

R&S®ZVL

Vector Network Analyzer

Service Manual Instrument



1303.6580.82 – 10

The Service Manual Instrument describes the following R&S®ZVL models and options

- R&S ZVL3 (1303.6509K03)
- R&S ZVL6 (1303.6509K06)
- R&S ZVL3-75 (1303.6509K75)
- R&S ZVL13 (1303.6509K13)

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The following abbreviations are used throughout this manual:

R&S®ZVL is abbreviated as R&S ZVL.

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

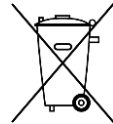
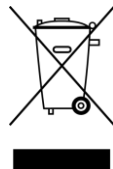
Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety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

Safety labels on products

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

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

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

Signal words and their meaning

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



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



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



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



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

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

Basic Safety Instructions

Operating states and operating positions

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

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

Electrical safety

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

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

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

Operation

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

Basic Safety Instructions

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

Repair and service

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

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

Batteries and rechargeable batteries/cells

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

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

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.
2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.

Basic Safety Instructions

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

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

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

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

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

Instrucciones de seguridad elementales

Señalización de seguridad de los productos

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

Símbolo	Significado	Símbolo	Significado
	Aviso: punto de peligro general Observar la documentación del producto		Tensión de alimentación de PUESTA EN MARCHA / PARADA
	Atención en el manejo de dispositivos de peso elevado		Indicación de estado de espera (standby)
	Peligro de choque eléctrico		Corriente continua (DC)
	Advertencia: superficie caliente		Corriente alterna (AC)
	Conexión a conductor de protección		Corriente continua / Corriente alterna (DC/AC)
	Conexión a tierra		El aparato está protegido en su totalidad por un aislamiento doble (reforzado)
	Conexión a masa		Distintivo de la UE para baterías y acumuladores Más información en la sección "Eliminación/protección del medio ambiente", punto 1.
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)	 	Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser Más información en la sección "Funcionamiento", punto 7.		

Instrucciones de seguridad elementales

Palabras de señal y su significado

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



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



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



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



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

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

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

Estados operativos y posiciones de funcionamiento

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

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

Instrucciones de seguridad elementales

Seguridad eléctrica

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

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

Instrucciones de seguridad elementales

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

Funcionamiento

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

Instrucciones de seguridad elementales

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

Reparación y mantenimiento

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

Instrucciones de seguridad elementales

Baterías y acumuladores o celdas

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

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

Transporte

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

Eliminación/protección del medio ambiente

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

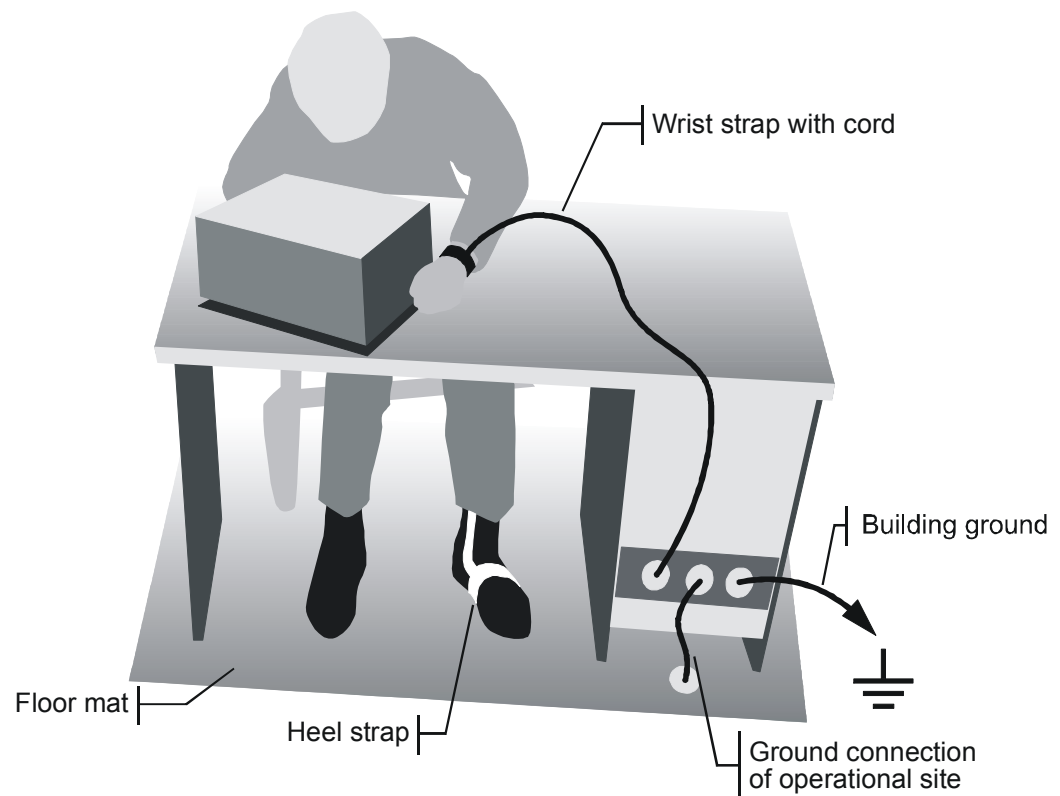
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

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



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

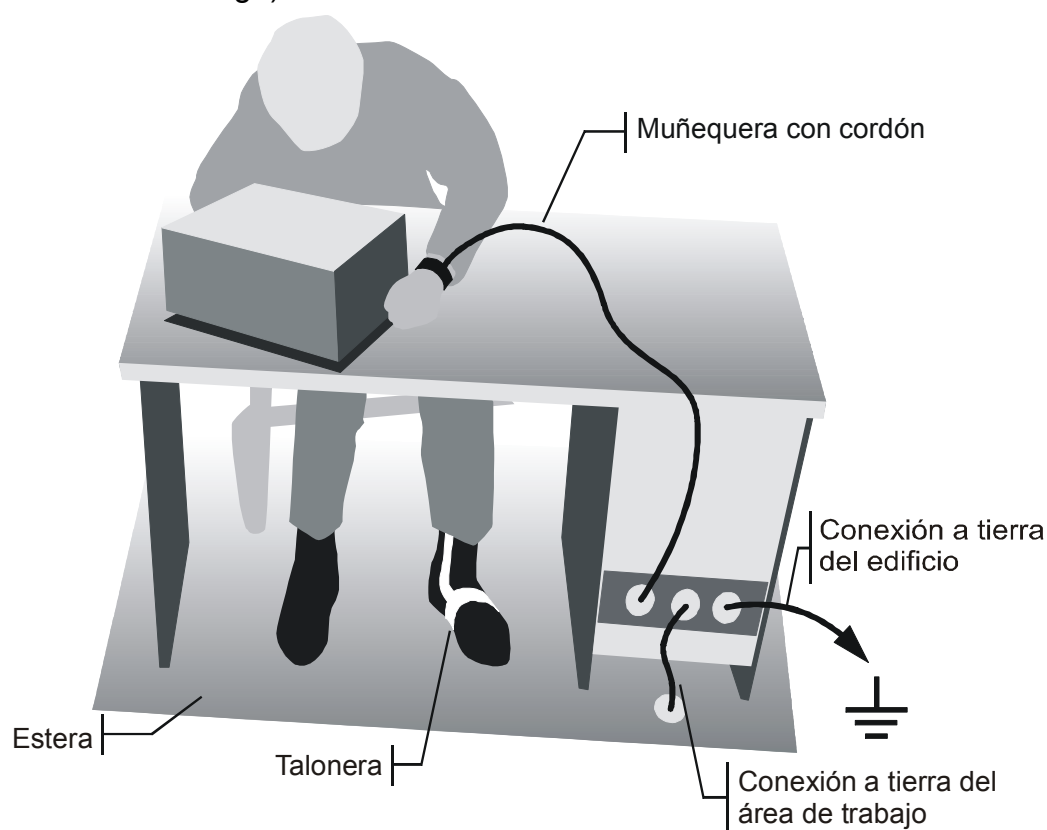
- Wrist strap with cord to ground connection
 - Conductive floor mat and heel strap combination
-

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

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



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

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

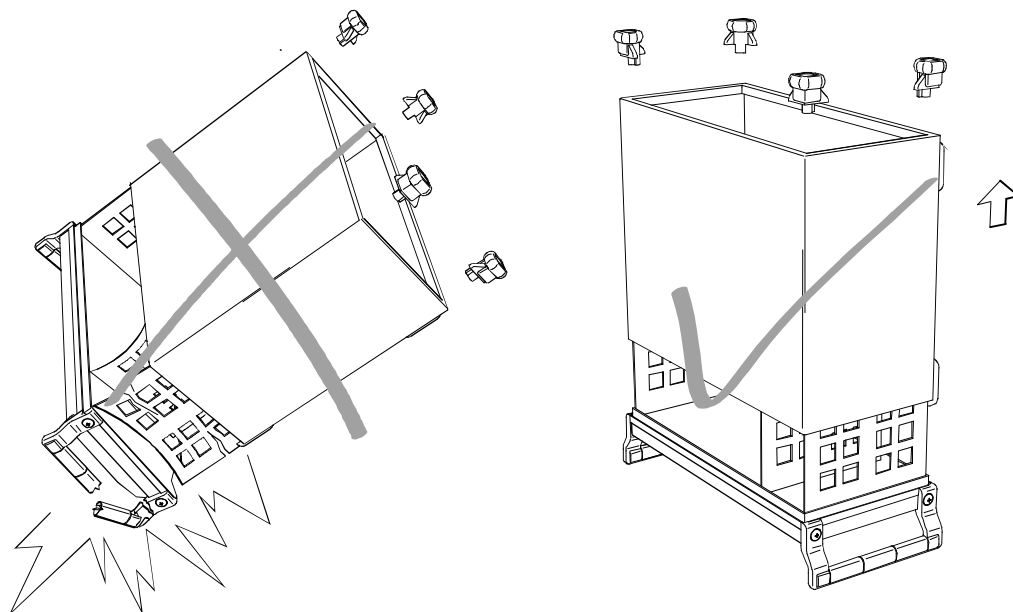
Safety Instructions for Units with Removable Cabinet

WARNING

Danger of injuries

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

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



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

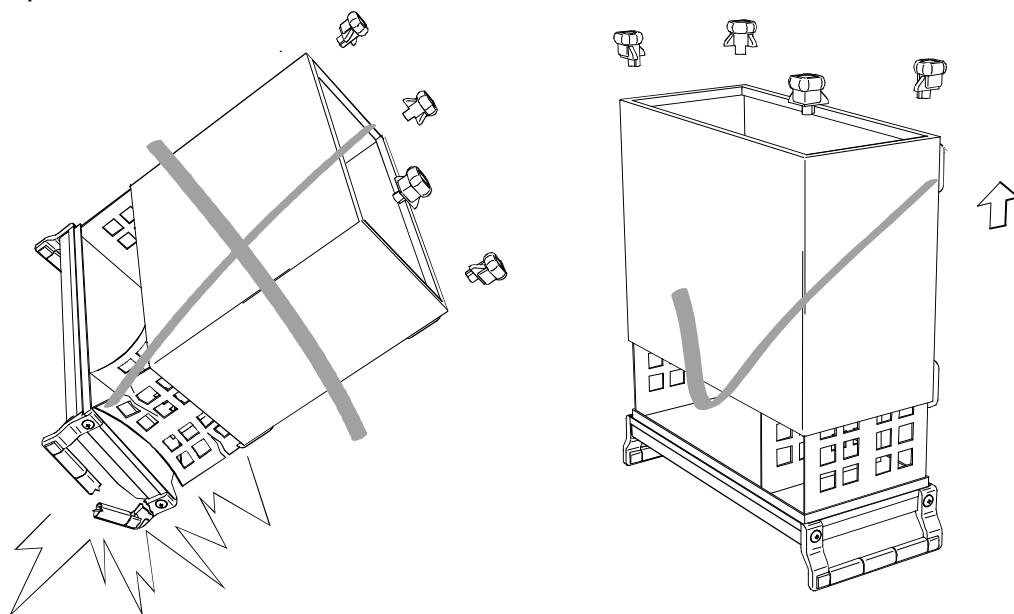
Informaciones de seguridad para aparatos con tubo de quita y pon

ADVERTENCIA

Peligro de heridas

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

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



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

Procedure for servicing and repairs

This section contains information on shipping an instrument or module to your service center.

Please contact your local Rohde & Schwarz service center if your equipment needs to be serviced or repaired. You can find the current address of your representative at www.rohde-schwarz.com.

Shipping the instrument or module

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

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

In many countries, an RMA process is available (pickup and delivery of your product). For details, contact your local representative.

When shipping the product, ensure that there is sufficient mechanical and antistatic protection.

- Where possible, use the original packaging to transport or ship the product. The front and rear protective covers prevent damage to the operating elements and the connectors.
- If you do not use the original packaging, ensure sufficient padding to prevent the product from moving around inside the box. Wrap antistatic film around the product to protect it from electrostatic charging.
- Comply with the relevant safety and security measures for products with batteries.

As the manufacturer, Rohde & Schwarz can ensure that your instruments perform optimally throughout their service life by regularly calibrating them on its own measurement systems. Rohde & Schwarz calibration includes preventative measures such as adjustments. The calibration documentation fulfills ISO 17025 requirements.

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Contents of Manuals for Spectrum Analyzer R&S ZVL

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 ZVL by the replacement of modules.

The service manual comprises four chapters and an annex (chapter 5) containing the R&S ZVL 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 Quick Start Guide and the Operating Manual on CD 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.

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1 Performance Test

Test Instructions

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

- Allow for a minimum warm-up time of 30 minutes at ambient temperature.
- Carry out all internal adjustments (start of the self alignment: [**Setup: Self Alignment**]).
- Press the **PRESET** key to establish a defined initial state before configuring a new measurement.

The following sections describe the procedures for checking the rated values. The values are specified in the data sheet. Additional uncertainties introduced by the measurement equipment must be taken into account when checking the rated values. Unless specified otherwise, all measurements will be performed with external reference frequency.

Inputs for settings during measurements are shown as follows:

[<KEY>] Press a key on the front panel, e.g. [**SPAN**].

[<Softkey>] Press a softkey, e.g. [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**].

Measurement Equipment & Accessories (ZVL3, ZVL3-75, ZVL6)

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Signal generator	Frequency: 10 MHz to 6 GHz Uncertainty of frequency: 0.1 ppm, 0.05 ppm with option -B4 Phase noise at 500 MHz: < -100 dBc (1Hz) @ 10 kHz < -120 dBc (1Hz) @ 100 kHz < -130 dBc (1Hz) @ 1 MHz			Frequency response Frequency accuracy of reference oscillator
2	Signal generator	Frequency: 10 MHz to 6 GHz			3 rd order IM
3	Power sensor	10 MHz to 6 GHz	R&S NRP-Z11		Frequency response
4	50-Ω termination	10 MHz to 6 GHz Return loss ≤ -10 dB			Noise display
6	6-dB power splitter	uncertainty DC to 6 GHz ≤ 0.2 dB			Frequency response
7	Rf cable	DC to 6 GHz	R&S ZV-Z91	1301.7572.25	Trace noise
8	N male short	DC to 6 GHz		0017.8080	Source power linearity Dynamic range
9	N male short	DC to 6 GHz		0017.8080	Source power linearity Dynamic range

Measurement Equipment & Accessories (ZVL3, ZVL3-75, ZVL6, ZVL13) R&S ZVL

Measurement Equipment & Accessories (ZVL3, ZVL3-75, ZVL6, ZVL13)

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Signal generator	Frequency: 10 MHz to 13.6 GHz Uncertainty of frequency: 0.1 ppm, 0.05 ppm with option -B4 Phase noise at 500 MHz: < -100 dBc (1Hz) @ 10 kHz < -120 dBc (1Hz) @ 100 kHz < -130 dBc (1Hz) @ 1 MHz			Frequency response Frequency accuracy of reference oscillator
2	Signal generator	Frequency: 10 MHz to 6 GHz			3 rd order IM
3	Power sensor	10 MHz to 13.6 GHz	R&S NRP-Z21		Frequency response
4	50-Ω termination	10 MHz to 13.6 GHz Return loss ≤ -10 dB			Noise display
6	6-dB power splitter	uncertainty DC to 13.6 GHz ≤ 0.2 dB			Frequency response
7	Rf cable	DC to 13.6 GHz	R&S ZV-Z91	1301.7572.25	Trace noise
8	N male short	DC to 13.6 GHz		0017.8080	Source power linearity Dynamic range
9	N male short	DC to 13.6 GHz		0017.8080	Source power linearity Dynamic range

Additional Equipment and Accessories for ZVL3-75

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
10	Adapter 50/75	DC to 3 GHz 50 <-> 75 Ohm	R&S RAM	0358.5414.02	
11	Rf cable	DC to 3 GHz 75 Ohm	R&S ZV-Z194	1306.4542.24	Trace noise
12	Through 75 Ω male / male	DC to 3 GHz	R&S ZCAN75 Through m/m	0800.8650.72	
13	N male short	DC to 3 GHz 75 Ohm	R&S ZCAN75 Short male	0800.8615.72	Source power linearity Dynamic range
14	N male short	DC to 3 GHz 75 Ohm	R&S ZCAN75 Short male	0800.8615.72	Source power linearity Dynamic range
15	N male load	DC to 3 GHz 75 Ohm	R&S ZCAN75 Load male	0800.8573.72	Noise Display

Performance Test R&S ZVL

Checking the frequency accuracy

Test equipment:	- Signal generator (refer to section "Measurement Equipment and Accessories", item 1) - R&S® ZVL3-75 additional: - R&S® RAM, item 10) - Through 75 Ω male/male, item 12)
Test setup:	only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13: Connect the Signal Generator to the Port 2 of the R&S® ZVL only R&S® ZVL3-75: Connect the Signal Generator via R&S® RAM and "Through 75 Ω" to the Port 2 of the R&S® ZVL !! Attention: male N50 Ω damage female N75 Ω, please be careful.
Signal Generator settings:	- Frequency 2 GHz - Level - 20 dBm (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13) - 14.2 dBm (R&S® ZVL3-75)
R&S® ZVL settings:	Verify the ZVL is using it's internal frequency reference: - [SETUP : 'Int. Reference' must be selected - [PRESET] - [MEAS : S21] - [CENTER : 2 GHz] - [SPAN : 10 KHz] (without FSL-B4) - [SPAN : 1 KHz] (with FSL-B4) - [PWR BW : Meas Bandwidth : 1kHz] (without R&S FSL-B4) - [PWR BW : Meas Bandwidth : 100Hz] (with R&S FSL-B4) - [SWEEP : Number of Points : 1001] (without R&S FSL-B4) - [SWEEP : Number of Points : 501] (with R&S FSL-B4)
Measurement:	- [MKR-> : Max Search : Bandfilter : Bandpass Search] Read out the Center:

Checking the display linearity

Test equipment:

- Signal generator (refer to section "Measurement Equipment and Accessories", item 1)
- Power sensor (refer to section "Measurement Equipment and Accessories", item 3)
- 6-dB power splitter (refer to section "Measurement Equipment and Accessories", item 6)

R&S® ZVL3-75 additional:

- R&S® RAM, item 10)
- Through 75 Ω male/male, item 12)

Test setup:

- Connect the power sensor (item 4) to the power meter and execute function 'ZERO' when there is no signal applied to the power sensor.
- Connect the RF output of the signal generator to the input of the splitter.
- Connect output 1 of the splitter to the power sensor / power meter.

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

- Connect output 2 of the splitter to the Port # of the R&S® ZVL.

only R&S® ZVL3-75:

- Connect output 2 of the splitter via R&S® RAM and "Through 75 Ω " to the Port # of the R&S® ZVL

!! Attention: male N50 Ω damage female N75 Ω , please be careful.

1st Measurement

0 to 30 dB below reference level

Signal generator settings:

- Frequency **{f_{GEN}*}**
- Level + 6 dBm (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
+ 11.8 dBm (R&S® ZVL3-75)

Refer to table under "Performance Test Report" for values of {f_{GEN}*}.

- Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows
0 dBm $\pm$ 0.2 dB (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
+5.75 dBm $\pm$ 0.2 dB (R&S® ZVL3-75)

R&S® ZVL settings:

- [**PRESET**]
- [**MEAS** : S12] (when measuring Port1)
- [**SETUP** : More : Service : Service Function 4.0.1.0.1] (when Port1)
- [**MEAS** : S21] (when measuring Port2)
- [**SETUP** : More : Service : Service Function 4.0.1.0.4] (when Port2)
- [**ENTER**]
- [**ESC**]
- [**ESC**]
- [**PWR BW** : Step Atten b1 : **10 dB**]
- [**PWR BW** : Step Atten b2 : **10 dB**]
- [**SPAN** : **2 Hz**]
- [**CENTER** : {f_{GEN}*}]
- [**PWR BW** : Meas Bandwidth : 10kHz]
- [**PWR BW** : Meas Bandwidth : Fine Adjust : Filter type : normal]
- [**TRACE** : More1/2 : Trace Statistics : Mean / Std Dev]

Reference measurement:

L : Read out the value of the R&S® ZVL Trace Statistics Mean:

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13: $Ref_{dBm} = L - L_{powermeter}$

only R&S® ZVL3-75:

$$Ref_{dBm} = L - L_{powermeter} + 5.75 \text{ dB}$$

Signal generator settings:

- Frequency {f_{GEN}*}

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

- Level Sig_Lev + 6 dB

only R&S® ZVL3-75:

- Level Sig_Lev + 11.8 dB

Refer to table under "Performance Test Report" for values of {Sig_Lev}.

- Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows the value of

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$L_{powermeter} = \{Sig_Lev\} \pm 0.2 \text{ dB}$$

only R&S® ZVL3-75:

$$L_{powermeter} = \{Sig_Lev\} + 5.75 \text{ dB} \pm 0.2 \text{ dB}$$

Evaluation:

L : Read out the value of the R&S® ZVL Trace Statistics Mean:

The difference between the level inaccuracy of the R&S® ZVL and Ref_{0dBm} is the uncertainty of the display linearity:

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$Linearity_{uncertainty} = L - L_{powermeter} - Ref_{0dBm}$$

only R&S® ZVL3-75:

$$Linearity_{uncertainty} = L - L_{powermeter} + 5.75 \text{ dB} - Ref_{0dBm}$$

2nd Measurement

Because the sensitivity of the power meter is limited, the internal RF 30 to 50 dB below reference attenuator of the R&S® ZVL is used to increase the dynamic range of the input signal.

R&S® ZVL settings:

- [**PWR BW** : Step Atten b1 : **30 dB**]
- [**PWR BW** : Step Atten b2 : **30 dB**]

Signal generator settings:

- Frequency $\{f_{GEN}^*\}$
- Level $- 4 \text{ dBm}$ (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
 $+ 1.8 \text{ dBm}$ (R&S® ZVL3-75)

- Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows:
 - $- 10 \text{ dBm} \pm 0.2 \text{ dB}$ (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
 - $- 4.25 \text{ dBm} \pm 0.2 \text{ dB}$ (R&S® ZVL3-75)

Reference measurement:

- Set the marker to the peak of the signal.
- [**MARKER**: SET MARKER: PEAK]

The signal level L is displayed by the level reading of the marker.

With the result of the 1st linearity measurement, a new correction factor is to be calculated. "Linearity_{uncertainty} (-30dB)" is the measured uncertainty of the R&S® ZVL linearity at 30 dB below reference level.

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$Ref_{20dBm} = L - L_{powermeter} - Linearity_{uncertainty} (-30dB)$$

only R&S® ZVL3-75:

$$Ref_{20dBm} = L - L_{powermeter} + 5.75 \text{ dB} - Linearity_{uncertainty} (-30dB)$$

Signal generator settings:

- Frequency $\{f_{GEN*}\}$

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

- Level $Sig_Lev + 6\text{ dB}$

only R&S® ZVL3-75:

- Level $Sig_Lev + 11.8\text{ dB}$

Refer to table under "Performance Test Report" for values of $\{Sig_Lev\}$.

➤ Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows the value of

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$L_{\text{powermeter}} = \{Sig_Lev\} \pm 0.2\text{ dB}$$

only R&S® ZVL3-75:

$$L_{\text{powermeter}} = \{Sig_Lev\} + 5.75\text{ dB} \pm 0.2\text{ dB}$$

Evaluation:

L :Read out the value of the R&S® ZVL Trace Statistics Mean:

The difference between the level inaccuracy of the R&S® ZVL and Ref_{0dBm} is the uncertainty of the display linearity:

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$Linearity_{\text{uncertainty}} = L - L_{\text{powermeter}} - Ref_{20dBm}$$

only R&S® ZVL3-75:

$$Linearity_{\text{uncertainty}} = L - L_{\text{powermeter}} + 5.75\text{ dB} - Ref_{20dBm}$$

Source power accuracy

Test equipment:	- Power sensor (refer to section "Measurement Equipment and Accessories", item 3) R&S® ZVL3-75 additional: - R&S® RAM, item 10) - Through 75 Ω male/male, item 12)
Test setup:	only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13: ➤ Connect the power sensor to the Port # of the R&S® ZVL. only R&S® ZVL3-75: ➤ Connect the power sensor via R&S® RAM and "Through 75 Ω" to the Port # of the R&S® ZVL !! Attention: male N50 Ω damage female N75 Ω, please be careful.
Power Sensor settings:	Refer to table under "Performance Test Report" for values of test frequencies {f _{GEN} *}.
R&S® ZVL settings:	- [PRESET] - [SPAN : 2 Hz] - [CENTER : {f_{GEN}*}] - [MEAS : S11] (when measuring Port1) - [SETUP : More : Service : Service Function 4.0.1.0.5] (when Port1) - [MEAS : S22] (when measuring Port2) - [SETUP : More : Service : Service Function 4.0.1.0.2] (when Port2) - [ENTER] - [ESC] - [ESC] - [PWR BW : Power : -10dBm] * Refer to table under "Performance Test Report" for values of test frequencies {f_{GEN}}.
Measurement:	Read out the level value of the power sensor. only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13: $\text{Source Power} = L_{\text{powermeter}}$ only R&S® ZVL3-75: $\text{Source Power} = L_{\text{powermeter}} + 5.75 \text{ dB}$

Source power linearity

Test equipment:	2x N male Short, refer to section "Measurement Equipment and Accessories", only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13: item 8 and 9 only R&S® ZVL3-75: item 13 and 14
Test setup:	Connect Shorts to all Test Ports of the R&S® ZVL !! Attention: male N50 Ω damage female N75 Ω, please be careful.
R&S® ZVL settings:	- [PRESET] - [SPAN : 2 Hz] - [CENTER : {f_{GEN}*}] - [MEAS : S11] (when measuring Port1) - [SETUP : More : Service : Service Function 4.0.1.0.5] (when Port1) - [MEAS : S22] (when measuring Port2) - [SETUP : More : Service : Service Function 4.0.1.0.2] (when Port2) - [ENTER] - [ESC] - [ESC] - [PWR BW : Meas Bandwidth : 1kHz] - [PWR BW : Meas Bandwidth : Fine Adjust : Filter type : normal] - [TRACE : More1/2 : Trace Statistics : Mean / Std Dev] - [PWR BW : Power : {l_{GEN}*}] * Refer to table under "Performance Test Report" for values of test frequencies {f_{GEN}} and levels {l_{GEN}}.
Reference measurement:	{l_{GEN}} = -10dBm L_{reference} : Read out the value of the R&S® ZVL Trace Statistics Mean:
Measurement:	{l_{GEN}*} L_{meas} : Read out the value of the R&S® ZVL Trace Statistics Mean:
Evaluation:	Actual value = L_{meas} – L_{reference}

Checking the dynamic range of test ports

Test equipment: 2x N male Short, refer to section "Measurement Equipment and Accessories",
only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:
item 8 and 9

only R&S® ZVL3-75:
item 13 and 14

Test setup: Connect Shorts to all Test Ports of the R&S® ZVL

R&S® ZVL settings:

- [**PRESET**]
- [**PWR BW** : Step Atten b1 : **0 dB**]
- [**PWR BW** : Step Atten b2 : **0 dB**]
- [**MEAS** : S12] (when measuring Port 1 -> Port 2)
- [**MEAS** : S21] (when measuring Port 2 -> Port 1)
- [**SWEEP** : Number of Points : **21**]
- [**SPAN** : **2 Hz**]
- [**CENTER** : {f_{GEN}*}]
- [**PWR BW** : Meas Bandwidth : 10 Hz]
- [**TRACE** : More1/2 : Trace Statistics : Mean / Std Dev]

Measurement: Read out the value of the R&S® ZVL Trace Statistics Mean:

Checking the trace noise of test ports

Test equipment: RF cable, refer to section "Measurement Equipment and Accessories",
only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:
item 7

only R&S® ZVL3-75:
item 11

Test setup: Connect PORT1 with PORT2
!! Attention: male N50 Ω damage female N75 Ω , please be careful.

R&S® ZVL settings:

- [**PRESET**]
- [**MEAS** : S21]
- [**CENTER** : Start : **10.001 MHz**]
- [**PWR BW** : Power : **-10 dBm**]
- [**PWR BW** : Step Atten b1 : **0 dB**]
- [**PWR BW** : Step Atten b2 : **0 dB**]
- [**PWR BW** : Meas Bandwidth : Fine Adjust : **2 kHz**]
- [**PWR BW** : Meas Bandwidth : Fine Adjust : Filter type : normal]
- [**SCALE** : Scale / Div : **0.1 dB**]
- [**TRACE** : Data -> Mem]
- [Data / Mem]
- [More1/2 : Trace Statistics : Mean / Std Dev]

Measurement: Read out the value of the R&S® ZVL Trace Statistics Std Dev:

Performance Test Report R&S ZVL

Table 1-1 Performance Test Report

ROHDE & SCHWARZ	Performance Test Report	Network Analyzer	Version 19. Februar 2007
Model (R&S ZVL3 / 3-75 / 6 / 13): Order number: 1303.6509 Serial number: Test person: Date: Sign:			

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Frequency accuracy Reference oscillator						
Model w/o R&S FSL-B4		1.999998	_____	2.000002	GHz	
Model with R&S FSL-B4		1.9999998	_____	2.0000002	GHz	
Display linearity 0 to -30 dB RF ATT: 10 dB Port # f _{GEN} : 100 MHz Sig_Lev:						
0 dBm		-	Reference	-	-	
-5 dBm		-0.2	_____	+0.2	dB	
-10 dBm		-0.2	_____	+0.2	dB	
-15 dBm		-0.2	_____	+0.2	dB	
-20 dBm		-0.2	_____	+0.2	dB	
- 25 dBm		-0.2	_____	+0.2	dB	
- 30 dBm		-0.2	_____	+0.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Display linearity -30 to -50 dB RF ATT: 30 dB Port # f_{GEN} : 100 MHz Sig_Lev : -10 dBm -15 dBm -20 dBm - 25 dBm - 30 dBm		- -0.2 -0.2 -0.2 -0.2	Reference _____ _____ _____ _____	- +0.2 +0.2 +0.2 +0.2	- dB dB dB dB	
Display linearity 0 to -30 dB RF ATT: 10 dB Port # f_{GEN} : 2990 MHz Sig_Lev : 0 dBm -5 dBm -10 dBm -15 dBm -20 dBm - 25 dBm - 30 dBm		- -0.2 -0.2 -0.2 -0.2 -0.2 -0.2	Reference _____ _____ _____ _____ _____ _____	- +0.2 +0.2 +0.2 +0.2 +0.2 +0.2	- dB dB dB dB dB dB	
R&S ZVL6 / 13: Display linearity 0 to -30 dB RF ATT: 10 dB Port # f_{GEN} : 5990 MHz Sig_Lev : 0 dBm -5 dBm -10 dBm -15 dBm -20 dBm - 25 dBm - 30 dBm		- -0.2 -0.2 -0.2 -0.2 -0.2 -0.2	Reference _____ _____ _____ _____ _____ _____	- +0.2 +0.2 +0.2 +0.2 +0.2 +0.2	- dB dB dB dB dB dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
R&S ZVL13: Display linearity 0 to -30 dB RF ATT: 10 dB Port # f _{GEN} : 13590 MHz Sig_Lev : 0 dBm -5 dBm -10 dBm -15 dBm -20 dBm - 25 dBm - 30 dBm		-	Reference	-	-	
		-0.2	_____	+0.2	dB	
		-0.2	_____	+0.2	dB	
		-0.2	_____	+0.2	dB	
		-0.2	_____	+0.2	dB	
		-0.2	_____	+0.2	dB	
		-0.2	_____	+0.2	dB	
Source power accuracy Port # f _{GEN} : 9.99 MHz 10.01 MHz 100 MHz 400 MHz 900 MHz 1500 MHz 2000 MHz 2500 MHz 2990 MHz R&S ZVL6 / 13: 3010 MHz 3500 MHz 4000 MHz 4500 MHz 5000 MHz 5500 MHz 5990 MHz R&S ZVL13: 7000 MHz 8000 MHz 9000 MHz 10000 MHz 11000 MHz 12000 MHz 13590 MHz		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	
		-11	_____	- 9	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
R&S ZVL13: Source power linearity Port # f_{GEN} : 9.9 MHz I_{GEN} : 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm R&S ZVL3 / 3-75 / 6: -50 dBm		+9.2 - -10.8 -20.8 -30.8 -40.8	_____ Reference _____ _____ _____ _____	+10.8 - -9.2 -19.2 -29.2 -39.2	dB - dB dB dB dB	
Port # Source power linearity f_{GEN} : 11 MHz I_{GEN} : 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm R&S ZVL3 / 3-75 / 6: -50 dBm		+9.2 - -10.8 -20.8 -30.8 -40.8	_____ Reference _____ _____ _____ _____	+10.8 - -9.2 -19.2 -29.2 -39.2	dB - dB dB dB dB	
Port # Source power linearity f_{GEN} : 100 MHz I_{GEN} : 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm R&S ZVL3 / 3-75 / 6: -50 dBm		+9.2 - -10.8 -20.8 -30.8 -40.8	_____ Reference _____ _____ _____ _____	+10.8 - -9.2 -19.2 -29.2 -39.2	dB - dB dB dB dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
Port # Source power linearity f_{GEN} : 2990 MHz I_{GEN} : 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm R&S ZVL3 / 3-75 / 6: -50 dBm		+9.2 - -10.8 -20.8 -30.8 -40.8	_____ Reference _____ _____ _____ _____	+10.8 - -9.2 -19.2 -29.2 -39.2	dB - dB dB dB dB	
R&S ZVL6 / 13: Source power linearity Port # f_{GEN} : 5990 MHz I_{GEN} : 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm R&S ZVL6: -50 dBm		+9.2 - -10.8 -20.8 -30.8 -40.8	_____ Reference _____ _____ _____ _____	+10.8 - -9.2 -19.2 -29.2 -39.2	dB - dB dB dB dB	
R&S ZVL13: Source power linearity Port # f_{GEN} : 13590 MHz I_{GEN} : 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm		+9.2 - -10.8 -20.8 -30.8	_____ Reference _____ _____ _____	+10.8 - -9.2 -19.2 -29.2	dB - dB dB dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Measurement uncertainty
R&S ZVL3 / 6:						
Dynamic range						
18°C-28°C						
Port #						
f _{GEN} :		-				
9 kHz		-	_____	-75	dB	
300 kHz		-	_____	-75	dB	
990 kHz		-	_____	-85	dB	
6.99 MHz		-	_____	-105	dB	
19.99 MHz		-	_____	-105	dB	
49.99 MHz		-	_____	-115	dB	
99.99 MHz		-	_____	-115	dB	
499.99 MHz		-	_____	-115	dB	
999.99 MHz		-	_____	-115	dB	
1499.99 MHz		-	_____	-115	dB	
1999.99 MHz		-	_____	-115	dB	
2499.99 MHz		-	_____	-115	dB	
2999.99 MHz		-	_____	-115	dB	
R&S ZVL6:		-	-	-	-	
3499.99 MHz		-	_____	-115	dB	
3999.99 MHz		-	_____	-115	dB	
4499.99 MHz		-	_____	-115	dB	
4999.99 MHz		-	_____	-115	dB	
5499.99 MHz		-	_____	-100	dB	
5999.99 MHz		-	_____	-100	dB	

E-8

Performance Test R&S ZVL-K1

Checking Level Accuracy and Frequency Response

- Test equipment:
- Signal generator (refer to section "Measurement Equipment and Accessories", item 1)
 - Power sensor (refer to section "Measurement Equipment and Accessories", item 3)
 - 6-dB power splitter (refer to section "Measurement Equipment and Accessories", item 6)

R&S® ZVL3-75 additional:

- R&S® RAM, item 10)
- Through 75 Ω male/male, item 12)

Checking frequency response

Determining the level accuracy at 65.833 MHz

- Test setup:
- Connect the power sensor (item 4) to the power meter and execute function 'ZERO' when there is no signal applied to the power sensor.
 - Connect the RF output of the signal generator to the input of the splitter.
 - Connect output 1 of the splitter to the power sensor / power meter.

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

- Connect output 2 of the splitter to the Port # of the R&S® ZVL.

only R&S® ZVL3-75:

- Connect output 2 of the splitter via R&S® RAM and "Through 75 Ω " to the Port # of the R&S® ZVL

!! Attention: male N50 Ω damage female N75 Ω , please be careful.

- Signal generator settings:
- Frequency 65.833 MHz
 - Level -14 dBm (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
 - 8.25 dBm (R&S® ZVL3-75)

- Measurement:
- Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows:
 - 20 dBm $\pm$ 0.2 dB (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
 - 14.25 dBm $\pm$ 0.2 dB (R&S® ZVL3-75)

R&S ZVL settings:

- [**PRESET**]
- [**MODE** : Spectrum Analyzer]
- [**AMPT** : RF Atten Manual : **10 dB**]
- [**AMPT** : **-20 dBm**]
- [**SPAN** : **30 kHz**]
- [**BW** : Res BW Manual : **10 kHz**]
- [**TRACE** : Detector Manual Select : RMS : **ENTER**]
- [**FREQ** : Center : **65.833 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 ZVL (level reading of marker 1) reflects the absolute level accuracy of the R&S ZVL. It can be calculated as follows:

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$\text{Level accuracy}_{65.833\text{MHz}} = L_{\text{ZVL}} - L_{\text{power meter}}$$

only R&S® ZVL3-75:

$$\text{Level accuracy}_{65.833\text{MHz}} = L_{\text{ZVL}} - L_{\text{power meter}} + 5.75 \text{ dB}$$

Test setup:

- Connect the power sensor (item 4) to the power meter and execute function 'ZERO' when there is no signal applied to the power sensor.
- Connect the RF output of the signal generator to the input of the splitter.
- Connect output 1 of the splitter to the power sensor / power meter.

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

- Connect output 2 of the splitter to the Port # of the R&S® ZVL.

only R&S® ZVL3-75:

- Connect output 2 of the splitter via R&S® RAM and "Through 75 Ω" to the Port # of the R&S® ZVL

!! Attention: male N50 Ω damage female N75 Ω, please be careful.

Signal generator settings:

- Frequency $\{f_{in}\} *$
- Level -14 dBm (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
 -8.25 dBm (R&S® ZVL3-75)

R&S ZVL settings:

- [**PRESET**]
- [**MODE** : Spectrum Analyzer]
- [**AMPT** : RF Atten Manual : RF_Att *)]
- [**AMPT** : **-20 dBm**]
- [**SPAN** : **100 kHz**]
- [**BW** : Res BW Manual : **10 kHz**]
- [**TRACE** : Detector Manual Select : RMS : **ENTER**]
- [**FREQ** : Center : { f_{in} } *)]
- [**AMPT** : Preamp : On / Off *)]

*) Refer to table under "Performance Test Report" for values of RF_Att, Preamp and f_{in} .

Reference measurement:

- f_{in} = **65.833 MHz**
- Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows:
 - 20 dBm $\pm$ 0.2 dB (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
 - 14.25 dBm $\pm$ 0.2 dB (R&S® ZVL3-75)

- Set marker to peak of signal:
- [**MKR->** : Peak]

The signal level L_{ZVL} is displayed by the level reading of marker 1

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$Ref_{65.833MHz} = L_{ZVL} - L_{power\ meter}$$

only R&S® ZVL3-75:

$$Ref_{65.833MHz} = L_{ZVL} - L_{power\ meter} + 5.75\ dB$$

Measurement

Signal generator settings:

- Frequency f_{in}

Refer to "Performance Test Report" table for values of f_{in} .

Power meter settings:

Determine signal level $L_{power\ meter}$. To achieve higher accuracy, compensating for the frequency response of the power sensor is recommended.

R&S ZVL settings:

- [**FREQ** : Center : { f_{in} }]

Refer to "Performance Test Report" table for values of f_{in} .

- - Set marker to peak of signal:
- [**MKR->** : Peak]

The signal level L_{ZVL} is displayed by the level reading of marker 1.

Evaluation:

The frequency response can be calculated as follows:

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$\text{Frequency response} = L_{ZVL} - L_{power\ meter} - Ref_{65.833\ MHz}$$

only R&S® ZVL3-75:

$$\text{Frequency response} = L_{ZVL} - L_{power\ meter} - Ref_{65.833\ MHz} + 5.75\ dB$$

Checking RF Attenuator

Test principle:	The RF attenuator of the R&S ZVL can be switched from 0 to 30 dB in 5 dB increments.
Test equipment:	- Signal generator (refer to section "Measurement Equipment and Accessories", item 1) - Power sensor (refer to section "Measurement Equipment and Accessories", item 3) - 6-dB power splitter (refer to section "Measurement Equipment and Accessories", item 6) R&S® ZVL3-75 additional: - R&S® RAM, item 10) - Through 75 Ω male/male, item 12)
Test setup:	➤ Connect the power sensor (item 4) to the power meter and execute function 'ZERO' when there is no signal applied to the power sensor. ➤ Connect the RF output of the signal generator to the input of the splitter. ➤ Connect output 1 of the splitter to the power sensor / power meter. only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13: ➤ Connect output 2 of the splitter to the Port # of the R&S® ZVL. only R&S® ZVL3-75: ➤ Connect output 2 of the splitter via R&S® RAM and "Through 75 Ω" to the Port # of the R&S® ZVL !! Attention: male N50 Ω damage female N75 Ω, please be careful.
Signal generator settings:	- Frequency 65.833 MHz $Ref_{dBm} = L - L_{power\ meter}$ ➤ Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows: – 20 dBm ± 0.2 dB (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13) – 14.2 dBm ± 0.2 dB (R&S® ZVL3-75)
R&S ZVL settings:	- [PRESET] - [MODE : Spectrum Analyzer] - [FREQ : 65.833 MHz] - [SPAN : 500 Hz] - [BW : Res BW Manual : 1 kHz] - [BW : Video BW Manual : 30 Hz] - [AMPT : Ref Level : 0 dBm] - [AMPT : RF Atten Manual : 10 dB]

Reference measurement:

- Set the marker to the peak of the signal.

- [**MKR->** : Peak]

The signal level L is displayed by the level reading of the marker.

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$\text{Ref}_{0\text{dBm}} = L - L_{\text{power meter}}$$

only R&S® ZVL3-75:

$$\text{Ref}_{0\text{dBm}} = L - L_{\text{power meter}} + 5.75 \text{ dB}$$

Measurement

Signal generator settings:

- Frequency 65.833 MHz
- Level – 14 dBm (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
– 8.2 dBm (R&S® ZVL3-75)

-

- Determine the output power of the signal generator with the power meter. Adjust the output power of the generator until the power meter shows:

- 20 dBm ± 0.2 dB (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
- 14.2 dBm ± 0.2 dB (R&S® ZVL3-75)

R&S ZVL settings:

- [**AMPT** : RF Atten Manual : {a_{ZVL}}]
- [**AMPT** : {-10 dBm + a_{ZVL}} dBm]
- [**MKR->** : Peak]

Evaluation:

The signal level L is displayed by the level reading of the marker.

The difference between the level inaccuracy of the R&S ZVL at 10 dB RF_Att (Ref_{0dBm}) is the uncertainty of the RF attenuation:

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$\text{Uncertainty} = L - L_{\text{power meter}} - \text{Ref}_{0\text{dBm}}$$

only R&S® ZVL3-75:

$$\text{Uncertainty} = L - L_{\text{power meter}} - \text{Ref}_{0\text{dBm}} + 5.75 \text{ dB}$$

Signal level at input	-20 dBm	-20 dBm	-20 dBm	-20 dBm	-20 dBm	-20 dBm	-20 dBm
a _{ZVL}	0 dB	5 dB	10 dB	15 dB	20 dB	25 dB	30 dB
Preamp	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Reference Level	-20 dBm	-20 dBm	-20 dBm	-20 dBm	-20 dBm	-20 dBm	-20 dBm

When a RF preamplifier is installed its gain accuracy has to be checked. Perform the two measurements with the settings from the table below,. The gain error of the preamp is calculated from the difference between the two level uncertainties.

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

$$\text{Uncertainty} = L - L_{\text{power meter}} - \text{Ref}_{0\text{dBm}}$$

only R&S® ZVL3-75:

$$\text{Uncertainty} = L - L_{\text{power meter}} - \text{Ref}_{0\text{dBm}} + 5.75 \text{ dB}$$

Signal level at input	-20 dBm	-20 dBm
a _{ZVL}	10 dB	10 dB
Preamp	OFF	ON
Reference Level	-20 dBm	-20 dBm

Checking Noise Display

Test equipment:	N male Load, refer to section "Measurement Equipment and Accessories", only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13: N male Load 50 Ω item 4 only R&S® ZVL3-75: N male Load 75 Ω item 15
Test setup:	➤ Terminate the RF input of the R&S ZVL with N male Load . !! Attention: male N50 Ω damage female N75 Ω, please be careful.
R&S ZVL settings:	- [PRESET] - [MODE : Spectrum Analyzer] - [AMPT : RF Atten Manual : 0 dB] - [SPAN : 0 Hz] - [BW : Res BW Manual : 1 kHz] - [BW : Video BW Manual 1 Hz] - [SWEEP : Sweep Time Manual : 0.2 s] - [AMPT : -40 dBm] - [FREQ : Center : {f_n}] Refer to "Performance Test Report" table for values of f_n.
Measurement:	➤ Set marker to peak: - [MKR-> : Peak]
Evaluation:	The noise level is displayed by the level reading of marker 1. If the RF preamplifier is present, repeat the measurement with the RF Preamp set to on: "AMPT: Preamp On"

Checking Phase Noise

Test equipment:

- Signal generator (refer to "Measurement Equipment", item 1)
 - Frequency 500 MHz
 - Level $\geq +5$ dBm
 - Phase noise at 500 MHz:
 - < -96 dBc/Hz @ 10 kHz
 - < -96 dBc/Hz @ 100 kHz
 - < -113 dBc/Hz @ 1 MHz
 - Power sensor (refer to section "Measurement Equipment and Accessories", item 3)
 - 6-dB power splitter (refer to section "Measurement Equipment and Accessories", item 6)
- R&S® ZVL3-75 additional:
- R&S® RAM, item 10)
 - Through 75 Ω male/male, item 12)

Test setup:

- Connect the power sensor (item 4) to the power meter and execute function 'ZERO' when there is no signal applied to the power sensor.
- Connect the RF output of the signal generator to the input of the splitter.
- Connect output 1 of the splitter to the power sensor / power meter.

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

- Connect output 2 of the splitter to the Port # of the R&S® ZVL.

only R&S® ZVL3-75:

- Connect output 2 of the splitter via R&S® RAM and "Through 75 Ω " to the Port # of the R&S® ZVL

!! Attention: male N50 Ω damage female N75 Ω , please be careful.

Signal generator settings:

- Frequency 500 MHz
- Level
 - 4 dBm (R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13)
 - + 1.8 dBm (R&S® ZVL3-75)

R&S ZVL settings:

- [**PRESET**]
- [**MODE** : Spectrum Analyzer]
- [**FREQ** : Center : **500 MHz**]
- [**AMPT** : -10 dBm]
- [**SPAN** : {2.2 * offset}]

Depending on the offset of the phase noise measurement, the span is set to 2.2 times the offset.

- [**TRACE 1** : Trace Mode: Average]
- [**SWEEP** : Sweep Count : **20** : **ENTER**]
- Activate phase noise marker:
 - [**MKR** : Phase Noise]
 - [**MKR** : Marker 2 : {offset}]

Evaluation:

Refer to "Performance Test Report" table for values of offset.
The phase noise is displayed in the marker field by the reading 'Delta 1 [T1 PHN]'.

Checking Third Order Intercept Point

- Test equipment:

 - 2x signal generators, refer to "Measurement Equipment", items 1 & 2.
 - 6-dB power splitter (refer to section "Measurement Equipment and Accessories", item 6)

R&S® ZVL3-75 additional:

 - R&S® RAM, item 10)
 - Through 75 Ω male/male, item 12)

Test setup:

 - Connect RF outputs of the signal generators to the inputs of the coupler.

only R&S® ZVL3, R&S® ZVL6 and R&S® ZVL13:

 - Connect output of the splitter to the Port # of the R&S® ZVL.

only R&S® ZVL3-75:

 - Connect output of the splitter via R&S® RAM and "Through 75 Ω " to the Port # of the R&S® ZVL

!! Attention: male N50 Ω damage female N75 Ω , please be careful.

Signal generator settings
(both generators):

 - Frequency: Generator 1 $f_{g1} = f_{in} - 500 \text{ kHz}$
 Generator 2 $f_{g2} = f_{in} + 500 \text{ kHz}$

Refer to "Performance Test Report" table for values of f_{in} .

 - Deactivate the automatic level control of the generators to avoid intermodulation between the generators.
 - Adjust the output level of signal generators for an input level at the R&S ZVL of $-15 \text{ dBm} \pm 0.5 \text{ dB}$ (reading on the display of the R&S ZVL).

R&S ZVL settings:

 - [**PRESET**]
 - [**MODE** : Spectrum Analyzer]
 - [**AMPT** : RF Atten Manual : **0 dB**]
 - [**AMPT** : **-10 dBm**]
 - [**SPAN** : **3.5 MHz**]
 - [**BW** : Res BW Manual : **30 kHz**]
 - [**BW** : Video BW Manual : **1 kHz**]
 - [**FREQ** : Center : $\{f_{in}\}$]

Refer to "Performance Test Report" table for values of f_{in} .

Measurement:

 - [**MEAS** : TOI]

Evaluation:

The third order intercept point (TOI) referenced to the input signal is displayed in the marker field by the reading [TOI].

Performance Test Report R&S ZVL-K1

Table 1-2 Performance Test Report

ROHDE & SCHWARZ Performance Test Report Spectrum Analyzer R&S ZVL Version 11-Okt-05						
Model (R&S ZVL3 / 3-75 / 6 / 13): Order number: 1303.6509 Serial number: Test person: Date: Signature:						
Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Level accuracy at 65.833 MHz R&S ZVL3 / 6 / 13:		-0.3	_____	+0.3	dB	
R&S ZVL3-75:		-0.5	_____	+0.5	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response						
RF attenuation 5 dB						
RF Preamp = Off						
f_{fresp} :						
10 MHz		-0.5	_____	+0.5	dB	
100 MHz		-0.5	_____	+0.5	dB	
500 MHz		-0.5	_____	+0.5	dB	
1000 MHz		-0.5	_____	+0.5	dB	
1500 MHz		-0.5	_____	+0.5	dB	
2000 MHz		-0.5	_____	+0.5	dB	
2500 MHz		-0.5	_____	+0.5	dB	
2990 MHz		-0.5	_____	+0.5	dB	
R&S ZVL6 / 13:						
3500 MHz		-0.8	_____	+0.8	dB	
4000 MHz		-0.8	_____	+0.8	dB	
4500 MHz		-0.8	_____	+0.8	dB	
5000 MHz		-0.8	_____	+0.8	dB	
5500 MHz		-0.8	_____	+0.8	dB	
5990 MHz		-0.8	_____	+0.8	dB	
R&S ZVL13:						
7000 MHz		-1.2	_____	+1.2	dB	
8000 MHz		-1.2	_____	+1.2	dB	
9000 MHz		-1.2	_____	+1.2	dB	
10000 MHz		-1.2	_____	+1.2	dB	
11000 MHz		-1.2	_____	+1.2	dB	
12000 MHz		-1.2	_____	+1.2	dB	
13590 MHz		-1.2	_____	+1.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response						
RF attenuation 10 dB						
RF Preamp = Off						
f_{resp} :						
10 MHz		-0.5	_____	+0.5	dB	
100 MHz		-0.5	_____	+0.5	dB	
500 MHz		-0.5	_____	+0.5	dB	
1000 MHz		-0.5	_____	+0.5	dB	
1500 MHz		-0.5	_____	+0.5	dB	
2000 MHz		-0.5	_____	+0.5	dB	
2500 MHz		-0.5	_____	+0.5	dB	
2990 MHz		-0.5	_____	+0.5	dB	
R&S ZVL6:						
3500 MHz		-0.8	_____	+0.8	dB	
4000 MHz		-0.8	_____	+0.8	dB	
4500 MHz		-0.8	_____	+0.8	dB	
5000 MHz		-0.8	_____	+0.8	dB	
5500 MHz		-0.8	_____	+0.8	dB	
5990 MHz		-0.8	_____	+0.8	dB	
R&S ZVL13:						
7000 MHz		-1.2	_____	+1.2	dB	
8000 MHz		-1.2	_____	+1.2	dB	
9000 MHz		-1.2	_____	+1.2	dB	
10000 MHz		-1.2	_____	+1.2	dB	
11000 MHz		-1.2	_____	+1.2	dB	
12000 MHz		-1.2	_____	+1.2	dB	
13590 MHz		-1.2	_____	+1.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response						
RF attenuation 20 dB						
RF Preamp = Off						
f_{resp} :						
10 MHz		-0.5	_____	+0.5	dB	
100 MHz		-0.5	_____	+0.5	dB	
500 MHz		-0.5	_____	+0.5	dB	
1000 MHz		-0.5	_____	+0.5	dB	
1500 MHz		-0.5	_____	+0.5	dB	
2000 MHz		-0.5	_____	+0.5	dB	
2500 MHz		-0.5	_____	+0.5	dB	
2990 MHz		-0.5	_____	+0.5	dB	
R&S ZVL6:						
3500 MHz		-0.8	_____	+0.8	dB	
4000 MHz		-0.8	_____	+0.8	dB	
4500 MHz		-0.8	_____	+0.8	dB	
5000 MHz		-0.8	_____	+0.8	dB	
5500 MHz		-0.8	_____	+0.8	dB	
5990 MHz		-0.8	_____	+0.8	dB	
R&S ZVL13:						
7000 MHz		-1.2	_____	+1.2	dB	
8000 MHz		-1.2	_____	+1.2	dB	
9000 MHz		-1.2	_____	+1.2	dB	
10000 MHz		-1.2	_____	+1.2	dB	
11000 MHz		-1.2	_____	+1.2	dB	
12000 MHz		-1.2	_____	+1.2	dB	
13590 MHz		-1.2	_____	+1.2	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
Frequency response RF attenuation 10 dB RF Preamp = On f _{fresp} :						
10 MHz		-0.5	_____	+0.5	dB	
100 MHz		-0.5	_____	+0.5	dB	
500 MHz		-0.5	_____	+0.5	dB	
1000 MHz		-0.5	_____	+0.5	dB	
1500 MHz		-0.5	_____	+0.5	dB	
2000 MHz		-0.5	_____	+0.5	dB	
2500 MHz		-0.5	_____	+0.5	dB	
2990 MHz		-0.5	_____	+0.5	dB	
R&S ZVL6 / 13:						
3500 MHz		-0.8	_____	+0.8	dB	
4000 MHz		-0.8	_____	+0.8	dB	
4500 MHz		-0.8	_____	+0.8	dB	
5000 MHz		-0.8	_____	+0.8	dB	
5500 MHz		-0.8	_____	+0.8	dB	
5990 MHz		-0.8	_____	+0.8	dB	
Attenuator accuracy a _{ATT} :						
0 dB		-0.3	_____	+0.3	dB	
5 dB		-0.3	_____	+0.3	dB	
10 dB		-	Reference		-	
15 dB		-0.3	_____	+0.3	dB	
20 dB		-0.3	_____	+0.3	dB	
25 dB		-0.3	_____	+0.3	dB	
30 dB		-0.3	_____	+0.3	dB	
Preamp on a _{ATT} 10 dB		-0.3	_____	+0.3	dB	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S ZVL3 / 3-75 / 6:						
Noise display in 1 kHz						
RF Preamp = Off						
f_{noise} :						
9 kHz		-	_____	-70	dBm	
95 kHz		-	_____	-70	dBm	
1005 kHz		-	_____	-80	dBm	
10.01 MHz		-	_____	-100	dBm	
50.01 MHz		-	_____	-110	dBm	
199.99 MHz		-	_____	-110	dBm	
499.99 MHz		-	_____	-110	dBm	
999.99 MHz		-	_____	-110	dBm	
1499.99 MHz		-	_____	-110	dBm	
1999.99 MHz		-	_____	-110	dBm	
2499.99 MHz		-	_____	-110	dBm	
2999.99 MHz		-	_____	-110	dBm	
R&S ZVL6:						
3499.99 MHz		-	_____	-110	dBm	
3999.99 MHz		-	_____	-110	dBm	
4499.99 MHz		-	_____	-110	dBm	
4999.99 MHz		-	_____	-110	dBm	
5499.99 MHz		-	_____	-110	dBm	
5999.99 MHz		-	_____	-110	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S ZVL13:						
Noise display in 1 kHz						
RF Preamp = Off						
f_{noise} :						
9 kHz		-	_____	-75	dBm	
95 kHz		-	_____	-75	dBm	
1995 kHz		-	_____	-95	dBm	
19.99 MHz		-	_____	-95	dBm	
50.01 MHz		-	_____	-95	dBm	
199.99 MHz		-	_____	-95	dBm	
499.99 MHz		-	_____	-95	dBm	
999.99 MHz		-	_____	-95	dBm	
1499.99 MHz		-	_____	-95	dBm	
1999.99 MHz		-	_____	-95	dBm	
2499.99 MHz		-	_____	-95	dBm	
2999.99 MHz		-	_____	-95	dBm	
3499.99 MHz		-	_____	-95	dBm	
3999.99 MHz		-	_____	-95	dBm	
4499.99 MHz		-	_____	-95	dBm	
4999.99 MHz		-	_____	-95	dBm	
5499.99 MHz		-	_____	-95	dBm	
5999.99 MHz		-	_____	-95	dBm	
6999.99 MHz		-	_____	-95	dBm	
7999.99 MHz		-	_____	-95	dBm	
8999.99 MHz		-	_____	-95	dBm	
9999.99 MHz		-	_____	-95	dBm	
10999.99 MHz		-	_____	-90	dBm	
11999.99 MHz		-	_____	-90	dBm	
13599.99 MHz		-	_____	-90	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S ZVL3 / 3-75 / 6: Noise display in 1 kHz RF Preamp = On f_{noise}						
9 kHz		-	_____	-85	dBm	
95 kHz		-	_____	-85	dBm	
1005 kHz		-	_____	-95	dBm	
10.01 MHz		-	_____	-120	dBm	
50.01 MHz		-	_____	-126	dBm	
199.99 MHz		-	_____	-126	dBm	
499.99 MHz		-	_____	-126	dBm	
999.99 MHz		-	_____	-126	dBm	
1499.99 MHz		-	_____	-126	dBm	
1999.99 MHz		-	_____	-126	dBm	
2499.99 MHz		-	_____	-126	dBm	
2999.99 MHz		-	_____	-126	dBm	
R&S ZVL6:						
3499.99 MHz		-	_____	-126	dBm	
3999.99 MHz		-	_____	-126	dBm	
4499.99 MHz		-	_____	-126	dBm	
4999.99 MHz		-	_____	-126	dBm	
5499.99 MHz		-	_____	-126	dBm	
5999.99 MHz		-	_____	-126	dBm	

Characteristic	Included in	Min. value	Actual value	Max. value	Unit	Tolerance
R&S ZVL13: Noise display in 1 kHz RF Preamp = On f_{noise} :						
9 kHz		-	_____	-75	dBm	
95 kHz		-	_____	-75	dBm	
1995 kHz		-	_____	-95	dBm	
19.99 MHz		-	_____	-110	dBm	
50.01 MHz		-	_____	-110	dBm	
199.99 MHz		-	_____	-110	dBm	
499.99 MHz		-	_____	-110	dBm	
999.99 MHz		-	_____	-110	dBm	
1499.99 MHz		-	_____	-110	dBm	
1999.99 MHz		-	_____	-110	dBm	
2499.99 MHz		-	_____	-110	dBm	
2999.99 MHz		-	_____	-110	dBm	
3499.99 MHz		-	_____	-110	dBm	
3999.99 MHz		-	_____	-110	dBm	
4499.99 MHz		-	_____	-110	dBm	
4999.99 MHz		-	_____	-110	dBm	
5499.99 MHz		-	_____	-110	dBm	
5999.99 MHz		-	_____	-110	dBm	
Phase noise						
Offset frequency:						
10 kHz		-	_____	-96	dBc (1 Hz)	
100 kHz		-	_____	-96	dBc (1 Hz)	
1 MHz		-	_____	-113	dBc (1 Hz)	
3rd order intercept point						
f_{in} :						
30 MHz		5	_____	-	dBm	
500 MHz		5	_____	-	dBm	
1000 MHz		5	_____	-	dBm	
2990 MHz		5	_____	-	dBm	
R&S ZVL6 / 13:						
4000 MHz		5	_____	-	dBm	
5000 MHz		5	_____	-	dBm	
5990 MHz		5	_____	-	dBm	

Contents - Chapter 2 "Adjustment"

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2 Adjustment

ATTENTION



The adjustment should be carried out by qualified personnel only since any change considerably influences the measurement accuracy of the instrument.
Any unauthorized adjustment will void warranty!

Measuring Equipment

Table 2-1 Measuring Equipment and Accessories for Manual Adjustment of the R&S ZVL Reference Oscillator

Item	Type of equipment	Specifications recommended	Equipment recommended	R&S Order No.	Use
1	Signal generator	Frequency: 1 GHz Output level: >20 dBm Uncertainty of frequency: 0.1 ppm	R&S SMT06		Frequency Accuracy of Reference Oscillator

Adjusting the Frequency Accuracy

Automatic adjustment of the reference oscillator without adjustment software: (Instruments with and without option R&S FSL-B4)

Test equipment: Signal generator (refer to "Measurement Equipment", item 1):
 Frequency 1000 MHz
 Level -15 dBm
 Frequency accuracy $<1 \times 10^{-9}$

Note: 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 RF output of the signal generator to RF input of the R&S ZVL.

R&S ZVL settings:
 [**MODE** : Spectrum Analyzer]
 [**SETUP** : MORE: SERVICE: PASSWORD: **894129**]

Adjustment:

Note: Before the following measurement, the FSL must warm up for at least 30 minutes to heat up the reference oscillator.

- Start automatic adjustment by entering service function

[**MODE** : Spectrum Analyzer]

[**SETUP** : MORE : SERVICE : SERVICE FUNCTION : **2.3.12**]

The instrument is performing the automatic adjustment. The new tuning values are stored in EEPROM automatically.

Troubleshooting

Check the input signal:

The automatic adjustment routine will check the power level of the input signal. The adjustment will be aborted, if the input level is not within the range from -10 dBm to -20 dBm.

The automatic adjustment will also be aborted if the input signal is not within the nominal frequency range:

Model without OCXO (option R&S FSL-B4): 1.0 GHz $\pm$ 20 kHz

Model with OCXO (option R&S FSL-B4): 1.0 GHz $\pm$ 2 kHz

For verification proceed as follows:

R&S ZVL settings:

[**SETUP** : REFERENCE : INT]

- Toggle to internal reference.

Signal generator settings:

Frequency 1 GHz as above

R&S ZVL settings:

[**PRESET**]

[**MODE** : Spectrum Analyzer][**FREQ** : 1 GHz]

[**SPAN** : 100 kHz]

[**BW** : MANUAL RES BW : 10 kHz]

[**MARKER** : SIG COUNT : ON]

Measurement:

- Read out the power level of the marker and check whether the input level is within the range from -10 dBm to -20 dBm.
- Read out the frequency value (Count:) of the marker and check whether the input signal frequency is in the nominal frequency range as shown above.

Check warming up of instrument: The automatic adjustment routine will check the drift of the internal reference oscillator. If there is too much drift (warming up is not completed) the adjustment will be aborted.

Check the R&S FSL-B4 option: Power down the instrument, remove option R&S FSL-B4, power up again and perform the automatic adjustment, as described before. If this works fine, probably the R&S FSL-B4 option is defective.

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3 Repair

This chapter describes the design of the R&S ZVL, simple measures for repair and troubleshooting and, in particular, the replacement of modules. For troubleshooting and diagnostics, a self test is available for polling diagnostic voltages of the modules and detecting limit violations.

The firmware update and the installation of options are described in chapter 4 of this service manual.

Instrument Design and Function Description of ZVL3/3-75/6

A schematic of the R&S ZVL design is presented in the block diagrams below and in the attachments (see also chapter 5).

Block Diagram

See also the drawings in chapter 5 for a detailed block circuit.

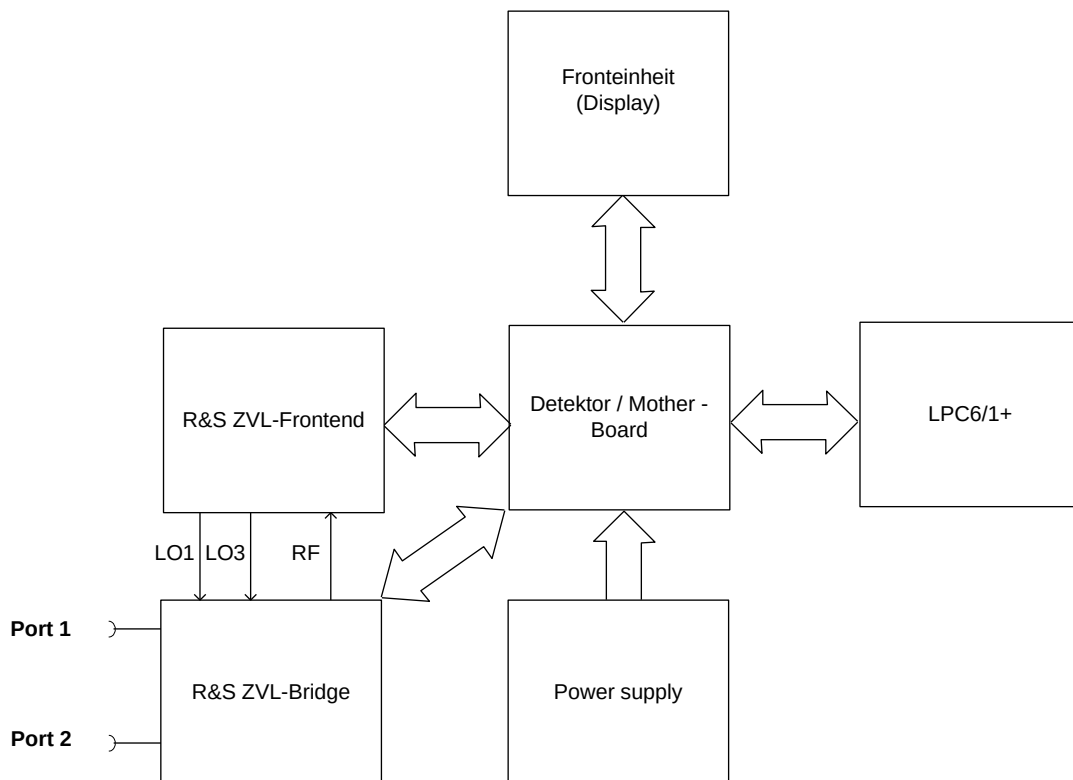


Fig. 3-1 Block diagram

Description of Block Diagram

The R&S FSL is a triple-conversion heterodyne receiver for the frequency range from 9 kHz to 3 GHz or 6 GHz, depending on the instrument model. After signals are received, they are processed by the frontend to a digital IF of approx. 49 MHz. This IF is fed to the motherboard where the digital filtering is provided. The remaining data is transferred to the host processor via a PCI interface. The hardware settings are controlled via a serial interface on the motherboard that is set from the host via the PCI interface.

R&S ZVL-Frontend

The frontend converts the receive frequencies in the range 9 kHz to 3 GHz or 6 GHz to an IF of 49 MHz. The module also includes the required local oscillators and associated frequency processing circuits.

The RF signal passes from the input connector via the limiter and the input switch to the electronic input attenuator, which can be set from 0 dB to -30 dB in steps of 5 dB. The input signal is applied to the switch as well as a 65.833 MHz signal which has a close tolerance level for the self-alignment routine of the instrument. After the input attenuator a 15 dB RF amplifier can be switched into the signal path when the RF preamplifier option is fitted.

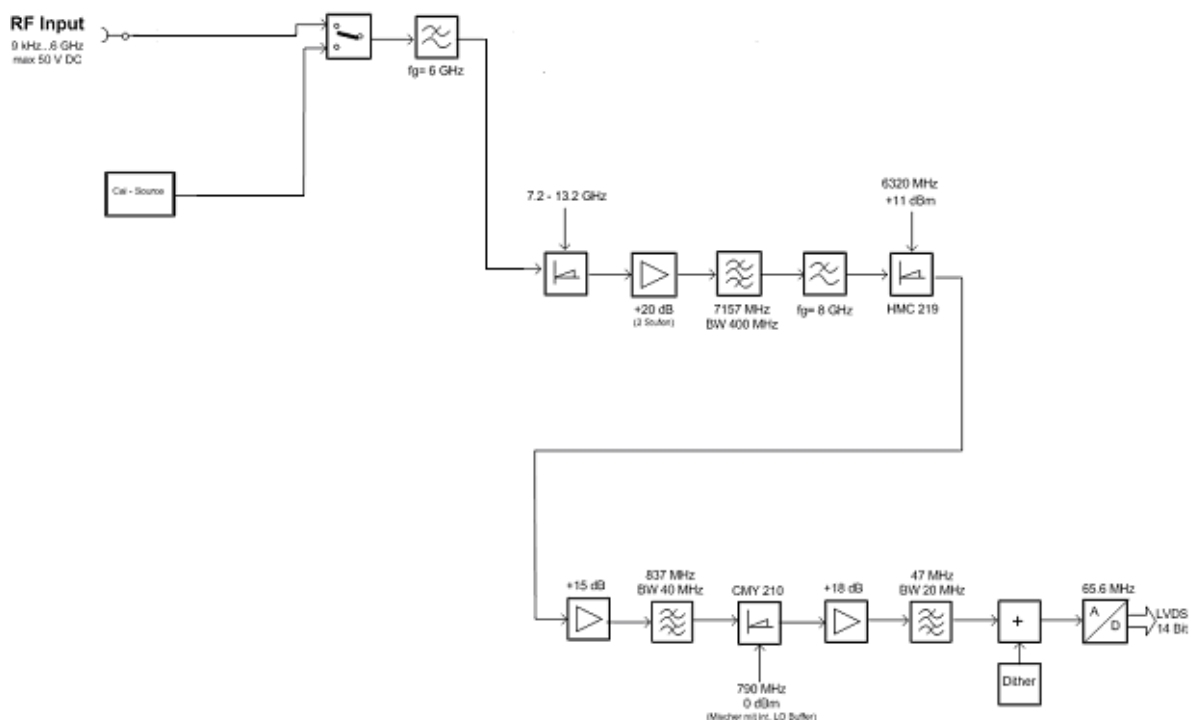


Fig. 3-2 R&S ZVL-Frontend: RF-to-IF conversion

The input signal in the range 0 GHz to 3 GHz (to 6 GHz for the 6 GHz model) is then converted to the first IF of 7159 MHz. The input signal passes via the input low pass to the first mixer. This low pass at the mixer input provides for suppression of the image frequency (image = LO + IF) such that the conversion remains unambiguous. The input signal is converted to the first intermediate frequency by means of the first LO (7159 MHz to 10159 MHz, or 7159 MHz to 13159 MHz).

The mixer is followed by a low-noise IF amplifier, which compensates for the loss due to mixing. The signal then passes a filter with a 3 dB bandwidth of approximately 500 MHz for filtering the first intermediate frequency. A second mixer converts the signal to 839 MHz, a third mixer to 49 MHz. The band pass filters in between the mixers have a bandwidth of 40 MHz in the second IF and approx. 20 MHz in the third IF. The last IF is digitized using a 14 bit ADC running at 65833 MHz. The data is sent to the motherboard via a parallel interface.

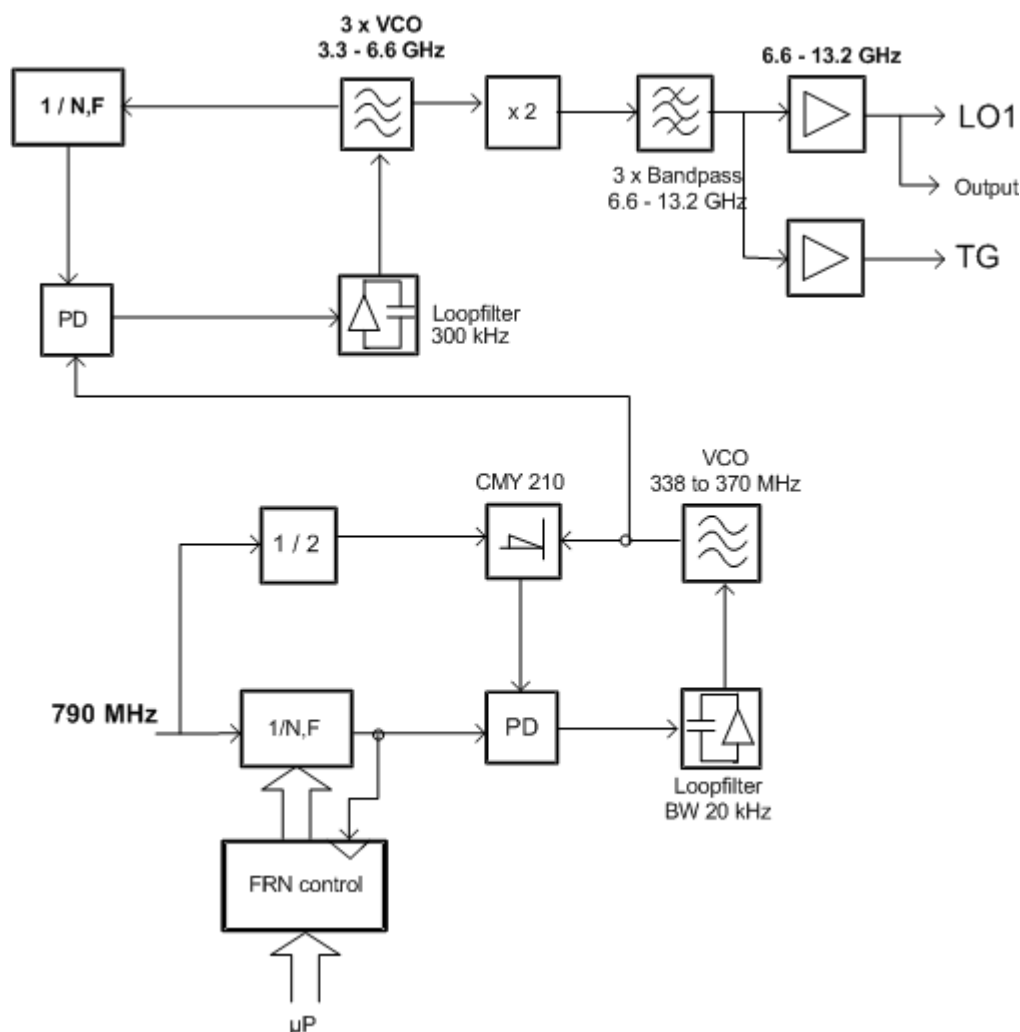


Fig. 3-3 R&S ZVL-Frontend: Generation of first local oscillator frequency

The first local oscillator frequency is generated on the frontend using three VCOs, which are synchronized to a sweep VCO running from 338 MHz to 370 MHz and doubled in frequency to reach the LO1 frequency of 7159 MHz to 13159 MHz. For good phase noise performance, the sweep VCO is first mixed with 395 MHz (LO3 / 2) and then synchronized to the output of a fractional N divider.

As reference signal for the LO1 synthesizer and for the third local oscillator, a 790 MHz oscillator is used (Fig.3-4). This VCO is synchronized to a TCXO at 10 MHz. With the OCXO option or with an external 10 MHz reference connected, this temperature-compensated quartz oscillator is synchronized to one of these signals. If neither is present, the TCXO is adjusted with a digital-to-analog converter on the board. A VCO at 3.16 GHz is synchronized to the 790 MHz and doubled in frequency for the use as the second local oscillator.

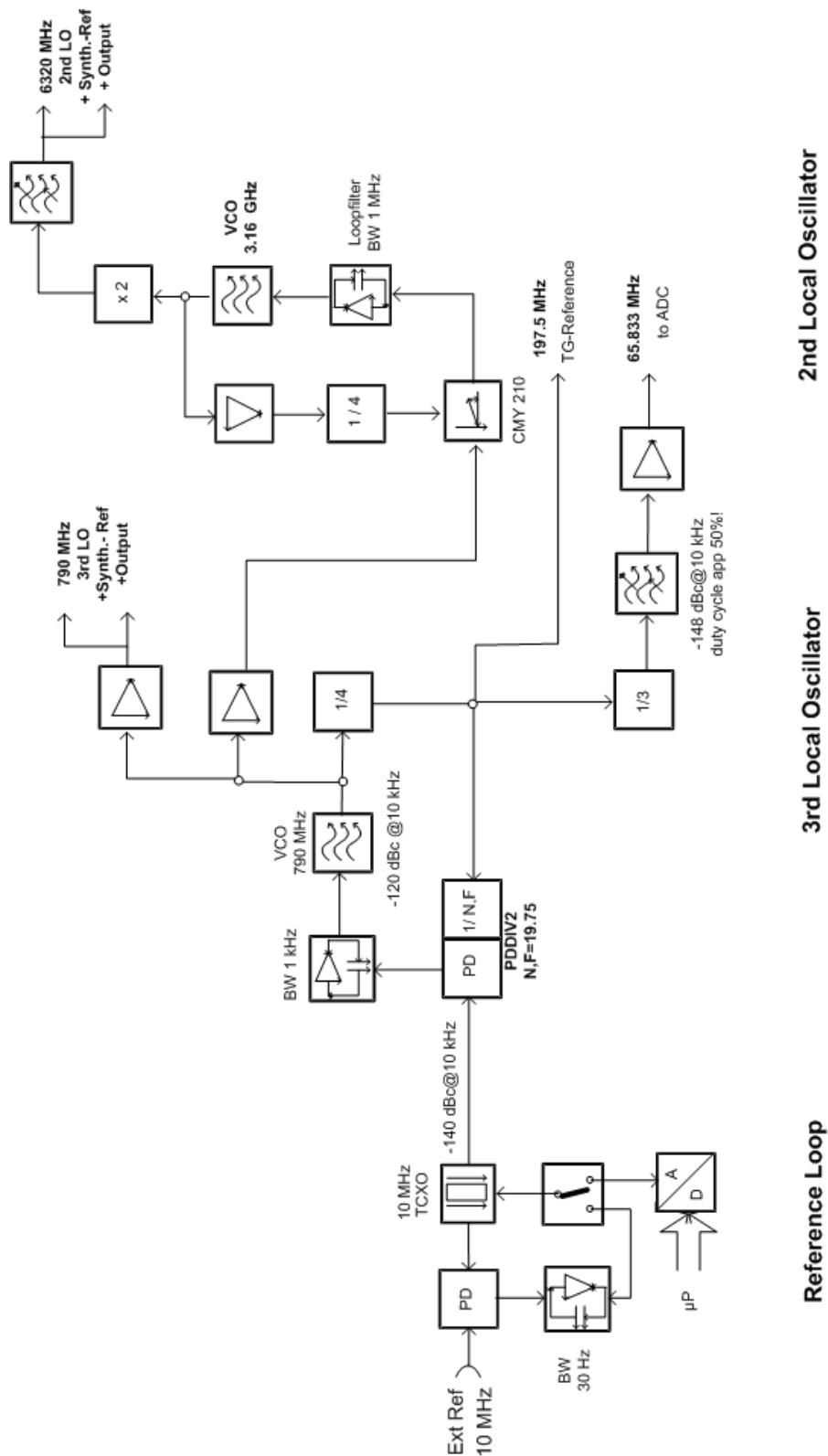


Fig. 3-4 ZVL-Frontend: Generation of second and third local oscillator frequencies

R&S ZVL-Bridge

The R&S ZVL-Bridge includes two internal bridges, two step attenuators, one switch able preamplifier and one tracking generator. If the R&S ZVL is switched to network analyzer mode, the R&S ZVL-Bridge is used to measure all four S-Parameters of the DUT. If the R&S ZVL works as spectrum analyzer (only with Option R&S®ZVL-K1) the internal bridges will be bypassed.

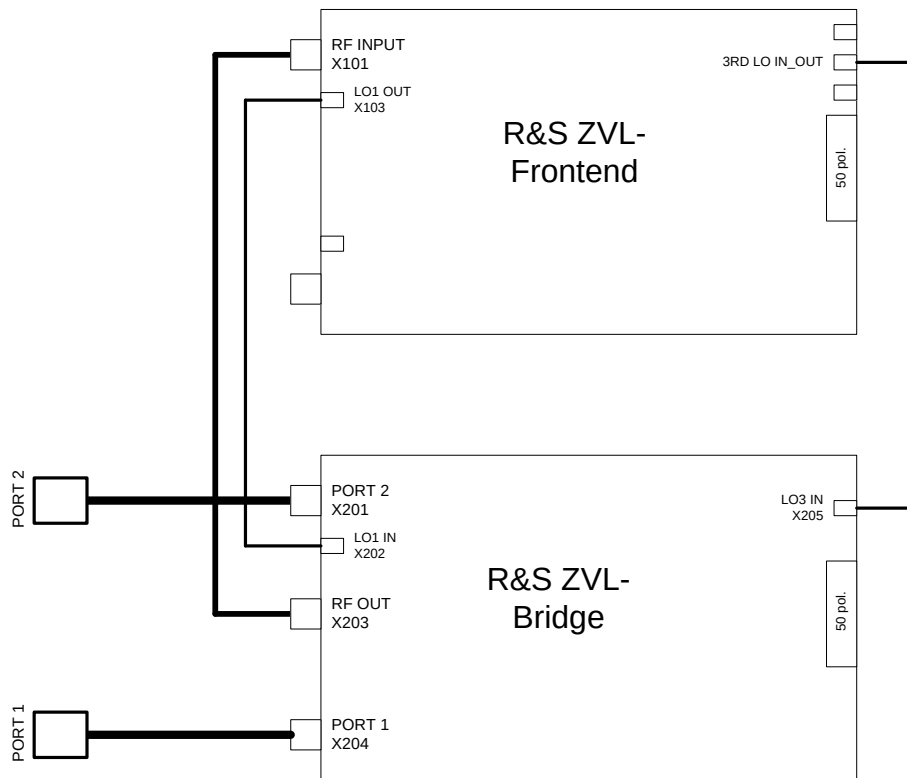


Fig. 3-5 RF-Connections between R&S ZVL-Frontend and R&S ZVL-Bridge

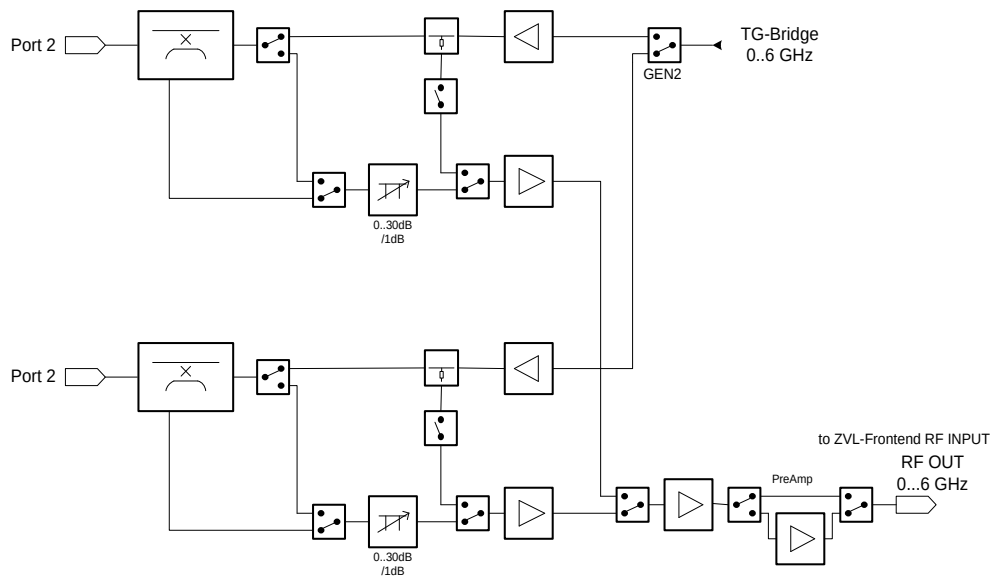


Fig. 3-6 R&S ZVL-Bridge: Switch able bridges with attenuator and preamp

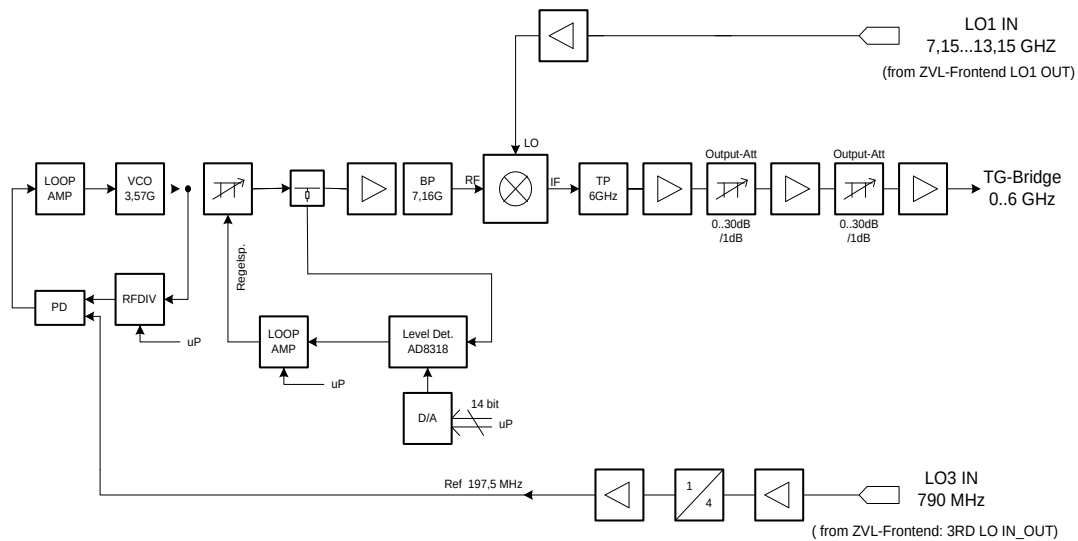


Fig. 3-7 R&S ZVL-Bridge: Tracking generator

Instrument Design and Function Description of ZVL13

ZVL13_Frontend:

Below 6 GHz the ZVL13 works like ZVL6. Above 6 GHz and additional MW-Converter on ZVL13_Frontend converts the signal. The PreAmp is on the ZVL13_Frontend

ZVL13-Bridge:

The ZVL13-Bridge works like ZVL_Bridge. Difference: On ZVL13-Bridge there are switches with higher frequency range. ZVL13_Bridge has no PreAmp. The PreAmp of the ZVL13 is located on ZVL13_Frontend.

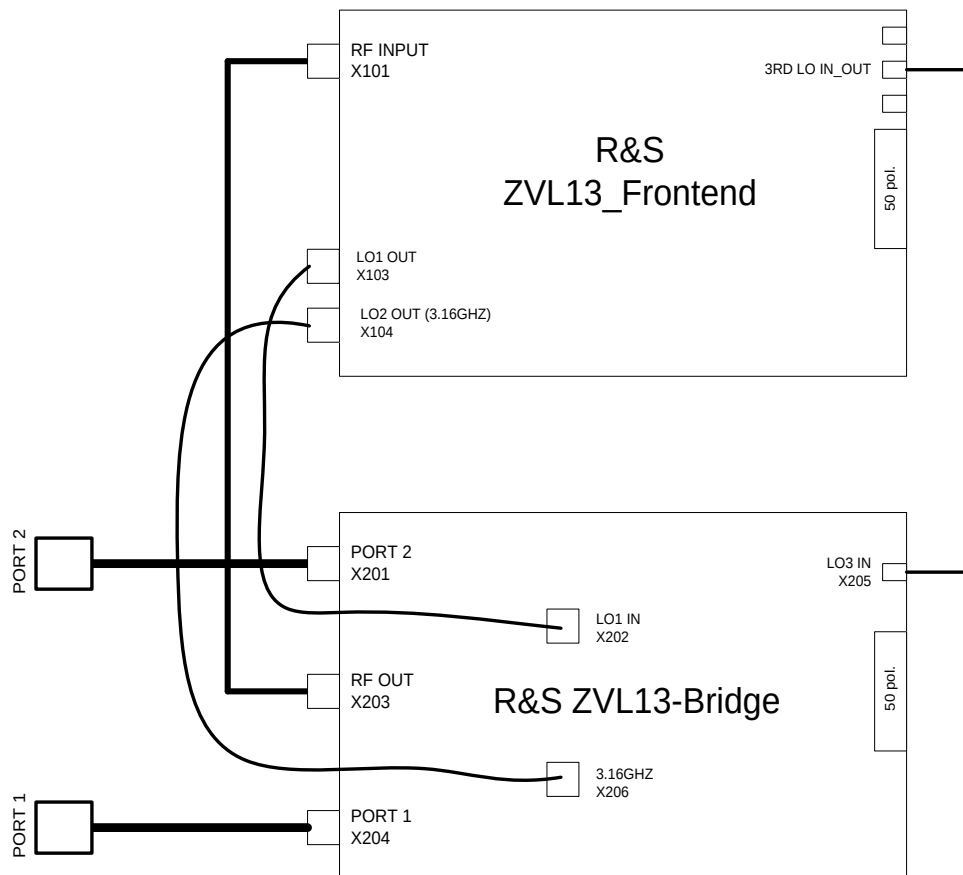


Fig. 3-8 RF-Connections between R&S ZVL13_Frontend and R&S ZVL13_Bridge

DC Power Supply (Option R&S FSL-B30)

With the DC power supply option, the R&S FSL can be operated from a DC voltage of 10 V to 28 V. A DC/DC converter transforms the input voltage to the same voltages as the AC power supply does. The option is installed on the rear panel of the R&S ZVL.

Battery Pack (Option R&S FSL-B31)

Option R&S FSL-B31 is a battery pack for the R&S ZVL. If option R&S FSL-B30 is installed, the R&S ZVL can be operated independently of the AC supply for approx. one hour. The option comprises a charger, two NiMH battery packs and an external power supply. The charger and the batteries are accommodated in a housing that can be installed on the top of the R&S ZVL in no time.

The battery pack is charged by means of the power supply that is included. Option R&S FSL-B32 is an additional battery pack (without external power supply).

OCXO Reference (Option R&S FSL-B4)

The R&S ZVL contains the R&S FSL-B4 option, an oven-controlled crystal oscillator (OCXO). This OCXO generates a 10 MHz signal, which is routed to the frontend and used as a reference signal.

Front Panel

The front panel consists of an aluminum case panel (part of the R&S ZVL frame) and a mounting plate which accommodates the LCD, the backlight inverter, the keyboard mat with the membrane and the rotary knob. The case panel incorporates the controller.

LCD

The color LCD provides users with a visible output of any information, measurements, etc. The resolution of the LCD is 640 * 480 pixels (VGA).

The display incorporates 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 release a contact when the rubber key is pressed. Two LEDs for the STANDBY/ON key (orange for STANDBY/green for ON) are also accommodated on this membrane.

The key evaluation and LED are controlled via a film cable connector on the controller board. Like the two LEDs, it is controlled in a special microprocessor on the controller board by means of a matrix technique. This microprocessor allows the status of the STANDBY/ON key to be stored when the instrument is switched off via the power switch.

Controller

The controller contains all the necessary components on a board, including the 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.

Power Supply Module

The power supply module provides all currents necessary for the operation of the R&S ZVL. 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. On the secondary side, it generates the following DC voltages: +5.2 V, +12 V, -12 V.

Module Replacement

This section describes the service concept and contains the spare parts list and the basic documents for the overall R&S ZVL instrument.

Note: *The numbers indicated in brackets refer to the position in the list of mechanical parts in chapter 5.
These items correspond to the item numbers in the illustrations on board replacement (see also chapter 5):*

*1303.6509 (Network Analyzer R&S ZVL, items 1-99),
1300.2525 (Base Unit, items 100-699),
1300.2531 (Front Panel, items 700-940),
1300.2502 (OCXO R&S FSL-B4, item 1000),
1300.2502 (Additional Interface R&S FSL-B5, item 1100),
1300.2502 (IEC/IEEE Bus R&S FSL-B10, item 1200),
1300.2502 (DC Power Supply R&S FSL-B30, items 1300-1320),
1300.2502 (Battery Pack R&S FSL-B31 items 1400-1420),*

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

DANGER



Danger of shock hazard

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

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

ATTENTION



Danger of damage to components of the module

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

ATTENTION



Protection of mechanical components

Always use a torque wrench of 100 Ncm to tighten all SMA connectors of the bridge, frontend and both port sockets. Do not use an open-end wrench.

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
Controller	SYSTEM MESSAGES/ SELFTEST / CAL		BIOS update
Flash disk	SYSTEM MESSAGES/ SELFTEST / CAL		Cold boot/ EEPROM update using service function / FW update
Lithium battery	SYSTEM MESSAGES/ SELFTEST / CAL		
LCD / DC/AC converter			
Push-button board set			
Flexible switchboard			
Power supply	SYSTEM MESSAGES/ SELFTEST / CAL		
Fan			
RF input connector	SELFTEST / CAL	Frequency response	
Motherboard	SYSTEM MESSAGES/ SELFTEST / CAL		NO Cold boot/ EEPROM update using service function
Front connector board			
R&S ZVL-Frontend	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
R&S ZVL-Bridge	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency response	Cold boot
OCXO R&S FSL-B4	SYSTEM MESSAGES/ SELFTEST / CAL	Frequency accuracy	
Additional Interface R&S FSL-B5	SYSTEM MESSAGES/ SELFTEST / CAL		
IEC/IEEE Bus R&S FSL-B10	SYSTEM MESSAGES/ SELFTEST / CAL		
DC Power Supply R&S FSL-B30			
Battery Pack R&S FSL-B31			

Performing a Cold Boot

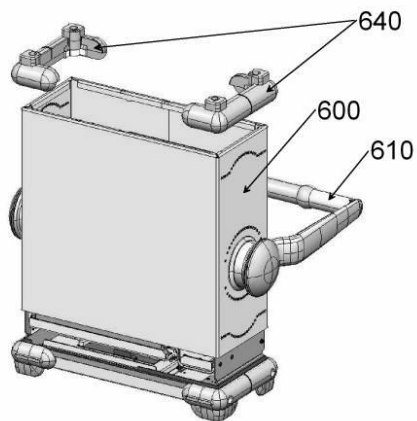
- Connect the power cable, press and hold down the decimal-point key and switch on power at the rear panel simultaneously. Release the decimal point when the BIOS memory test or the recognized hard disk message appears. *Do not keep the key pressed until the Windows logo is displayed!*
- Verify that during start up of the analyzer firmware the **INFO - COLDBOOT** message box is displayed:
Coldboot active!
- If this message box is not shown, switch off the analyzer and perform a cold boot with the pressed decimal-point key again. It is mandatory before proceeding that this **Coldboot active!** message has been displayed on the screen.

Replacing the Controller A90

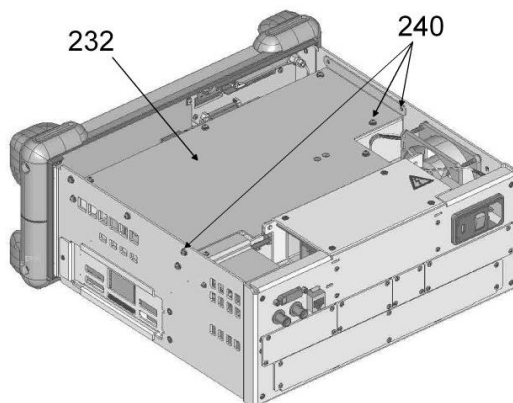
(See chapter 5, spare parts list, item 162, and explosion drawings 1300.2525.01 sheet 3+4)

Opening the Instrument and Removing the Controller

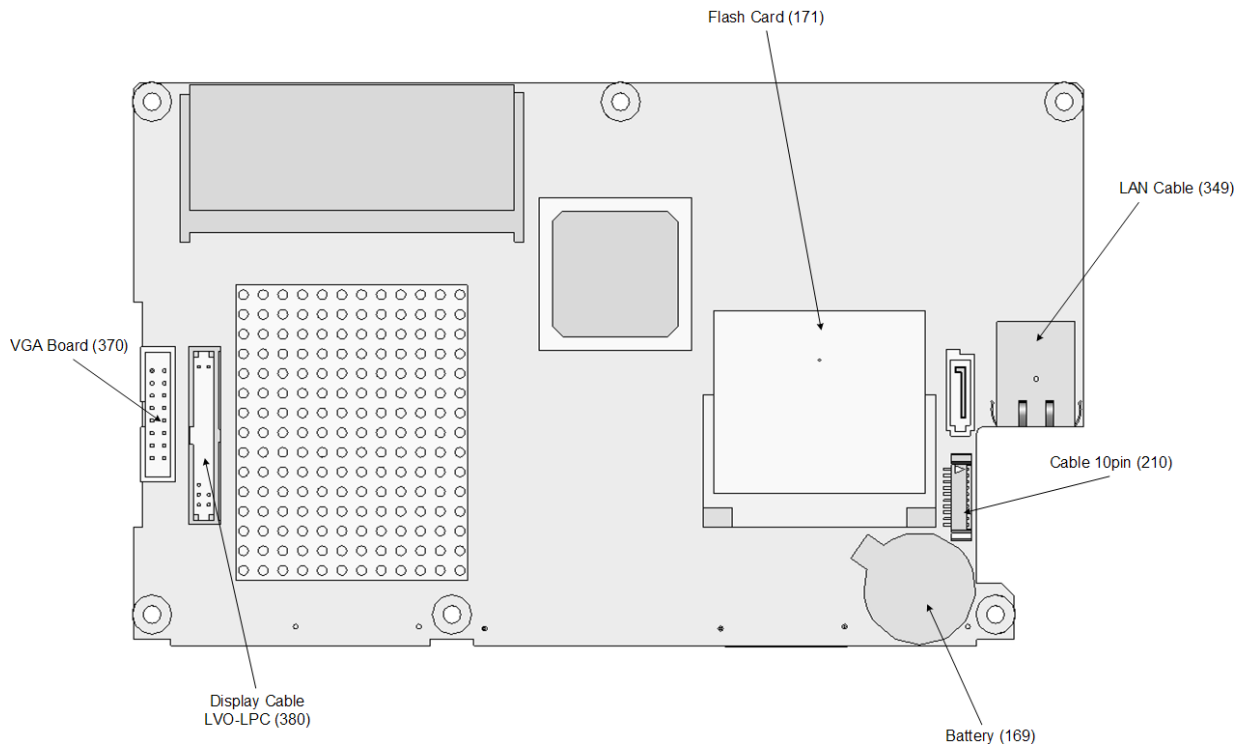
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side. Remove the cover (232) to the bottom of the instrument.

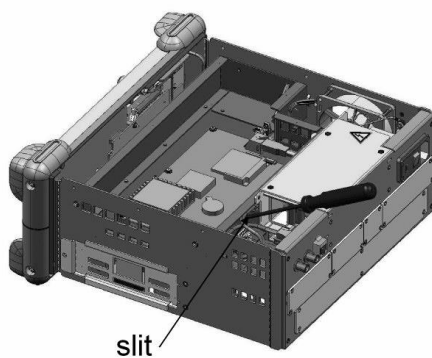


- Disconnect cable VGA board (370), cable 10pin (210), cable LVO-LPC (380) and LAN cable (349) at the controller (162).



- Unscrew six combination screws (200) at the component side of the controller (162).
- Remove the controller (162) to the bottom of the instrument.

Note: The force needed to disconnect the controller connector of the motherboard is high. Pulling the controller to the bottom is best done by means of the slits. Using a flat, blunt tool, carefully push the board step by step to the bottom. Do not insert the tool too deep into the slits!



- Remove the flash card (171) from the controller (162).

Installing the New Controller and Completing the Instruments

- Insert the flash card (171) into the new controller (162).
- Connect cable 10pin (210) to the new controller (162).
- Carefully plug the new controller (162) to the motherboard and fasten it using the six combination screws (200).
- Connect display cable VGA board (370), cable 10pin (210), cable LVO-LPC (380) and LAN cable (349) to the controller (162).
- Remount the cover (232) to the bottom of the instrument. Screw the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side.
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).

Putting into Operation

- Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in standby mode.
 - **BIOS Update:**

You can receive the BIOS image from your service representative or from the R&S support center.
Follow the instructions in the PDF file supplied with the image on how to create the boot CD ROM.
 - Disconnect the instrument from the AC supply (remove the battery pack, if there is one!).
 - Plug a USB CD ROM drive with BIOS update CD ROM and a USB keyboard into the USB connector.
 - Connect the instrument to the AC supply and switch on the power switch. The instrument is now in standby mode.
 - Switch on the R&S ZVL and wait until the memory test appears on the boot screen and then press the DEL key. The BIOS screen appears.
 - Select “Advanced BIOS Features” with the cursor keys and press ENTER.
 - Select “Select Boot Options” and press ENTER.
 - Select “First Boot Device” with the cursor keys.
 - Press the “+” key until USB-CDROM appears as “First Boot Device”.
 - Press the F10 key and confirm the “SAVE to CMOS and EXIT” query with “Y”.
 - The R&S ZVL will now reboot and automatically starts the BIOS update from the CD ROM.
Please note that under NO circumstance during the BIOS update should the power be switched off.
 - After the BIOS update has finished, a message is displayed indicating that you can switch off the power.
 - Switch off the power, unplug the USB CD ROM drive and keyboard. Insert the battery pack, if there is one.
 - Switch on the power and the R&S ZVL will restart.
 - Check basic functions of the R&S ZVL. See chapter: Functional test

Replacing the Lithium Battery on the Controller

(See chapter 5, spare parts list, item 169, and explosion drawings 1300.2525.01 sheet 3+4.)

The lithium battery is accommodated on the controller.

WARNING**Danger of injury**

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

Keep away from children.

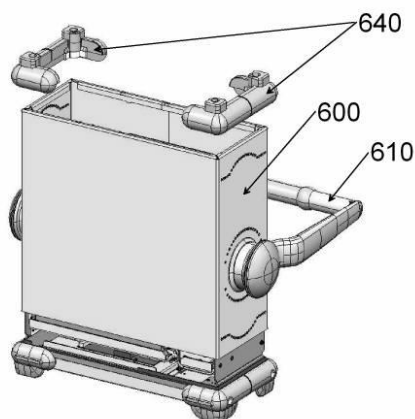
If the battery is replaced improperly, there is a danger of explosion. Only replace the battery by an R&S type (see spare parts list, item 169).

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

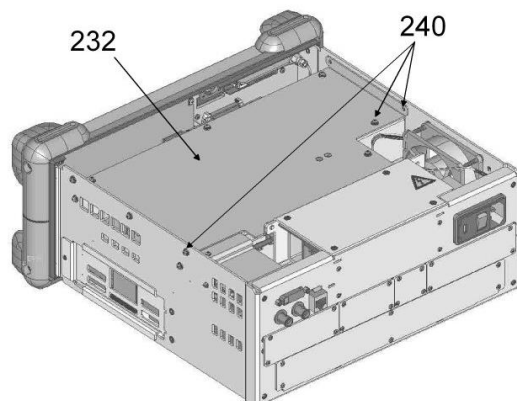
Do not short-circuit the battery!

Opening the Instrument and Removing the Lithium Battery

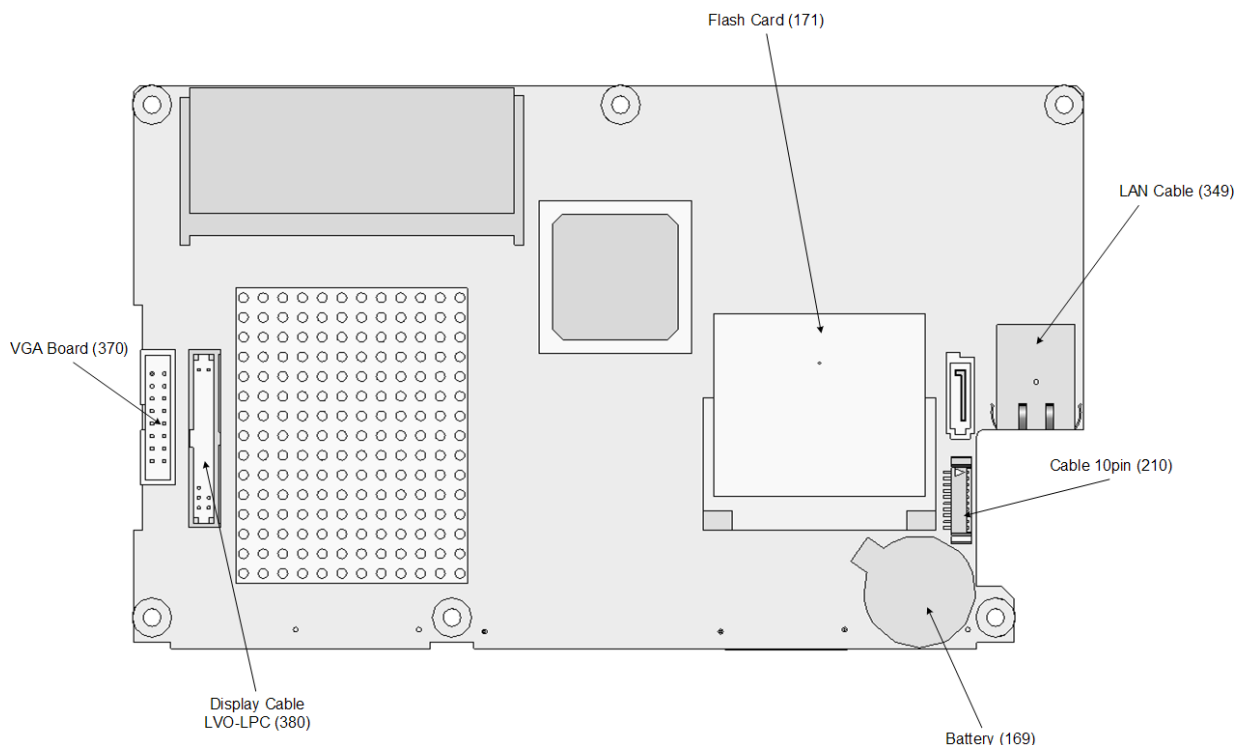
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side. Remove the cover (232) to the bottom of the instrument.



- Carefully push contact springs of the battery holder up and remove battery (169).



Installing the New Battery and Completing the Instrument

- Carefully push contact springs of the battery holder up and insert battery into the holder beneath the springs.

Note: The plus pole (+) of the battery points upwards.

WARNING



Danger of injury because of battery explosion
If the battery is short-circuit, there is danger of explosion.
Do not short-circuit the battery! Only replace the battery by R&S type (see spare parts list).

- Remount the cover (232) to the bottom of the instrument. Screw the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side.
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).

Putting into Operation

- Connect the instrument to the mains and switch on its power switch. The instrument is now in standby mode.
- After the change of the battery a cold boot is necessary. See "Performing a Cold Boot" section in this chapter.
 - Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing Flash Card A60

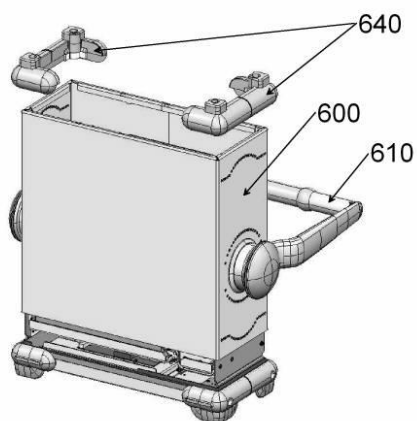
(See chapter 5, spare parts list, item 171, and explosion drawings 1300.2525.01 sheet 3+4.)

The spare part is already formatted for the R&S ZVL and contains the complete software.

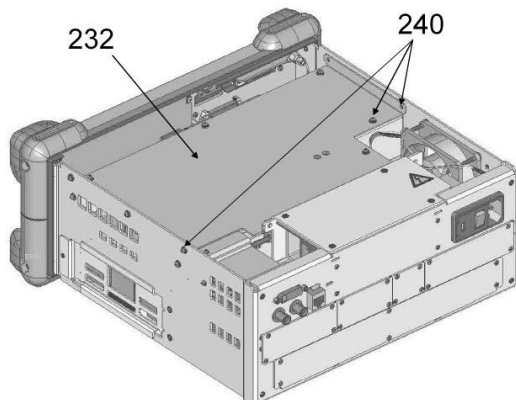
Note: *Do not replace the flash card and the motherboard at the same time. If the service function cannot be performed, for example because the R&S ZVL application does not boot up, do not replace also the motherboard. In this case, reinstall the old flash card and then replace the motherboard.*

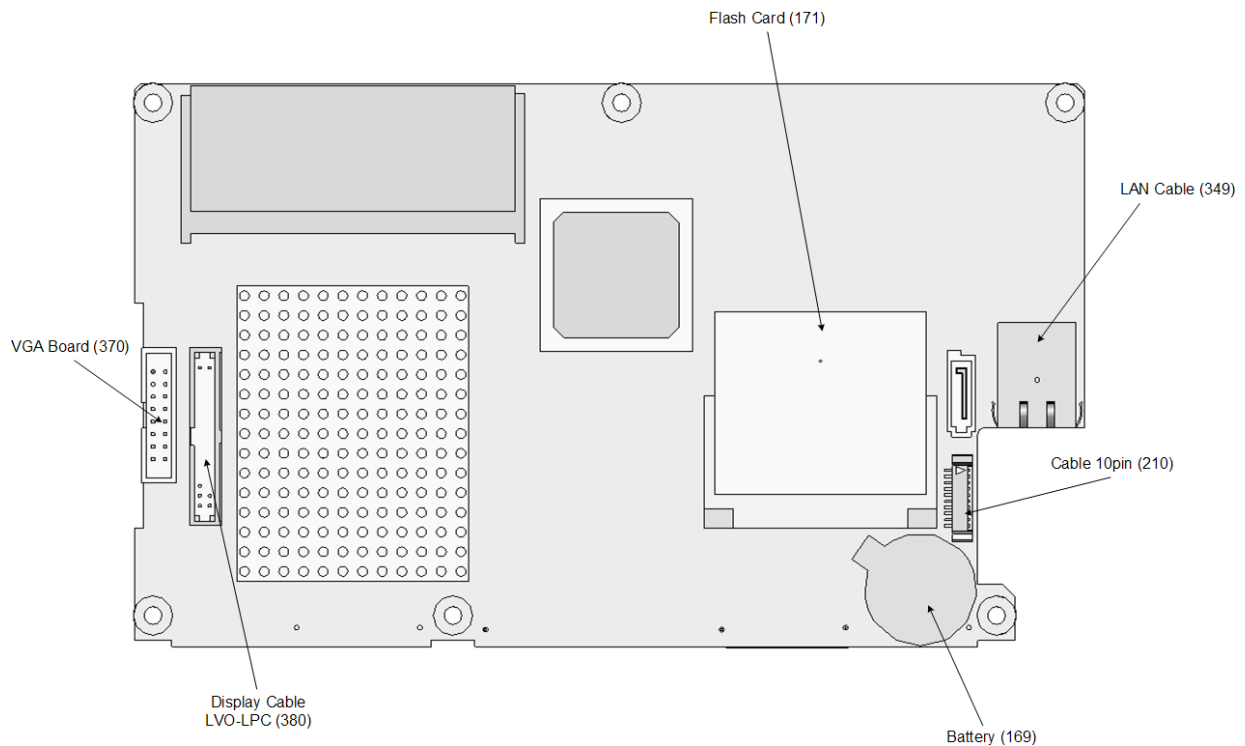
Opening the Instrument and Removing the Controller and Flash Card

- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side. Remove the cover (232) to the bottom of the instrument.





- Remove the flash card (171) from the controller (162).

Installing the New Flash Card and Completing the Instruments

- Insert the new flash card (171) into the controller (162).
- Remount the cover (232) to the bottom of the instrument. Screw the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side.
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).

Putting into Operation

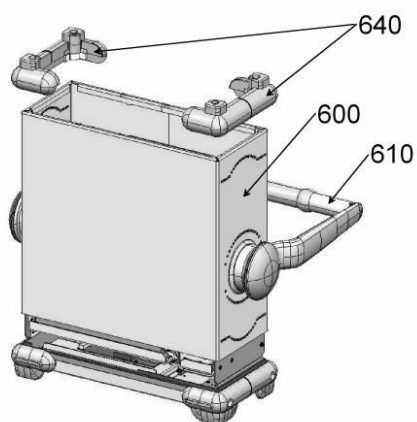
- Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in standby mode.
- A cold boot is necessary after replacing the flash card.
See "Performing a Cold Boot" section in this chapter.
- A backup of the EEPROM files must be made with the aid of a service function.
 - [SETUP : MORE : SERVICE : ENTER PASSWORD : 20122004 ENTER]
 - [SETUP : MORE : SERVICE : SERVICE FUNCTION : 10.0.4 ENTER]
- Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the TFT Display

(See chapter 5, spare parts list, items 760, and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

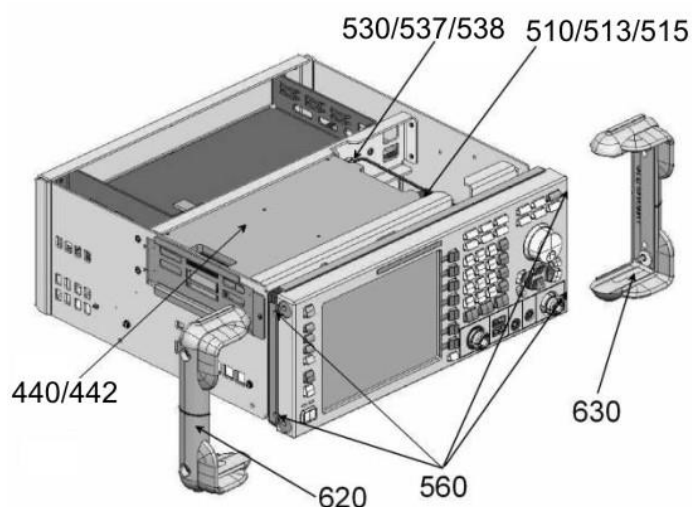
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Unscrew four screws (560) at both sides of the front panel.

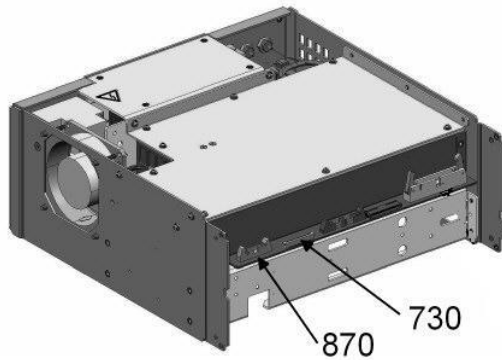


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

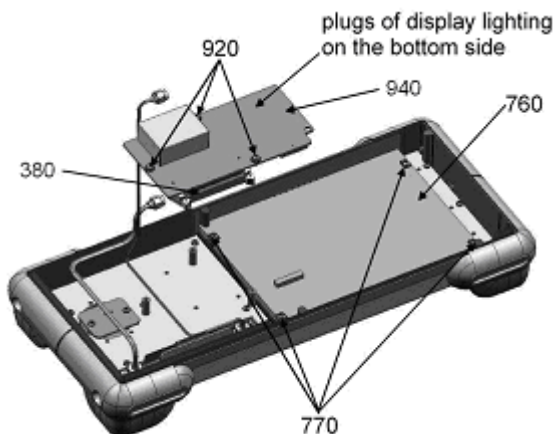
Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.

Removing the LVO Displayconnector

- Remove ribbon cable (380) at LVO Displayconnector (940).
- Unscrew the three combination screws (920) and remove the LVO Displayconnector (940).
- Pull off the two plugs of the display lighting on the LVO Displayconnector (940).



Removing the LCD

- Unscrew the four combination screws (770) at the display (760) and remove it.

Installing the New LCD and Completing the Instrument

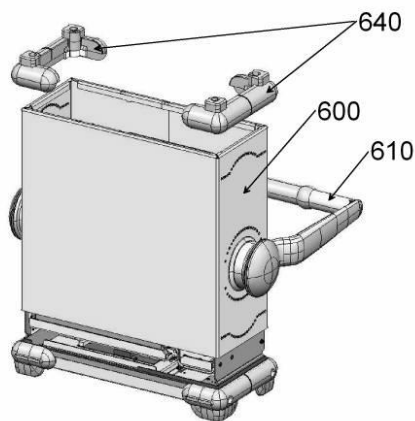
- **When mounting the LVO Displayconnector (940) to the display (760), make sure it is free of mechanical stress.**
- Mount the display and screw in the four combination screws (770) at the display (760).
- Pull on the two plugs of the display lighting to the LVO Displayconnector (940).
- Reconnect the LVO Displayconnector (940) to the display (760). You must hear the connection engage.
- Screw in the three combination screws (920), making sure LVO (940) is free of mechanical stress.
- Connect ribbon cable (380) to LVO Displayconnector (940).
- Replace the front panel and pull on the cables to the front connector (870) and flexible switchboard (730).
- Screw in four screws (560) at both sides of the front panel.
- Connect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Screw the two front-panel feet (620, 630) (designation: BW2-shock mount.front).
- Note:** *Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.*
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
 - Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the LVO Displayconnector in the Front Module

(See chapter 5, spare parts list, items 940, and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

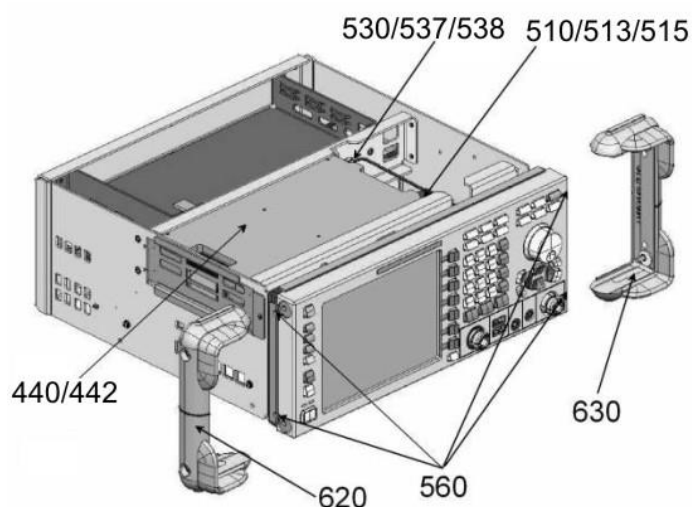
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Unscrew four screws (560) at both sides of the front panel.

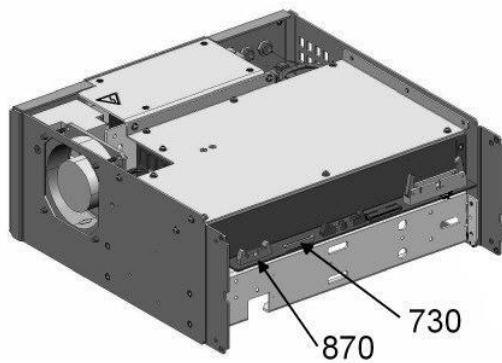


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

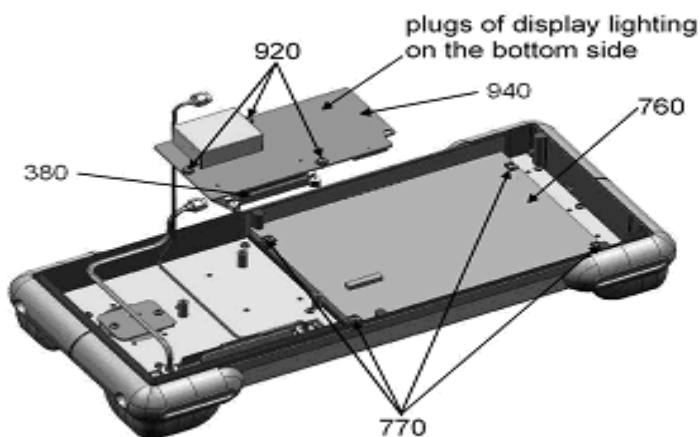
Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.

Removing the LVO Displayconnector

- Remove ribbon cable (380) at LVO Displayconnector (940).
- Unscrew the three combination screws (920) and remove the LVO Displayconnector (940).
- Pull off the two plugs of the display lighting on the LVO Displayconnector (940).



Installing the New LVO Displayconnector and Completing the Instrument

- **When mounting the LVO Displayconnector (940) to the display (760), make sure it is free of mechanical stress.**
- Pull on the two plugs of the display lighting to the LVO Displayconnector (940).
- Reconnect the LVO Displayconnector (940) to the display (760). You must hear the connection engage.
- Screw in the three combination screws (920), making sure LVO (940) is free of mechanical stress.
- Connect ribbon cable (380) to LVO Displayconnector (940).
- Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
- Screw in four screws (560) at both sides of the front panel.
- Connect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Screw in the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: *Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.*

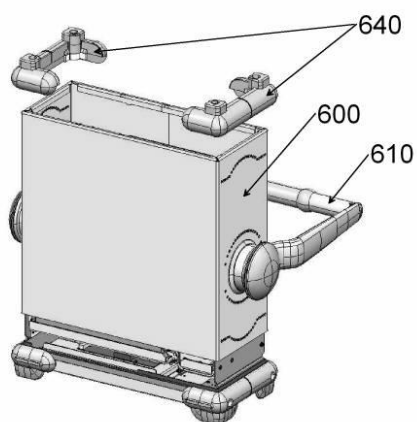
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
 - Check basic functions of the R&S@ZVL. See chapter: Functional test

Replacing the Push-Button Board Set in the Front Module

(See chapter 5, spare parts list, items 720, and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

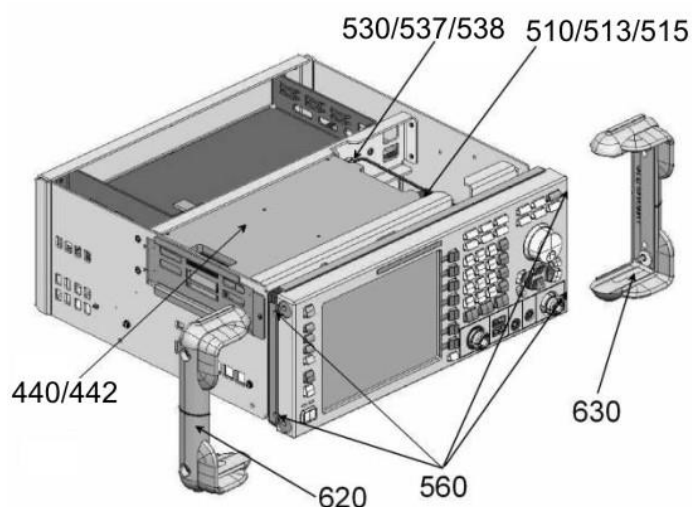
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Unscrew four screws (560) at both sides of the front panel.

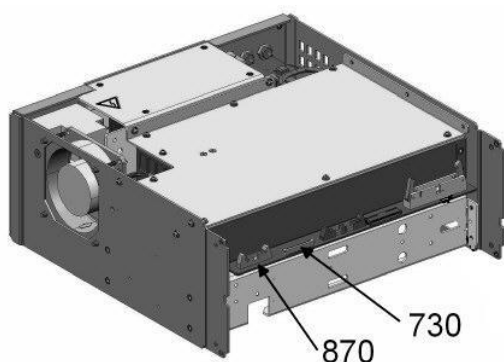


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

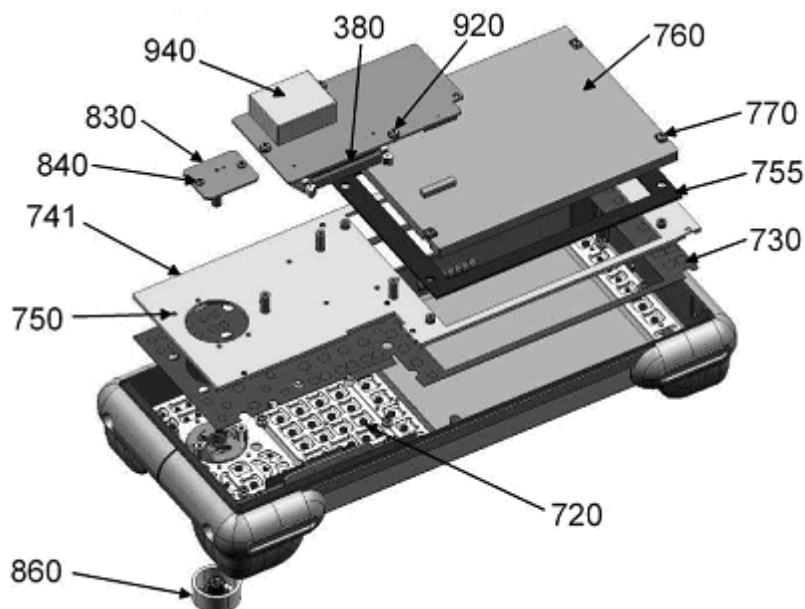
- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.
- Remove ribbon cable (380) at LVO Displayconnector (940).

Removing the Push-Button Board Set



- Unscrew the three combination screws (920) and remove the LVO Displayconnector (940) with ribbon cable.
- Pull off the two plugs of the display lighting on the bottom side of LVO Displayconnector (940).
- Unscrew the four combination screws (770) at the display (760) and remove it.
- Remove the powder seal (755).
- Remove the knob (860) at the front side.
- Disconnect the flat cable at the encoder board (830).

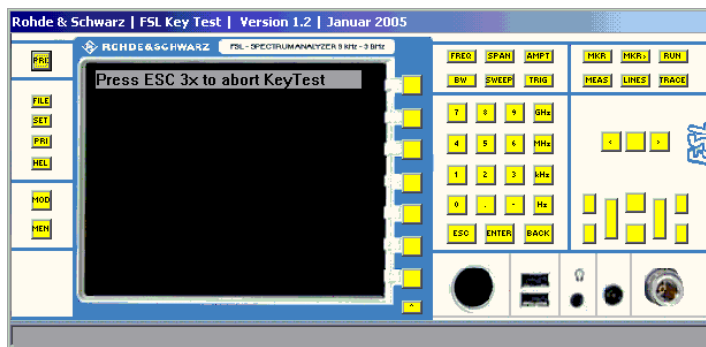
- Unscrew the two die-cast screws (840) at the encoder board (830) and remove it.
- Unscrew the nine die-cast screws (750) at the keyboard panel (741) and remove it.
- Remove the flexible switchboard (730).
- Remove the push-button board set (720).

Installing the New Push-Button Board Set and Completing the Instrument

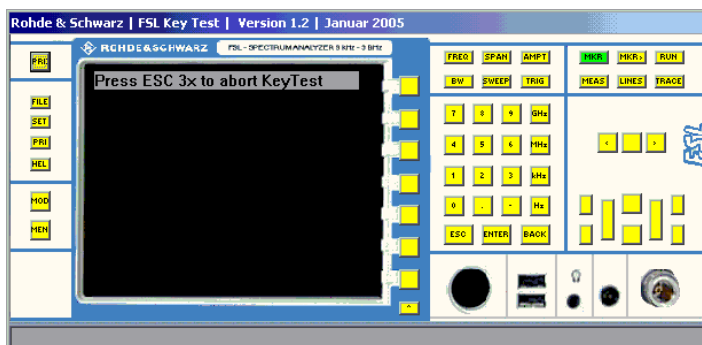
- Mount the new push-button board set (720) onto the front cover.
- Mount the flexible switchboard (730).
- Mount the keyboard panel (741) with nine die-cast screws (750).
- Mount the encoder board (830) with two die-cast screws (840).
- Connect the flat cable to the encoder board (830).
- Mount the knob (860) to the encoder board at the front side.
- Mount the powder seal (755).
- Mount the display and screw the four combination screws (770) at the display (760).
- **When mounting the LVO Displayconnector (940) to the display (760), make sure it is free of mechanical stress.**
- Pull on the two plugs of the display lighting to the LVO Displayconnector (940).
- Reconnect the LVO Displayconnector (940) to the display (760). You must hear the connection engage.
- Screw in the three combination screws (920), making sure LVO (940) is free of mechanical stress.
- Connect ribbon cable (380) to LVO Displayconnector (940).
- Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
- Screw four screws (560) at both sides of the front panel.
- Connect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Screw the two front-panel feet (620, 630) (designation: BW2-shock mount.front).
- Note:** *Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.*
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).

Check the Push-Button Board Set

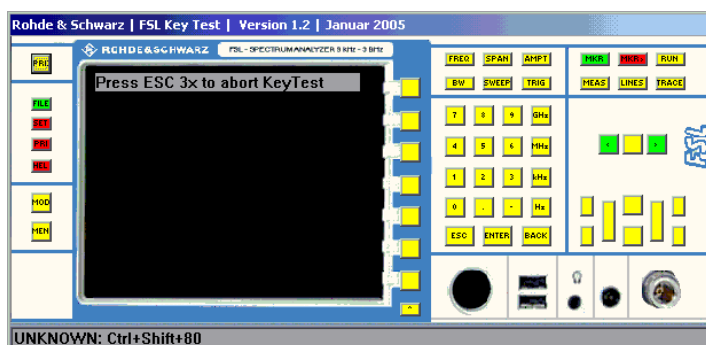
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- Starting the key test tool:
 - [SETUP : MORE : SERVICE : ENTER PASSWORD : 894129 ENTER]
 - [SETUP : MORE : SERVICE : SERVICE FUNCTION : 2.0.14.0 ENTER]



- After the first pressing of a key the corresponding button changes its color from yellow to green:



- If the key is pressed a second time, the corresponding button changes its color from green to red.
- If a key does not match the given key code, the corresponding button does not change its color and the unknown key code is displayed at the dialog status line.



- To verify that all keys work properly, all keys should be pressed twice and finally all displayed buttons should have a red color. Otherwise the keyboard does not work properly.
- Press ESC key three times to abort the key test tool during the test.

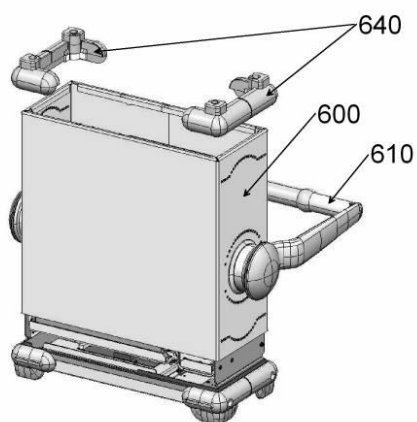
- Check basic functions of the R&S@ZVL. See chapter: Functional test

Replacing the Flexible Switchboard in the Front Module

(See chapter 5, spare parts list, items 730, and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

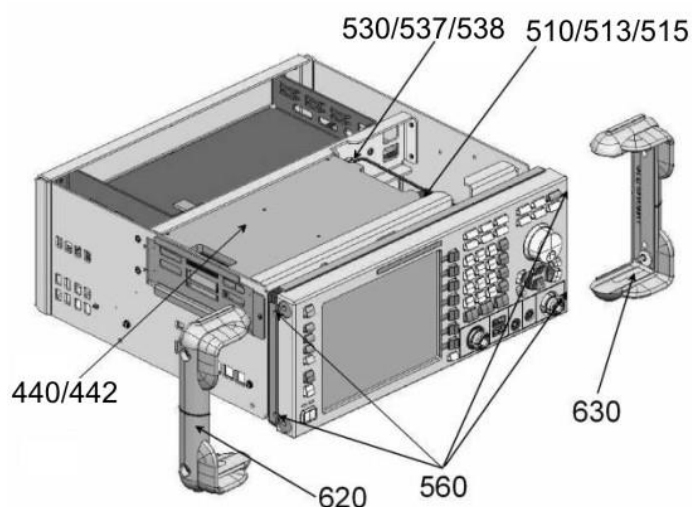
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Unscrew four screws (560) at both sides of the front panel.

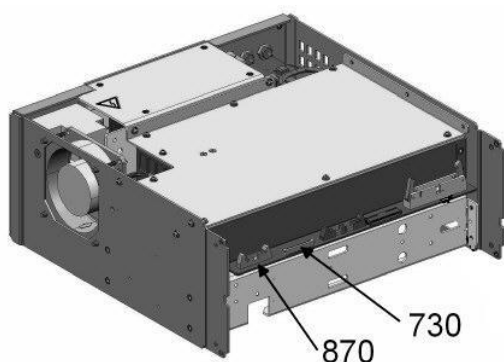


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

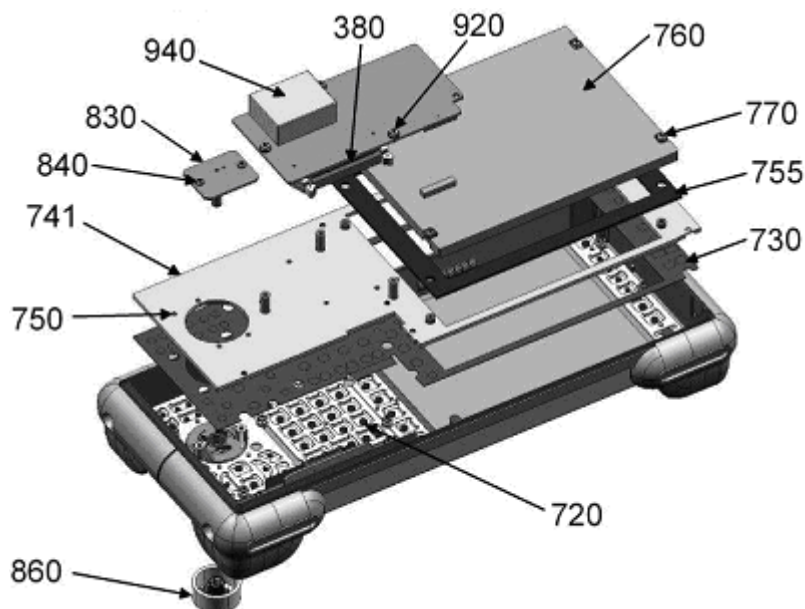
- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.
- Remove ribbon cable (380) at LVO Displayconnector (940).

Removing the Flexible Switchboard



- Unscrew the three combination screws (920) and remove the LVO Display connector (940).
- Pull off the two plugs of the display lighting on the bottom side of LVO Display connector (940).
- Unscrew the four combination screws (770) at the display (760) and remove it.
- Remove the powder seal (755).
- Remove the knob (860) at the front.
- Disconnect the flat cable at the encoder board (830).

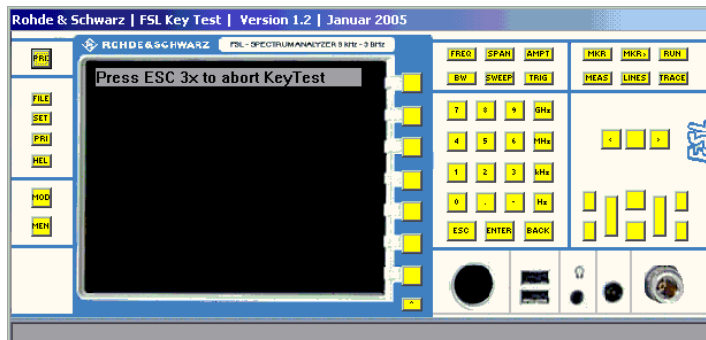
- Unscrew the two die-cast screws (840) at the encoder board (830) and remove it.
- Unscrew the nine die-cast screws (750) at the keyboard panel (741) and remove it.
- Remove the flexible switchboard (730).

Installing the New Flexible Switchboard and Completing the Instrument

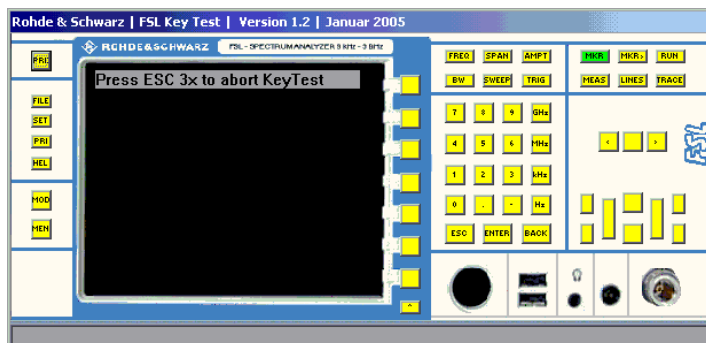
- Mount the new flexible switchboard (730).
 - Mount the keyboard panel (741) with nine die-cast screws (750).
 - Mount the encoder board (830) with two die-cast screws (840).
 - Connect the flat cable to the encoder board (830).
 - Mount the knob (860) to the encoder board at the front side.
 - Mount the powder seal (755).
 - Mount the display and screw in the four combination screws (770) at the display (760).
 - **When mounting the LVO Displayconnector (940) to the display (760), make sure it is free of mechanical stress.**
 - Pull on the two plugs of the display lighting to the LVO Displayconnector (940).
 - Reconnect the LVO Displayconnector (940) to the display (760). You must hear the connection engage.
 - Screw in the three combination screws (920), making sure LVO (940) is free of mechanical stress.
 - Connect ribbon cable (380) to LVO Displayconnector (940).
 - Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
 - Screw four screws (560) at both sides of the front panel.
 - Connect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
 - Screw in the two front-panel feet (620, 630) (designation: BW2-shock mount.front).
- Note:** *Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.*
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
 - Mount and screw the two rear-panel feet (640).

Check the Flexible Switchboard

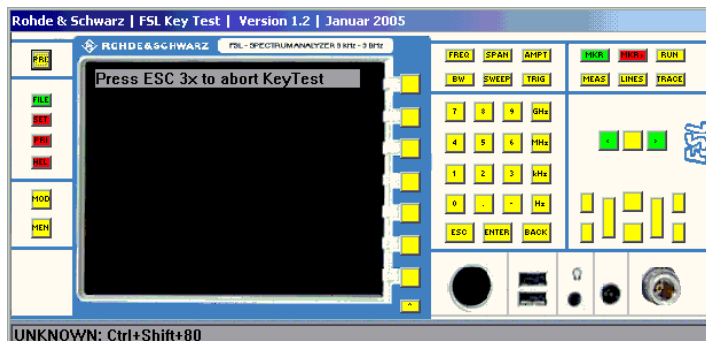
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- Starting the key test tool:
 - [SETUP : MORE : SERVICE : ENTER PASSWORD : 894129 ENTER]
 - [SETUP : MORE : SERVICE : SERVICE FUNCTION : 2.0.14.0 ENTER]



- After the first pressing of a key the corresponding button changes its color from yellow to green:



- If the key is pressed a second time, the corresponding button changes its color from green to red.
- If a key does not match the given key code, the corresponding button does not change its color and the unknown key code is displayed at the dialog status line.



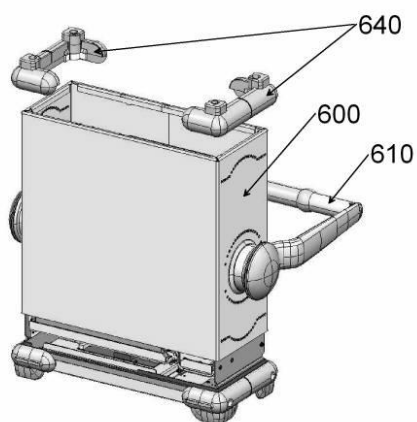
- To verify that all keys work properly, all keys should be pressed twice and finally all displayed buttons should have a red color. Otherwise the keyboard does not work properly.
- Press ESC key three times to abort the key test tool during the test.
- Check basic functions of the R&S@ZVL. See chapter: Functional test

Replacing the Encoder Board in the Front Module

(See chapter 5, spare parts list, items 830, and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

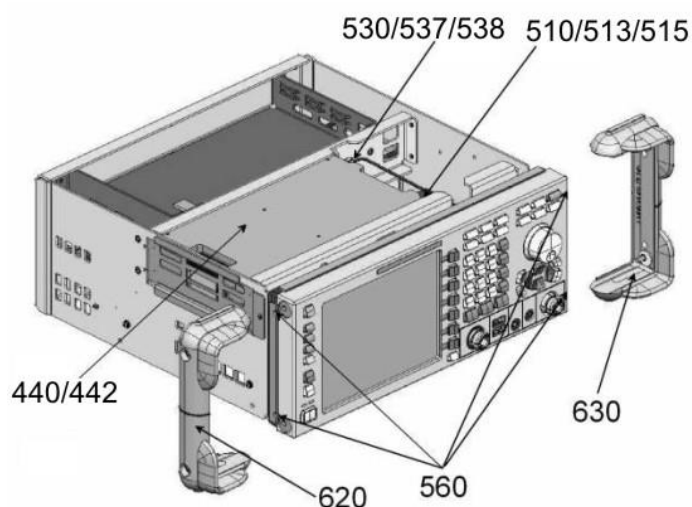
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Unscrew four screws (560) at both sides of the front panel.

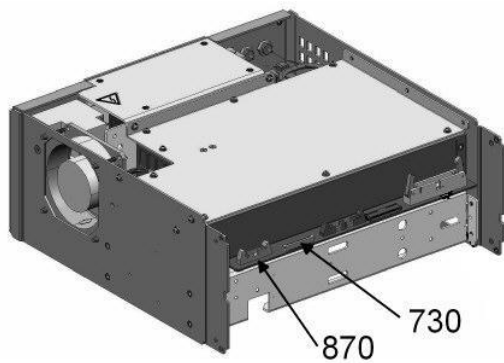


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

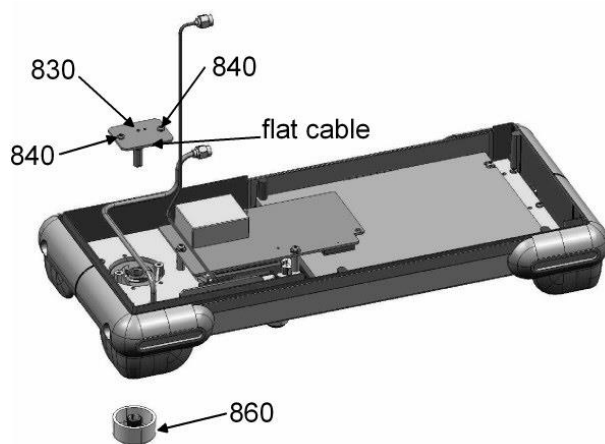
- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.

Removing the Encoder Board



- Remove the knob (860) at the front.
- Disconnect the flat cable at the encoder board (830).
- Unscrew the two die-cast screws (840) at the encoder board (830) and remove it.

Installing the New Encoder Board and Completing the Instrument

- Mount the new encoder board (830) with two die-cast screws (840).
- Connect the flat cable to the encoder board (830).
- Mount the knob (860) to the encoder board at the front.
- Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
- Screw in four screws (560) at both sides of the front panel.
- Connect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Screw the two front-panel feet (620, 630) (designation: BW2-shock mount front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

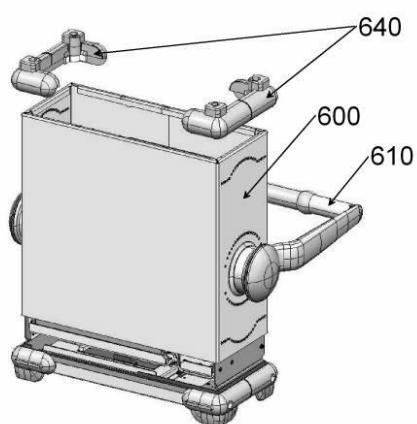
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
 - Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the Front Connector in the Front Module

(See chapter 5, spare parts list, items 870, and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

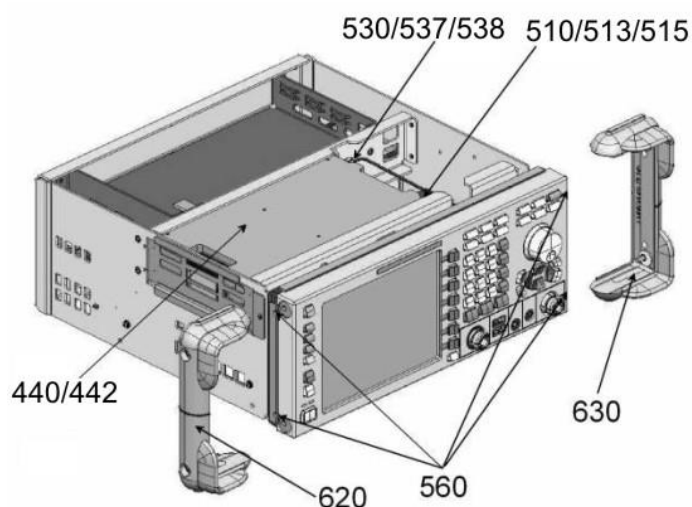
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Unscrew four screws (560) at both sides of the front panel.

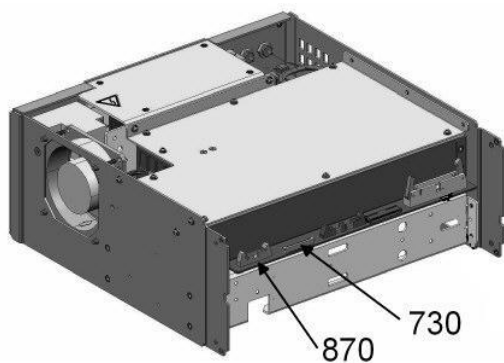


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

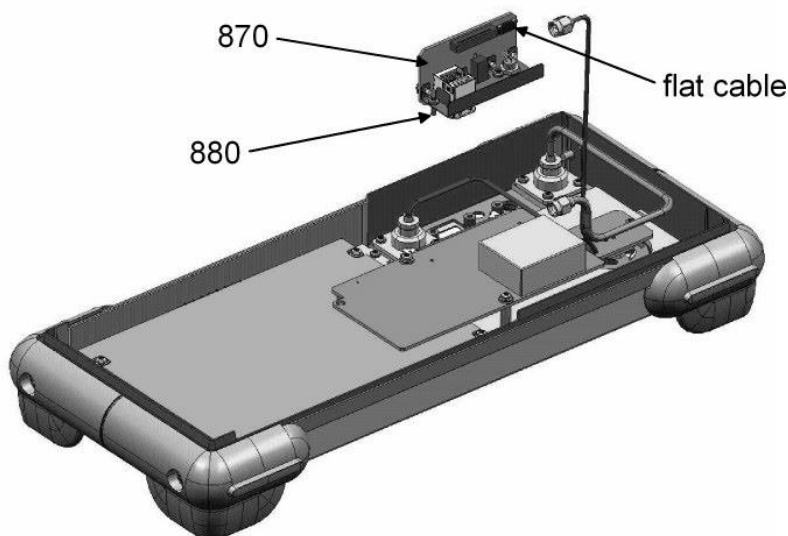
- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.

Removing the Front Connector



- Remove flat cable at the front connector (870).
- Unscrew the three die-cast screws (880) at the front connector (870) and remove it.

Installing the New Front Connector and Completing the Instrument

- Mount the new front connector (870) with three die-cast screws (880).
- Reconnect flat cable to front connector (870).
- Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
- Screw in four screws (560) at both sides of the front panel.
- Connect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Screw in the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: *Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.*

- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.

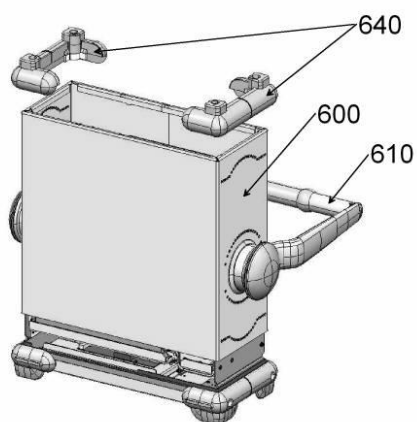
- Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the Screened Filter Glass in the Front Module

(See chapter 5, spare parts list, items 710, and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

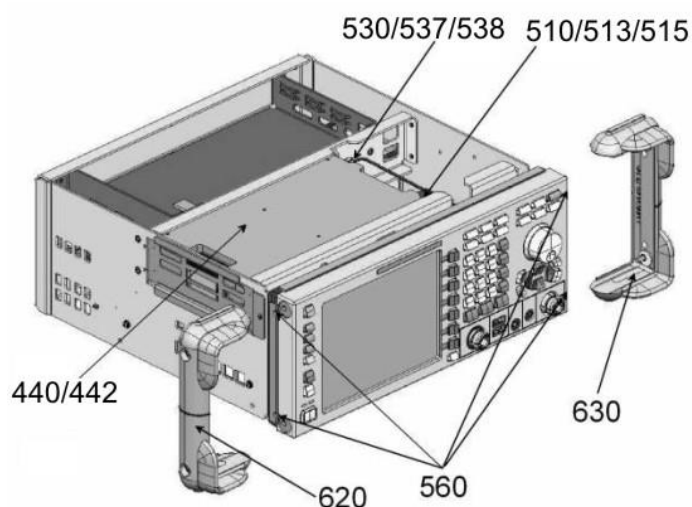
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Unscrew four screws (560) at both sides of the front panel.

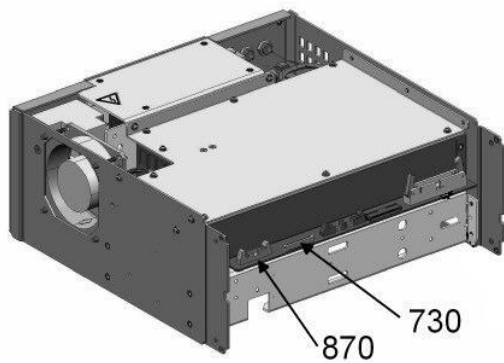


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

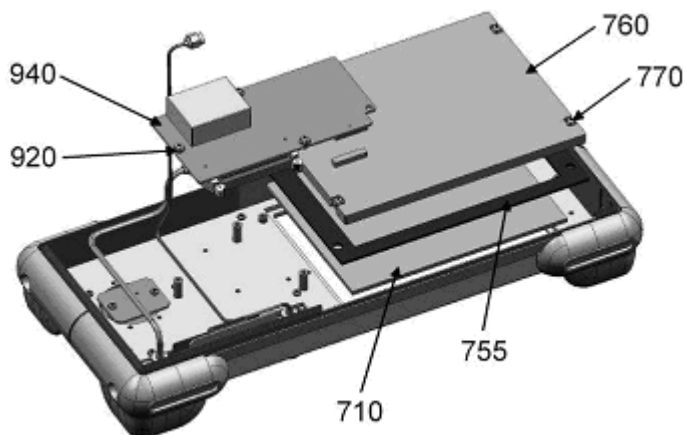
- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.
- Remove ribbon cable (380) at LVO Displayconnector (940).

Removing the Screened Filter Glass



- Unscrew the three combination screws (920) and remove the LVO Display connector (940) with ribbon cable.
- Unscrew the four combination screws (770) at the display (760) and remove it.
- Remove the powder seal (755).
- Remove the screened filter glass (710).

Installing the New Screened Filter Glass and Completing the Instrument

- Mount the new screened filter glass (710).

Note: Remove the green foil (inside unit) and the white foil (at front of unit) of the new screened filter glass (710).

- Mount the powder seal (755).
- Mount the display and screw in the four combination screws (770) at the display (760).
- **When mounting the LVO Displayconnector (940) to the display (760), make sure it is free of mechanical stress.**
- Reconnect the LVO Displayconnector (940) to the display (760). You must hear the connection engage.
- Screw in the three combination screws (920), making sure LVO (940) is free of mechanical stress.
- Connect ribbon cable (380) to LVO Displayconnector (940).
- Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
- Screw in four screws (560) at both sides of the front panel.
- Connect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Screw in the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.

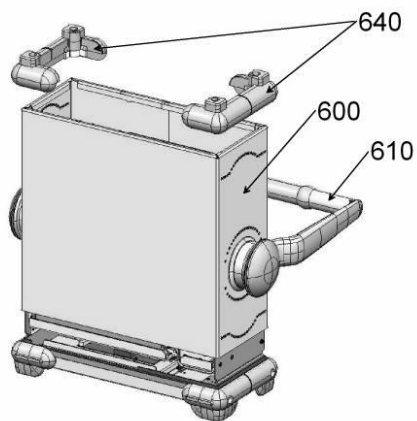
- Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing RF Cable W1 or RF Cable W2 (MOD03, 06)

(See chapter 5, spare parts list, items 510, 530 and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

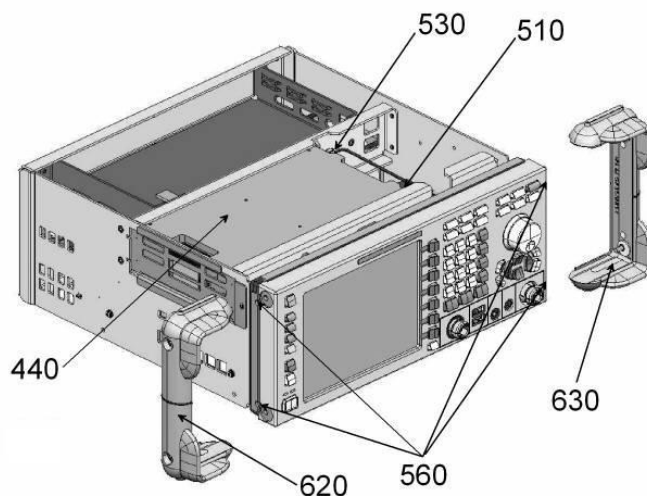
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (510) and RF cable W2 (530) at R&S ZVL-Bridge (440).
- Unscrew four screws (560) at both sides of the front panel.

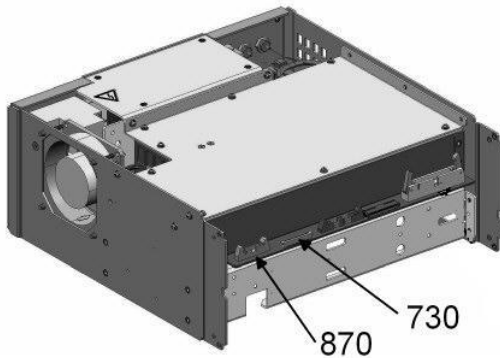


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

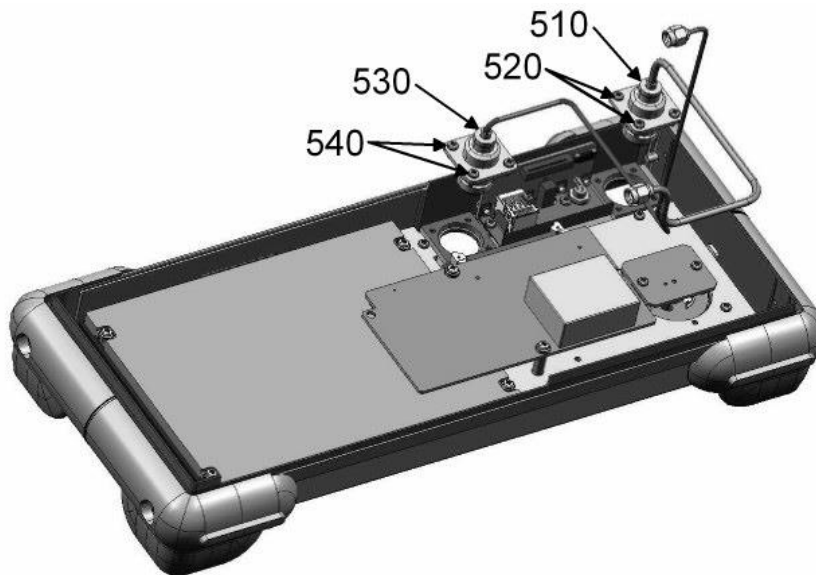
- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.

Removing the RF Cable W1 or RF Cable W2



- Unscrew the four die-cast screws (520 or 540) and remove RF cable W1 (510) or RF cable W2 (530).

Installing the New RF Cable W1 or RF Cable W2 and Completing the Instrument

- Mount the new RF cable W1 (510) or RF cable W2 (530) onto the front module with four die-cast screws (520 or 540).
- Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
- Screw in four screws (560) at both sides of the front panel.
- Connect RF cable W1 (510) and RF cable W2 (530) at R&S ZVL-Bridge (440).
- Screw in the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: *Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.*

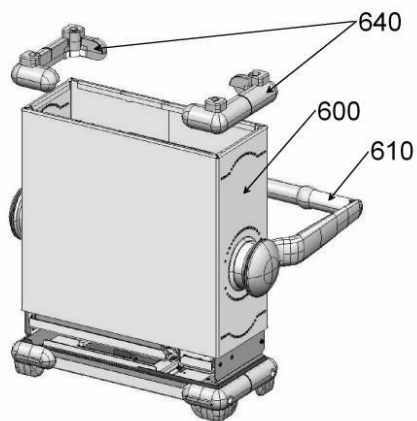
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- Perform a frequency response correction as described in chapter 2 "Adjustment".
- Perform a calibration as described in chapter 1 "Performance Test".
 - Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing Adaptor X1 or Adaptor X2 (MOD13)

(See chapter 5, spare parts list, items 511, 535 and explosion drawings 1300.2525.01 sheet 3+4 and 1300.2531.01.)

Opening the Instrument and Removing the Front Module

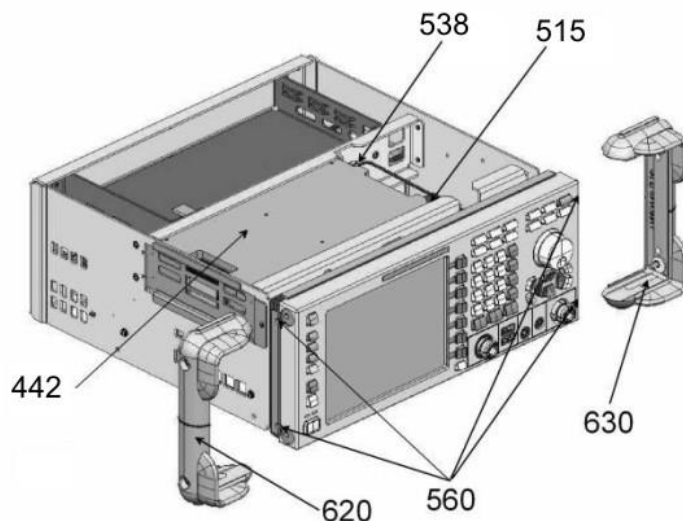
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Disconnect RF cable W1 (515) and RF cable W2 (538) at R&S ZVL13-Bridge (442).
- Unscrew four screws (560) at both sides of the front panel.

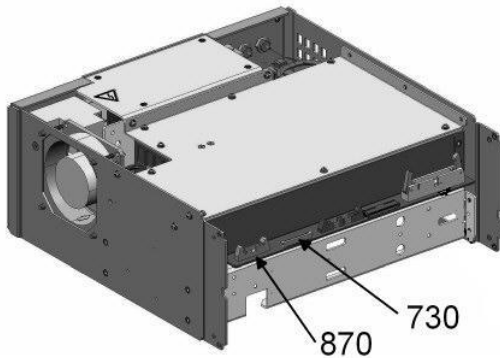


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

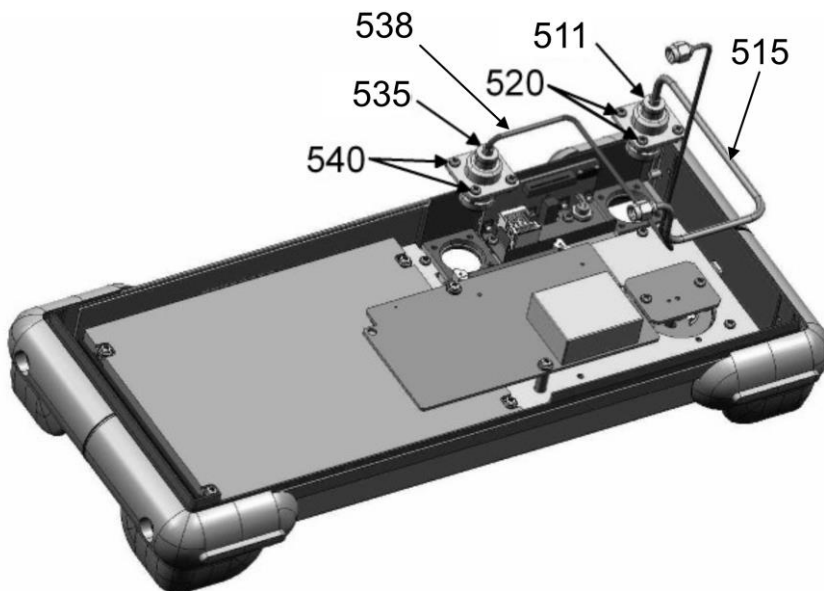
- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.

Removing the RF Cable W1 or RF Cable W2



- Remove the RF cable W1 (515) or RF cable W2 (538).
- Unscrew the four die-cast screws (520 or 540) and remove the Adaptor X1 or Adaptor X2 (511 or 535).

Installing the New RF Cable W1 or RF Cable W2 and Completing the Instrument

- Mount the new Adaptor X1 (511) or Adaptor X2 (535) onto the front module with four die-cast screws (520 or 540).
- Connect RF cable W1 (515) or RF cable W2 (538) at the Adaptor X1 (511) or Adaptor X2 (535).
- Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
- Screw in four screws (560) at both sides of the front panel.
- Connect RF cable W1 (515) and RF cable W2 (538) at R&S ZVL13-Bridge (442).
- Screw in the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

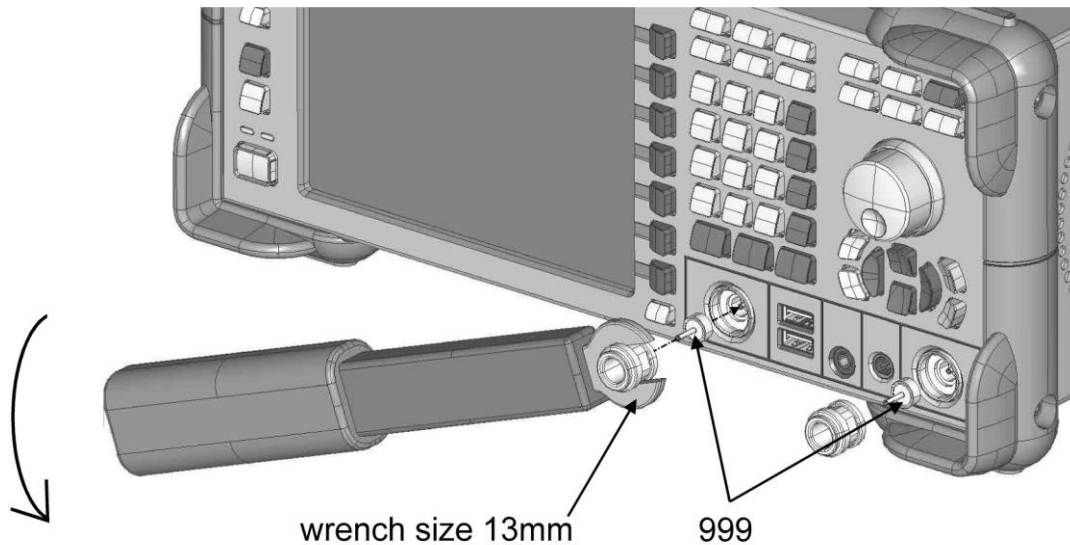
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- Perform a frequency response correction as described in chapter 2 "Adjustment".
- Perform a calibration as described in chapter 1 "Performance Test".
- Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing Testport Adapter Insert 75Ω (only ZVL3 - 75Ω)

(See chapter 5, spare parts list, items 999.

Removing the Testport Adapter Insert

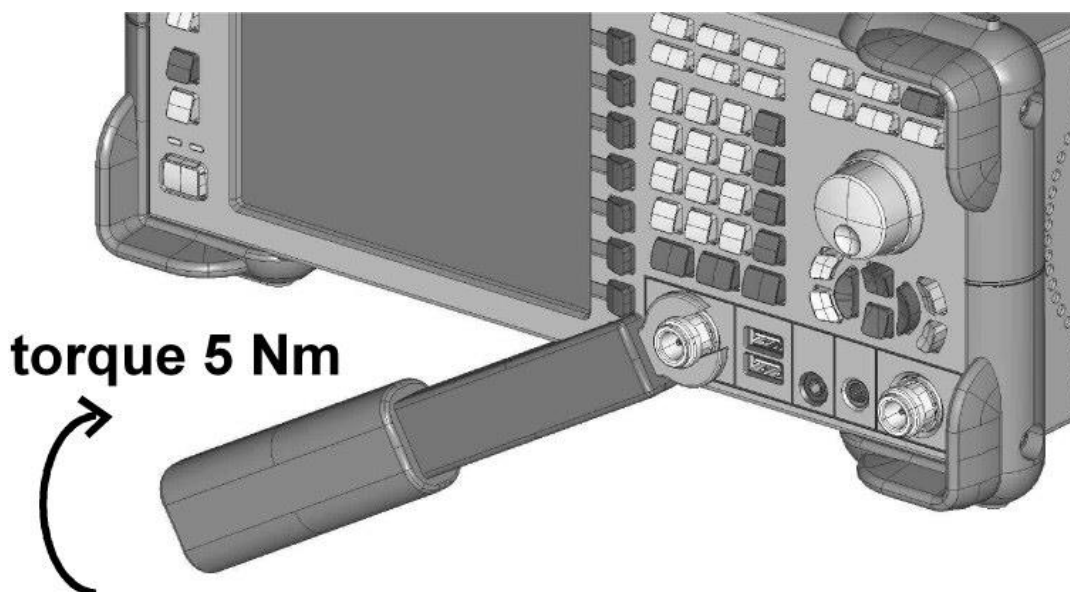
- Switch off the instrument and disconnect the power plug.
- Remove the Testport Adapter head by using a [spanner wrench](#) size 13 mm.



Remove the Testport Adapter Insert 75 Ohm (999).

Installing the New Testport Adapter Insert

- Mount the new Testport Adapter Insert (999) into the connector.
- Screw in the Testport Adapter head by using a torque wrench (torque 5 Nm)!

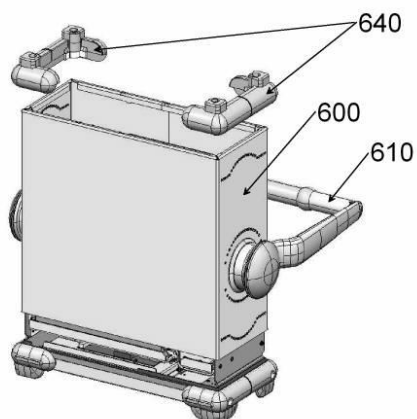


Replacing the Power Supply

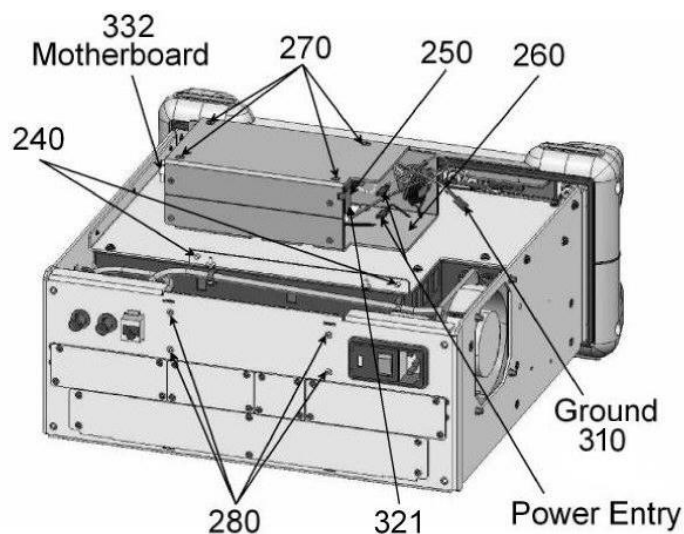
(See chapter 5, spare parts list, item 250, and explosion drawings 1300.2525.01 sheet 3+4)

Opening the Instrument and Removing the Power Supply

- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Disconnect cables to ground, motherboard and power entry.
- Unscrew the two combination screws (240) at the bottom of the instrument.
- Unscrew the four screws (280) at the rear of the instrument and remove the power supply (250) with holder (260) and cables to the bottom of the instrument.
- Disconnect cables (310, 321, 332) at the power supply (250).
- Unscrew the four combination screws (270) from inside of power supply holder (260) and remove the power supply (250).



Installing the New Power Supply

- Mount the new power supply (250) with four combination screws (270) into the holder (260)
- Connect cables (310, 321, 332) to the power supply (250).
- Mount the power supply (250) with holder (260) and cables into the instrument with four screws (280) at the rear of the instrument.
- Screw the two combination screws (240) at the bottom of the instrument.
- Connect cables to ground, motherboard and power entry.

Note: *Connect the blue and the black wires to either of the two outside plugs of the power entry.*

- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.

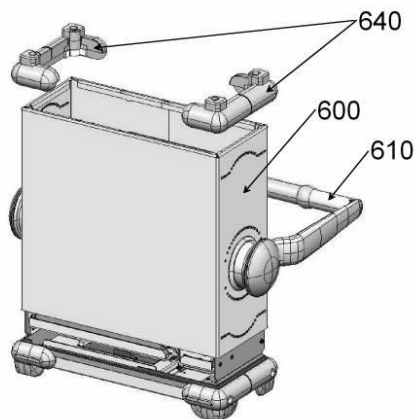
- Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the Fan

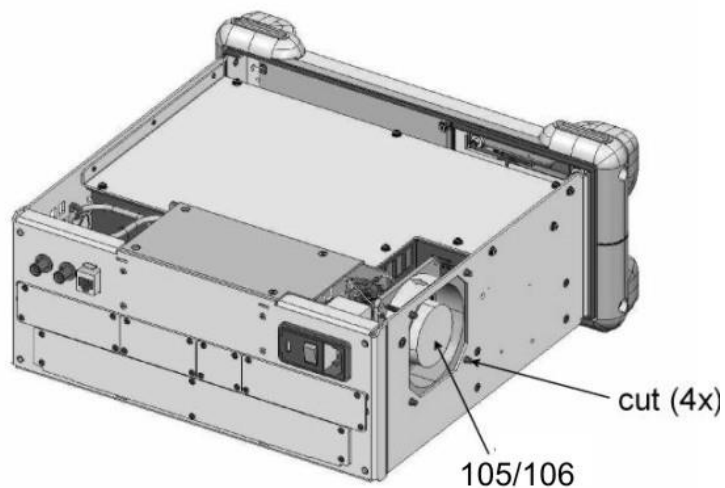
(See chapter 5, spare parts list, item 105/106, and explosion drawings 1300.2525.01 sheet 3+4)

Opening the Instrument and Removing the Power Supply

- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Remove the fan (105/106) from the instrument frame.
- Disconnect the fan cable at the motherboard connector X35 (FAN).



Installing the New Fan and Completing the Instrument

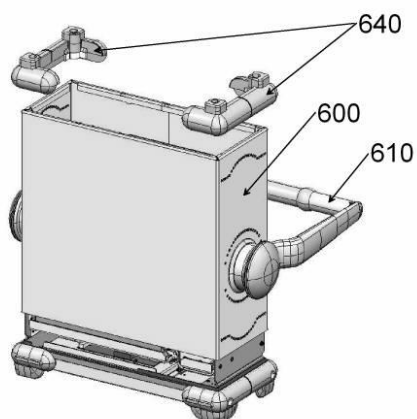
- Connect the fan cable at the motherboard connector X35 (FAN).
- Insert the new fan (105/106) and mount it to the frame with the rubber studs.
Note: *Please note the direction of the airflow printed on the fan. The fan must blow the cold air into the instrument.*
Make sure to route the cables with enough space to the fan.
- Cut the rubber studs outside the frame.
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the VGA Board A95

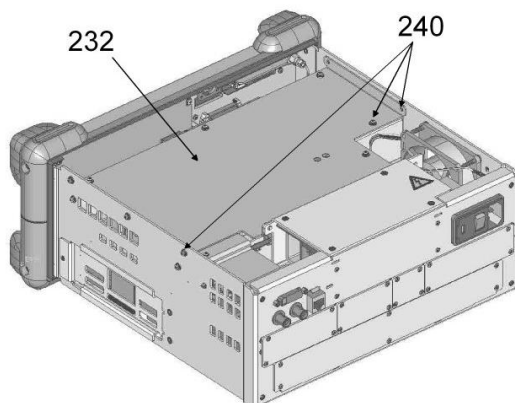
(See chapter 5, spare parts list, item 370, and explosion drawings 1300.2525.01 sheet 1, 2, 4)

Opening the Instrument and Removing the VGA Board

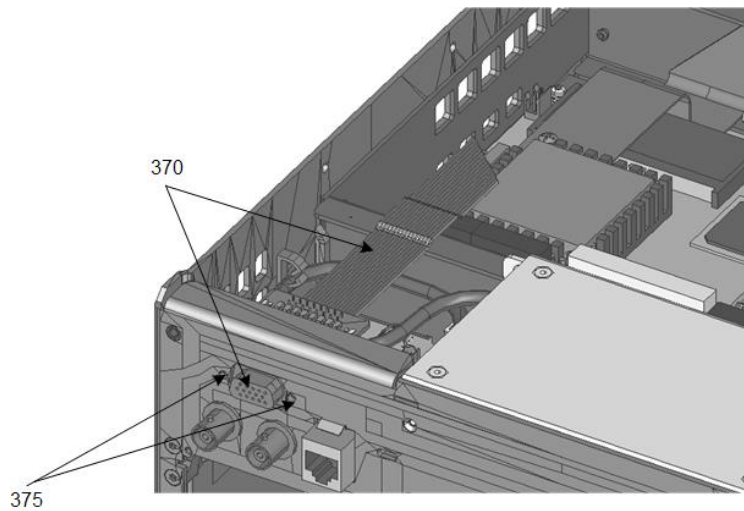
- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side. Remove the cover (231 or 232) to the bottom of the instrument.



- Remove both lockingscrews (375) from the instrument frame.
- Disconnect cable VGA board (370) at controller (162) and remove VGA board (370).



Installing the New VGA Board and Completing the Instrument

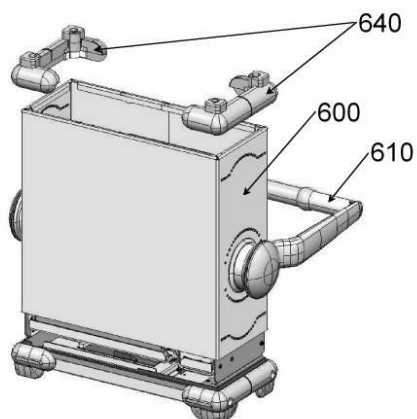
- Mount the new VGA board (370) with two lockingscrews (375) into the instrument frame.
- Connect cable VGA board (370) to controller (162)
- Remount the cover (232) to the bottom of the instrument. Screw the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side.
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- Check the VGA connector by using an external monitor.
- Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the R&S ZVL-Bridge A200

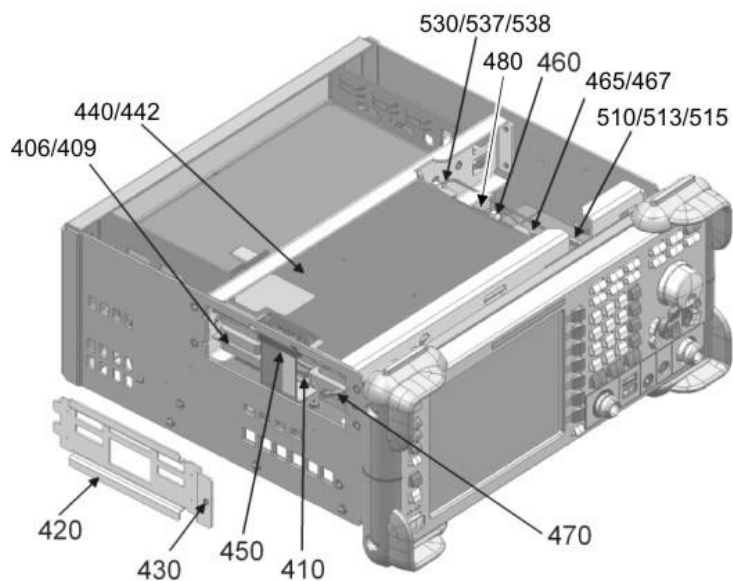
(See chapter 5, spare parts list, item 440/442 and explosion drawings 1300.2525.01 sheet 3+4)

Opening the Instrument and Removing the Board

- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew one screw (430) and remove the locking plate (420).
- Disconnect RF cable W1 (510/513/515), W2 (530/537/538), W6 (460), W7 (465/467), W8 (470) and W12 (480) (only ZVL13) at R&S ZVL-Bridge (440/442).
- Disconnect data cable W10 (450) at the R&S ZVL-Bridge board (440/442).
- Push out board to the left side of the instrument.



Installing the new R&S ZVL-Bridge board and completing the Instrument

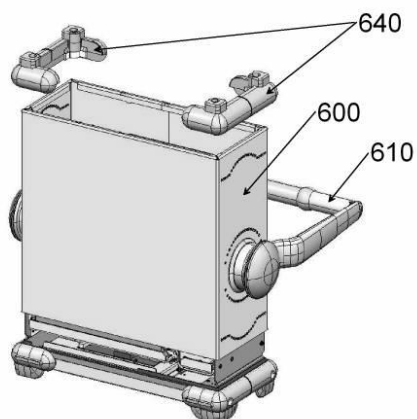
- Plug the new R&S ZVL-Bridge board into the instrument and reconnect data cable W10 (450) to the board.
- Connect RF cable W8 (470) to R&S ZVL-Bridge (440/442).
- Mount the locking plate (420) with one screw (430).
- Connect RF cable W1 (510/513/515), W2 (530/537/538), W6 (460), W7 (465/467) and W12 (480) (only ZVL13) to R&S ZVL-Bridge (440/442).
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- A cold boot is necessary after replacing the R&S ZVL-Bridge.
See "Performing a Cold Boot" section in this chapter.
- Perform a frequency response correction using the correction software.
- Calibrate the instrument as described in chapter 1.
 - Check basic functions of the R&S®R&S ZVL. See chapter: Functional test

Replacing the R&S ZVL-Frontend A100

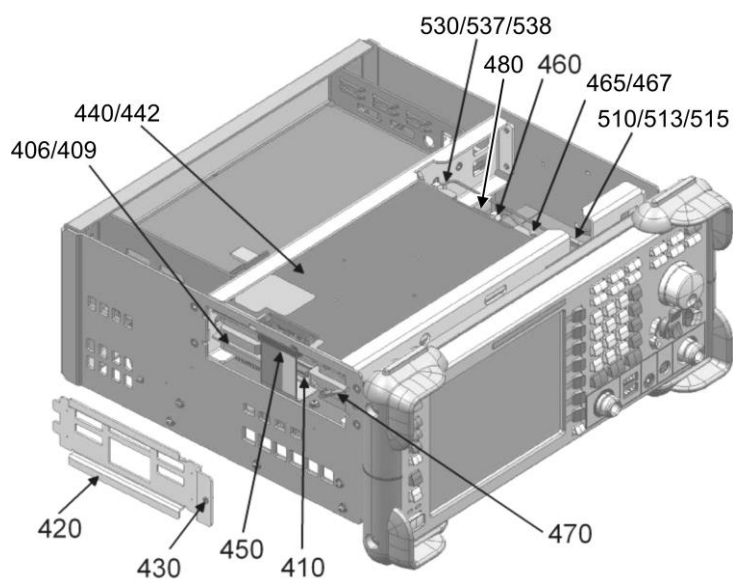
(See chapter 5, spare parts list, item 406 and explosion drawings 1300.2525.01 sheet 3+4)

Opening the Instrument and Removing the Board

- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew one screw (430) and remove the locking plate (420).
- Disconnect RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442), W6 (460), W7 (465/467), W8 (470) and W12 (480) (only ZVL13) at R&S ZVL-Frontend (406/409).
- Disconnect data cable W10 (450) at the R&S ZVL-Bridge board (440/442) and data cable W4 (410) at the R&S ZVL-Frontend (406/409).
- Push out board to the left side of the instrument.



Installing the new R&S ZVL-Frontend board and completing the Instrument

- Plug the new R&S ZVL-Frontend board into the instrument and reconnect data cable W4 (410) to the frontend board (406/409) and data cable W10 (450) to the R&S ZVL-Bridge board (440/442).
- Connect RF cable W8 (470) to R&S ZVL-Frontend (406/409).
- Mount the locking plate (420) with one screw (430).
- Connect RF cable W2 (530/537/538) to R&S ZVL-Bridge (440/442), W6 (460), W7 (465/467) and W12 (480) (only FSL13) to R&S ZVL-Frontend (406/409).
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- A cold boot is necessary after replacing the R&S ZVL-Frontend.
See "Performing a Cold Boot" section in this chapter.
 - Perform a frequency response correction using the correction software R&S ZVL-Service.
- Calibrate the instrument as described in chapter 1.
 - Check basic functions of the R&S®R&S ZVL. See chapter: Functional test

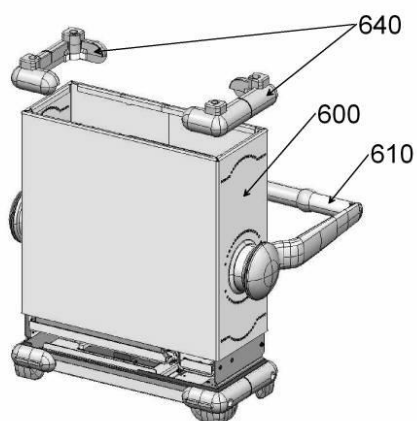
Replacing the Motherboard A10

(See chapter 5, spare parts list, item 112, and explosion drawings 1300.2525.01 sheet 3+4)

Note: Do not replace the motherboard and the flash card at the same time. If the instrument does not allow you to enter the service function, do not replace also the flash card. In this case, reinstall the old motherboard and then replace the flash card.

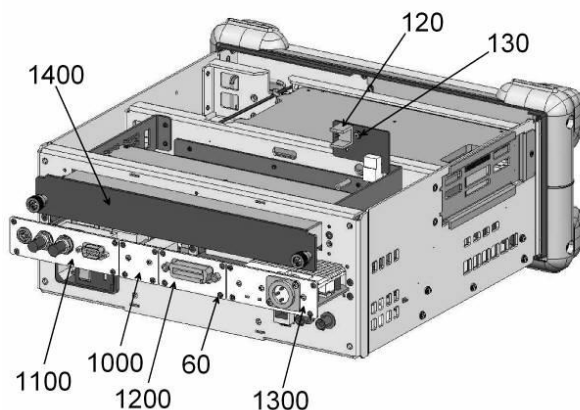
Opening the Instrument

- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



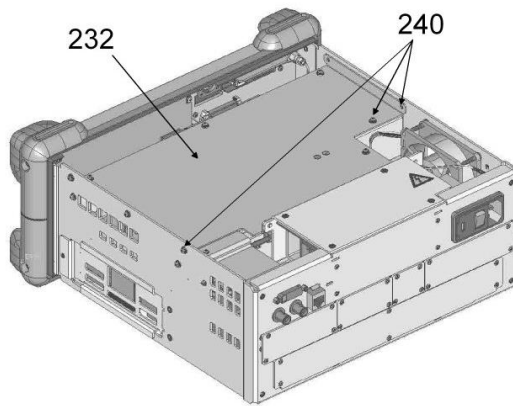
Removing Hardware Options and Battery Adapter

- Unscrew four screws (60) at every option and remove the OCXO board (1000), additional interface (1100), IEC/IEEE bus (1200) and DC power supply (1300) to the rear of the instrument.
- Unscrew two thumbscrews and remove the battery pack option (1400) to the rear of the instrument.
- Unscrew the two combination screws (130) and remove the battery adapter (120) to the top of the instrument.



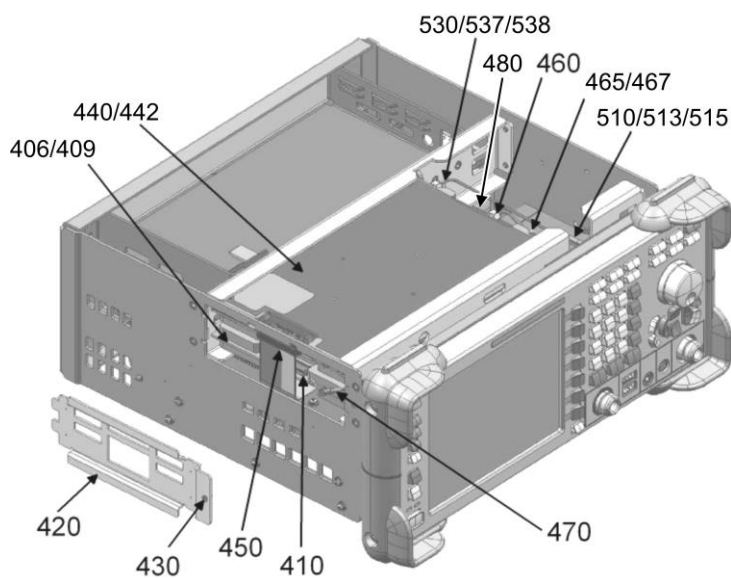
Removing LPC Cover

- Unscrew the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side. Remove the cover (232) to the bottom of the instrument.



Removing the R&S ZVL-Bridge board and R&S ZVL-Frontend board

- Unscrew one screw (430) and remove the locking plate (420).
- Disconnect RF cable W1 (510/513/515) and W2 (530/537/538) at R&S ZVL-Bridge (440/442) and remove W6 (460), W7 (465/467), W8 (470) and W12 (480) (only ZVL13).
- Disconnect data cable W10 (450) at the R&S ZVL-Bridge board (440/442) and data cable W4 (410) at the R&S ZVL-Frontend (406/409).
- Push out both boards to the left side of the instrument.

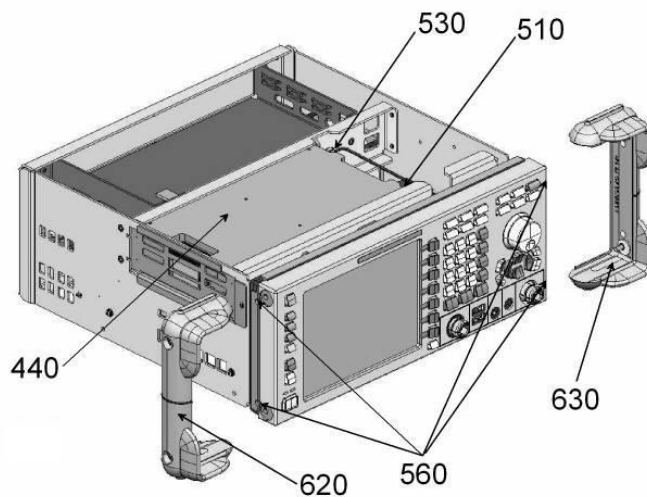


Removing the Front Module

- Unscrew and remove the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.

- Unscrew four screws (560) at both sides of the front panel.

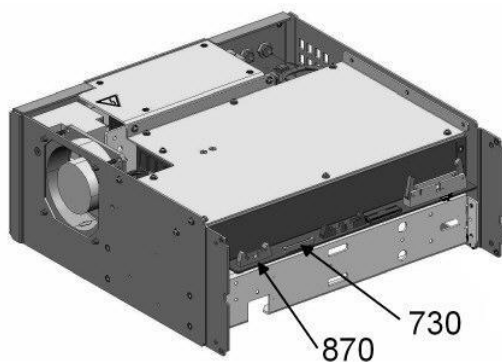


- Remove the front panel to the front of the instrument.

Note: Be aware that the cables are still connected to the motherboard.

- Pull off the connecting cables to front connector (870) and flexible switchboard (730).

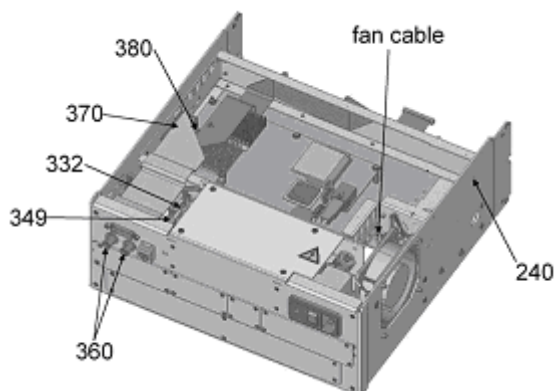
Note: When pulling off the connecting cables, be careful with the flexible switchboard (730). It is a film cable which can only be disconnected after sliding up the lock of the film cable plug.



- Place the front module on a clean surface.
- Remove ribbon cable (380) at LVO Displayconnector (940).

Disconnecting Cables

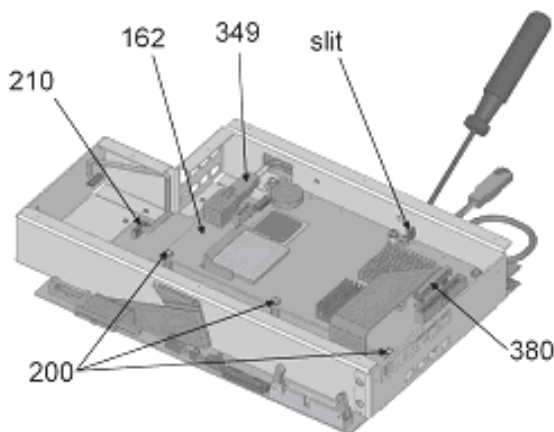
- Disconnect the fan cable at the motherboard connector X35 (FAN)
- Disconnect the LAN cable RJ45 (349) at the rear panel coupler (340).
- Disconnect both cable W3 (360) and power supply cable (332) at the motherboard.
- Disconnect cable VGA board (370) and displaycable (380) at controller (162).



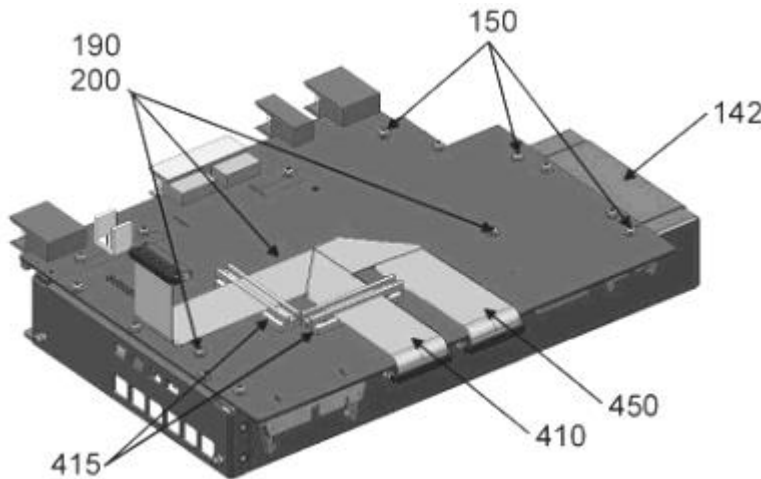
Removing the Motherboard

- Unscrew the three combination screws (240), two combination screws 240) at the left-hand side and one combination screw (240) at the right-hand side.
- Remove the motherboard (112) including LPC shielding box (142) and controller (162) to the bottom of the instrument.
- Disconnect cable 10pin (210) and LAN cable RJ45 (349) at controller (162).
- Unscrew six combination screws (200) and remove the controller (162).

Note: The force needed to disconnect the controller connector of the motherboard is high. Pulling the controller to the bottom is best done by means of the slits. Using a flat, blunt tool, carefully push the board step by step to the bottom. Do not insert the tool too deep into the slits!



- Unscrew 15 combination screws (150) and remove the LPC shielding box (142) from motherboard.
- Disconnect and remove cable 10pin (210), data cable W10 (450) and data cable W4 (410) from motherboard.
- Unscrew 3 combination screws (200) and remove 3 spacer (190).



Installing the New Motherboard

- Mount the 3 spacer (190) with 3 combination screws (200).
- Mount the LPC shielding box (142) with 15 combination screws (150) to motherboard.
- Connect cable 10pin (210).
- Carefully plug the controller (162) to the motherboard and fasten it using the six combination screws (200).
- Connect LAN cable (349) and cable LVO-LPC (380) to the controller (162).
- Mount the motherboard unit to the instrument and screw in three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side of the instrument.
- Connect cable VGA board (370) to controller (162).
- Connect both W3 cables (360), the power supply cable (332) and the fan cable to the motherboard.
- Connect the RJ45 LAN cable (349) to the rear panel coupler (340) and the controller (162).
- Mount the cover (232) to the bottom of the instrument. Screw in the nine combination screws (240) at the bottom of the instrument, three combination screws (240) at the left-hand side and two combination screws (240) at the right-hand side.
- Mount the battery adapter (120) with two combination screws (130).
- Remount all hardware options into the instrument.
- Connect data cable W4 (410) and data cable W10 (450) to the motherboard and secure it using two cable holders (415).
- Plug the R&S ZVL-Bridge board and R&S ZVL-Frontend board into the instrument and reconnect data cable W4 (410) to the frontend board (406/409) and data cable W10 (450) to the R&S ZVL-Bridge board (440/442).
- Connect RF cable W8 (470) to R&S ZVL-Frontend (406/409) and R&S ZVL-Bridge (440/442).

- Mount the locking plate (420) with one screw (430).
- Connect RF cable W6 (460), W7 (465/467), W12 (480) (only ZVL13) to R&S ZVL-Frontend (406/409) and R&S ZVL-Bridge (440/442).
- Connect ribbon cable (380) to LVO Displayconnector (940) at front panel.
- Replace the front panel and pull on the cables to front connector (870) and flexible switchboard (730).
- Screw in four screws (560) at both sides of the front panel.
- Connect RF cable W1 (510/513/515) and RF cable W2 (530/537/538) at R&S ZVL-Bridge (440/442).
- Screw the two front-panel feet (620, 630) (designation: BW2-shock mount.front).

Note: *Foot (620) is only for the left-hand side, and foot (630) is only for the right-hand side of the instrument.*

- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).

Putting into Operation

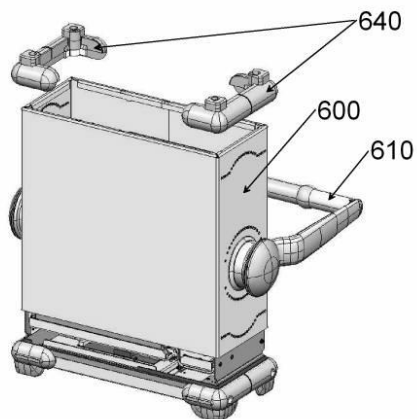
- Connect the instrument to the mains and switch on the instrument power switch. The instrument is now in standby mode.
- **No cold boot after replacing the motherboard!**
- Switch on the instrument with the ON/STANDBY key.
- A backup of the EEPROM files must be made with the aid of a service function.
 - [SETUP : MORE : SERVICE : ENTER PASSWORD : 20122004 ENTER]
 - [SETUP : MORE : SERVICE : SERVICE FUNCTION : 10.0.3 ENTER]
- Check basic functions of the R&S ZVL. See chapter: Functional test

Replacing the Battery Adapter Board

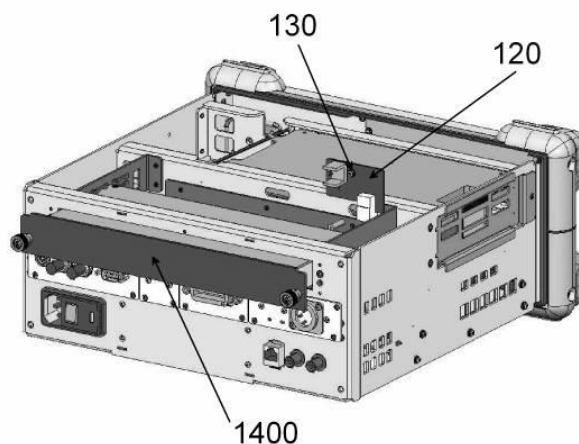
(See chapter 5, spare parts list, item 120, and explosion drawings 1300.2525.01 sheet 3+4)

Opening the Instrument and Removing the Battery Adapter

- Switch off the instrument and disconnect the power plug.
- Unscrew and remove the two rear-panel feet (640) (designation: BW2-shock mount.rear).
- Push the enclosure (600) with handle (610) backwards and remove it.



- Unscrew two thumbscrews and remove the battery pack option (1400) to the rear of the instrument.
- Unscrew the two combination screws (130) and remove the battery adapter (120) to the top of the instrument.



Installing the New Battery Adapter and Completing the Instrument

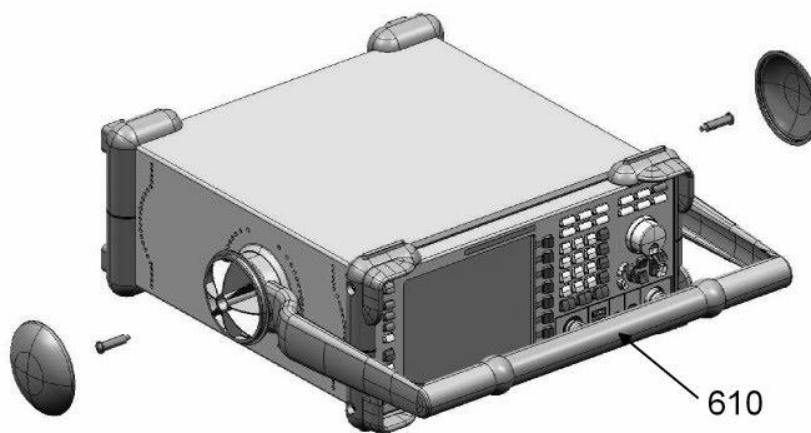
- Mount the new battery adapter (120) with two combination screws (130).
- Mount the battery pack option back into the instrument.
- Replace the enclosure (600) with handle (610) and push it back to the instrument.
- Mount and screw in the two rear-panel feet (640).
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.

Replacing the Swivel Handle

(See chapter 5, spare parts list, item 610, and explosion drawings 1300.2525.01 sheet 3)

Removing the Handle

- Switch off the instrument and disconnect the power plug.
- Remove the blue cover on both sides.
- Unscrew and remove the swivel handle (610).



Installing the New Handle

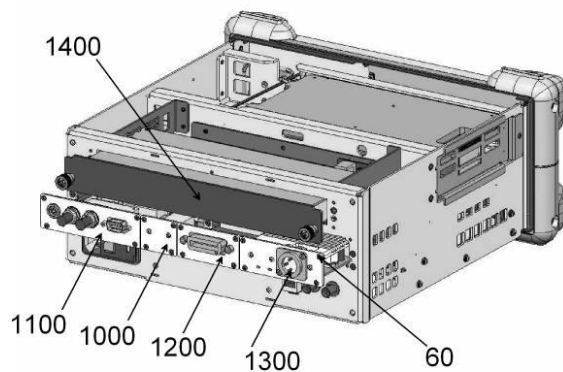
- Remove the blue cover on both sides of the new handle.
- Mount and screw the handle (610) to the instrument.
- Mount both blue covers.

Replacing the OCXO Board (Option R&S FSL-B4)

(See chapter 5, spare parts list, item 1000, and explosion drawings 1300.2502.01.)

Removing the OCXO Board

- Switch off the instrument and disconnect the power plug.
- Unscrew four screws (60) and remove the OCXO board (1000) to the rear of the instrument.



Installing the New OCXO Board and Completing the Instrument

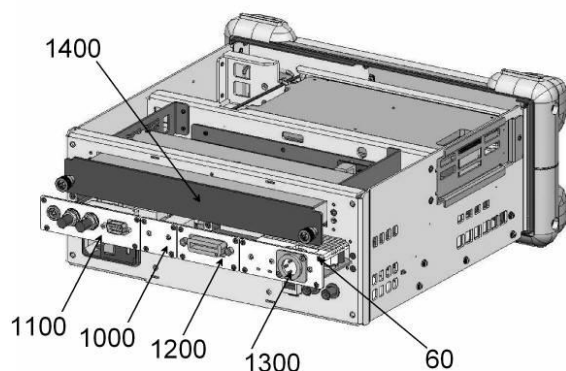
- Mount the new OCXO board (1000) with four screws (60) to the rear of the instrument.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
 - Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the Additional Interface (Option R&S FSL-B5)

(See chapter 5, spare parts list, item 1100, and explosion drawings 1300.2502.01.)

Removing the Additional Interface

- Switch off the instrument and disconnect the power plug.
- Unscrew four screws (60) and remove the additional interface (1100) to the rear of the instrument.



Installing the New Additional Interface and Completing the Instrument

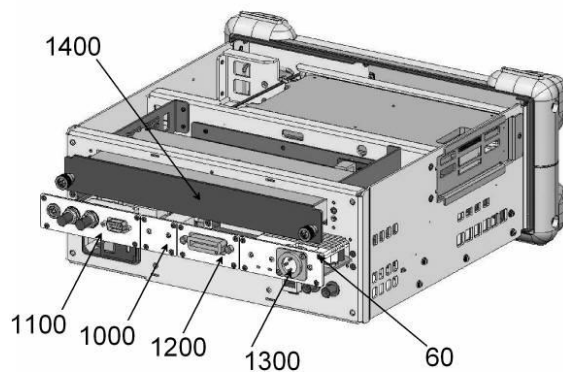
- Mount the new additional interface (1100) with four screws (60) to the rear of the instrument.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
 - Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the IEC/IEEE Bus Board (Option R&S FSL-B10)

(See chapter 5, spare parts list, item 1200, and explosion drawings 1300.2502.01.)

Removing the IEC/IEEE Bus Board

- Switch off the instrument and disconnect the power plug.
- Unscrew four screws (60) and remove the IEC/IEEE bus board (1200) to the rear of the instrument.



Installing the New IEC/IEEE Bus Board and Completing the Instrument

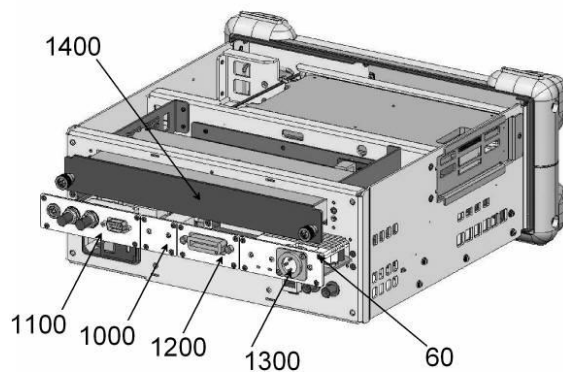
- Mount the new IEC/IEEE bus board (1200) with four screws (60) to the rear of the instrument.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
- This option is not listed in the table hardware info.
 - Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the DC Power Supply (Option R&S FSL-B30)

(See chapter 5, spare parts list, item 1300, and explosion drawings 1300.2502.01.)

Removing the DC Power Supply

- Switch off the instrument and disconnect the power plug.
- Unscrew four screws (60) and remove the DC power supply (1300) to the rear of the instrument.



Installing the New DC Power Supply and Completing the Instrument

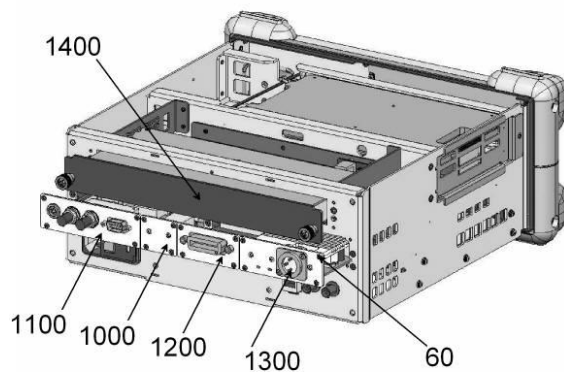
- Mount the new DC power supply (1300) with four screws (60) to the rear of the instrument.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
 - Check basic functions of the R&S®ZVL. See chapter: Functional test

Replacing the Battery Pack (Option R&S FSL-B31)

(See chapter 5, spare parts list, item 1400, and explosion drawings 1300.2502.01)

Removing the Battery Pack

- Switch off the instrument and disconnect the power plug.
- Unscrew two thumbscrews and remove the battery pack (1400) to the rear of the instrument.



Installing the new Battery Pack and completing the Instrument

- Mount the new battery pack (1400) with two thumbscrews to the rear of the instrument.
- Connect the instrument to the mains, switch on the instrument power switch and switch on the instrument with the ON/STANDBY key.
 - Check basic functions of the R&S ZVL. See chapter: Functional test

Functional test

After repair or installing new hardware, we recommend to check basic functions of the R&S®ZVL.

- After starting the instrument, check whether the option is listed in table hardware info:
 - [**SETUP** : MORE : SYSTEM INFO : HARDWARE INFO]
- Start self test and check results: (only with Option R&S ZVL-K1)
 - [**MODE** : Spectrum Analyzer]
 - [**SETUP** : MORE : SERVICE : SELFTEST], then [SELFTEST RESULTS]
- Start alignment and check the result: (only with Option R&S ZVL-K1)
 - [**MODE** : Spectrum Analyzer]
 - [**SETUP** : ALIGNMENT : SELF ALIGNMENT], then [SHOW ALIGN RESULTS]
- Connect open standard of the calibration kit (e.g. R&S ZV-Z21) to PORT 1
 - [**PRESET**]
 - [**PWR BW** : Meas Bandwidth :1 kHz]
 - [**MEAS** : S11]
 - [**SCALE** : Scale/Div : **1 dB**]

Tolerance of measured value 300 kHz to 6 GHz: 0 dB $\pm$ 2 dB

- [**FORMAT** : Phase]
- [**MKR** : 100 MHz]

Tolerance of read out marker value @100 MHz: $-4^{\circ} \pm 5^{\circ}$

- Connect open standard of the calibration kit (e.g. R&S ZV-Z21) to PORT 2
 - [**PRESET**]
 - [**PWR BW** : Meas Bandwidth :1 kHz]
 - [**MEAS** : S22]
 - [**SCALE** : Scale/Div : **1 dB**]

Tolerance of measured value 300 kHz to 6 GHz: 0 dB $\pm$ 2 dB

- [**FORMAT** : Phase]
- [**MKR** : 100 MHz]

Tolerance of read out marker value @100 MHz: $-4^{\circ} \pm 5^{\circ}$

- Connect short standard of the calibration kit (e.g. R&S ZV-Z21) to PORT 1
 - [**PRESET**]
 - [**PWR BW** : Meas Bandwidth : 1 kHz]
 - [**MEAS** : S11]
 - [**SCALE** : Scale/Div : **1 dB**]

Tolerance of measured value 300 kHz to 6 GHz: 0 dB $\pm$ 2 dB

- [**FORMAT** : Phase]
- [**MKR** : 100 MHz]

Tolerance of read out marker value @100 MHz: $+177^{\circ} \pm 5^{\circ}$

- Connect short standard of the calibration kit (e.g. R&S ZV-Z21) to PORT 2
 - [**PRESET**]
 - [**PWR BW** : Meas Bandwidth :1 kHz]
 - [**MEAS** : S11]
 - [**SCALE** : Scale/Div : **1 dB**]

Tolerance of measured value 300 kHz to 6 GHz: 0 dB $\pm$ 2 dB

- [**FORMAT** : Phase]
- [**MKR** : 100 MHz]

Tolerance of read out marker value @100 MHz: +177° $\pm$ 5°

- Connect match standard of the calibration kit (e.g. R&S ZV-Z21) to PORT 1
 - [**PRESET**]
 - [**PWR BW** : Meas Bandwidth :1 kHz]
 - [**MEAS** : S11]
 - [**SCALE** : Scale/Div : **1 dB**]

Tolerance of measured value 300 kHz to 6 GHz: < -20 dB

- Connect match standard of the calibration kit (e.g. R&S ZV-Z21) to PORT 2
 - [**PRESET**]
 - [**PWR BW** : Meas Bandwidth :1 kHz]
 - [**MEAS** : S22]
 - [**SCALE** : Scale/Div : **1 dB**]

Tolerance of measured value 300 kHz to 6 GHz: < -20 dB

- Connect PORT 1 to PORT 2 with RF cable (e.g. R&S ZV-Z91)
 - [**PRESET**]
 - [**PWR BW** : Meas Bandwidth :1 kHz]
 - [**MEAS** : S21]
 - [**SCALE** : Scale/Div : **1 dB**]

Tolerance of measured value 300 kHz to 6 GHz: 0 dB $\pm$ 2 dB

Troubleshooting

Malfunctions may have simple causes but also may be caused by faulty components.

These troubleshooting instructions enable you to locate error causes down to board level and make the instrument ready for use again by means of board replacement.

We recommend that the instrument be shipped to our experts in the service centers (see address list) for module replacement and further error elimination.

DANGER



Danger of shock hazard
Disconnect boards from the AC supply before you plug or unplug them!
Be careful not to cause short-circuits when measuring voltages!

The following utilities are provided in the R&S ZVL for diagnostic purposes:

Permanent monitoring of levels and frequencies in the instrument

Self test

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	Calibration kit		R&S ZV-Z21	1085.7099.02	only for recommended functional test
3	RF cable		R&S ZV-Z91	1301.7572.25	only for recommended functional test

Troubleshooting Start-up Problems

Error: R&S ZVL cannot be switched on.

- Check power-on switch at the rear.
If the power switch is OFF: Switch on power supply.
- Measure voltages on the power supply connector, if the power supply starts, but the screen remains dark:

Pin 1	rated value: +12 V
Pin 2	rated value: +5.2 V
Pin 3	rated value: +5.2 V
Pin 4	rated value: GND
Pin 5	rated value: GND
Pin 6	rated value: -12 V

Error: Fan does not work.

- Check voltage at connector:
X35 pins 1+ 3 : rated value 6 V to 12 V
 - voltage o.k.: fan is defective
 - voltage too low: fan is blocked or power consumption too high

Troubleshooting Problems with Boot Process

Error: R&S ZVL does not start the measurement application.

The R&S ZVL performs the following operations after you have turned it on (in consecutive order). Only if all operations have been processed correctly can you use the R&S ZVL.

In case you have to resolve any problems, it is recommended to connect and use a keyboard and mouse to the USB interfaces.

- **Hardware initialization and selftest**
The BIOS initializes the hardware components of the R&S FSL and performs a self test of the hardware. If the BIOS detects errors in the hardware, for example in the main memory, it aborts the boot process and shows a corresponding error message.
- **Starting the operating system (Windows XP)**
If the hardware works correctly, the BIOS starts the operating system. The R&S FSL uses Windows XP as the operating system.

If the flash disk that contains the operating system is broken, the system shows an error message before it begins to initialize the operating system. In that case, the flash disk has to be replaced.

During initialization, the operating system performs a self test to check if all necessary software components work correctly. If the operating system detects any errors it aborts the boot process and shows a corresponding error message (for example a "blue screen").

- **Starting the firmware (measurement application) of the R&S FSL**
Finally, the R&S FSL starts the instrument firmware that contains the measurement application.

If the firmware does not start or not start correctly, a cold start or firmware update may be necessary.

For more information on how to perform a cold start see chapter "Performing a Cold Boot" above.

For more information on how to update the firmware, refer to the Quick Start Guide.

Chapter 4 "Firmware Update/Installation of Options"

The update of the R&S ZVL firmware is described in chapter 1 of the Quick Start Guide.

Installation instructions for R&S ZVL options are available for download on the internet.

Please visit our homepage at <http://www.rohde-schwarz.com>.

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5 Documents

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

Spare Parts

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

CAUTION



Risk of shock hazard and instrument damage

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

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

Available Power Cables

Table 5-1 List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013.00	BS1363: 1967' 10 A 250 V complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12 , 10 A 250 V complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0006.7036.00	Type 498/13 10 A 125 V complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0041.4752.00	GB2099 , GB1002 10 A 250 V approvals CCC	China
DS 0041.6232.00	JIS C 8303 7A 125V AC approvals PSE (JET)	Japan
DS 0006.7107.00	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00	DIN 49 441, 10 A, 250 V, straight approvals VDE,ÖVE,CEBEC,KEMA,S,D,N,FI,LCIE,IMQ,UCIEE	Europe (except Switzerland)
DS 0086.4400.00	DIN 49 441, 10 A, 250 V, angular approvals VDE,ÖVE,CEBEC,KEMA,S,D,N,FI,LCIE,IMQ,UCIEE	



Spare Parts List

List of R&S ZVL parts including spare parts

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

Overall dimension: W x H x L, 408.8 x 158.1 x 465.3

Overall dimension
without handle: W x H x L, 342.3 x 158.1 x 367.0

Rack mount: 3E 3/4 T350

Accessories: 19" Adapter ZZA-S334, Stock No. 1109.4487.00

Note: The recommended spare parts are marked with an x in the last column.

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

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
Drawing 1303.6509.01 (R&S ZVL Network Analyzer)					
20	BASIC UNIT (R&S ZVL3/6)	1300.2525.05	1 S		
22	BASIC UNIT (R&S ZVL3 – 75 OHM)	1300.2525.10	1 S		
24	BASIC UNIT (R&S ZVL13)	1300.2525.13	1 S		
30	LABEL ZVL3	1303.7011.00	1 S		
40	LABEL ZVL6	1303.7028.00	1 S		
45	LABEL ZVL13	1303.7392.00	1 S		
50	REAR PANEL FOR BATTERY	1300.2860.00	1 S		
52	REAR PANEL FOR ADD. INTERFACE	1300.2977.00	1 S		
54	REAR PANEL FOR OCXO	1300.2983.00	1 S		
56	REAR PANEL FOR IEC-BUS	1300.2990.00	1 S		
58	REAR PANEL FOR DC-POWER	1300.2825.00	1 S		
60	SCREW DIN965-M2.5x6-A4-PA	1148.3288.00	22 S		
1000	OCXO (FSL-B4)	1300.3180.02	1 S	A61	X
1100	ADDITIONAL INTERFACE (R&S FSL-B5)	1300.3209.02	1 S	A60	X
1200	IEC-BUS (R&S FSL-B10)	1300.3167.02	1 S	A62	X
1300	DC SUPPLY (R&S FSL-B30)	1300.3238.02	1 S	A63	X
1330	CONNECTOR 3 PINS (R&S FSL-B30)	0520.5048.00	1 S		X

List of R&S ZVL parts including spare parts

R&S ZVL

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
1400	BATTERY PACK (R&S FSL-B31)	1300.6420.00	1 S	A64	X
Drawing 1300.2525.01 sheet 3, sheet 4 (Basic Unit)					
101	FRAME R&S ZVL WITH VGA	1303.7634.00	1 S		
105	FAN 80x80x25 (R&S ZVL3/6/3 – 75 OHM)	1300.2790.00	1 S	E1	X
106	FAN 80x80x25 (R&S ZVL13)	1303.7386.00	1 S	E1	X
112	MOTHERBOARD-UDC	2112.1800.02	1 S	A10	X
120	BATTERY ADAPTER BOARD	1300.3109.02	1 S	A11	X
130	COMBINATION SCREW M2.5x6-A2	1148.3059.00	2 S		
142	LPC SHIELDING BOX / UDC-MB	1303.6880.00	1 S		
150	COMBINATION SCREW M2.5x6-A2	1148.3059.00	18 S		
162	CONTROLLER LPCA	1206.0717.00	1 S	A90	X
169	LITHIUM BATTERY	0858.2049.00	1 S	G1	X
171	FLASH CARD ZVL (LPCA)	1300.4928.03	1 S	A50	X
190	SPACER M2,5x18	1300.4705.00	3 S		
200	COMBINATION SCREW M2.5x6-A2	1148.3059.00	9 S		
210	CABLE 10P AWG26	1300.4463.00	1 S	W6	
232	LPC/DVI COVER	1303.6909.00	1 S		
240	COMBINATION SCREW M2.5x6-A2	1148.3059.00	14 S		
250	POWER SUPPLY	1300.4134.00	1 S	A20	X
260	HOLDER POWER SUPPLY	1300.2625.00	1 S		
265	LABEL (FLASH)	0042.5169.00	1 S		
270	COMBINATION SCREW M2.5x6-A2	1148.3059.00	4 S		
280	SCREW DIN965/ISR-M2.5x6-A4-PA	1148.3288.00	4 S		
289	POWER ENTRY FILTERED	2100.3610.00	1 S	A21	X
291	FUSE	0099.6729.00	2 S		
300	GROUND WIRE 1	1300.2731.00	1 S		
310	GROUND WIRE 2	1300.2748.00	1 S		
321	POWER CABLE	1300.3873.00	1 S		
325	CABLE TIE	0015.9038.00	1 S		

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
332	POWER SUPPLY CABLE 12 PINS	1300.3773.00	1 S		
340	RJ45 COUPLER JACK STRAIGHT	1093.9122.00	1 S	X91	X
342	SILICONE CORD RD 4x8MM	1130.0164.00	1 S		
349	PATCHCABLE CAT 6 0.5M	0041.9283.00	1 S	W8	
351	CABLE HOLDER	1130.0941.00	3 S		
360	CABLE W3	1300.2777.00	2 S	W3	
370	VGA BOARD	1303.7663.02	1 S	A95	X
375	LOCKING SCREW	1093.9180.00	2 S		
380	DISPLAYCABLE LVO-LPC	1303.6915.00	1 S	W41	
385	FLAT CABLE HOLDER	0254.2055.00	2 S		
406	R&S ZVL FRONTEND (R&S ZVL3/6/3 – 75 OHM)	1303.6715.02	1 S	A100	X
409	R&S ZVL13_FRONTEND	1303.7263.02	1 S	A100	X
410	DATA CABLE W4	1300.2783.00	1 S		
415	FLAT CABLE HOLDER	0627.2116.00	2 S		
420	LOCKING PLATE	1300.2654.00	1 S		
430	SCREW DIN965/ISR-M2.5x6-A4-PA	1148.3288.00	1 S		
440	R&S ZVL BRIDGE (R&S ZVL3/6/3 – 75 OHM)	1303.6615.02	1 S	A200	X
442	R&S ZVL13 BRIDGE	1303.7105.02	1 S	A200	X
450	DATA CABLE W10	1303.6667.00	1 S		
460	RF CABLE W6	1303.6673.00	1 S	W6	
465	RF CABLE W7 (R&S ZVL3/6/3 – 75 OHM)	1303.6850.00	1 S	W7	
467	RF CABLE W7 (R&S ZVL13)	1303.7411.00	1 S	W7	
470	RF CABLE W8	1303.6696.00	1 S	W8	
480	RF CABLE W12 (R&S ZVL13)	1303.7428.00	1 S	W12	
502	FRONT PANEL (R&S ZVL3/6/13)	1300.2531.05	1 S		
504	FRONT PANEL (R&S ZVL3 – 75 OHM)	1300.2531.07	1 S		
510	RF CABLE W1 (R&S ZVL3/6)	1300.2754.00	1 S	W1	X
511	ADAPTOR (R&S ZVL13)	0343.0257.00	1 S	X1	X
513	RF CABLE W1 (R&S ZVL3 – 75 OHM)	1303.7292.00	1 S	W1	

List of R&S ZVL parts including spare parts

R&S ZVL

Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
515	RF CABLE W1 (R&S ZVL13)	1303.7534.00	1 S	W1	
520	DIE-CAST SCREW 2.5x6	1300.4457.00	4 S		
530	RF CABLE W2 (R&S ZVL3/6)	1300.2760.00	1 S	W2	X
535	ADAPTOR (R&S ZVL13)	0343.0257.00	1 S	X2	X
537	RF CABLE W2 (R&S ZVL3 – 75 OHM)	1303.7305.00	1 S	W2	
538	RF CABLE W2 (R&S ZVL13)	1303.7540.00	1 S	W2	
540	DIE-CAST SCREW 2.5x6	1300.4457.00	4 S		
560	SCREW DIN965/ISR-M2.5x6-A4-PA	1148.3288.00	4 S		
600	BW2-TUBE 3E3/4T350	1300.2677.00	1 S		
610	BW2-SWIVEL HANDLE 3/4	1096.6501.00	1 S		X
620	BW2-SHOCK MOUNT. FR. LEFT 3HU	1096.6430.00	1 S		X
630	BW2-SHOCK MOUNT. FR. RIGHT 3HU	1096.6447.00	1 S		X
640	BW2-SHOCK MOUNT. REAR 3HU	1096.6460.00	2 S		X
Drawing 1300.2531.01 (FRONT PANEL)					
702	FRONT COVER (R&S ZVL3/6/13)	1303.6650.00	1 S		
704	FRONT COVER (R&S ZVL3 – 75 OHM)	1303.6973.00	1 S		
705	SEALING 2.0 SI	0396.1035.00	0.88 M		
710	SCREENED FILTER GLASS	1300.4311.00	1 S		X
722	PUSH-BUTTON BOARD SET	1303.7005.00	1 S	A11	X
730	FLEXIBLE SWITCHBOARD	1300.4092.00	1 S	A12	X
741	KEYBOARD PANEL	1300.3780.00	1 S		
750	DIE-CAST SCREW 2.5x6	1300.4457.00	9 S		
755	POWDER SEAL	1300.3321.00	1 S		
760	TFT DISPLAY 640x3x480 6.5INCH	0041.6932.00	1 S	A40	X
770	COMBINATION SCREW M2.5x6-A2	1148.3059.00	4 S		
830	ENCODER BOARD	1300.3044.02	1 S	A30	X
840	DIE-CAST SCREW 2.5x6	1300.4457.00	2 S		
850	FLEX-STRIP.10P. R=0.5	1300.4470.00	1 S		
855	COLLAR	0852.1105.00	1 S		

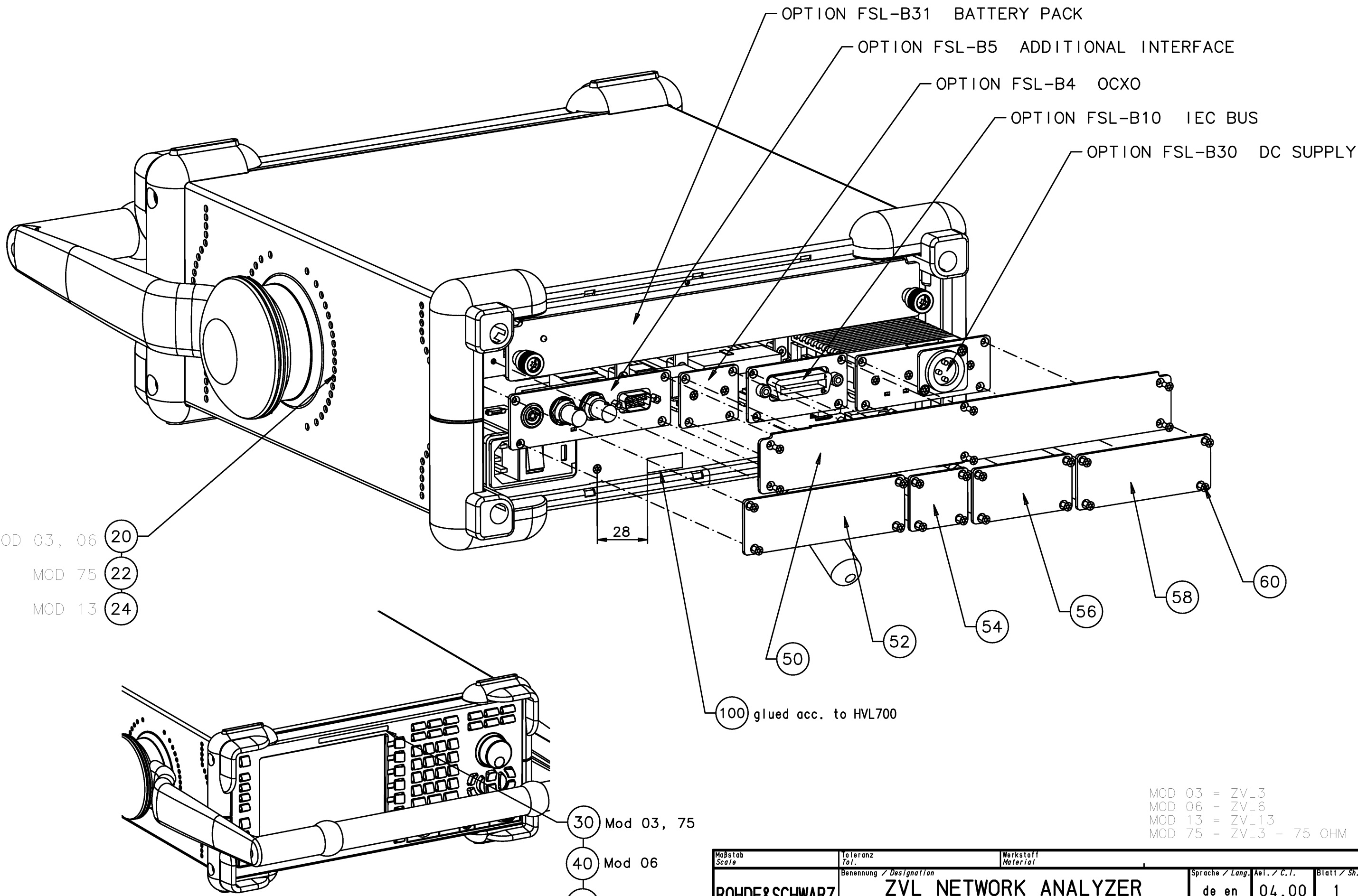
Position	Designation	Stock No.	Number	Electrical designation	Recommended spare parts
860	KNOB	0852.1086.00	1 S		
870	FRONT CONNECTOR	1300.3838.02	1 S	A20	X
880	DIE-CAST SCREW 2.5x6	1300.4457.00	3 S		
890	SHROUD 9.6x13.9	0852.1234.00	1 S		
900	SPRING STRIP	1300.3438.00	2 S		
920	COMBINATION SCREW M2.5x6-A2	1148.3059.00	3 S		
940	LVO DISPLAYCONNECTOR OPTREX	1303.7063.00	1 S	A41	X
960	ABSORBER CLASS PLATE	1300.4992.00	4 S		
999	TESTPORT ADAPTER INSERT 75OHM	1303.7286.00	2 S	X1 / X2	X



Mechanical Drawings

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MOD 03, 06 (20)
MOD 75 (22)
MOD 13 (24)

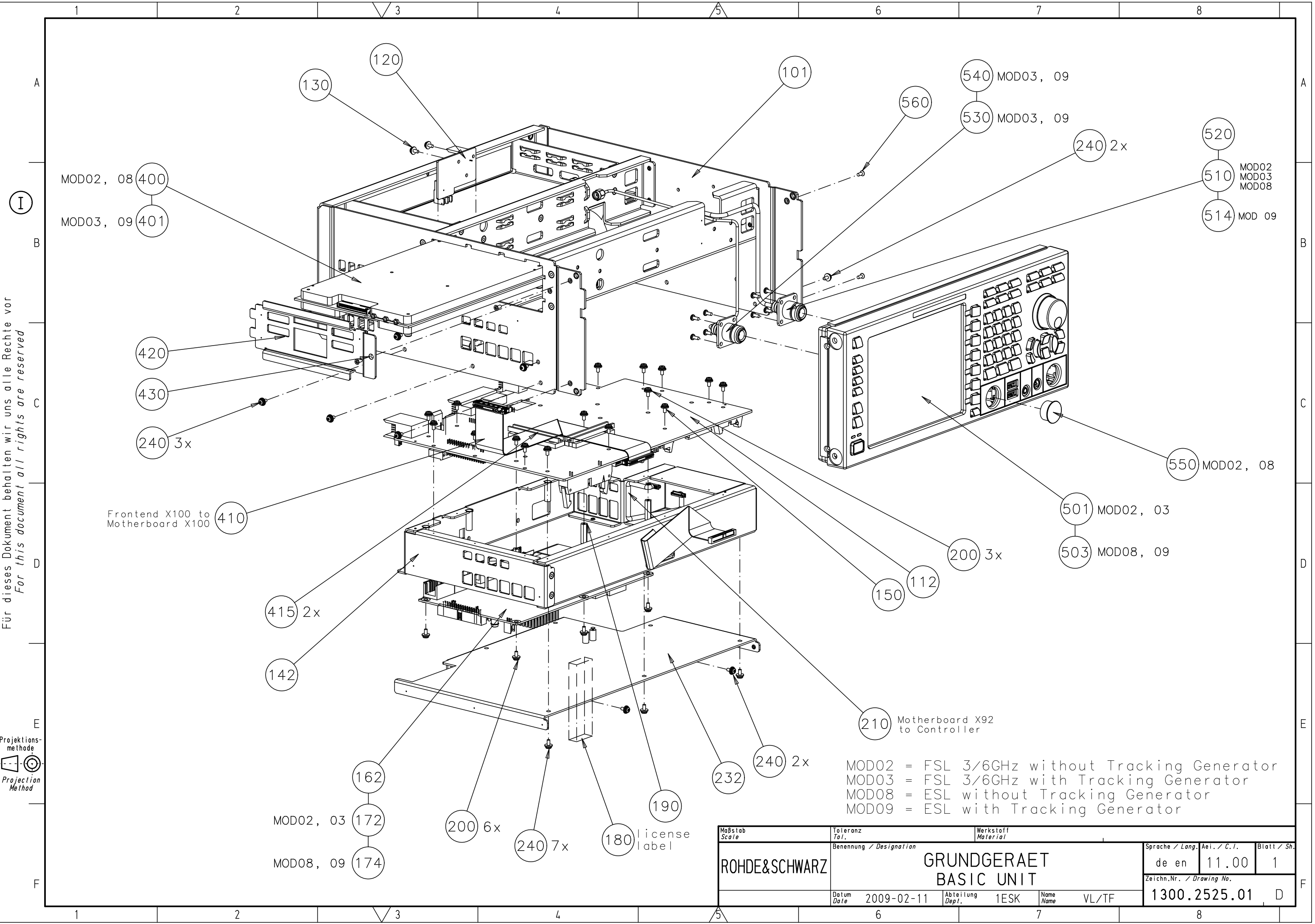
(30) Mod 03, 75
(40) Mod 06
(45) Mod 13

MOD 03 = ZVL3
MOD 06 = ZVL6
MOD 13 = ZVL13
MOD 75 = ZVL3 - 75 OHM

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.		Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	ZVL NETWORK ANALYZER ZVL NETWORK ANALYZER	de en	04.00	1
Datum Date	2012-03-26	Abteilung Dept.	MTEK	Name Name	hm
			Zeichn.Nr. / Drawing No.		
			1303.6509.01 D		

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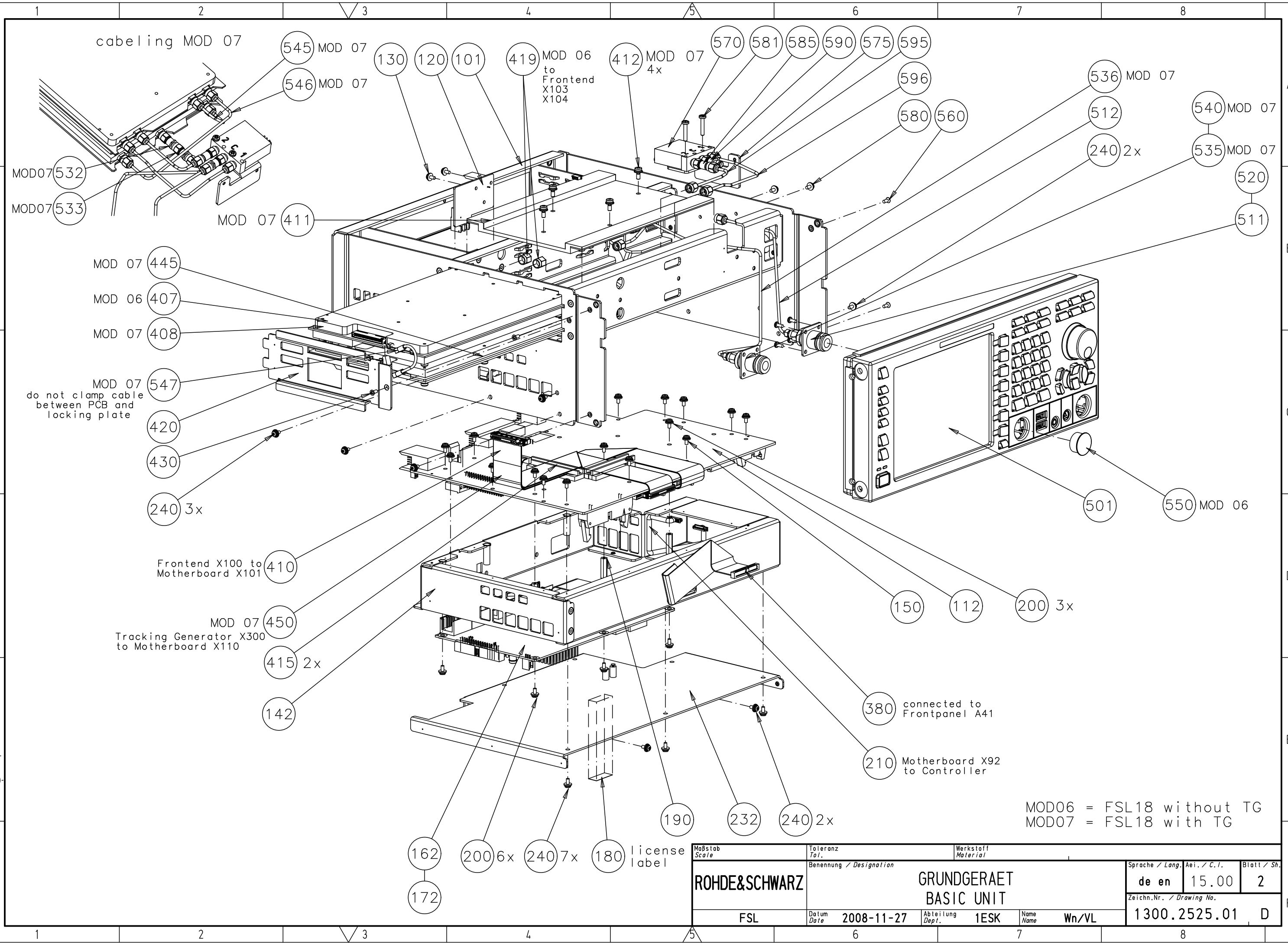
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methode
Projection
Method



Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	GRUNDGERAET BASIC UNIT	de en	11.00	1	
Datum Date	2009-02-11	Abteilung Dept.	1ESK	Name Name	VL/TF	Zeichn.Nr. / Drawing No. 1300.2525.01
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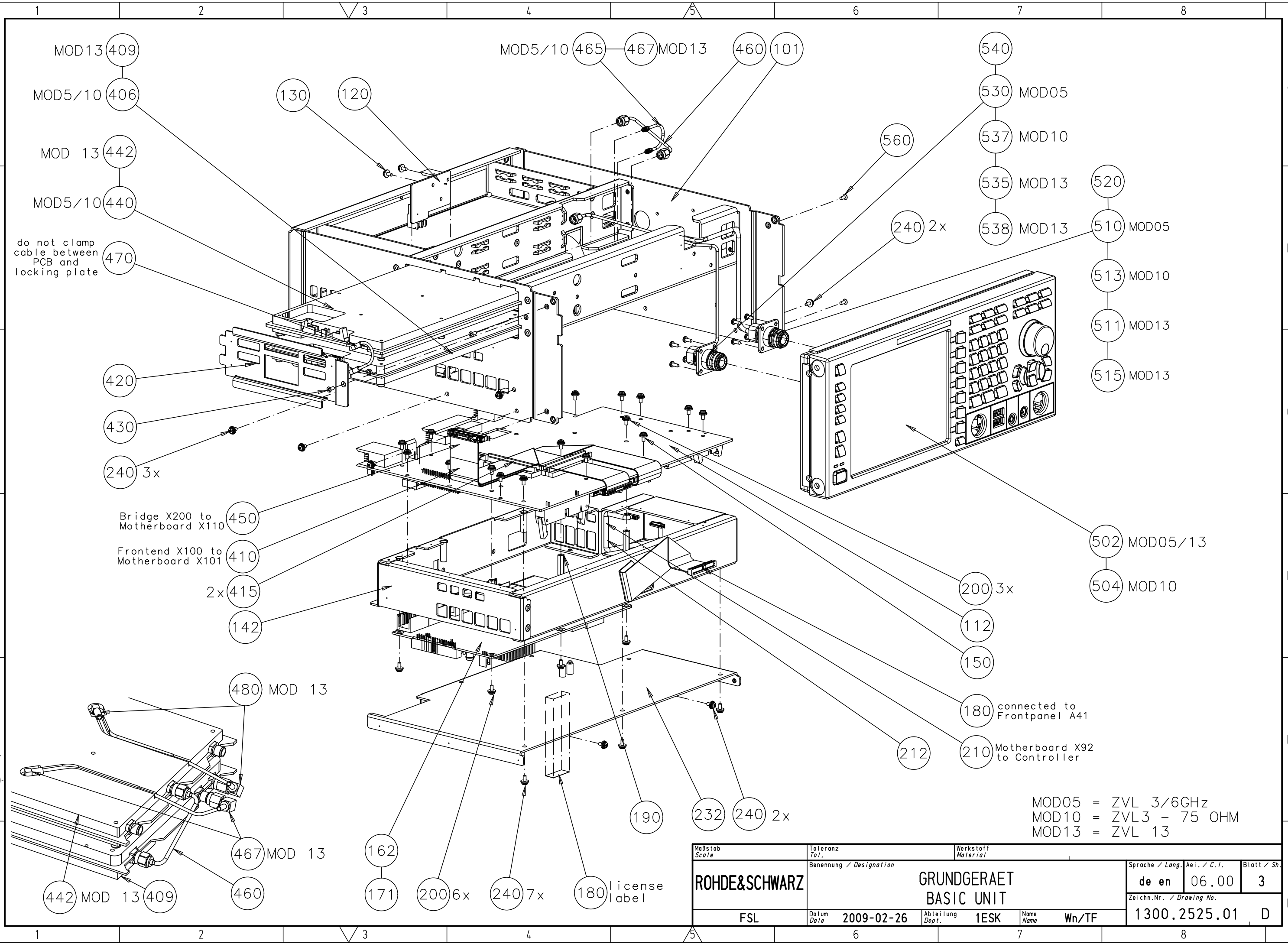


MOD06 = FSL18 without TG
MOD07 = FSL18 with TG

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang.	Aei. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	GRUNDGERAET BASIC UNIT	de en	15.00	2
FSL	Datum Date	2008-11-27	Abteilung Dept.	1ESK	Name Name
				Wn/VL	Zeichn.Nr. / Drawing No.
					1300.2525.01
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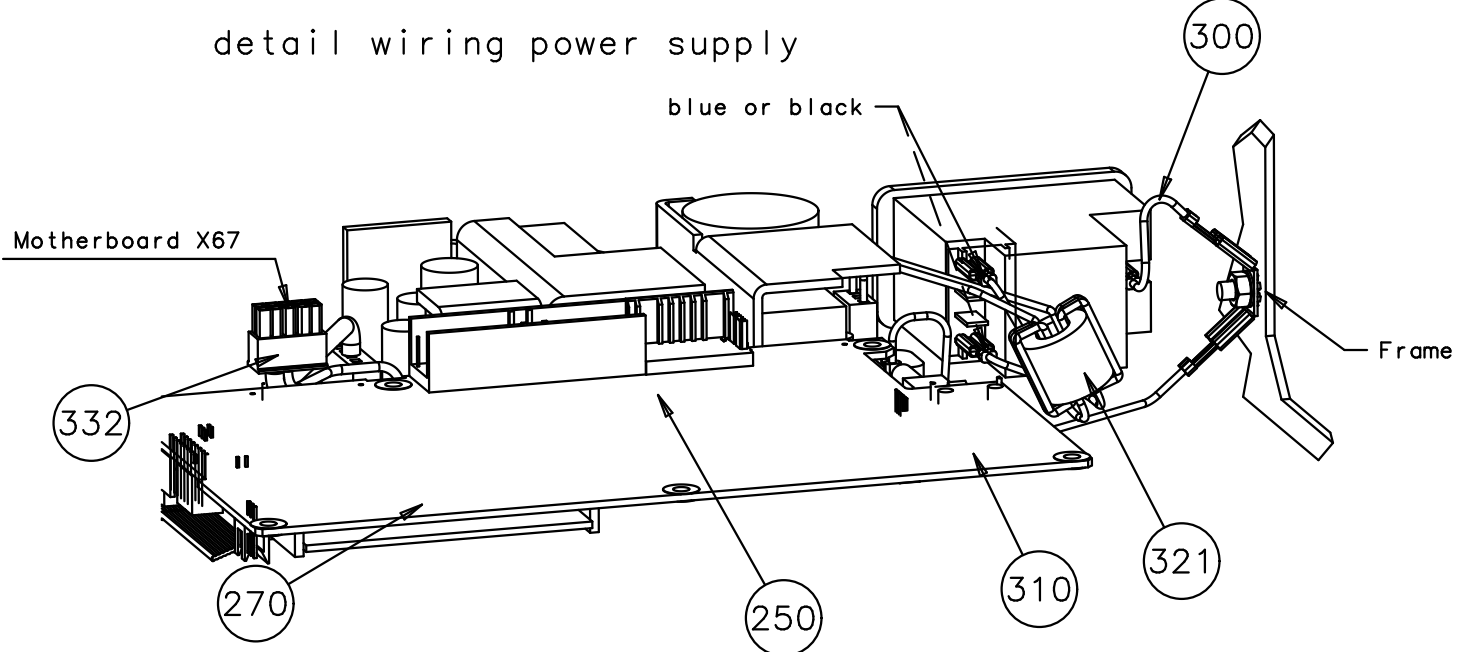
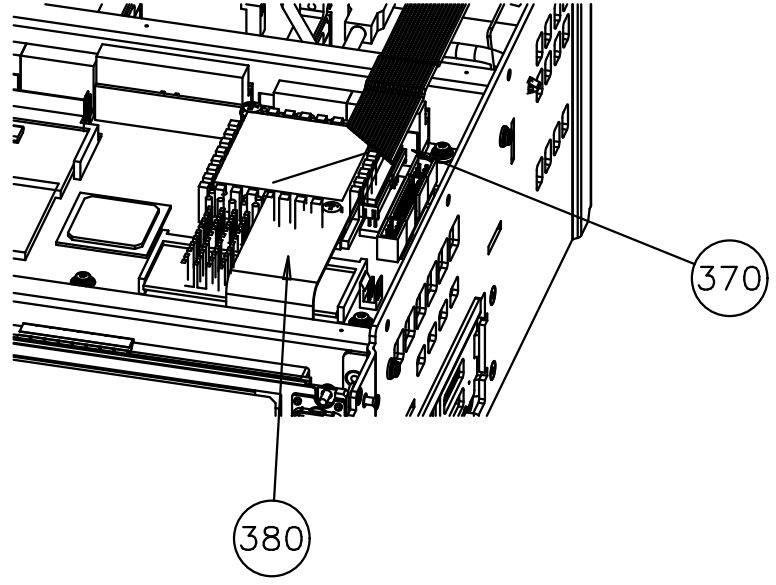
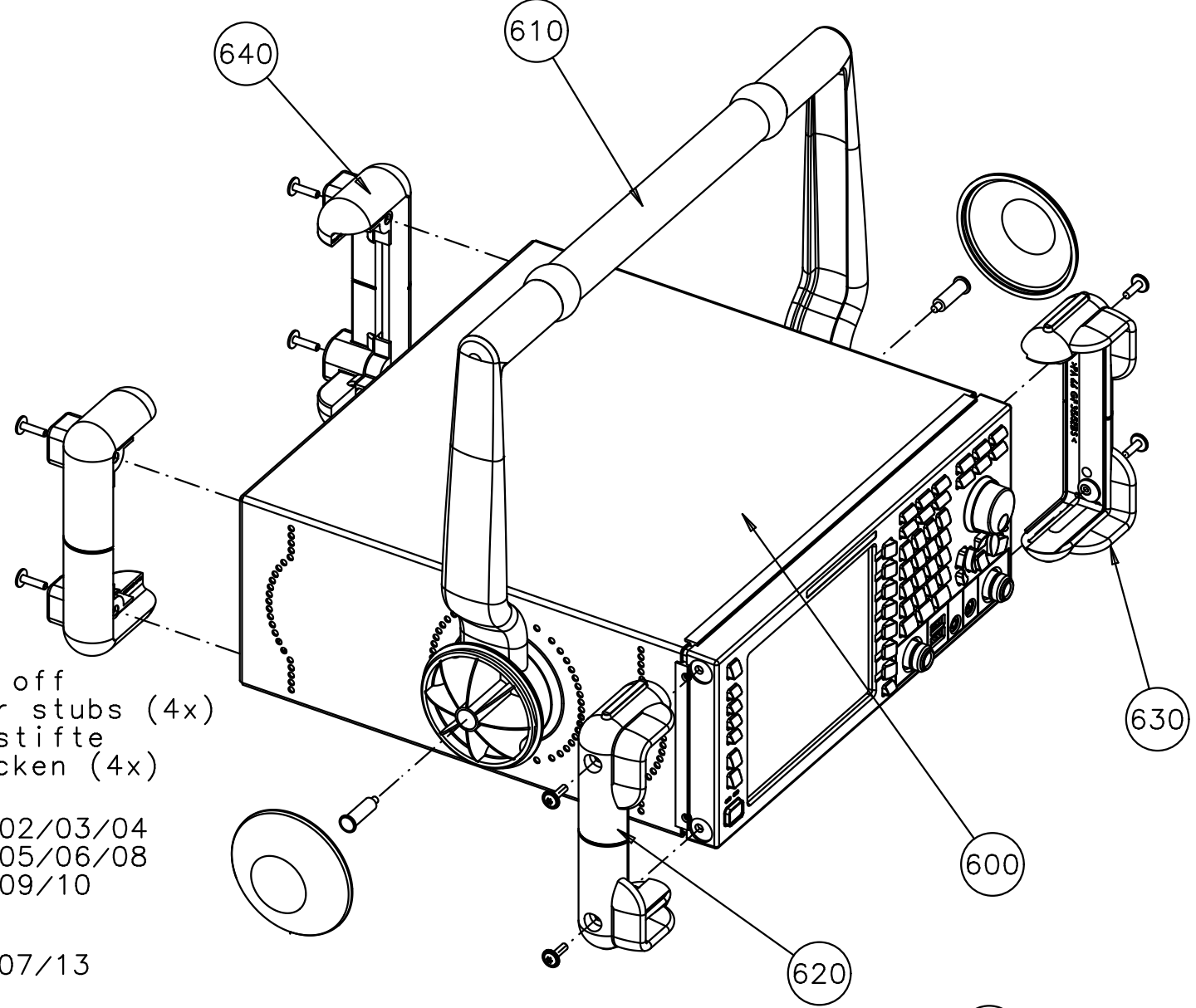
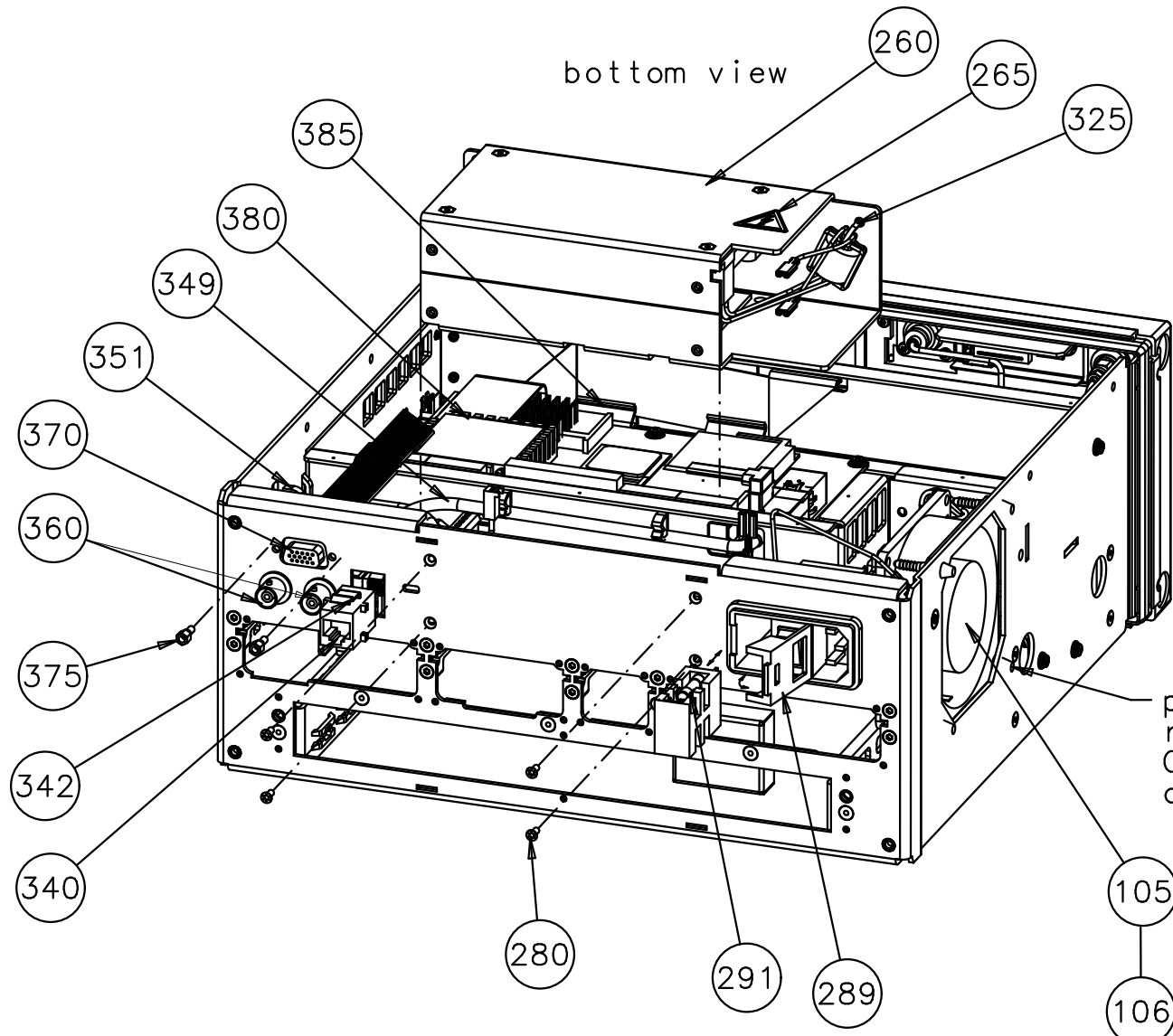


MOD05 = ZVL 3/6GHz
MOD10 = ZVL3 - 75 OHM
MOD13 = ZVL 13

Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	GRUNDGERAET BASIC UNIT	de en 06.00	3
FSL	Datum Date 2009-02-26	Abteilung Dept. 1ESK	Name Wn/TF	Zeichn.Nr. / Drawing No. 1300.2525.01

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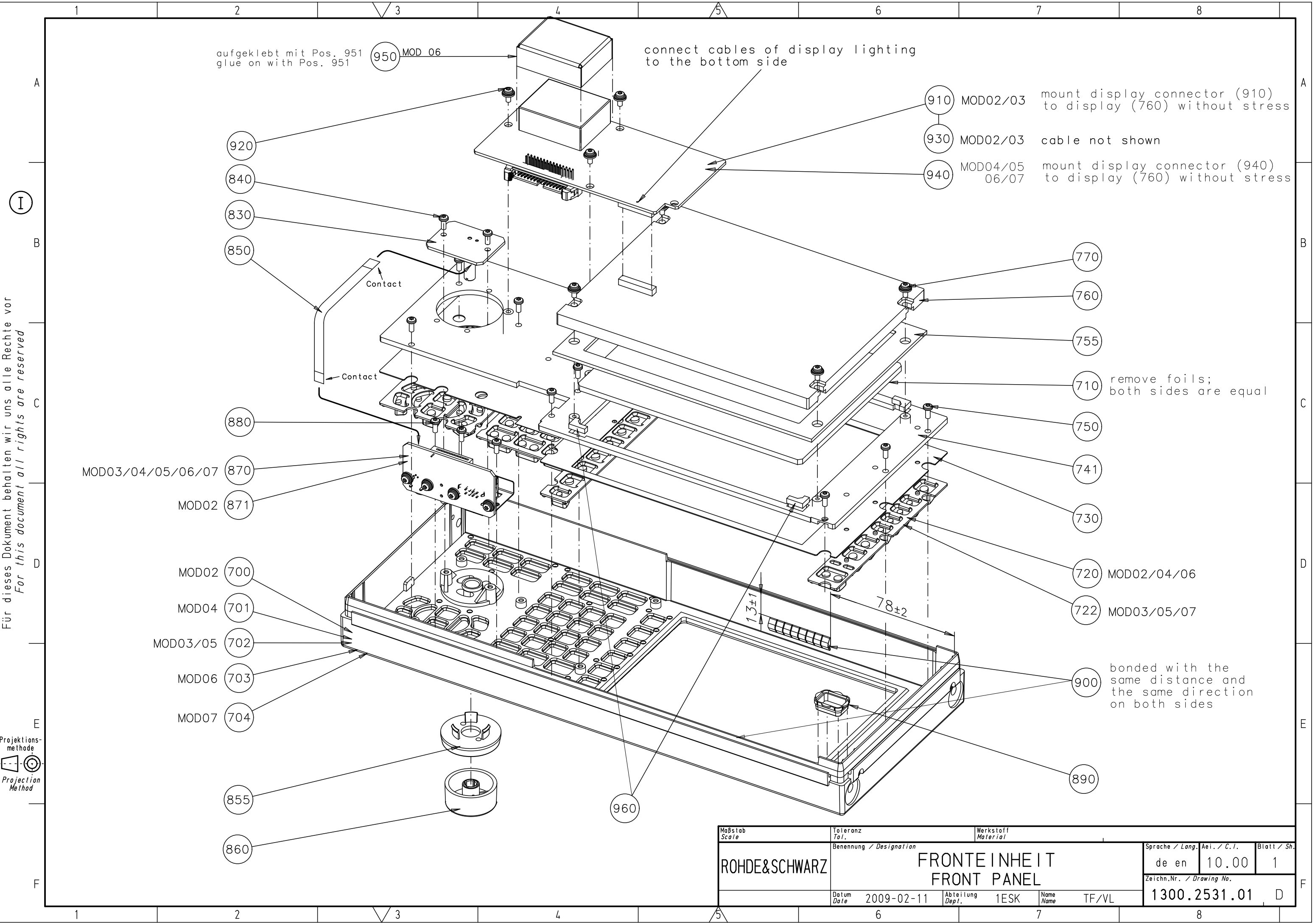
Projektions-
methode
Projection
Method



Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Ael. / C.I.	Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation	GRUNDGERAET BASIC UNIT	de en 04.00	4
Datum Date	Abteilung Dept.	Name Name	Zeichn.Nr. / Drawing No.	
2013-04-16	MTEK	mk	1300.2525.01	D

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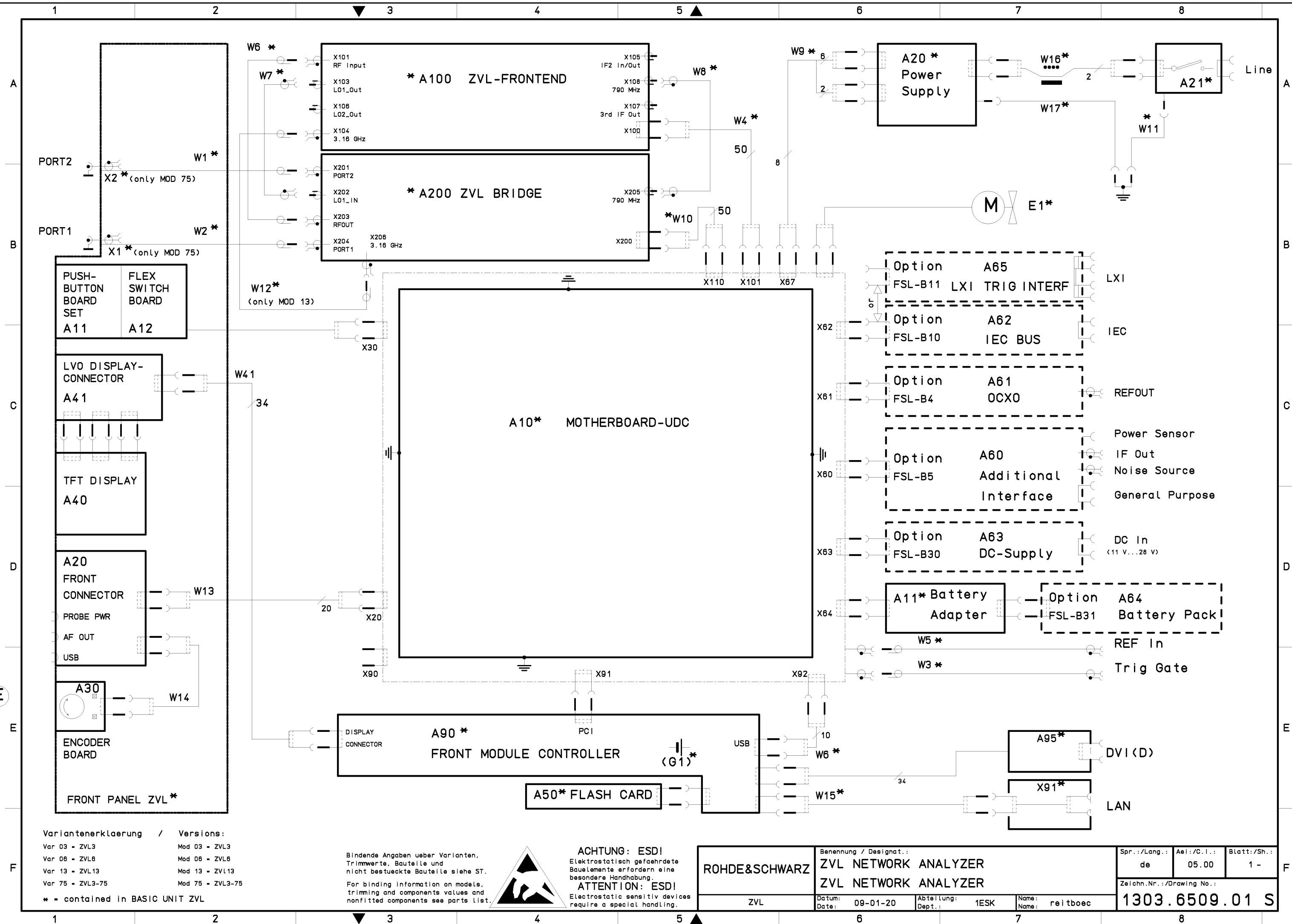


Maßstab Scale	Toleranz Tol.	Werkstoff Material	Sprache / Lang. Aei. / C.I.			Blatt / Sh.
ROHDE&SCHWARZ	Benennung / Designation		de en	10.00	1	
	FRONTEINHEIT FRONT PANEL		Zeichn.Nr. / Drawing No.		1300.2531.01	
Datum Date		2009-02-11	Abteilung Dept.	1ESK	Name Name	TF/VL



Block Circuit Diagram

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Variantenerklärung / Versions:
Var 03 = ZVL3
Var 06 = ZVL6
Var 13 = ZVL13
Var 75 = ZVL3-75
Mod 03 = ZVL3
Mod 06 = ZVL6
Mod 13 = ZVL13
Mod 75 = ZVL3-75
* = contained in BASIC UNIT ZVL

Bindende Angaben ueber Varianten,
Trimmwerte, Bauteile und
nicht bestueckte Bauteile siehe ST.
For binding information on models,
trimming and components values and
nonfitted components see parts list.



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

ROHDE&SCHWARZ	Benennung / Designat.: ZVL NETWORK ANALYZER ZVL NETWORK ANALYZER			Spr.:/Lang.: de	Aei:/C.I.: 05.00	Blatt:/Sh.: 1 -
	ZVL	Datum: Date: 09-01-20	Abteilung: Dept.: 1ESK	Name: Name: reitboec	Zeichn.Nr.:/Drawing No.: 1303.6509.01 S	