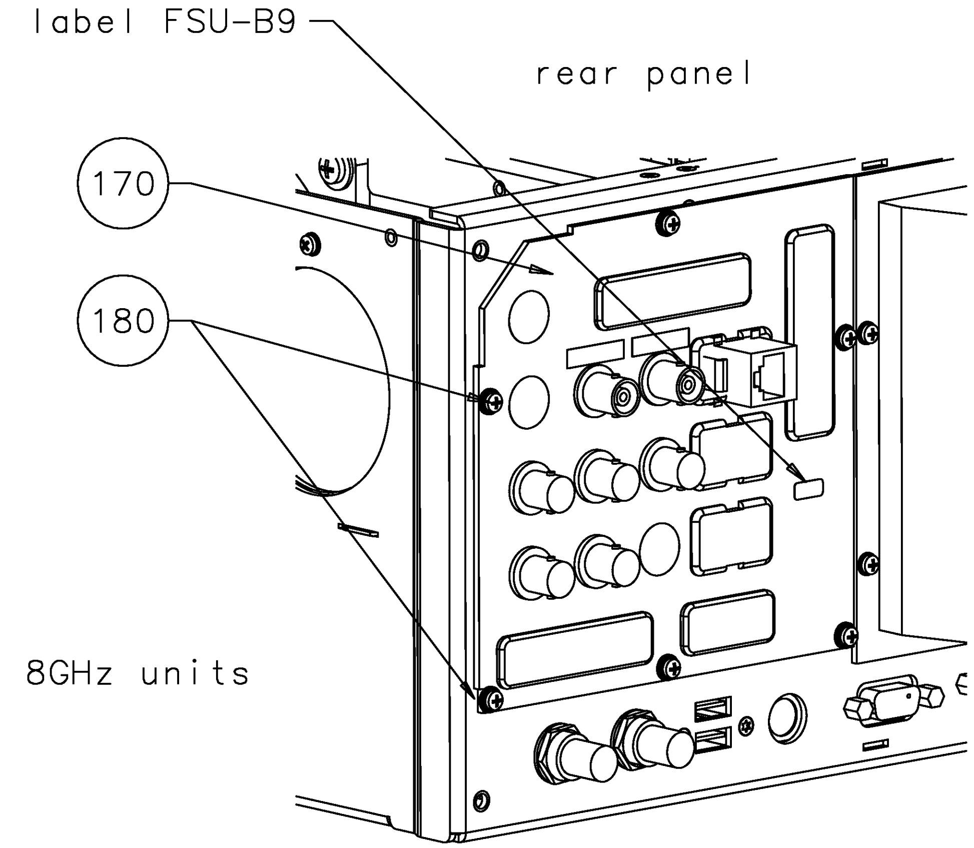


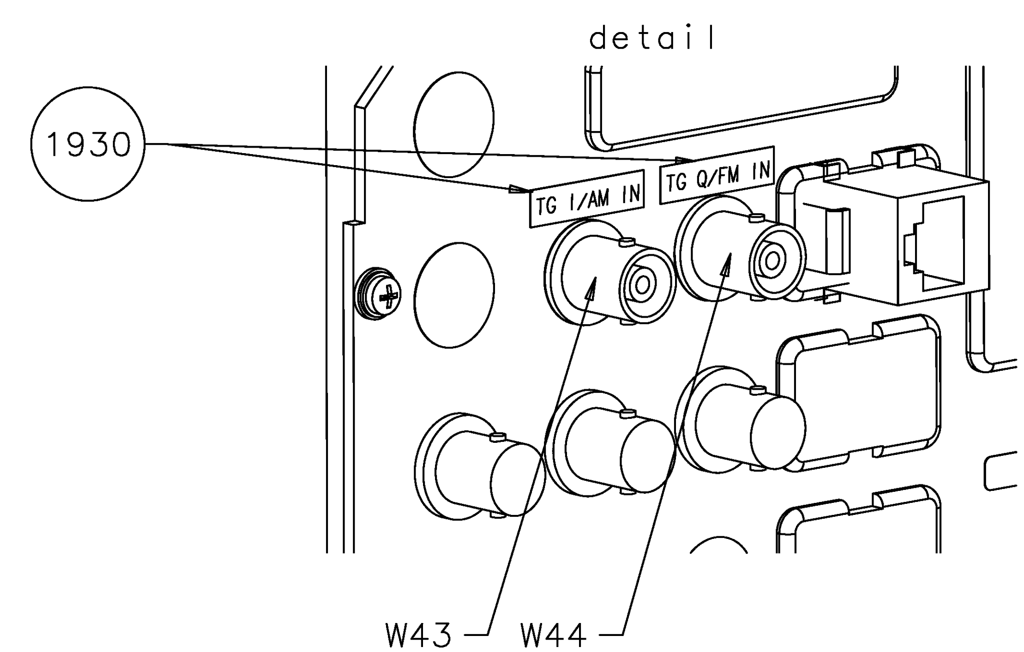
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: Einbauanweisung / Assembly Instruction		Sprache / Lang.: de en	Aei. / C.I.: 02.00	Blatt / Sh.: 1
Typ / Type: FSP-B20			Zeichn.Nr. / Drawing No.: 1155.1612.00 D		
I.Z. / used in: 1155.1606.01	Datum / Date: 11.02.2002	Abteilung / Dept.: 1ESK	Name: Wn		



Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material		
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSU-B9 Assembly Instruction	Sprache / Lang.: de en	Aei. / C.I.: 01.00	Blatt / Sh.: 1
Typ / Type: FSU-B9		Zeichn.Nr. / Drawing No.: 1142.9090.00 D		
i.Z. / used in: 1142.8994.01	Datum / Date: 30.07.2002	Abteilung / Dept.: 1ESK	Name: TF	



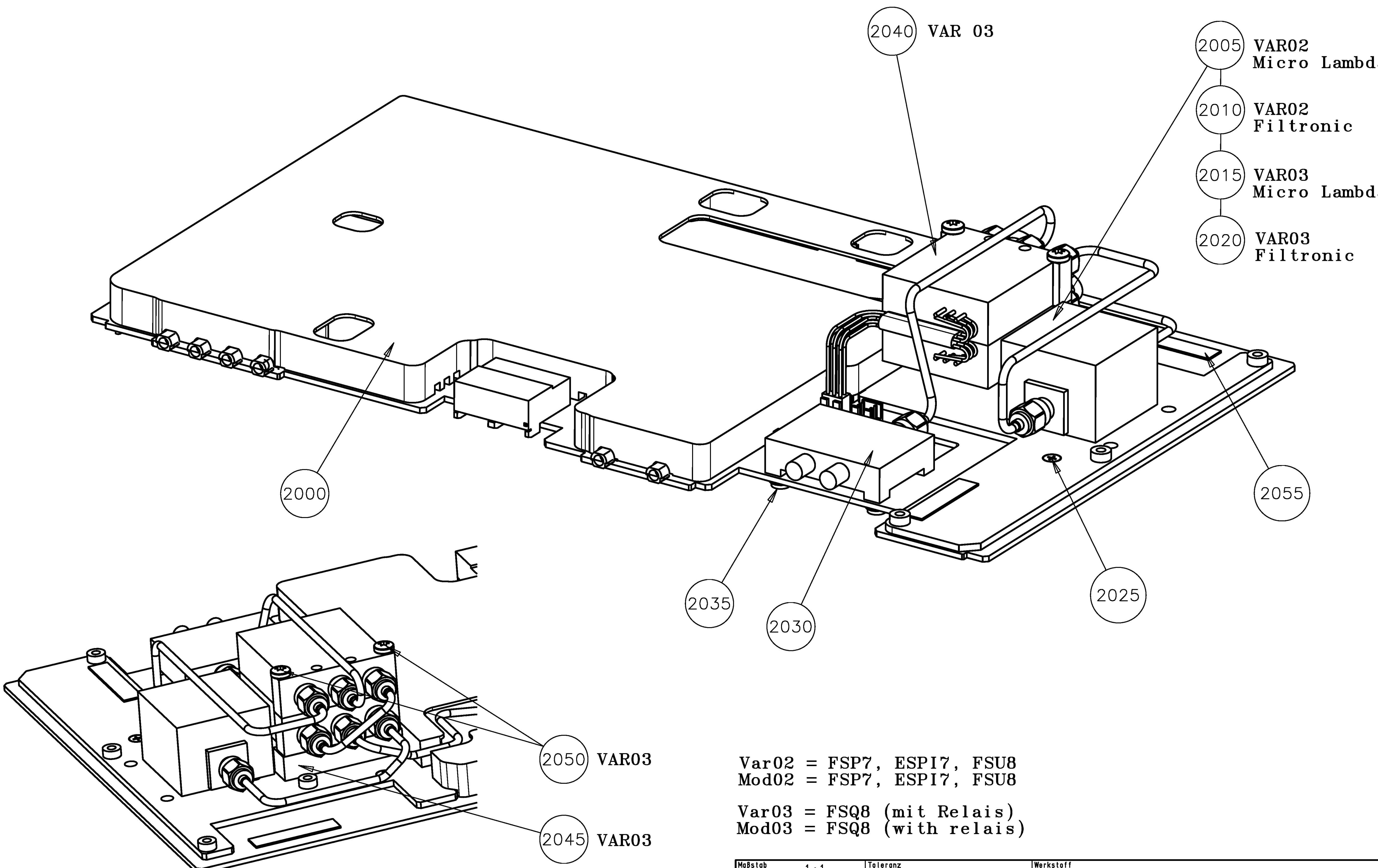




see connector designation of cables
and motherboard for cable mounting

Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANWEISUNG FSU-B9 Assembly Instruction	Sprache / Lang.: de en; Aei. / C.I.: 02.00	Blatt / Sh.: 2
Typ / Type: FSU-B9		Zeichn.Nr. / Drawing No.: 1142.9090.00 D	
I.Z. used in: 1142.8994.01	Datum / Date: 26.05.2003; Abteilung / Dept.: 1ESK	Name: Wn	

Projektions-methode / Projection Method

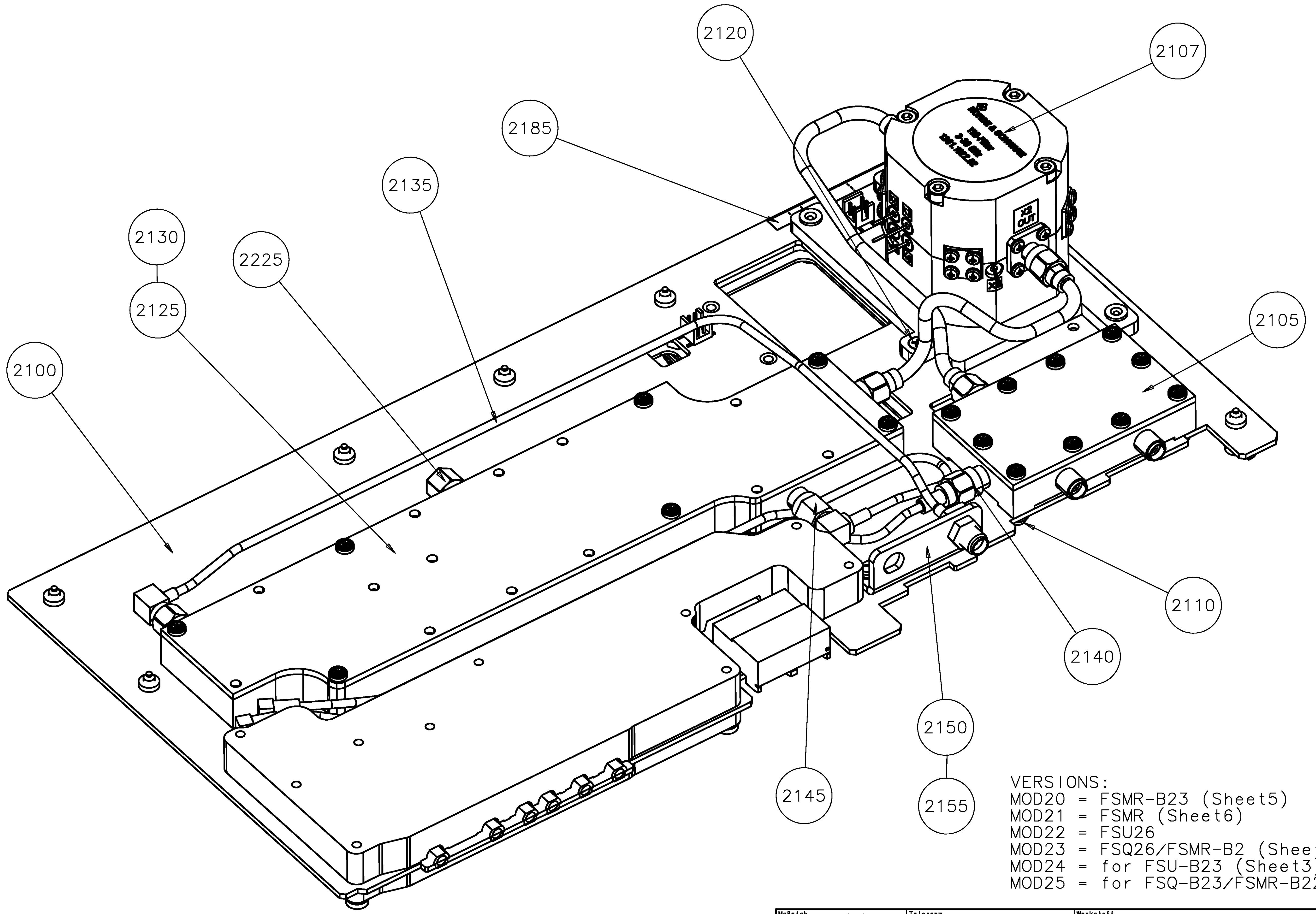


Var02 = FSP7, ESPI7, FSU8
Mod02 = FSP7, ESPI7, FSU8

Var03 = FSQ8 (mit Relais)
Mod03 = FSQ8 (with relais)

Projektions-methode
Projection Method

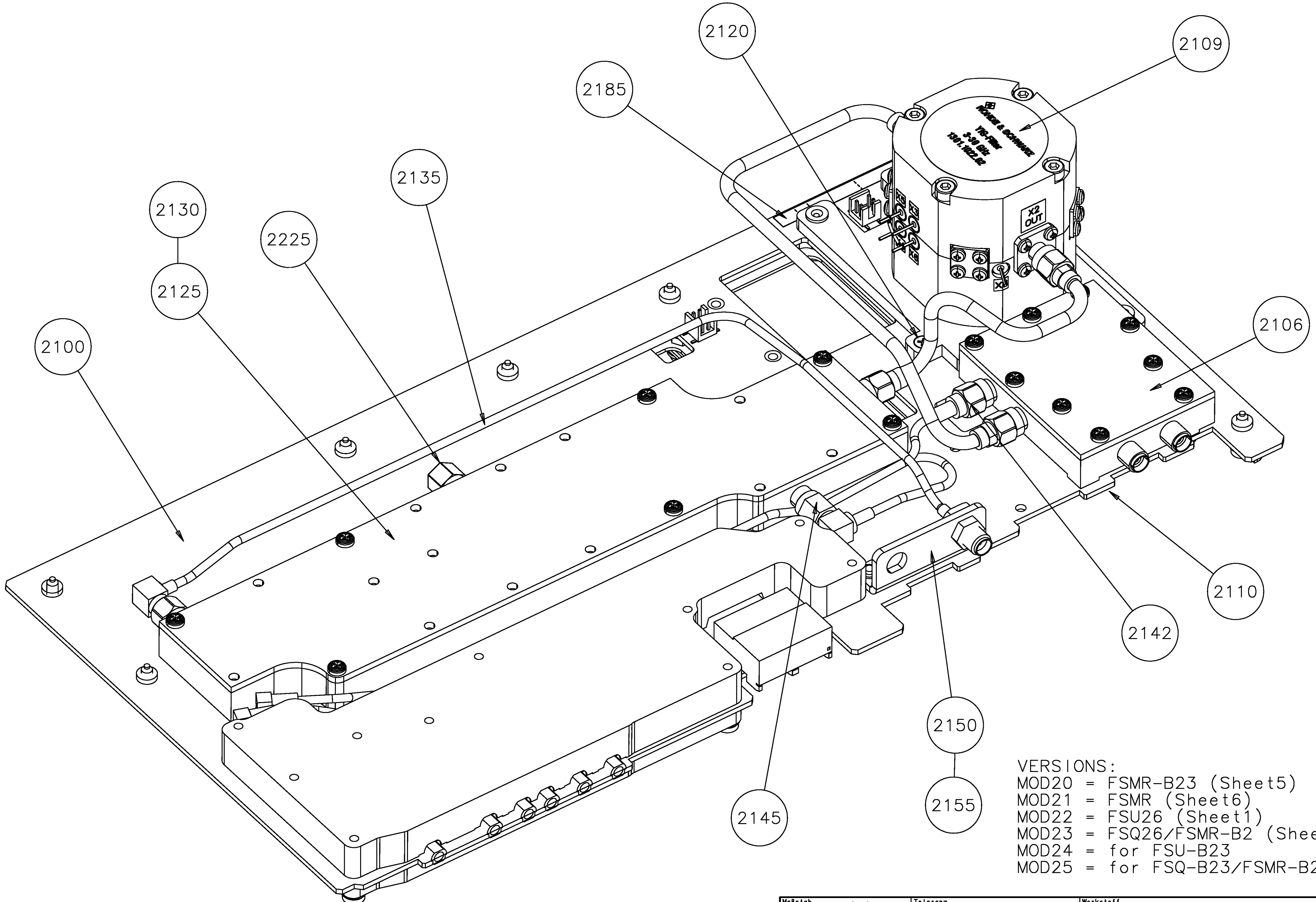
Maßstab / *Scale* 1:1	Toleranz / *Tol.*		Werkstoff / *Material*			
ROHDE&SCHWARZ	Benennung / *Designation* Converter Unit 8GHz			Sprache / *Lang.* de en	Aei. / *C.I.* 04.00	Blatt / *Sh.* 1
Typ / *Type* EMU				Zeichn.Nr. / *Drawing No.* 1130.2544.01 D		
I.Z. / *used in*	Datum / *Date* 14.05.2002	Abteilung / *Dept.* 1ESK	Name / *Name* Wn			



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)

Projektions-methode / Projection Method

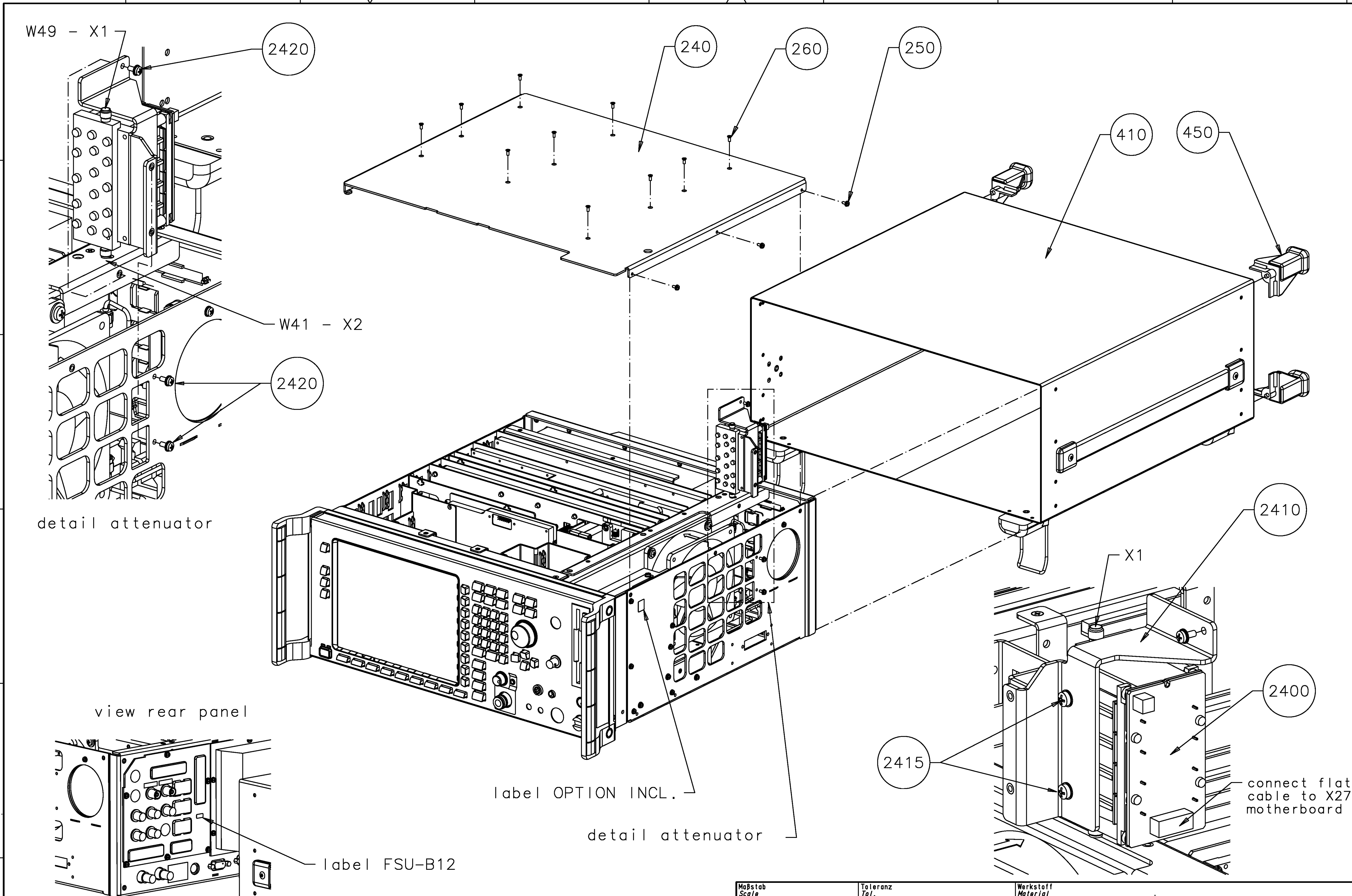
Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 26 / MW-Converter Unit 26	Sprache / Lang.: de en	Aei. / C.I.: 07.00; Blatt / Sh.: 1
Typ / Type: FSU26		Zeichn.Nr. / Drawing No.: 1130.3240.01 D	
I.Z. used in: 1130.9003.01	Datum / Date: 2005-11-14; Abteilung / Dept.: 1ESK; Name: Wn		



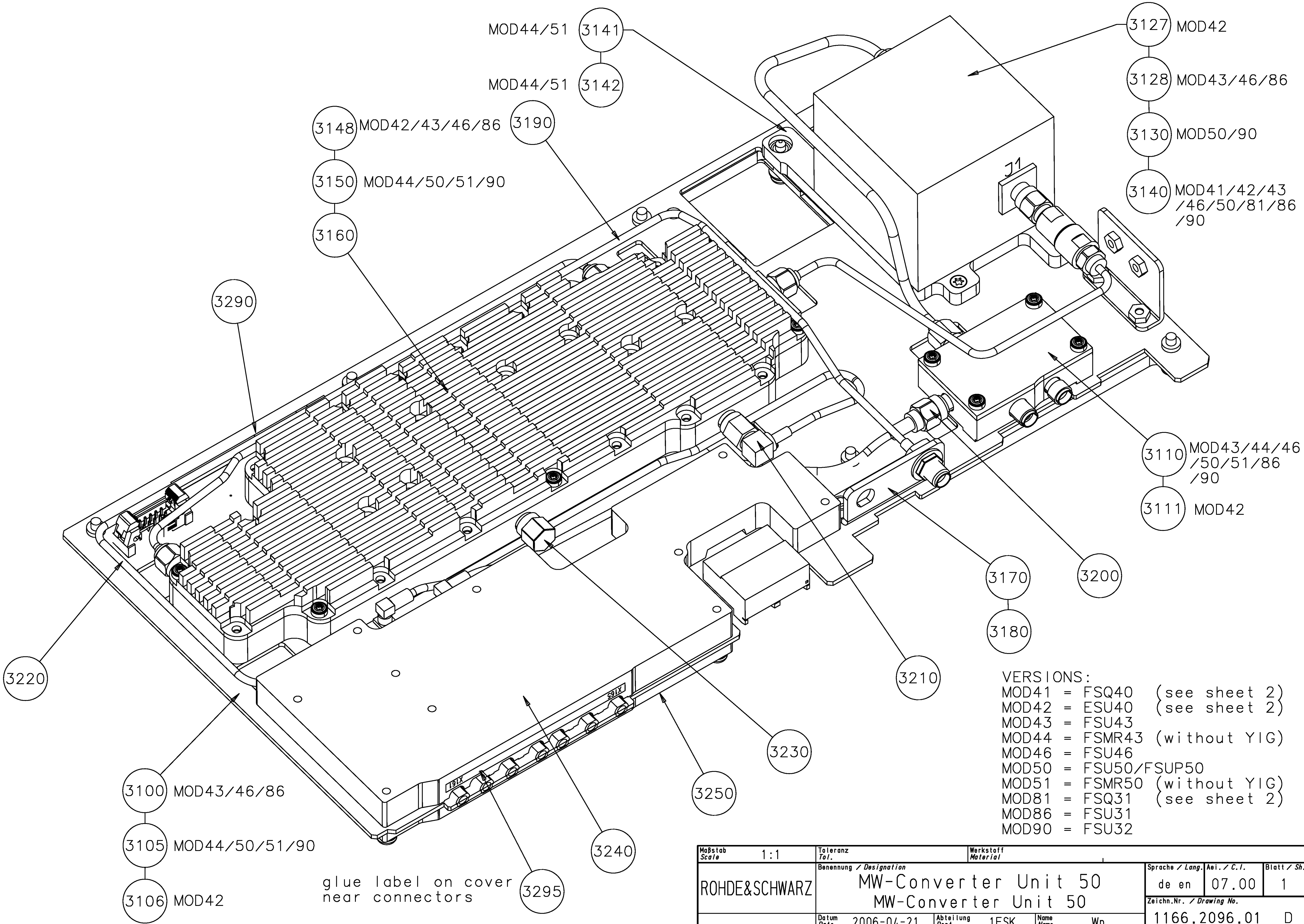
VERSIONS:
MOD20 = FSMR-B23 (Sheet5)
MOD21 = FSMR (Sheet6)
MOD22 = FSU26 (Sheet1)
MOD23 = FSQ26/FSMR-B2 (Sheet2)
MOD24 = for FSU-B23
MOD25 = for FSQ-B23/FSMR-B223 (Sheet4)

Projektions-methode / Projection Method

Maßstab / Scale: 1:1	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 26 / MW-Converter Unit 26	Sprache / Lang.: de en	Aei. / C.I.: 04.00 · Blatt / Sh.: 3
Typ / Type: FSU26		Zeichn.Nr. / Drawing No.: 1130.3240.01 D	
I.Z. used in: 1130.9003.01	Datum / Date: 2005-11-14 · Abteilung / Dept.: 1ESK · Name: Wn		



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		

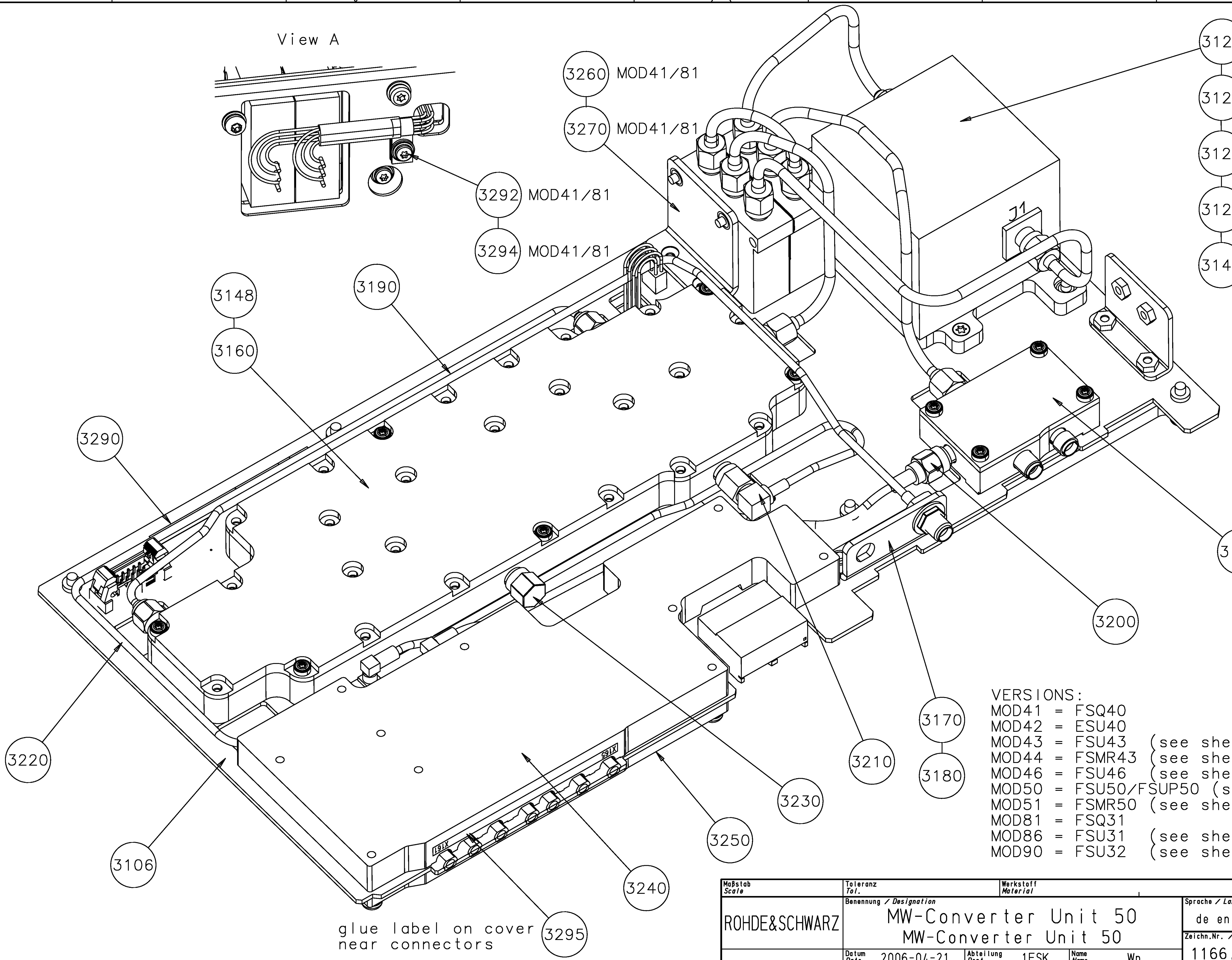


glue label on cover
near connectors

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.: 07.00; Blatt / Sh.: 1	
	Datum / Date: 2006-04-21; Abteilung / Dept.: 1ESK; Name / Name: Wn	Zeichn.Nr. / Drawing No.: 1166.2096.01 D	

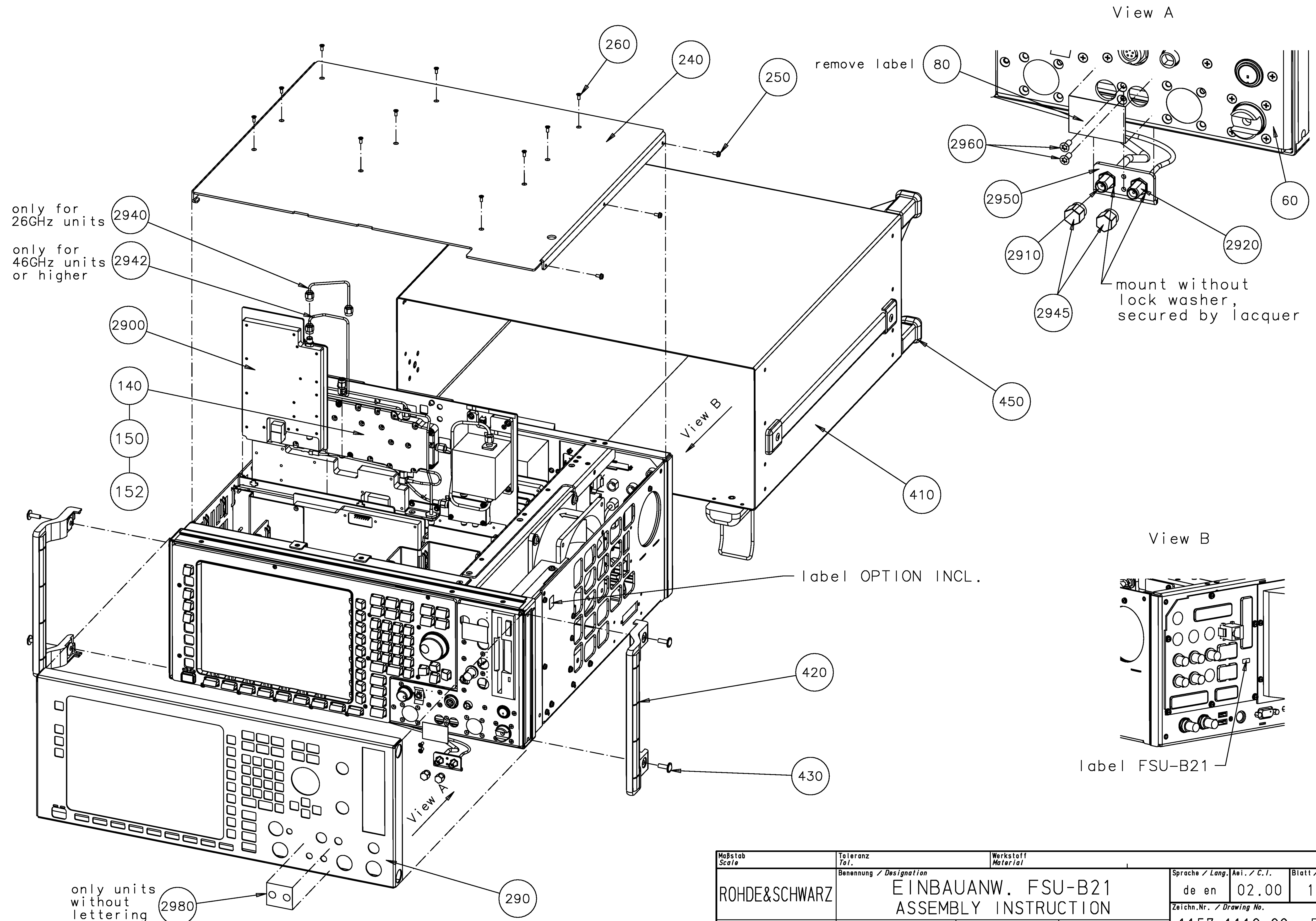
Projektions-methode / Projection Method



VERSIONS:
MOD41 = FSQ40
MOD42 = ESU40
MOD43 = FSU43 (see sheet 1)
MOD44 = FSMR43 (see sheet 1)
MOD46 = FSU46 (see sheet 1)
MOD50 = FSU50/FSUP50 (see sheet 1)
MOD51 = FSMR50 (see sheet 1)
MOD81 = FSQ31
MOD86 = FSU31 (see sheet 1)
MOD90 = FSU32 (see sheet 1)

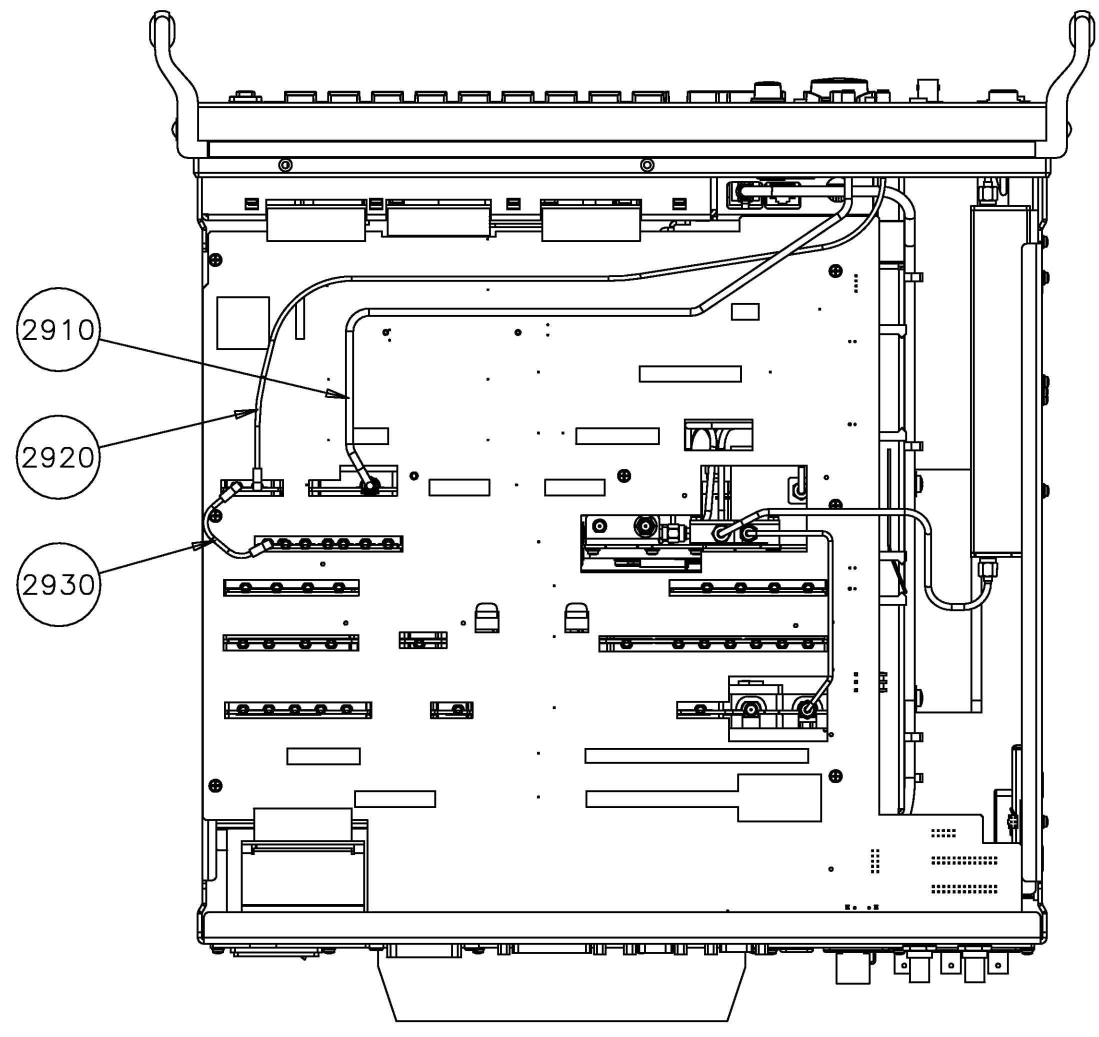
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: MW-Converter Unit 50 / MW-Converter Unit 50		Sprache / Lang.: de en	Aei. / C.I.: 07.00	Blatt / Sh.: 2
	Datum / Date: 2006-04-21	Abteilung / Dept.: 1ESK	Name / Name: Wn	Zeichn.Nr. / Drawing No.: 1166.2096.01	D

Projektions-methode / *Projection Method*



Projektions-methode
Projection Method

Maßstab *Scale*	Toleranz *Tol.*	Werkstoff *Material*		
ROHDE&SCHWARZ	Benennung / *Designation* EINBAUANW. FSU-B21 ASSEMBLY INSTRUCTION		Sprache / *Lang.* de en	Aei. / *C.I.* 02.00 · Blatt / *Sh.* 1
FSU-B21	Datum *Date* 08.10.2003	Abteilung *Dept.* 1ESK · Name *Name* Wn	Zeichn.Nr. / *Drawing No.* 1157.1110.00 D	

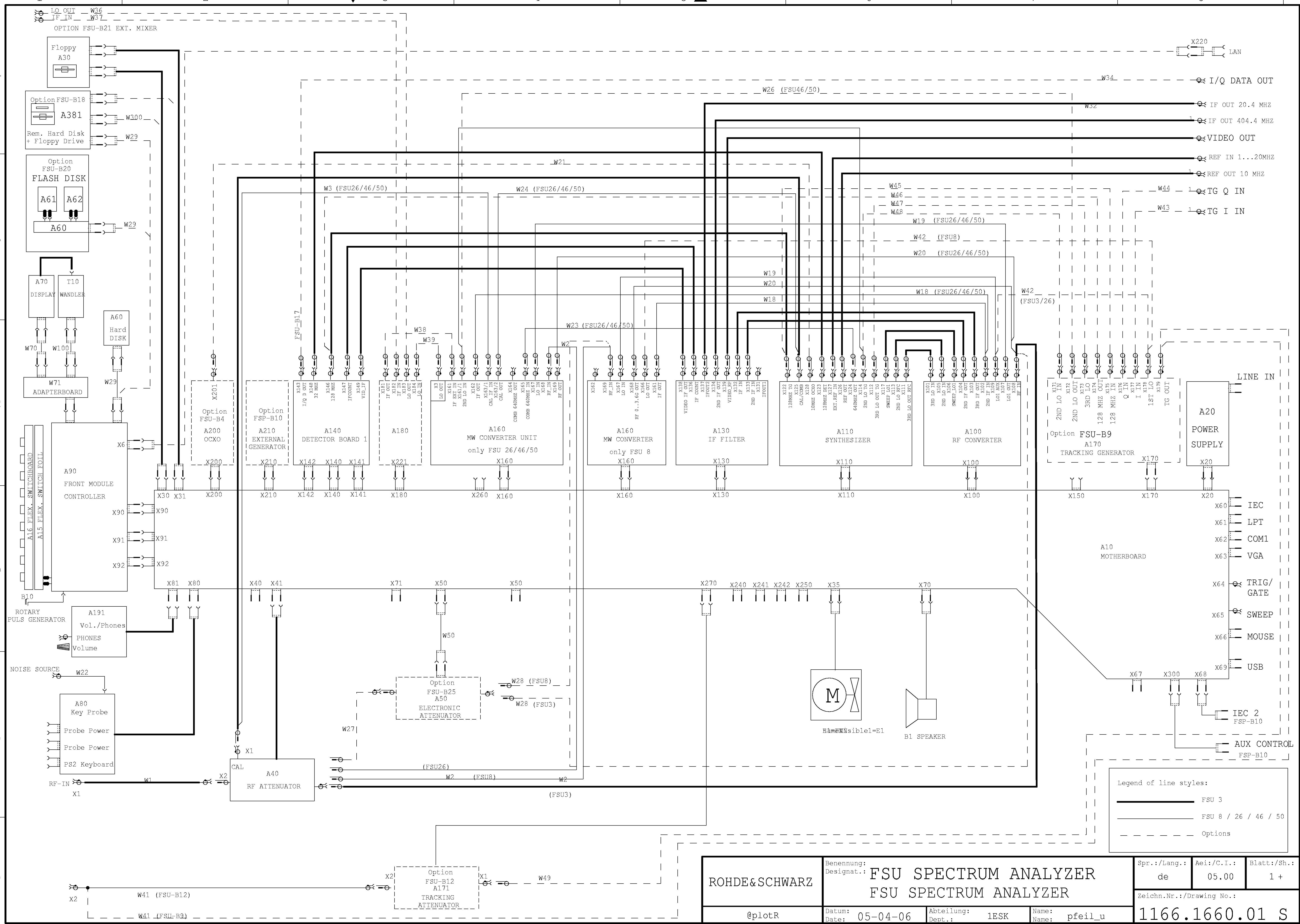


Projektions-methode
Projection Method

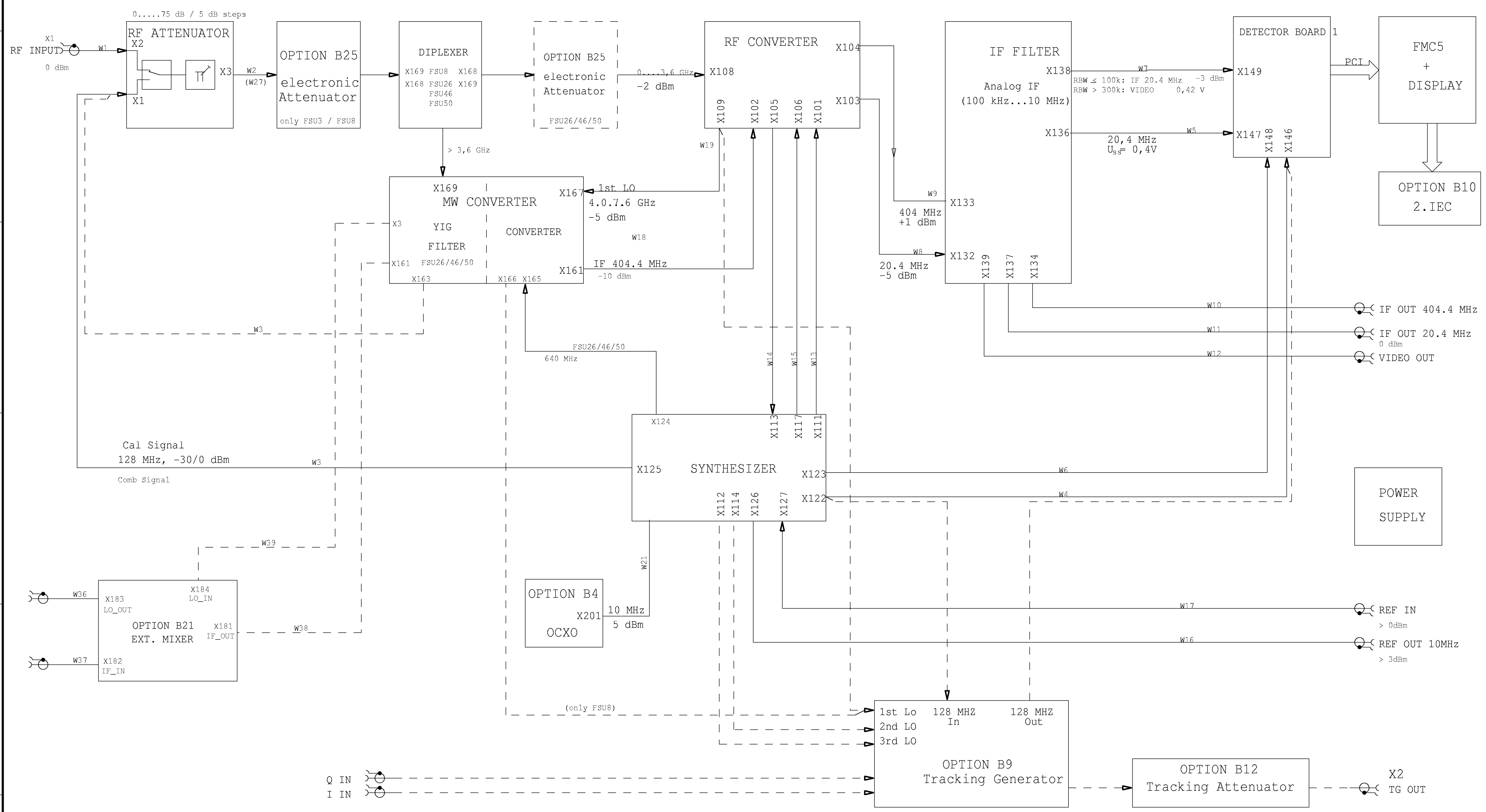
Maßstab / Scale	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	Benennung / Designation: EINBAUANW. FSU-B21 ASSEMBLY INSTRUCTION	Sprache / Lang.: de en	Aei. / C.I.: 01.00	Blatt / Sh.: 2
FSU-B21	Datum / Date: 04.06.2003 · Abteilung / Dept.: 1ESK · Name / Name: Wn	Zeichn.Nr. / Drawing No.: 1157.1110.00 D	

ROHDE&SCHWARZ

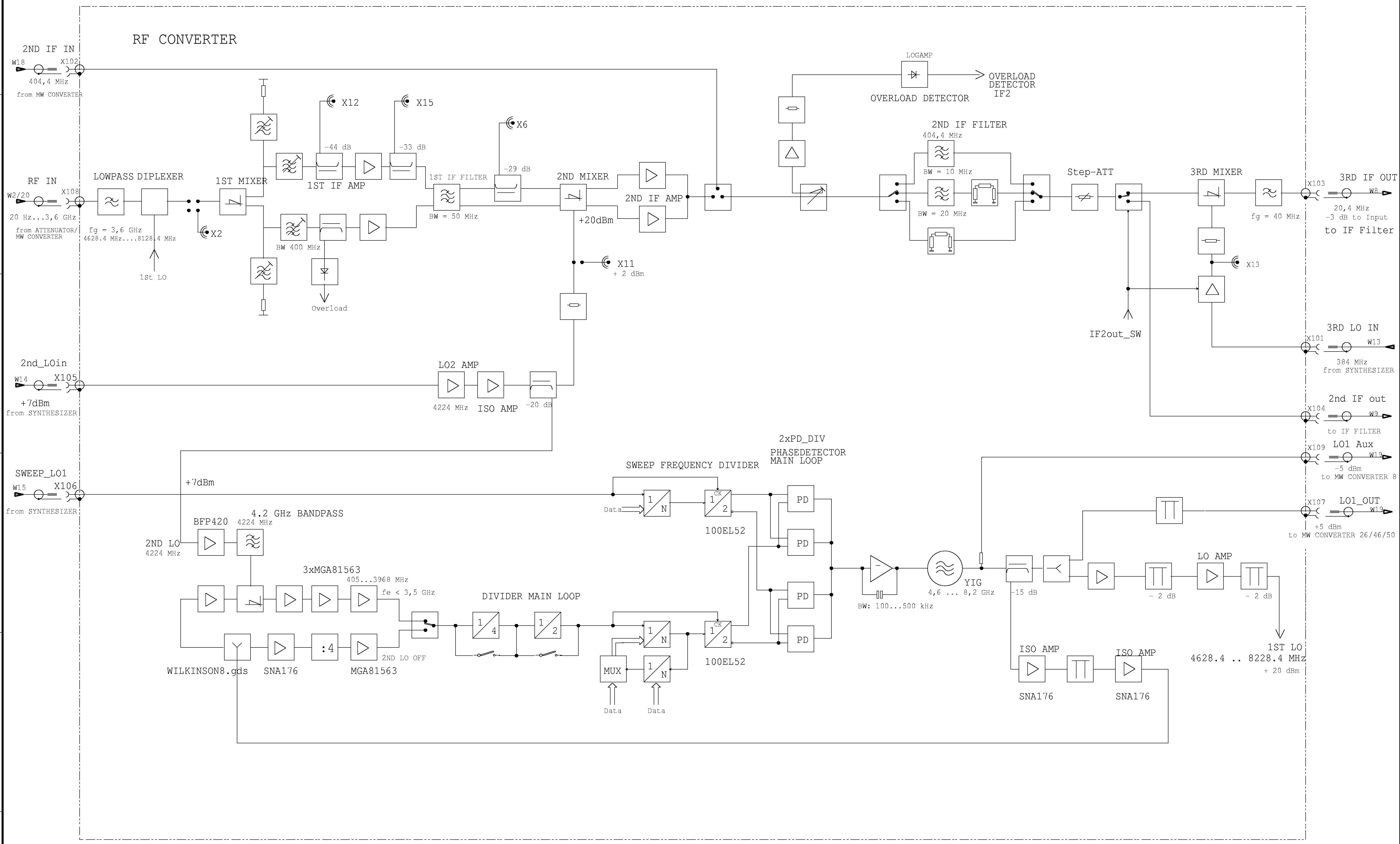
Block Circuit Diagram



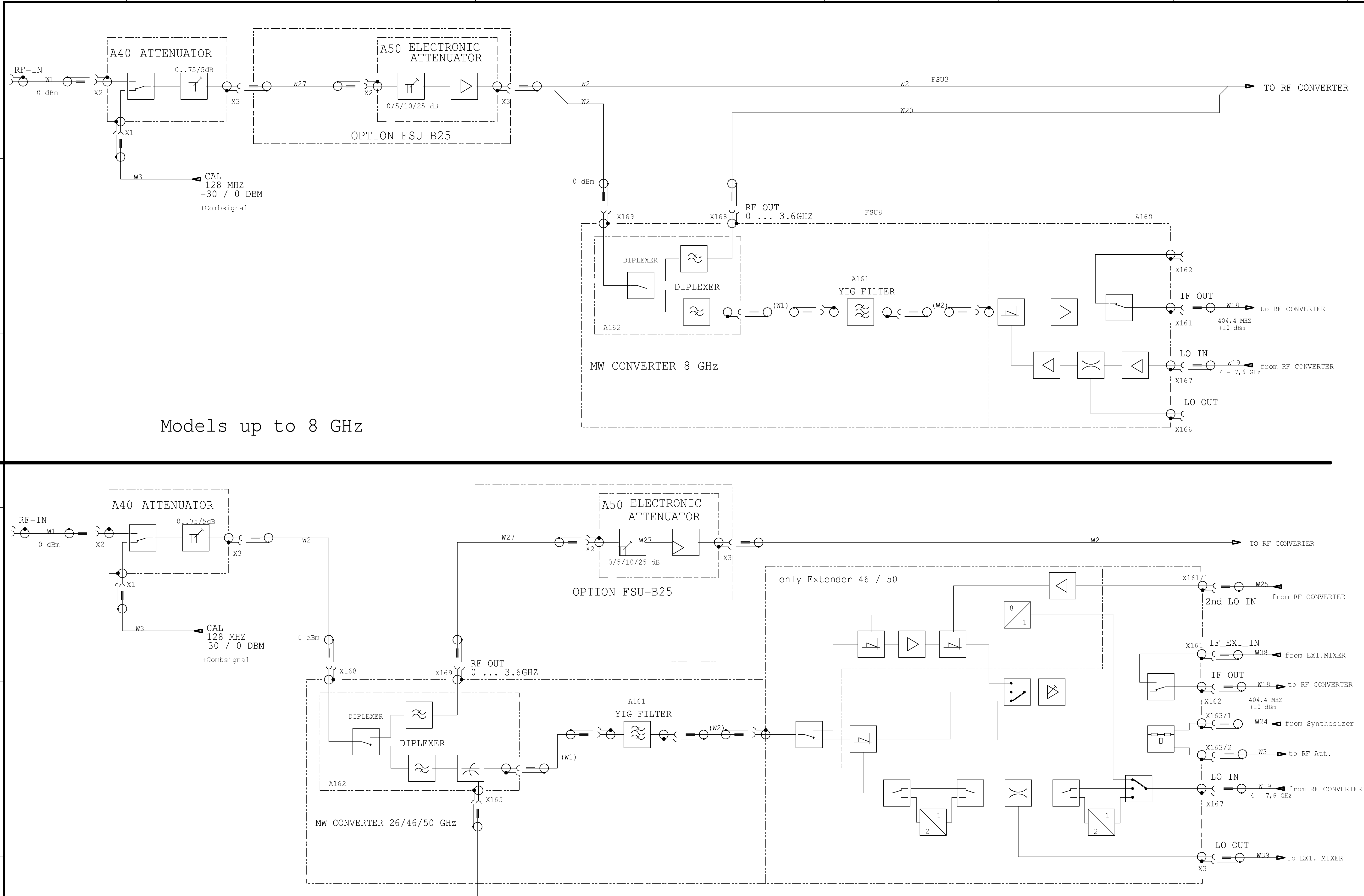
OPTION FSU-B21 EXT. MIXER
LO OUT
IF IN
Floppy A30
Option FSU-B18 A381
Rem. Hard Disk + Floppy Drive
Option FSU-B20 FLASH DISK
A61
A62
A60
A70 DISPLAY
T10 WANDLER
A60 Hard DISK
W71 ADAPTERBOARD
A90 FRONT MODULE CONTROLLER
A16 FLEX. SWITCHBOARD
A15 FLEX. SWITCH FOIL
B10 ROTARY PULS GENERATOR
A191 Vol./Phones
PHONES
Volume
NOISE SOURCE
A80 Key Probe
Probe Power
Probe Power
PS2 Keyboard
RF-IN
A40 RF ATTENUATOR
Option FSU-B4 A200 OCXO
Option FSP-B10 A210 EXTERNAL GENERATOR
A140 DETECTOR BOARD 1
A180
A160 MW CONVERTER UNIT only FSU 26/46/50
A160 MW CONVERTER only FSU 8
A130 IF FILTER
A110 SYNTHESIZER
A100 RF CONVERTER
Option FSU-B9 A170 TRACKING GENERATOR
A20 POWER SUPPLY
LINE IN
A10 MOTHERBOARD
Option FSU-B25 A50 ELECTRONIC ATTENUATOR
Option FSU-B12 A171 TRACKING ATTENUATOR
B1 SPEAKER
LAN
I/Q DATA OUT
IF OUT 20.4 MHZ
IF OUT 404.4 MHZ
VIDEO OUT
REF IN 1...20MHZ
REF OUT 10 MHZ
TG Q IN
TG I IN
IEC
LPT
COM1
VGA
TRIG/ GATE
SWEEP
MOUSE
USB
IEC 2 FSP-B10
AUX CONTROL FSP-B10
Legend of line styles:
FSU 3
FSU 8 / 26 / 46 / 50
Options
ROHDE&SCHWARZ
@plotR
Benennung: Designat.:
FSU SPECTRUM ANALYZER
FSU SPECTRUM ANALYZER
Datum: Date: 05-04-06
Abteilung: Dept.: 1ESK
Name: Name: pfeil_u
Spr.:/Lang.: de
Aei:/C.I.: 05.00
Blatt:/Sh.: 1 +
Zeichn.Nr.:/Drawing No.: 1166.1660.01 S



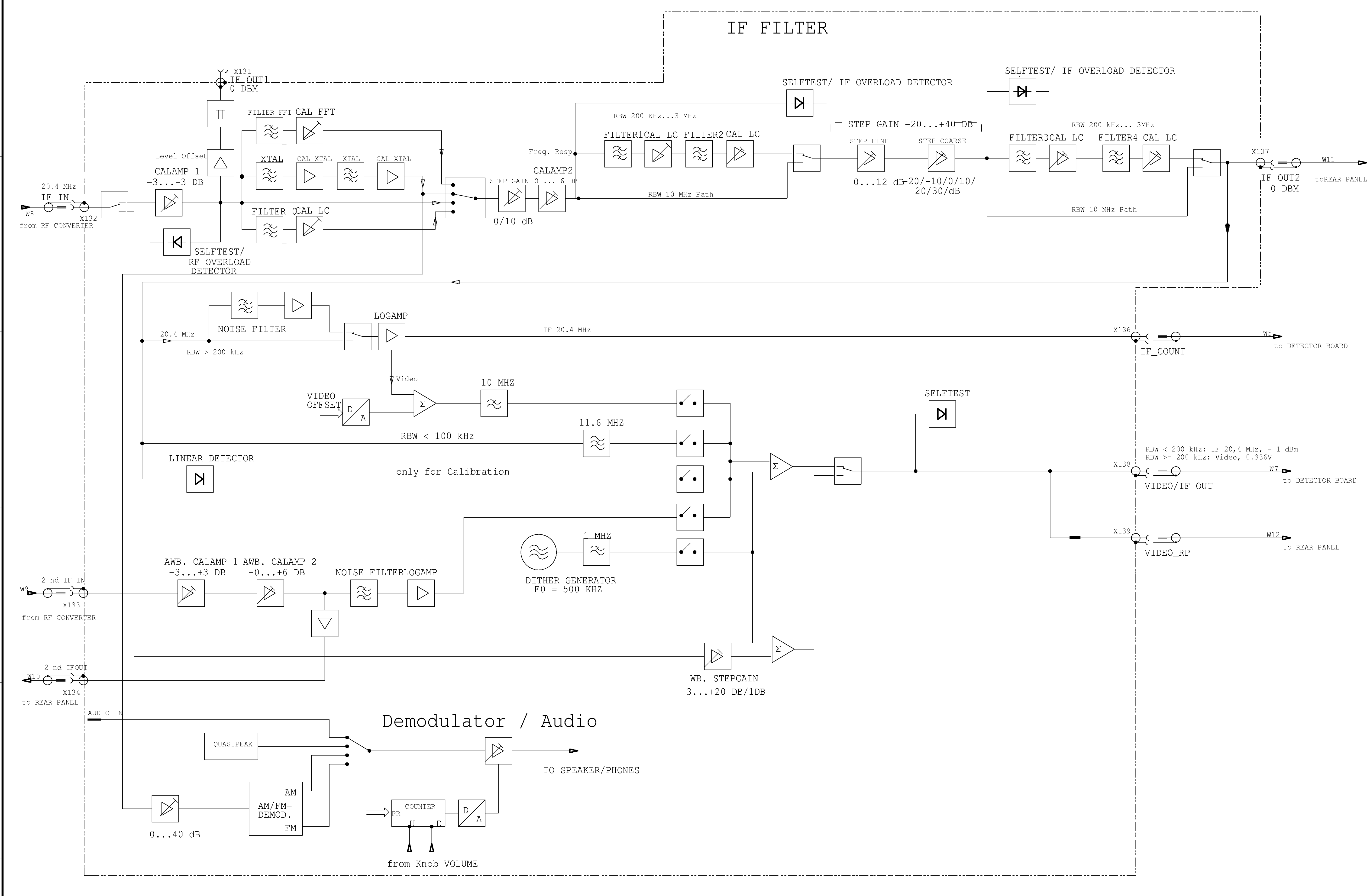
ROHDE&SCHWARZ	Benennung: Designat.: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 05.00	Blatt:/Sh.: 2 +
@plotR	Datum: Date: 05-04-06 · Abteilung: Dept.: 1ESK · Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1166.1660.01 S		



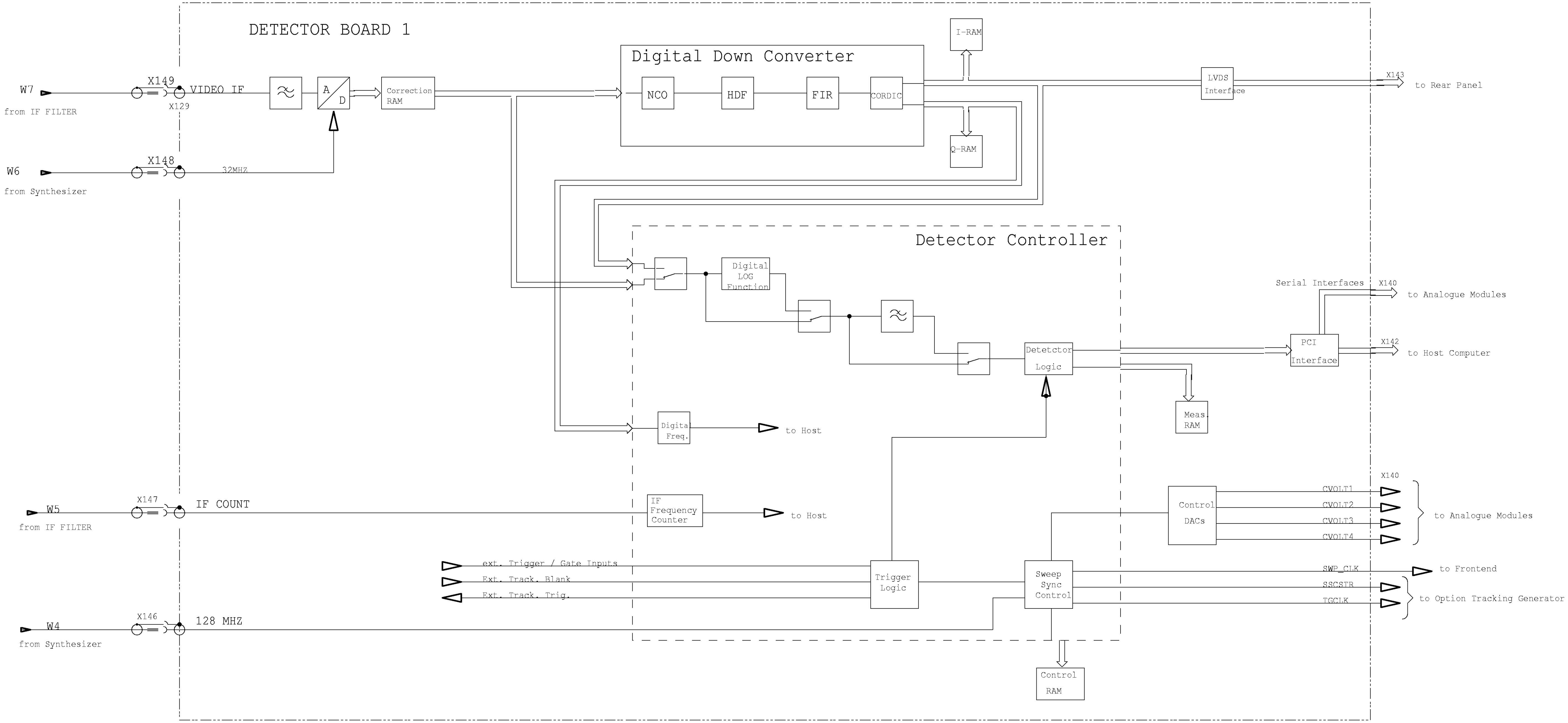
ROHDE&SCHWARZ	Benennung: Designat.: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 05.00	Blatt:/Sh.: 3 +
@plotR	Datum: Date: 05-04-06 · Abteilung: Dept.: 1ESK · Name: Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1166.1660.01 S		



ROHDE&SCHWARZ	Benennung: Designat.: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 05.00	Blatt:/Sh.: 4 +
@plotR	Datum: Date: 05-04-06	Abteilung: Dept.: 1ESK	Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1166.1660.01 S

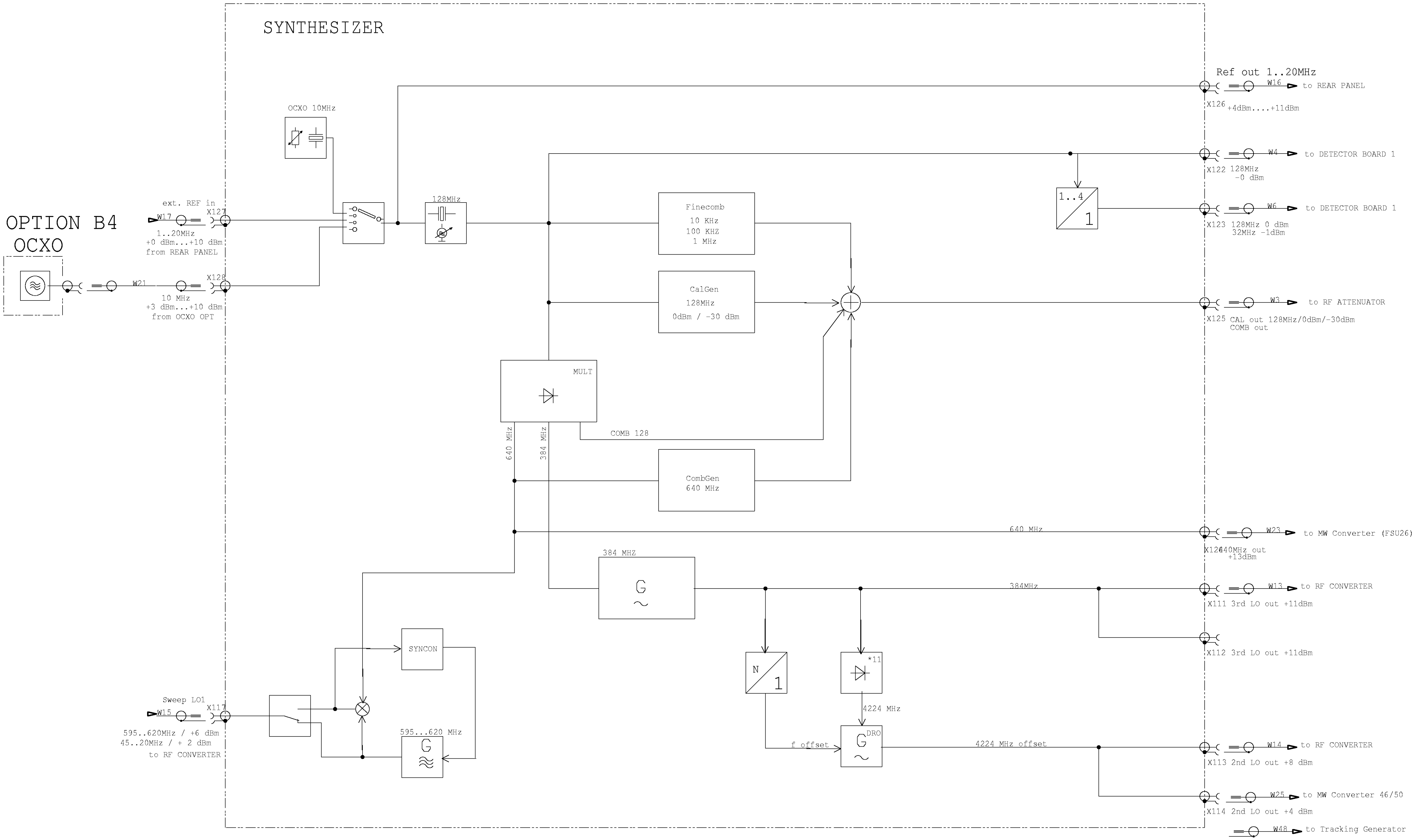


ROHDE&SCHWARZ	Benennung: Designat.: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 05.00	Blatt:/Sh.: 5 +
@plotR	Datum: Date: 05-04-06 · Abteilung: Dept.: 1ESK · Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1166.1660.01 S		

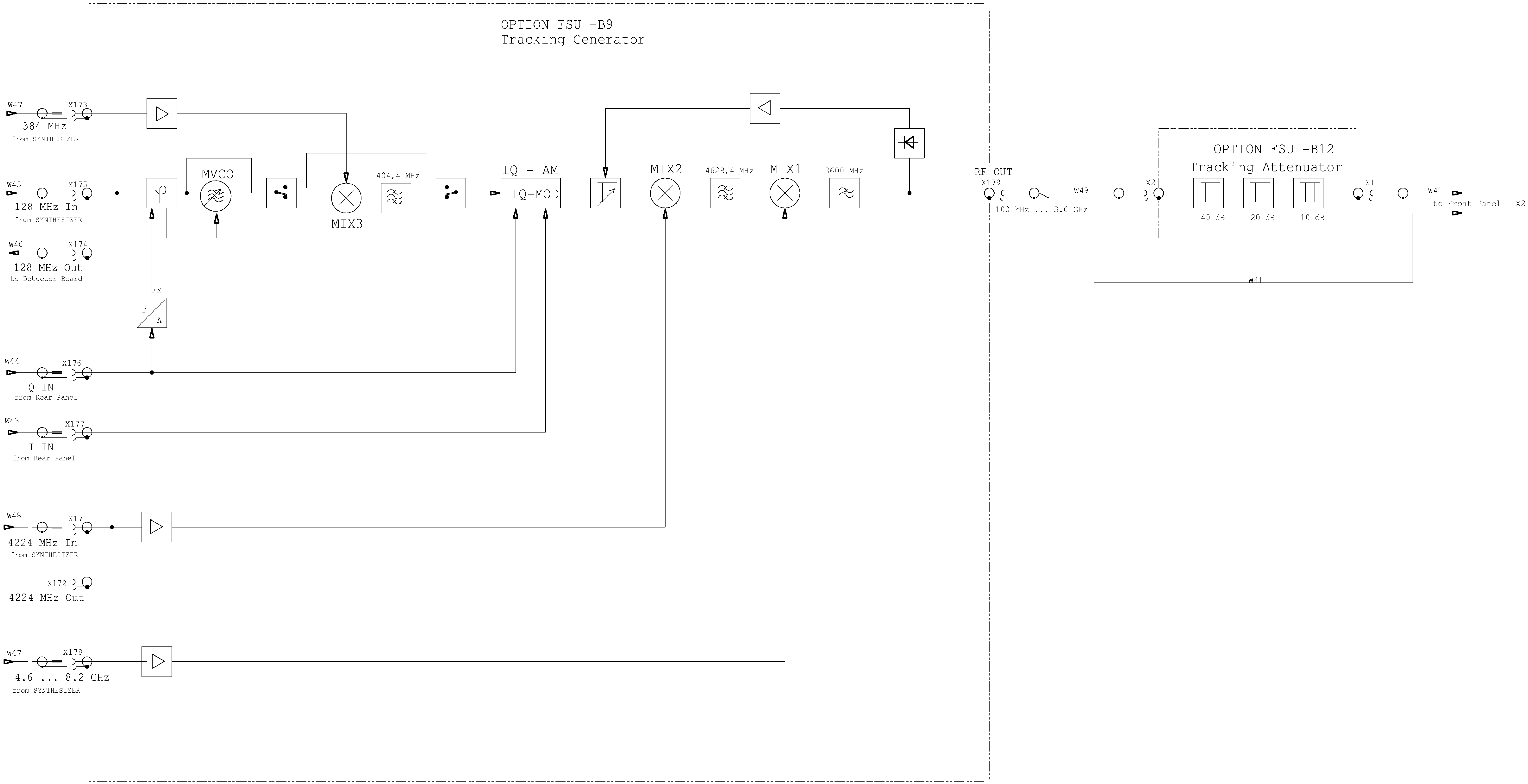


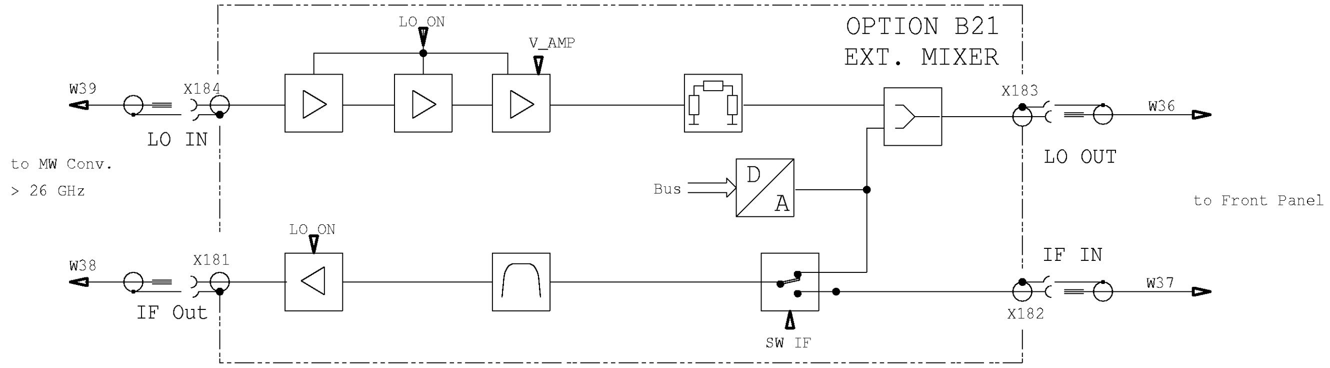
E

ROHDE&SCHWARZ	Benennung: / Designat.: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 05.00	Blatt:/Sh.: 6 +
@plotR	Datum: / Date: 05-04-06 · Abteilung: / Dept.: 1ESK · Name: / Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1166.1660.01 S		



ROHDE&SCHWARZ	Benennung:/Designat.: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 05.00	Blatt:/Sh.: 7 +
@plotR	Datum:/Date: 05-04-06	Abteilung:/Dept.: 1ESK	Name:/Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1166.1660.01 S		





ROHDE&SCHWARZ	Benennung: / Designat.: FSU SPECTRUM ANALYZER FSU SPECTRUM ANALYZER			Spr.:/Lang.: de · Aei:/C.I.: 05.00 · Blatt:/Sh.: 8 -
@plotR	Datum: / Date: 05-04-06	Abteilung: / Dept.: 1ESK	Name: / Name: pfeil_u	Zeichn.Nr.:/Drawing No.: 1166.1660.01 S