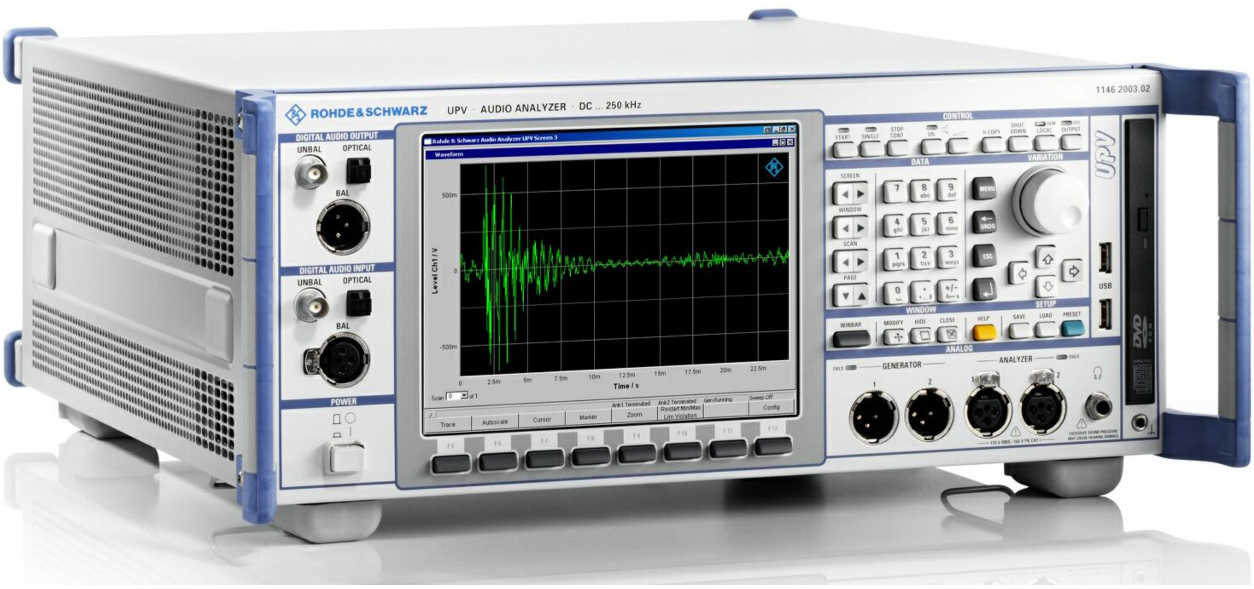
Service Manual



Audio Analyzer DC to 250 kHz

R&S®UPV R&S®UPV66

1146.2003.02 1146.2003.66

ROHDE&SCHWARZ
Test & Measurement

Tabbed Divider Overview

Safety Instructions

Procedure in Case of Service and Ordering of Spare Parts

Tabbed Divider

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

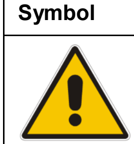
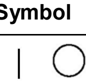
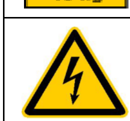
Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are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

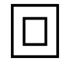
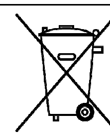
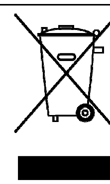
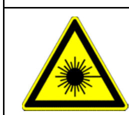
The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English.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

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

Safety labels on products

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

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

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

Signal words and their meaning

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

DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates information considered important, but not hazard-related, e.g. messages relating to property damage. In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

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

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

Electrical safety

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

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

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

Operation

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

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

Repair and service

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

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

Batteries and rechargeable batteries/cells

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

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

Transport

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

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

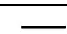
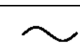
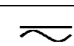
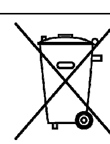
Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa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

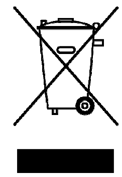
Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto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

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

Señalización de seguridad de los productos

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

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

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

Palabras de señal y su significado

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

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

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

Estados operativos y posiciones de funcionamiento

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

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

Seguridad eléctrica

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

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

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

Funcionamiento

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

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

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

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

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

Eliminación/protección del medio ambiente

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

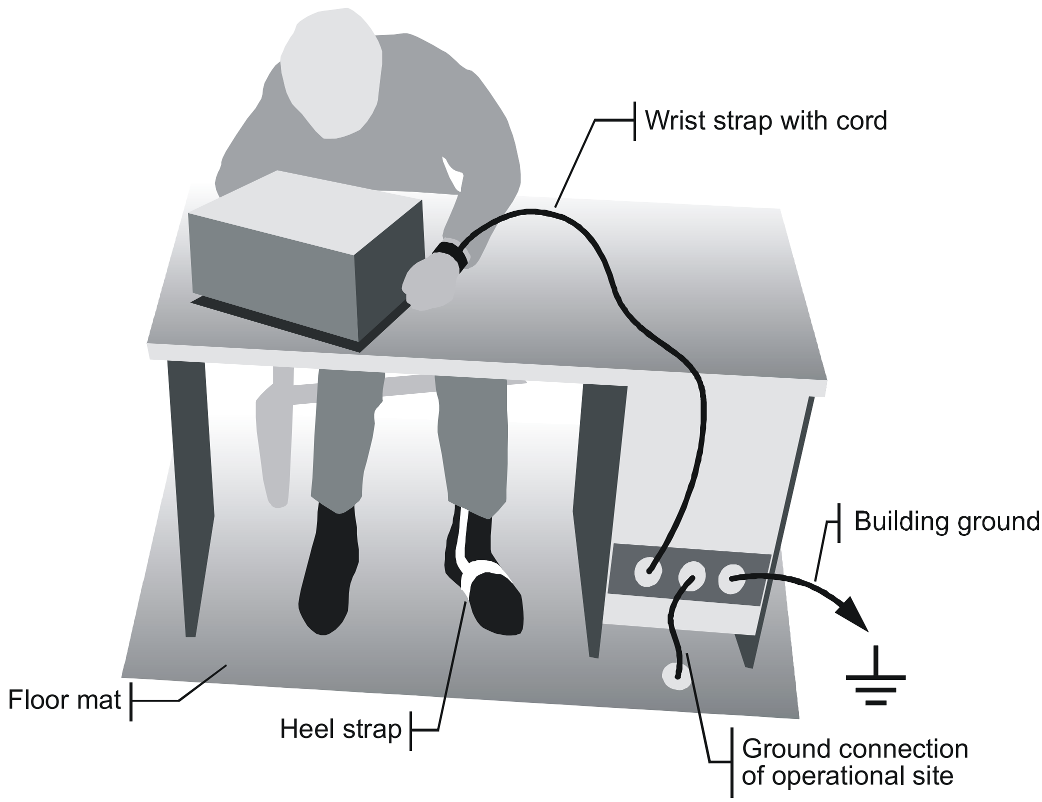
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

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



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

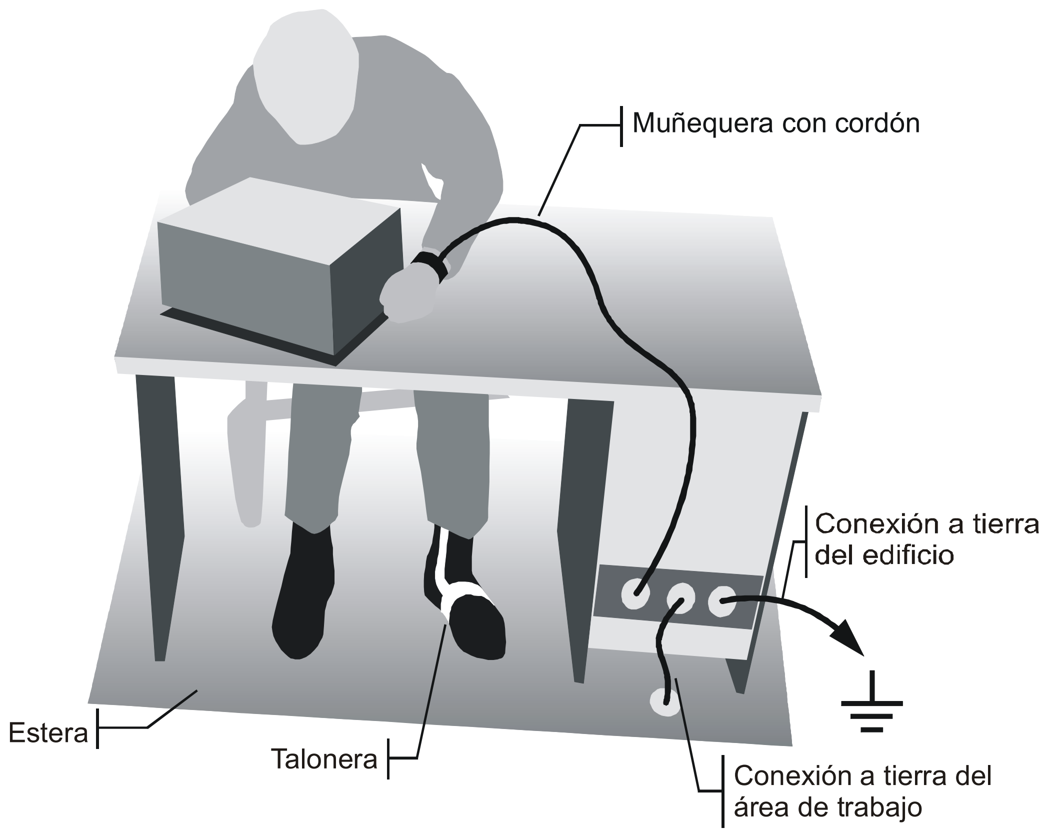
- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

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



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

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

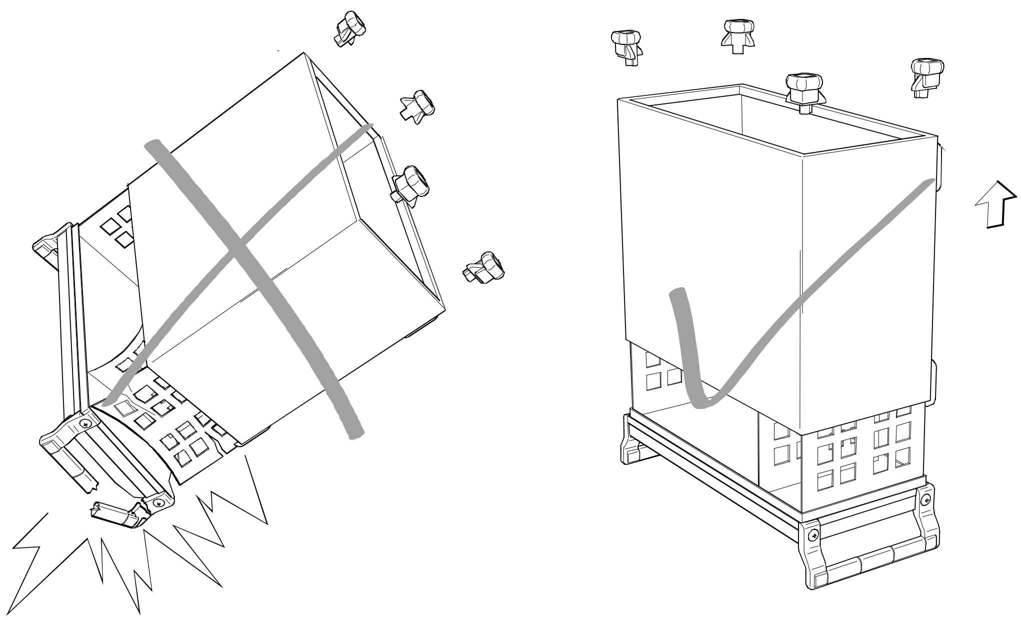
Safety Instructions for Units with Removable Cabinet

⚠ WARNING

Danger of injuries

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

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



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

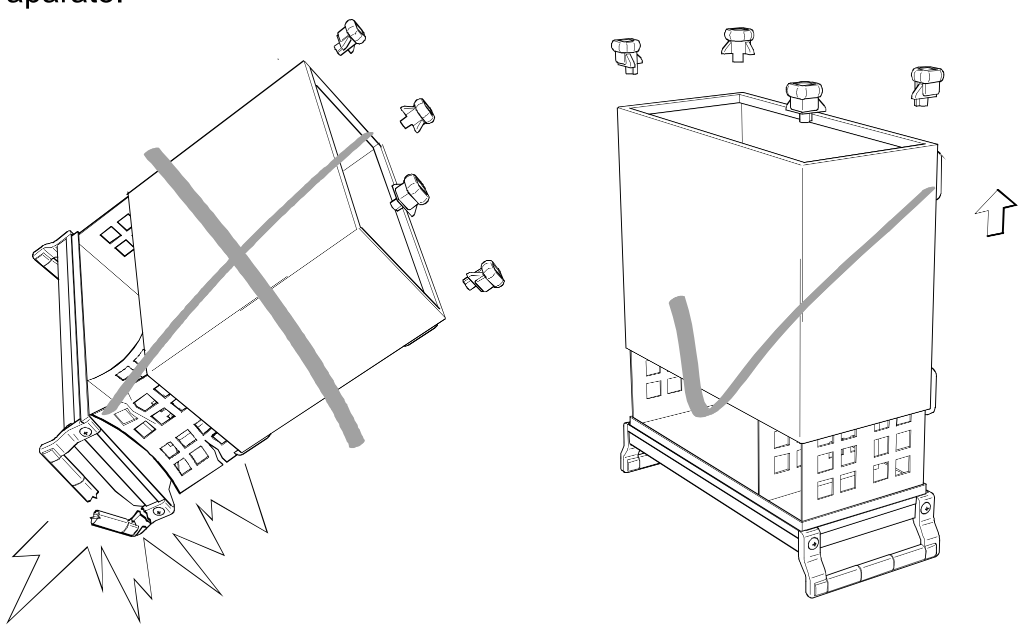
Informaciones de seguridad para aparatos con tubo de quita y pon

ADVERTENCIA

Peligro de heridas

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

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



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

Procedure in Case of Service and Ordering of Spare Parts

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

Please contact your local Rohde & Schwarz service center if you need service or repair work of your equipment or to order spare parts. The list of the Rohde & Schwarz representatives is provided at the beginning of this service manual. You can find the current address of your representative on our homepage www.rohde-schwarz.com. Navigate to Service & Support / Service Locations.

Shipping the Instrument

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

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

In some countries, an RMA process is available for the return shipment of the instrument. For details, contact your local representative.

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

- Use the original packaging for transporting or shipping the instrument. The protective caps for the front and rear prevent damage to the operating elements and the connectors.
- If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the box. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

Rohde & Schwarz offers repair and calibrations of the test systems it produces. The calibration documentation fulfills ISO 17025 requirements.

Shipping Defective Modules

Also when shipping a module, be careful to provide for sufficient mechanical and antistatic protection.

- Ship the module in a sturdy, padded box.
- Wrap the module in antistatic foil.

If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the tightly fitting packaging is conductive.

Exception:
If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

Ordering Spare Parts

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

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

Refurbished Modules

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

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

Taking Back Defective Replaced Modules

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

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

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

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

Contents

1 Performance Test

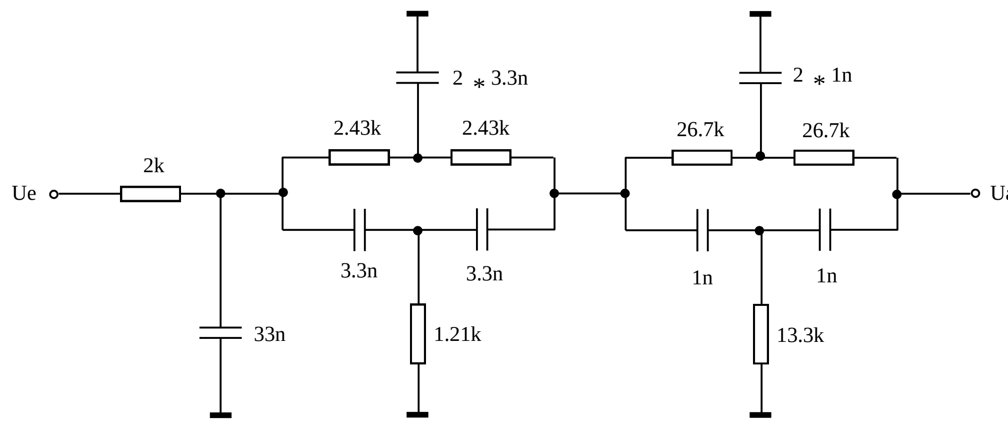
Warm-up time for the R&S UPV 1 hour

Measuring Equipment and Accessories

Measuring equipment	Characteristics	Recommendation
Digital multimeter	ACV, DCV, Ω	HP3458A
Frequency counter	Including option PM9691/011, extremely stable oven oscillator for PM 668x	PM6680
Audio analyzer		Reference R&S UPV
Signal generator		DUT R&S UPV
Sinewave generator		Reference R&S UPV
Sinewave generator	2-channel ARB generator	ADS
Output Switcher	8 Channels	R&S UPZ 1120.8004.03
Multicore cable	25-pole D sub plug to 8 XLR cable jacks	1401.7709.02
DFD lowpass		
Notch filter		
Various test cables and connections		

Difference-frequency distortion lowpass LP DFD

Circuit diagram:



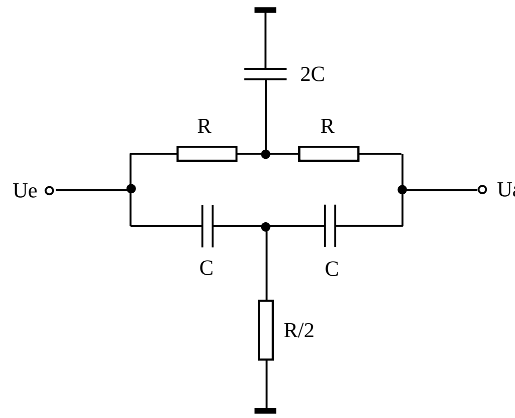
Setup:
To avoid any interference, the filter should be built in a metal housing. Use BNC connectors for the input and output.

Components:

Resistors **Metal film, tolerance ±1 %**		**Capacitors** **Polypropylene, tolerance ±1 %**	
Value	R&S order number	Value	R&S order number
1.21 kΩ	RL 0083.0655.00	1.0 nF	CK 0007.7598.00
2.00 kΩ	RL 0083.0826.00	3.3 nF	CK 0007.7623.00
2.43 kΩ	RL 0083.0884.00	33 nF	CK 0007.7681.00
13.3 kΩ	RL 0082.2577.00		
26.7 kΩ	RL 0083.1597.00		

Notch filter NOTCH THD, for THD measurement of generator

Circuit diagram:



Setup:
To avoid any interference, the filter should be built in a metal housing. Use BNC connectors for the input and output.

Components:

Resistors: Metal film, tolerance ±0.1 %
Capacitors: Polypropylene, tolerance ±1 %

Notch frequency	R	R&S order number	C	R&S order number
20 Hz	24.0 kΩ	RL 0084.3793.00	330 nF	CK 0008.1893.00
1 kHz	4.81 kΩ	RL 0084.2451.00	33 nF	CK 0007.7681.00
7 kHz	3.32 kΩ	RL 0084.2145.00	6.8 nF	CK 0007.7646.00
20 kHz	2.40 kΩ	RL 0083.9875.00	3.3 nF	CK 0007.7623.00

Notch frequency: $f_1 = \frac{1}{2\pi RC}$

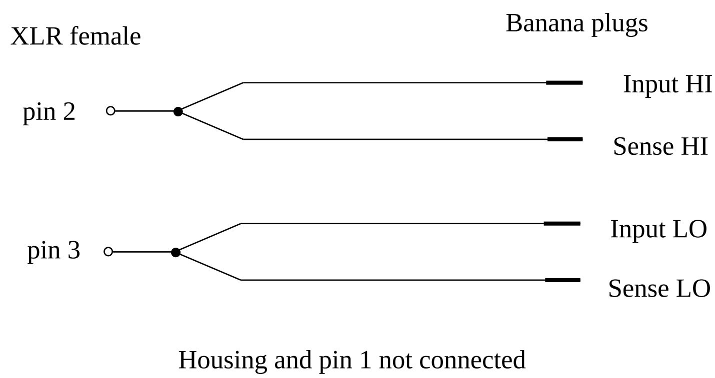
The attenuation $a_n = U_e/U_a$ of the notch filter for the harmonics $n * f_1$ of the fundamental f_1 must be taken into account in the THD measurement:

Frequency	Attenuation a_n	
f_1	>60 dB	—
$2 * f_1$	9.1 dB	2.85
$3 * f_1$	5.1 dB	1.80
$4 * f_1$	3.3 dB	1.50
$5 * f_1$	2.3 dB	1.30

Test cable for measurement of the source resistance

Material: XLR female connector
2 two-leaded cables
4 banana plugs

Setup:



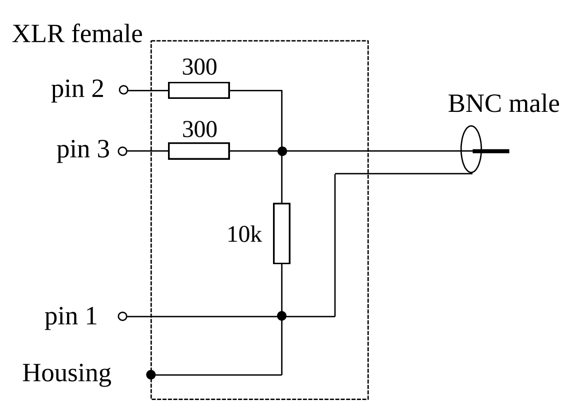
Test cable for measurement of the unbalance rejection

Material: XLR female cable connector, consisting of:
- Housing (order name: NM3FXI, Neutrik)
- Cable outlet (order name: CML, Neutrik)
- BNC cable
- 10 kΩ resistor (metal film, tolerance ±1%)
- 2 matched 300 Ω resistors

The two 300 Ω resistors must be matched to an accuracy of at least 0.01 % in order to achieve a measurement limit of <-90 dB. The absolute value is not important, but it should be in the range between 295 Ω and 305 Ω.

The two matched 300 Ω resistors can be ordered using order no. 0633.2889.00 as a spare part from R&S, Central Service in Munich (ΔR < 0.005 %, ΔTK < 1 ppm/K).

Setup:



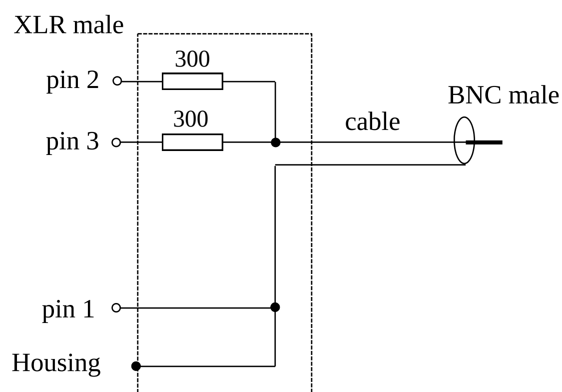
Test cable for measurement of the common mode rejection

Material: XLR cable connector, consisting of:
- Housing (order name: NM3FXI, Neutrik)
- Cable outlet (order name: CML, Neutrik)
- BNC cable
- 2 matched 300 Ω resistors

The two 300 Ω resistors must be matched to an accuracy of at least 0.01 % in order to achieve a measurement limit of <-90 dB. The absolute value is not important, but it should be in the range between 295 Ω and 305 Ω.

The two matched 300 Ω resistors can be ordered using order no. 0633.2889.00 as a spare part from R&S, Central Service in Munich (ΔR < 0.005 %, ΔTK < 1 ppm/K).

Setup: The 2 resistors are built in the XLR male cable connector.



Cable from XLR female to 2*banana plugs

Material: Balanced cable
2 banana plugs

Setup: Remove XLR male connector from the balanced cable.
Connect the banana plug for Input HI to pin 2 of the XLR female connector.
Connect the banana plug for Input LO to pin 3 of the XLR female connector.
The shielding is not connected.

Note: Instead of this cable, the following adapter system can be used:
Adapter XLR/BNC, R&S UPL-Z1, order no. 1078.3704.02
+ BNC cable, commercially available
+ Adapter BNC female / 2*banana plugs, R&S order no. FJ 0099.6687.00

Cable from XLR female to BNC male

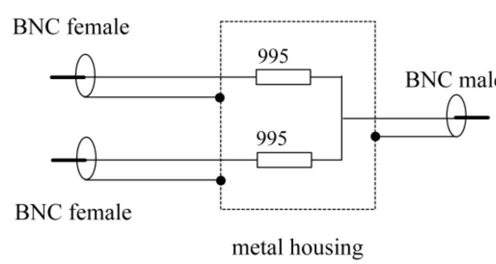
Material: XLR female cable connector
BNC cable

Setup: Remove the BNC connector on one end of the BNC cable.
Connect pin 2 of the XLR female connector to the inner conductor of the BNC cable.
Connect pin 3 of the XLR female connector to the outer conductor (shielding) of the BNC cable.
Pin 1 and the housing connection of the XLR female connector are not connected.

Note: Instead of this cable, the XLR/BNC adapter R&S UPL-Z1, order no. 1078.3704.02 can be used.

Resistance network RES NET 1

Circuit diagram and setup:



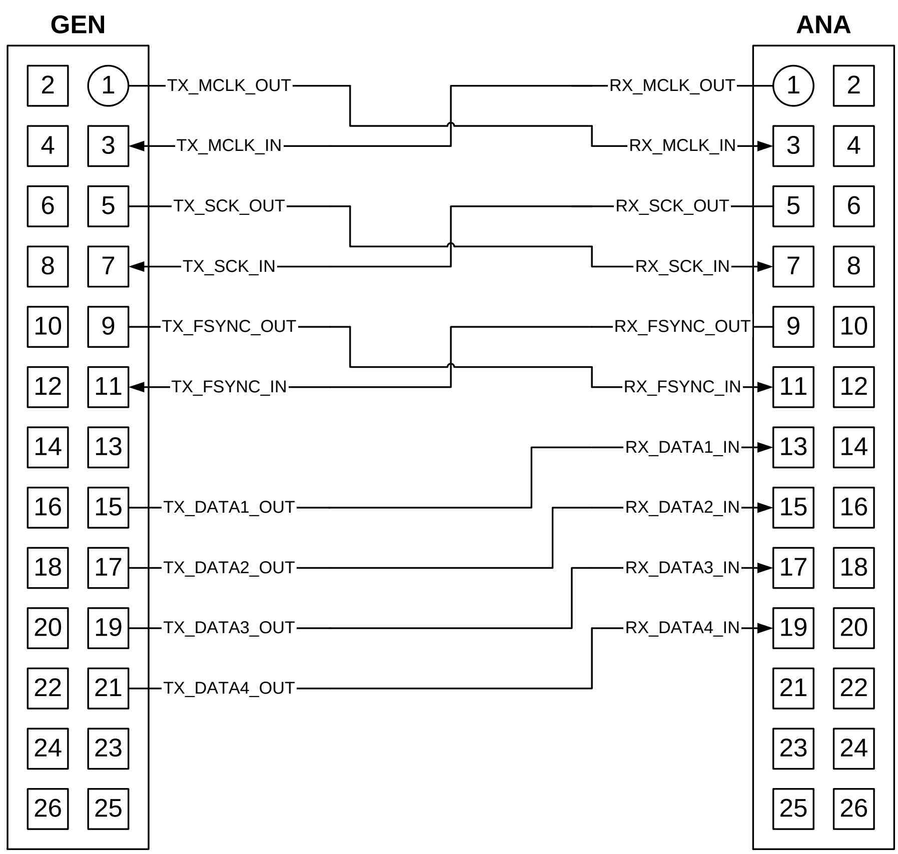
Material: 2 BNC female mounting jacks
1 BNC male mounting jack
1 metal housing

Components:

Resistors (metal film)		
Value	**Tolerance**	**R&S order no.**
995 Ω	±0.1 %	
parallel from		
1 kΩ	±0.1 %	RL 0083.9146.00
200 kΩ	±1 %	RL 0083.2235.00

Short-circuit for R&S UPV-B42

Part No: 3584.7986.00



Test Sequence

Performance Test Analog Generator

Adaptation of the measuring instruments to the generator output

The output of the generator is XLR male. The balanced signal is present between pin 2 and pin 3. The same is true for the unbalanced signal, however: pin 2 is HI, pin 3 is LO (corresponding to AES-14). The inputs to the digital multimeter are banana jacks and the input to the frequency counter is a BNC female connector. This means that a direct connection is not possible using a commercially available cable. The easiest way of adaptation is as follows:

➢ Retrofit the outputs of the generator to BNC female using R&S UPL-Z1 (XLR/BNC adapter set).

➢ Retrofit the input to the digital multimeter to BNC female using an adapter BNC female / 2*banana plug.

Commercially available BNC cables can then be used for further connections.

As an alternative, special cables can be made for XLR female to 2*banana plug or XLR female to BNC male. The configuration of such cables is described in the chapter "*Measuring Equipment and Accessories*" starting on page 1.1.

Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

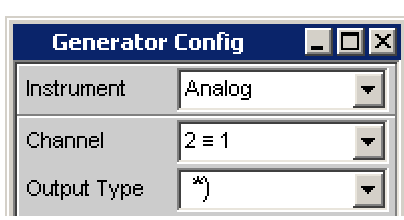
Press the PRESET key and confirm your input request with “↵”

or

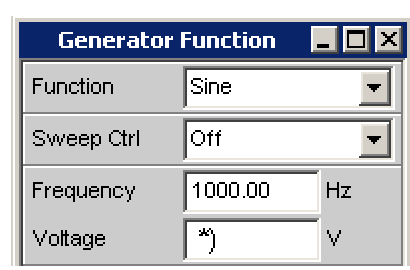
Press the MENU key and select “Preset (Load Default)” in the submenu.

Sinewave level Error at 1 kHz

Set R&S UPV:



*) according to test report



*) according to test report

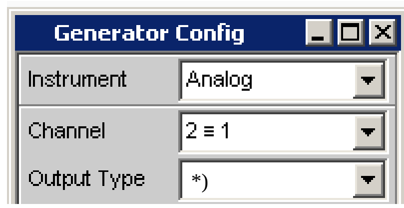
Meas. instrument: AC voltmeter

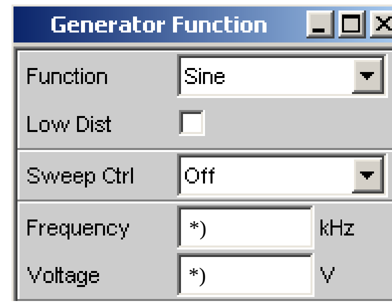
Measurement: Connect the AC voltmeter to the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.
For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: This test item is affected by the level adjustment of the analog generator.

Sinewave frequency response

Set R&S UPV:





*) according to test report

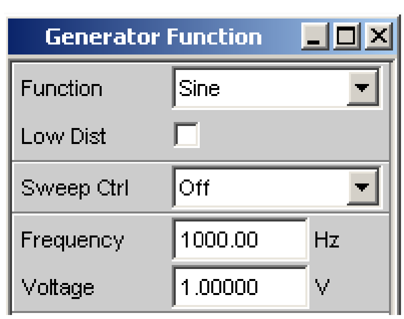
Meas. instrument: AC voltmeter

Measurement: Connect the frequency counter to the output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. Relative display in dB, reference is the voltage measured at 1 kHz. For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: This test item is affected by the adjustment of the lowpass filter after the main DAC of the analog generator.

Sinewave frequency error

Set R&S UPV:

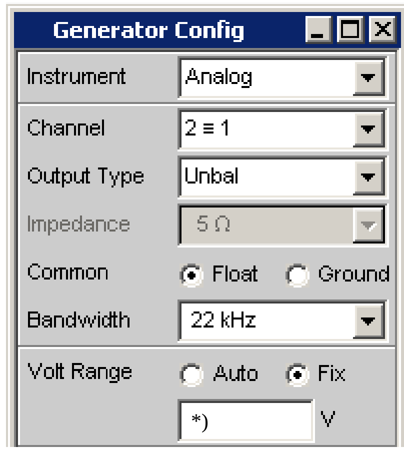


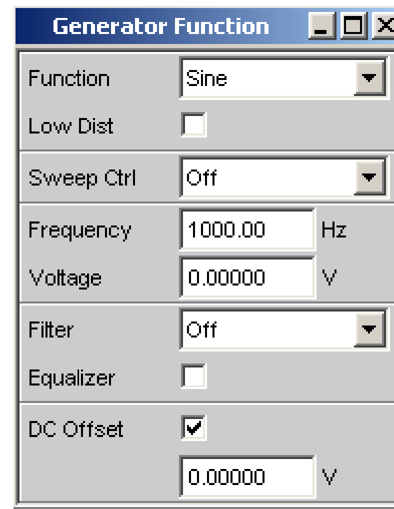
Meas. instrument: Frequency counter

Measurement: Connect the frequency counter to the output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose.

DC offset 0 V: Residual DC

Set R&S UPV:





*) according to test report

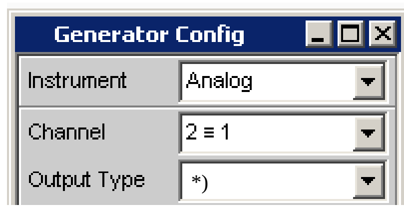
Meas. instrument: DC voltmeter

Measurement: To enable measurement of the small DC offset, the AC level of the generator must be switched off (set voltage in generator function panel to 0 V).
To set the generator hardware according to the levels specified in the performance test report, select Volt Range = Fix in the Generator Config Panel and choose the desired voltages.

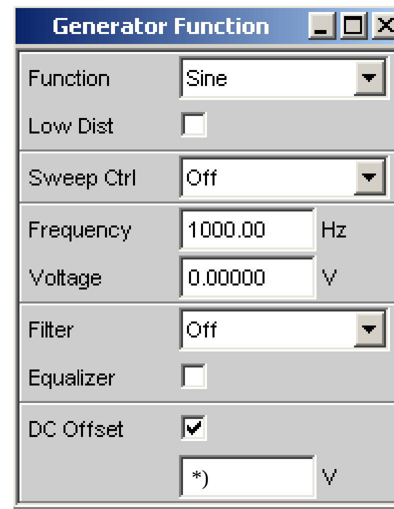
Note: This test item is affected by the DC offset adjustment.

DC offset: setting error

Set R&S UPV:



*) according to test report



*) according to test report

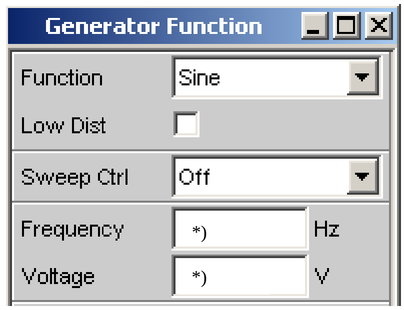
Meas. instrument: DC voltmeter

Measurement: Connect the DC voltmeter to the output of R&S UPV generator and measure the DC voltage at the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.
For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: This test item is affected by the following adjustments.
- Level adjustment analog generator
- DC offset adjustment

THD+N inherent distortion

Set R&S UPV:



*) according to test report

Meas. instrument: Analyzer for THD+N: R&S UPV

Settings of the Ref R&S UPV analyzer:

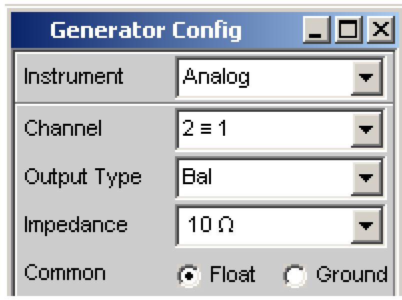
Instrument	Analog 22 kHz	Analog 80 kHz
Channel	1	1
Ch1 Input	Bal	Bal
Ch1 Range	Auto	Auto
Function	THD+N & SINAD	THD+N & SINAD
Dynamic Mode	Prec	Prec
Unit	dB	dB
Frq Lim Low	20.00 Hz	20.00 Hz
Frq Lim Upp	21.50 kHz	87.00 kHz

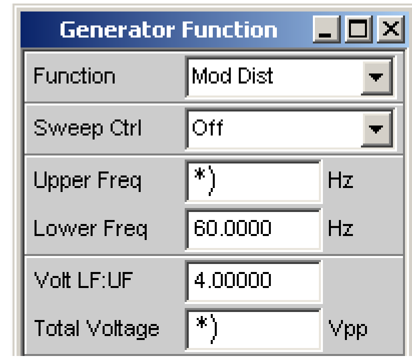
Test setup: Connect the Ref R&S UPV analyzer to the output of the R&S UPV generator.
Output Bal: Use a balanced cable (XLR).
Output Unbal: Use an adapter XLR female / BNC female and an unbalanced cable (BNC).

Measurement: For the remaining R&S UPV settings and measurement procedure, see the test report.
Measurement in channel 1 is sufficient.

Mod Dist inherent distortion

Set R&S UPV:





*) according to test report

Meas. instrument: Analyzer for Mod Dist: Ref R&S UPV

Set Ref R&S UPV:

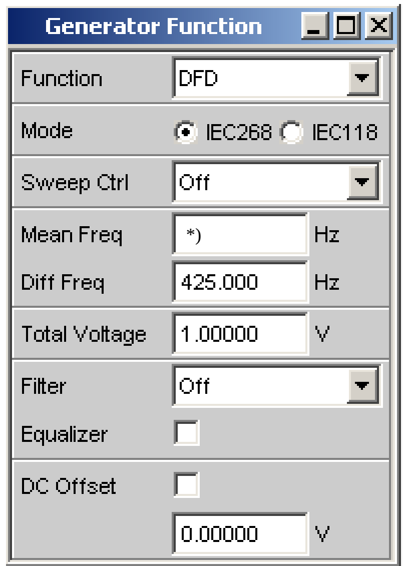
Instrument	Analog 22 kHz (Analyzer)
Channel(s)	1
Ch1 Input	Bal
Ch1 Range	Auto
Function	Mod Dist
Dynamic Mode	Prec
Unit	dB

Test setup: Connect a balanced XLR cable between the output of the R&S UPV generator and the input of the Ref R&S UPV analyzer.

Measurement: For the remaining R&S UPV settings and measurement procedure, see the test report.
Measurement in channel 1 is sufficient.

DFD level error

Set R&S UPV:



*) according to test report

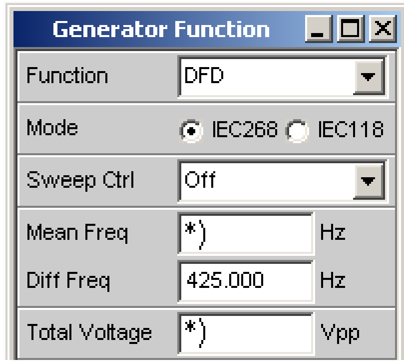
Meas. instrument: AC voltmeter

Measurement: Connect the AC voltmeter to the output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. Measure the RMS value of the output voltage of the UPV generator. For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: This test item is affected by the level adjustment of the analog generator. Measurement in channel 1 is sufficient.

DFD d2 inherent distortion

Set R&S UPV:



*) according to test report

Meas. instrument: Selective voltmeter: Ref R&S UPV

Set Ref R&S UPV:

Instrument	Analog 22 kHz (Analyzer)
Channel	1
Ch1 Input	Bal
Ch1 Range	Auto
Function	RMS Selective
Unit Ch1	dBr
Reference	Value: 3.5000 V
Bandwidth	BP 3 %
Freq Mode	Fix: 425.00 Hz

Accessories: External RC lowpass: LP DFD

Test method:

- ➢ Connect the LP DFD between the output of the R&S UPV generator and input to the Ref R&S UPV analyzer. You will need an adapter XLR female / BNC female and an adapter BNC female / XLR male for this purpose.
  The lowpass eliminates the influence of the inherent distortions of the analyzer.
  The attenuation of the lowpass in the passband does affect the measurement and is taken into account in the reference value of the analyzer.
- ➢ Make a selective measurement of the RMS voltage at the output of the lowpass filter.
  The displayed measured value (in dBr) is the DFD d2 inherent distortion (in dB).

Measurement: For the remaining R&S UPV settings and measurement procedure, see the test report.
Measurement in channel 1 is sufficient.

DFD d3 inherent distortion

Set R&S UPV: This is the same setting as the one used for measurement of DFD d2.

Meas. instrument: Analyzer for DFD d3: Ref R&S UPV

Set Ref R&S UPV:

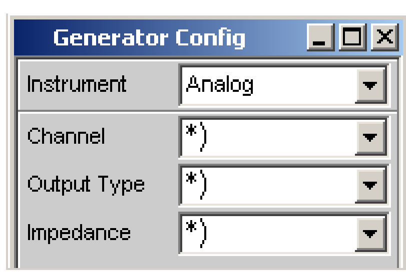
Instrument	Analog 22 kHz (Analyzer)
Channel	1
Ch1 Input	Bal
Ch1 Range	Auto
Function	DFD
Meas Mode	d3 (IEC268)
Unit	dB

Measurement: Connect the Ref R&S UPV analyzer to the output of the R&S UPV generator.
For the remaining R&S UPV settings and measurement procedure, see the test report.
Measurement in channel 1 is sufficient.

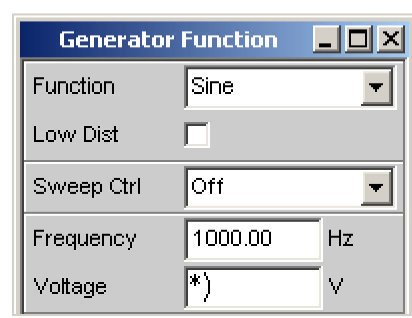
Output impedance

The output impedance R_{off} of the deactivated channel is measured using an ohmmeter. The output impedance R_{on} of the activated channel is calculated based on voltage division with a known impedance, e.g. the impedance R_{off} of the deactivated channel measured previously.

Set R&S UPV:



*) according to test report



*) according to test report

Meas. instruments: Digital multimeter for impedance measurement (ohmmeter)
AC voltmeter

Test setup for measurement of R_{off}:

Connect the ohmmeter to the output of the R&S UPV generator.
R_{off} must be measured directly at the output terminals. In order to avoid errors in measurement due to lead resistances, we recommend that you make the impedance measurement using a four-wire system. The configuration of an appropriate cable is described on page 1.4.

Measurement:

- Set the R&S UPV generator according to the test report.
- Measure the impedance R_{off} of the deactivated channel using the ohmmeter.

Test setup for measurement of R_{on}:

- Retrofit both channels of the R&S UPV generator to BNC female using R&S UPL-Z1 (XLR/BNC adapter).
- Connect the shortest possible BNC cables of the same length to both channels (if the cables are of the same length, their lead resistances cancel each other out in the formula for R_{on}).
- Connect both BNC cables using a BNC T-junction.
- Connect the AC voltmeter to the BNC T-junction. You will need an adapter BNC female / 2 * banana plug and a BNC / BNC female junction for this purpose.

Measurement:

- Set the channel(s) and output of the R&S UPV generator according to test report.
- Disconnect the BNC cable from the deactivated channel.
- Measure AC and note the measured value as U_1.
- Reconnect the deactivated channel.
- Measure AC and note the measured value as U_2 ($U_2 \approx 0.5 * U_1$).

Calculate the output impedance R_{on} according to the following formula:

$$R_{on} = \frac{1}{\dfrac{1}{R_{off}\left(\dfrac{U_1}{U_2} - 1\right)} - \dfrac{1}{R_{ac}}}$$

Where R_{ac} = Input impedance, AC voltmeter (negligible if $R_{ac} > 1000 * R_{off}$)

If R_{ac} is negligible, the formula for R_{on} simplifies to:

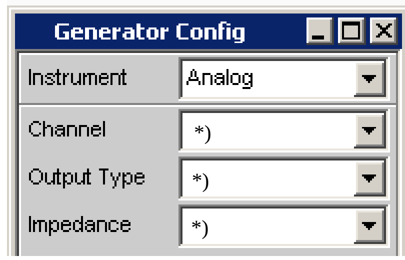
$$R_{on} = R_{off}\left(\frac{U_1}{U_2} - 1\right)$$

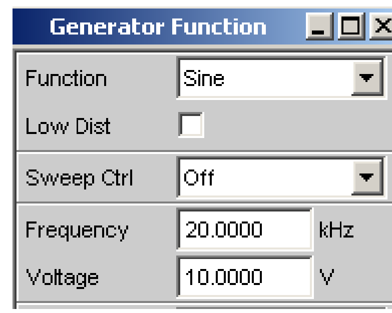
Note: For calculating R_{on} for **channel 1**, R_{off} for **channel 2** must used in the above formula and vice versa. R_{off} is known from the previous measurement.

Crosstalk

Due to the high crosstalk attenuation of typ. 120 dB a very small voltage of only a few µV must be measured on the deactivated channel. For this purpose, a selective voltmeter like the one provided in the Ref R&S UPV analyzer, for example, is required.

Set R&S UPV:





*) according to test report

Meas. instrument: Audio analyzer: Ref R&S UPV

Set Ref R&S UPV:

Instrument	Analog 22 kHz
Channel	1
Ch1 Input	Bal
Common	Float
Ch1 Range	Auto
Function	FFT
Unit	dBr
Reference	Value: 10.00 V

Test setup

Connect the Ref R&S UPV analyzer to the output of the DUT R&S UPV generator via a shielded cable.
Output Bal: Use a balanced cable (XLR).
Output Unbal: Use an adapter XLR female / BNC female and an unbalanced cable (BNC). The generator common must be set to **ground**.

Measurement:

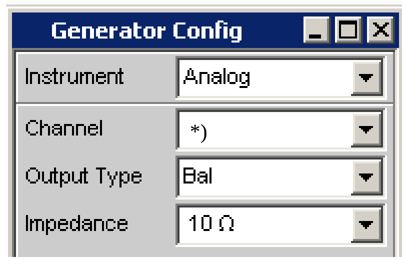
- ➢ Set the R&S UPV generator according to the test report.
- ➢ For improved legibility, scale the graphics panel from 19 kHz to 21 kHz.
- ➢ FFT measurement on a channel. Read off the lines using the cursor. The cursor must indicate a value of about 0 dBr (= 10 V). Set the other cursor to the frequency of the other channel and the crosstalk will be displayed directly.
- ➢ Repeat the same measurement on the other channel.

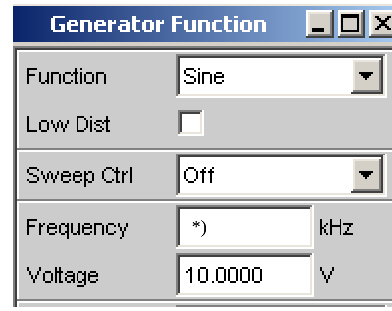
Note:

To avoid having the measurement result corrupted due to the internal coupling of the channels in the Ref R&S UPV, we recommend measuring the crosstalk in a single-channel fashion one after another.

Unbalance rejection

Set R&S UPV:

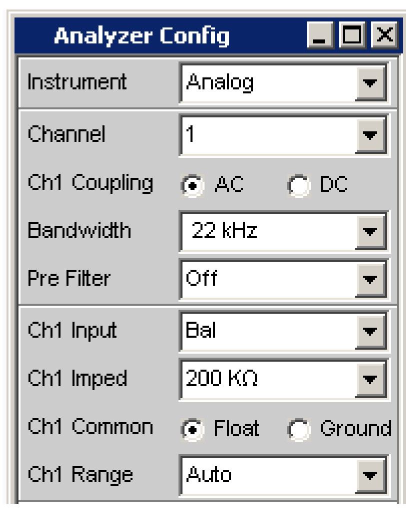


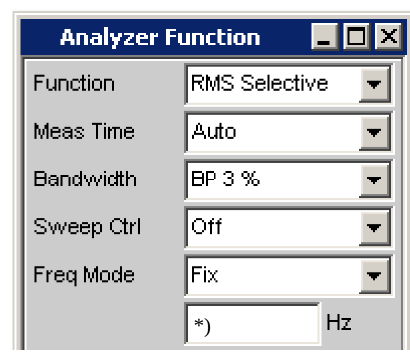


*) according to test report

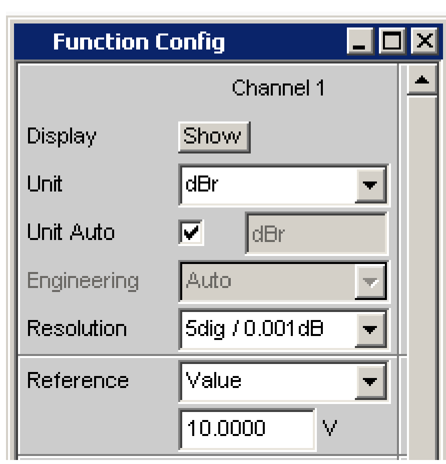
Meas. instrument: Selective voltmeter: Ref R&S UPV

Set Ref R&S UPV:

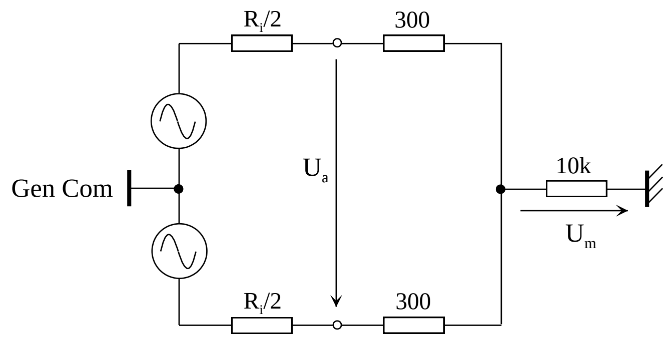




*) according to the frequency of the R&S UPV generator



Test setup:



The two 300 Ω resistors must be matched to an accuracy of at least 0.01 % in order to achieve a measurement limit of <-90 dB. The absolute value is not critical, but it should be in the range between 295 Ω and 305 Ω.

The three resistors must be installed in an XLR cable jack. The signal U_m is fed out with a BNC cable and connected to the balanced input of the analyzer. You will need an adapter XLR/BNC for this purpose.

The configuration of an appropriate cable is described on page 1.4.

Measurement:

- Set the R&S UPV generator according to the test report.
- Selective RMS measurement on the activated channel.
  The displayed measured value (in dBr) is negative.
- Enter the measured value with a positive sign as the unbalance rejection (with units of dB) into the report.

Note: This test item is affected by the adjustment of the unbalance rejection.

Performance Test, Analog Analyzer

Note: *The test equipment is listed in section "Measuring Equipment and Accessories" on page 1.1.*
In the following section, the abbreviation "DL" is used to refer to the limits in the data sheet.

Adaptation of the measuring instruments to the analyzer inputs

The analyzer inputs are two XLR jacks. The balanced input signal is applied between pin 2 and pin 3. The same is true for the unbalanced signal, however: pin 2 is HI and pin 3 is LO (corresponding to AES-14). The inputs to the digital multimeter are banana jacks and the input to the frequency counter is a BNC female connector. This means that a direct connection is not possible using a commercially available cable. The easiest way of adaptation is as follows:

- ➢ Retrofit the inputs of the analyzer to BNC female using R&S UPL-Z1 (XLR/BNC adapter set).
- ➢ Retrofit the input to the digital multimeter to BNC female using an adapter BNC female / 2*banana plug.

Commercially available BNC cables can then be used for further connections.

As an alternative, special cables can be made for XLR female to 2*banana plug or XLR male to BNC male. The configuration of such cables is described in the section "*Measuring Equipment and Accessories*" starting on page 1.4.

Before starting the test, set the R&S DUT R&S UPV and the Ref R&S UPV that you are using to a defined initial status. To do this, call up the default setting on the R&S UPV:

Press the PRESET key and confirm your input request with "↵" or
Press the MENU key and select "Preset (Load Default)" in the submenu.

In the panels shown here, the relevant parameters are shown with a black font (unlike "Preset") and have a note about setting variations according to the test report. For the sake of clarity, some important preset parameters are shown in "gray".

Level measurement RMS

Set R&S UPV:

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	according to test report
Input	Bal
Impedance	200 kΩ
Range	Fix: according to test report

Analyzer Function	
Function	RMS
Meas Time	Auto

Set Ref R&S UPV: Generator, Channel(s) 2 ≡ 1, Output BAL, Impedance 10 Ω. Level and frequency according to test report.

Meas. instrument: AC voltmeter

Test setup: Connect the AC voltmeter to a balanced output of the Ref R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. Connect the other balanced output of the Ref R&S UPV generator to the R&S UPV input under test using an XLR cable. The measurement is made on only one input in each case. The second generator output is connected to the voltmeter.

Measurement: For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: *This test item is influenced by the level software adjustment for the analog analyzer (see section "Software Adjustment" in chapter 2 "Adjustment").*

The R&S UPV analyzer has balanced (BAL) inputs with a measurement range division of 18 mV to 100 V in 5 dB steps. However, since many of the switch combinations are repeated, it is not necessary to individually measure all 16 of the ranges (see section "Manual Adjustment of the Analog Analyzer" in chapter 2 "Adjustment").

Level error at 1 kHz

Tolerance: DL = ±0.05 dB
typ. = ±0.03 dB (typical value in data sheet – no check is made)

R&S UPV analyzer: Bandwidth 22 kHz (adjusted in the range 3.0 V RMS)

Range V	Input Divider dB	Preamplifier dB	Range amplifier dB
0.1	0	+20	+10
0.3	0	0	+20
0.6	0	0	+15
1.8	0	0	+5
3.0	0	0	0
6.0	–15	0	+10
30.0	–30	0	+10

Bandwidth 40 kHz, 80 kHz, 250 kHz (adjusted in the range 3.0 V RMS):
Check only in the range 3.0 V RMS

Measurement: Input voltage = 0.75 ∗ range nominal value (according to test report)

Note: *This test item is influenced by the level software adjustment for the analog analyzer (see section "Software Adjustment" in chapter 2 "Adjustment").*

Frequency response

Set R&S UPV:

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	according to test report
Input	Bal
Impedance	200 kΩ
Range	Fix: according to test report

Analyzer Function	
Function	RMS
Meas Time	Auto

ADS Sig. generator: Level and frequency according to test report.

Meas. instrument: AC voltmeter

Test setup: Connect the AC voltmeter to an output of the ADS generator. At the output of the ADS generator, hook up a BNC T-junction and connect it to the R&S UPV input under test via a BNC cable and an XLR/BNC adapter.
The function generator R&S ADS generates the signal which is measured using the AC multimeter. The R&S ADS only allows unbalanced signal generation so it is necessary to divide the measurement into two parts. The signal is supplied using a special adaptation process.

Measurement: 1st part of the measurement:
Supply signal to XLR pin 2 of the analyzer input under test and save the measured values. XLR pin 3 of the R&S UPV should be at ground potential of the R&S ADS. The reference is the voltage measured at 1 kHz.

2nd part of the measurement:
Supply signal to XLR pin 3 of the R&S UPV. XLR pin 2 of the R&S UPV should be at ground potential of the function generator R&S ADS. The reference is the voltage measured at 1 kHz.
Input voltage Ue = 0.75 ∗ range nominal value (unless otherwise stated!)
The Bal measured value is the average value from the two measurements. It is computed as follows:

$$U_{Bal} = (U_{Pin\ 2} + U_{Pin\ 3}) / 2$$

Only one input is measured at a time. Check the two analyzer channels one after another.
For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: *This test item is influenced by the hardware adjustment in the ranges 6 V and 30 V for the analog analyzer (see section "Manual Adjustment of the Analog Analyzer" in chapter 2 "Adjustment").*

Overrange test

Set R&S UPV:

Generator Config	
Channel	2 ≡ 1
Output Type	Bal

Generator Function	
Function	Sine
Frequency	1 kHz
Voltage	3.7 V

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	22 kHz
Input	Gen Ch1
Range	Fix: ***)**

Analyzer Function	
Function	RMS
Meas Time	Auto

*) according to test report

Measurement: Set the generator signal and measurement ranges according to the test report, launch a single measurement and evaluate the result.

Inherent noise

Set R&S UPV:

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	***)**
Input	Bal
Impedance	300 Ω
Range ****)**	Fix: 18.0 mV RMS

Analyzer Function	
Function	***)**
Meas Time	Auto
Filter	***)**

*) most sensitive measurement range
*) according to test report
**) most sensitive measurement range

Test setup: Terminate input externally with ≤ 50 Ω. Use an XLR/BNC adapter and 50 Ω coaxial termination for this purpose.

Measurement: Set the R&S UPV according to the test report.
Read off the inherent noise shown on the numeric display.

Input impedances

Set R&S UPV:

Analyzer Config	
Instrument	Analog
Bandwidth	22 kHz
Channel Input	2 ≡ 1
Impedance	*)
Coupling	DC
Range	Fix: 30.0 V RMS

Analyzer Function	
Function	RMS or DC
Meas Time	Auto

*) according to test report

Meas. instrument: Ohmmeter (digital multimeter)

Test setup: Connect the ohmmeter to the R&S UPV input under test. You will need an adapter XLR male / 2 * banana plug for this purpose.

Measurement: Set the R&S UPV according to the test report. Measure the input impedance.

Crosstalk Attenuation

Set R&S UPV:

Analyzer Config	
Instrument	Analog
Channel	1 & 2
Coupling	AC
Bandwidth	22 kHz
Input	Bal
Impedance	600 Ω (channel not connected)
Range	Auto

Analyzer Function	
Function	RMS Selective
Meas Time	Auto
Bandwidth	BP Fix 1 kHz
Freq Mode	Fix: 20 kHz

Ref R&S UPV gen:. SINE, Output BAL, 10 V, 20 kHz

Test setup: Connect the signal generator to the R&S UPV input under test using an XLR cable. The channel that is not connected needs to be terminated internally into 600 Ω.

Measurement: Set the R&S UPV according to the test report.

Due to the high crosstalk attenuation of typ. 135 dB a very small voltage of only a few µV must be measured on the deactivated channel. A selective RMS measurement is made in both channels one after another.

Relative display in dBr: The reference in each case is the other channel.
Measure the crosstalk from channel 1 → 2 and from channel 2 → 1.

Note: *Make the entry in the test report with a positive sign as the actual crosstalk attenuation. The data sheet limits (DL) represent positive dB values.*

Common mode rejection CMR

Set R&S UPV:

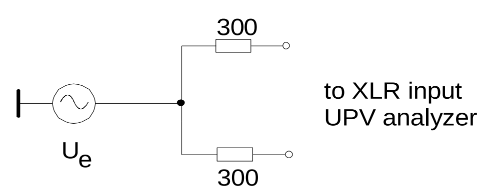
Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	22 kHz
Input	Bal
Impedance	200 kΩ
Range	***)**

Analyzer Function	
Function	RMS Selective
Meas Time	Auto
Bandwidth	BP Fix 3 %
Freq Mode	Fix: ***)**

*) according to test report

Ref R&S UPV gen: Sine, Unbal, Ground, level and frequency according to test report

Test setup:



Connect the signal generator R&S UPV to the R&S UPV input under test using a special cable. You must use a BNC cable with XLR connectors in which two resistors are installed.
The two 300 Ω resistors must be matched to ±0.01 %.
The absolute value is not critical but it should be in the range from 295 Ω to 305 Ω.

Measurement: Set the R&S UPV according to the test report.
Make a selective RMS measurement in both channels.
Relative display in dBr: The reference is the generator voltage U_e.

Note: *Make the entry in the test report with a positive sign as the actual common mode rejection. The data sheet limits (DL) represent positive dB values.*

This test item is influenced by the hardware adjustment of the common mode rejection for the analog analyzer (see section "Manual Adjustment of the Analog Analyzer" in chapter 2 "Adjustment").

Frequency error

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	Unbal
Bandwidth	80 kHz

Generator Function	
Function	Sine
Low Dist	*)
Frequency	*)
Voltage	*)

*) according to test report

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	*)
Input	Gen Ch1
Range	Fix: 3.0 V RMS

Analyzer Function	
Function	RMS
Meas Time	Auto
Freq/Phase	Frequency
Meas Time	Prec

*) according to test report

Meas. instrument: External frequency counter

Measurement: Set the R&S UPV according to the test report.
Connect the UPV generator to the frequency counter via an XLR/BNC adapter, BNC cable and BNC / 2 ∗ banana adapter.
Check the generator frequency with the counter. Set the relative display Δ% Hz in the frequency numeric display (Freq/Phase Config Panel): As the reference frequency, set the frequency display for the frequency counter in the Freq/Phase Config Panel. Read off the frequency numeric display.

Phase coincidence

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	Bal
Bandwidth	80 kHz

Generator Function	
Function	Sine
Low Dist	On
Frequency	*)
Voltage	***)**

*) according to test report

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	***)**
Input	Gen Ch1
Range	Fix: ***)**

Analyzer Function	
Function	RMS
Meas Time	Auto
Freq/Phase	Freq & Phase
Meas Time	Prec

*) according to test report

Input signal: The R&S UPV Low Distortion Generator provides the signal to both channels simultaneously via the set internal analyzer/generator connection.
If no R&S UPV Low Dist Generator is available, the signal can also be supplied externally (unbalanced) e.g. using the function generator R&S ADS or a comparable device. The test bandwidth can range up to the full 250 kHz. Change the above R&S UPV setting for Analyzer Config under Input to "Bal". Be aware of the lower test depth of the phase coincidence for unbalanced signals since only one side of the balanced input unit including the input divider is driven with a signal and tested.

Measurement: Set the R&S UPV according to the test report.
Only the phase coincidence between the two analyzer channels is determined since the actual functioning of the phase measurement is handled by the firmware. Read off the phase in the frequency & phase numeric display in ° (degrees).

DC measurement

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	Bal

Generator Function	
Function	Sine
Voltage	0 V
DC-Offset	*)

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	DC **)
Bandwidth	*)
Input	*)
Range	Fix: *)

Analyzer Function	
Level Monitor	DC
Meas Time	Auto Fast
Freq/Phase	Off

*) according to test report
**) before the measurement create a DC calibration by “Once” in the diagnostic panel

DC offset

Analyzer input: Short-circuit the input to the R&S UPV analyzer or terminate it internally into 300 Ω (Input Bal, Impedance 300 Ω).

Measurement: In the R&S UPV analyzer, set Range Fix and Analyzer Bandwidth according to the test report. Read off the value of the DC offset in the numeric display.

DC measurement error

Input signal: The input signal is generated with the DUT R&S UPV universal generator using DC offset (Bal) and measured using the DC multimeter.

Measurement: In the R&S UPV analyzer, set Range Fix and Analyzer Bandwidth according to the test report. A test of the DC measurement accuracy in the 3 V analyzer range is sufficient assuming the level ranges for the AC measurement were checked using section "*Level error at 1 kHz*".
Read off the DC value in the numeric display.

THD total harmonic distortion

THD inherent distortion

Note:

The test THD Inherent Distortion is to be performed as a loop measurement with the R&S UPV generator / analyzer since the specifications in the data sheet apply to the total distortion of the analyzer ***and*** *generator. This test must always be made together with the R&S UPV Low Dist Generator, Option R&S UPV-B1. The following analyzer tests can be made only with the installed option R&S UPV-B1.*

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	***)**

Generator Function	
Function	Sine
Low Dist	On
Frequency	***)**
Voltage	***)**

Analyzer Config	
Instrument	Analog
Channel	1 & 2
Coupling	AC
Bandwidth	***)**
Input Ch1	Gen Ch1
Input Ch2	Gen Ch2
Range	Fix: ***)**

Analyzer Function	
Function	THD
Meas Mode	All di
Dynamic Mode	Prec

*) according to test report

Measurement:

Set the R&S UPV analyzer and generator according to the test report. The signal should be supplied via the R&S UPV's internal connection between the DUT generator and DUT analyzer.
Read off the THD value in dB in the numeric display.

THD measurement error

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	***)**

Generator Function	
Function	Sine
Low Dist	Off
Frequency	***)**
Voltage	4 V

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	***)**
Input	Bal
Common	Ground
Range	Fix: 3.0 V RMS

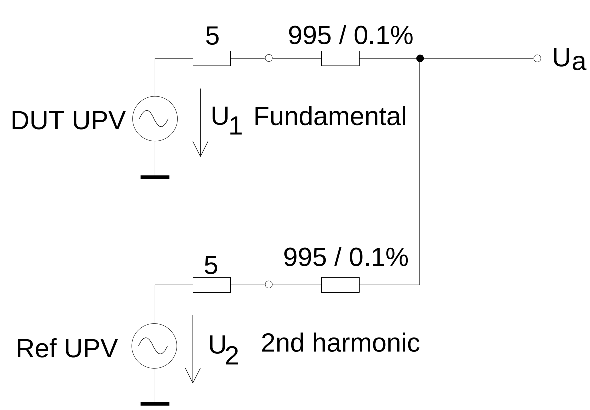
Analyzer Function	
Function	THD
Meas Mode	Select di
Even	2
Harmonics	Prec
Dynamic Mode	

*) according to test report

Ref R&S UPV gen:

Generator	Analog,Bandwidth 80 kHz
Channel(s)	1
Output	Unbal
Impedance	5 Ω
Common	Float
Function	Sine
Low Dist	Off
Ref Volt	4 V
Frequency	= 2∗fundamental according to test report
Voltage	U_2, according to table below or test report

Signal generation:



Fundamental: DUT R&S UPV
Harmonic: Ref R&S UPV

Frequency and level settings:

Frequency	Level
Fundamental	4 V
Harmonic d2	xy dBr

The reference for dBr is the "Ref-Volt" in the R&S UPV generator panel.
If "Ref-Volt" = voltage of the fundamental, then the following applies:
xy = Harmonic d2

Measurement: Set the R&S UPV analyzer and generators according to the test report.
Read off the THD value in dB in the numeric display.

Nominal value for xy ≤ –30 dB: = xy dB,

for other xy: $20 \cdot \lg \frac{xy\_factor}{\sqrt{1 + xy\_factor}}$ with $xy\_factor = 10^{\frac{xy}{20}}$

THD+N total harmonic distortion + noise

THD+N inherent distortion

Note: *The test THD+N Inherent Distortion is to be performed as a loop measurement with the R&S UPV generator / analyzer since the specifications in the data sheet apply to the total distortion of the analyzer* ***and*** *generator. The test is always made along with the appropriate R&S UPV generator.*

THD+N with Low Dist Generator

Note: *This test is made as a loop measurement together with the R&S UPV Low Dist Generator, Option R&S UPV-B1. The following analyzer tests can be made only with the installed option R&S UPV-B1.*

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	***)**

Generator Function	
Function	Sine
Low Dist	On
Frequency	***)**
Voltage	***)**

Analyzer Config	
Instrument	Analog
Channel	1 & 2
Coupling	AC
Bandwidth	***)**
Input Ch1	Gen Ch1
Input Ch2	Gen Ch2
Range	Fix: ***)**

Analyzer Function	
Function	THD+N &SINAD
Meas Mode	THD+N
Dynamic Mode	Prec
Rejection Bandw.	***)**
Frq Lim Low	***)**
Frq Lim Upp	***)**

*) according to test report

Measurement: Set the R&S UPV analyzer and generator according to the test report. The signal should be supplied via the R&S UPV's internal connection between the DUT generator and DUT analyzer.
Read off the THD+N value in dB in the numeric display.
The tolerance applies in case of full drive ($U_{in} \equiv$ Range)
For underdrive: Tolerance = (THD+N) + 20∗ log (Range / U_{in})

THD+N without Low Dist Generator

Note: *This test is made as a loop measurement along with the R&S UPV universal generator.*

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	***)**

Generator Function	
Function	Sine
Low Dist	Off
Frequency	***)**
Voltage	***)**

Analyzer Config	
Instrument	Analog
Channel	1 & 2
Coupling	AC
Bandwidth	***)**
Input Ch1	Gen Ch1
Input Ch2	Gen Ch2
Range	Fix: ***)**

Analyzer Function	
Function	THD+N &SINAD
Meas Mode	THD+N
Dynamic Mode	Prec
Rejection	***)**
Bandw.	***)**
Frq Lim Low	***)**
Frq Lim Upp	

*) according to test report

Measurement: Set the R&S UPV analyzer and generator according to the test report. The signal should be supplied via the R&S UPV's internal connection between the DUT generator and DUT analyzer.
Read off the THD+N value in dB in the numeric display.

THD+N measurement error

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	1
Output Type	Bal
Bandwidth	22 kHz
Ref Voltage	3.0 V

Generator Function	
Function	Multisine
No of Sine	2
Freq No1	1 kHz
Volt No1	0 dBr
Freq No2	2 kHz
Volt No2	–50 dBr

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	22 kHz
Input	Gen Ch1
Range	Fix: 3.0 V RMS

Analyzer Function	
Function	THD+N & SINAD
Meas Mode	THD+N
Dynamic Mode	*)
Rejection	*)

*) according to test report

Signal generation

Multisine from DUT generator: 1 kHz, 3.0 V and 2 kHz, 0.009487 V ≡ –50 dBr referred to a 3 V reference produces a nominal value of THD+N = –50 dB

Fundamental: DUT R&S UPV
Harmonic d2: DUT R&S UPV

Measurement:

Set the R&S UPV according to the test report. The signal should be supplied via the R&S UPV's internal connection between the DUT generator and DUT analyzer.
Read off THD+N in dB in the numeric display.

Notch filter frequency response test

Note: *For the THD, THD+N, Mod Dist distortion measurements, the analog notch filter is automatically activated with dynamic mode "precision" to improve the dynamic range of the measurement function routine. The notch filter can also be manually activated for the functions FFT, RMS, RMS Selective.*

Test 1 with analyzer bandwidth 80 kHz:

Note: *This test is performed at different base frequencies up to 25 kHz. The frequency response is tested with respect to the fundamental tuning and the gain.*

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	1
Output Type	Bal
Bandwidth	80 kHz
Ref Voltage	2.0 V

Generator Function	
Function	Multisine
No of Sine	2
Freq No1	***)**
Volt No1	0 dBr
Freq No2	***)**
Volt No2	***)**

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	80 kHz
Input	Gen Ch1
Range	Fix: 3.0 V RMS

Analyzer Function	
Function	THD+N & SINAD
Meas Mode	THD+N
Dynamic Mode	Prec
FrqLim Low	10 Hz
FrqLim Up	80 kHz

*) according to test report

Signal generation: Multisine from DUT R&S UPV generator produces the nominal values for THD+N according to the test report.

DUT R&S UPV multisine:

No of Sine	Frequency	Level	Comment
1	f_1	0 dBr	Fundamental
2	$f_2 = 2 * f_1$	–30, –50 dBr	2nd harmonic

Measurement: Set the R&S UPV according to the test report.
Read off THD+N in dB in the numeric display.

Test 2 with analyzer bandwidth 250 kHz:

Note: *This test is performed at different base frequencies up to 90 kHz. The frequency response is tested with respect to the fundamental tuning and the gain.*

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	1
Output Type	Unbal
Ref Voltage	4.0 V

Generator Function	
Function	Sine
Low Dist	On
Frequency	$= f_2$ ***)**
Voltage	$= U_2$ ***)**

*) according to test report

Analyzer Config	
Instrument	Analog
Channel	$2 \equiv 1$
Coupling	AC
Bandwidth	250 kHz
Input	Bal
Range	Fix: 3.0 V RMS

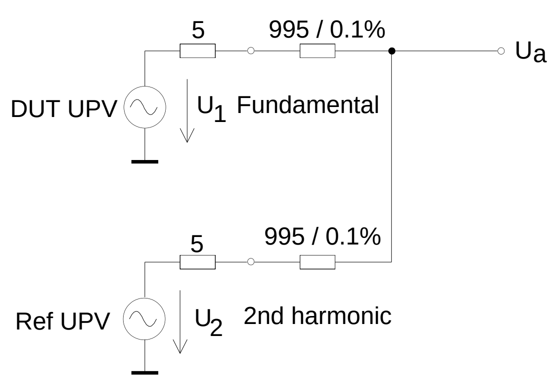
Analyzer Function	
Function	THD+N & SINAD
Meas Mode	THD+N
Dynamic Mode	Prec
FrqLim Low	20 Hz
FrqLim Up	250 kHz

*) according to test report

Ref R&S UPV gen:

Generator	Analog, Bandwidth 80 kHz
Channel(s)	1
Output	Unbal
Impedance	5 Ω
Common	Float
Function	Sine
Low Dist	On
Ref Volt	4 V
Frequency	$f_1 = 2^{nd}$ harmonic according to test report
Voltage	0 dBr, $= U_2$, 2^{nd} harmonic according to test report

Signal generation:



The DUT R&S UPV generates the fundamental and the Ref R&S UPV the harmonic.

Measurement: Connect the output signal U_a from the resistor network to the DUT R&S UPV inputs under test with a BNC cable using an XLR/BNC adapter.
For connecting the output signal of Ref R&S UPV to the resistor network use also an XLR/BNC adapter.
Set the DUT R&S UPV and Ref R&S UPV according to the test report.
Read off THD+N in dB in the numeric display.

Mod Dist modulation factor

Mod Dist inherent distortion

Note: *For this test, the DUT R&S UPV Low Dist Generator, Option R&S UPV-B1 is used in the signal processing along with the Ref R&S UPV Low Dist Generator for higher test frequencies. These analyzer tests can be made only with the installed option R&S UPV-B1.*

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	Unbal

Generator Function	
Function	Sine
Low Dist	***)**
Frequency	f_{hf} ***)**
Voltage	***)**

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	***)**
Input	Bal
Common	Ground
Range	Fix: ***)**

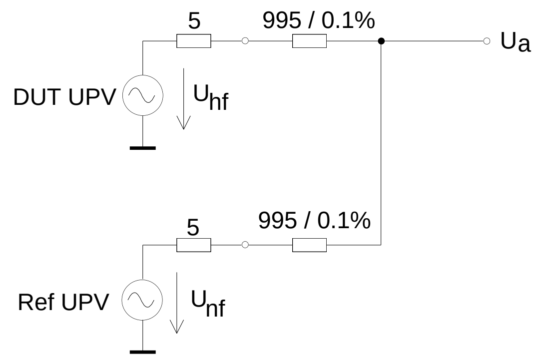
Analyzer Function	
Function	Mod Dist
Dynamic Mode	Prec
Post FFT	Off ***)**
Min FFT Size	****)**
	4k ***) **)**

*) according to test report
**) Post FFT On and Min FFT Size 256 k:
Only for analyzer bandwidth 250 kHz and test with 100 kHz upper frequency

Ref R&S UPV gen:

Generator	ANLG 80 kHz
Channel(s)	1
Output	Unbal
Impedance	5 Ω
Common	Float
Function	Sine
Low Dist	On
Frequency	f_{nf} , according to test report
Voltage	U_{nf} , according to formula or according to test report

Test setup:



The addition of two sinusoidal signals is handled with a resistor network. Both generators must be sufficiently decoupled and the possibility of inherent modulation distortion in signal generation must be excluded.

When mixing the signals, the DUT R&S UPV provides the HF carrier frequency and the Ref R&S UPV the low-frequency interference. In the case of the HF frequencies up to 50 kHz, it is better to use a universal generator since the noise in the vicinity of the carrier is lower than with the low distortion generator. With the upper HF carrier frequencies, the test is performed at higher LF frequencies so that the intermodulation frequencies have a greater separation from the carrier. The Low Dist Generator in the DUT R&S UPV is switched on for this purpose.

DUT R&S UPV	generates U_{hf} with f_{hf} = 4 kHz to 110 kHz
Ref R&S UPV	generates U_{nf} with f_{nf} = 30 Hz to 500 Hz

(with Low Dist Generator)

The RMS value of the total signal U_a (based on U_{nf} and U_{hf}) at the output of the resistor network is known as U_{eff}. Since the ratio of U_{nf} to U_{hf} must be equal to 4:1 but the adapter produces 1:1 with a division factor of 2, this ratio is set using the generator levels:

$$\boxed{U_{nf} = \frac{4 \cdot U_{eff}}{\sqrt{4.25}}} \qquad \boxed{U_{hf} = \frac{U_{eff}}{\sqrt{4.25}}}$$

Measurement: Set the R&S UPV analyzer and generator according to the test report.

- Set the voltage(s)
- Set f_{hf}; Vary f_{nf}
- Set a new f_{hf}; Vary f_{nf}
- Set the next voltage …

Read off the mod dist inherent distortion in dB in the numeric display.

Mod Dist measurement error

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	1
Output Type	Unbal
Bandwidth	80 kHz
Ref Voltage	0.7 V
	= U_{hf}

Generator Function	
Function	Multisine
No of sine	6
Freq No1	***)**
Volt No1	***)**
:	:
Volt No6	***)**
Freq No6	***)**

*) according to table below and test report

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	***)**
Input	Bal
Common	Ground
Range	Fix: 3.0 V RMS

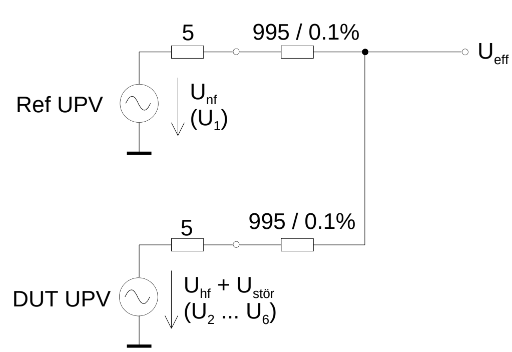
Analyzer Function	
Function	Mod Dist
Dynamic Mode	Prec

*) according to test report

Ref R&S UPV gen:

Generator	ANLG 80 kHz
Channel(s)	1
Output	Unbal
Impedance	5 Ω
Common	Float
Function	Sine
Low Dist	On
Frequency	f_{nf}, according to test report
	Voltage U_{nf}, according to formula above or test report

Test setup:



Signal generation: LF signal: R&S UPV

HF signal + Mod Dist interference signal:
DUT R&S UPV
A multisine is added in.

Explanation of the DUT R&S UPV multisine settings:

No of Sine	Frequency	Level	Comment
1	f_{nf}	–140 Br	LF interference signal (supplied by Ref R&S UPV)
2	f_{hf}	0 dBr	HF useful signal
3	$f_{hf} - 2 * f_{nf}$	U_3	d3u modulation in dBr
4	$f_{hf} - f_{nf}$	U_4	d2u modulation in dBr
5	$f_{hf} + f_{nf}$	U_5	d2o modulation in dBr
6	$f_{hf} + 2 * f_{nf}$	U_6	d3o modulation in dBr

The reference for dBr is the level of f_{hf} → DUT R&S UPV Ref Voltage = U_{hf} (see the "Generator Config" panel above).

$$U_{hf} = 0.7\text{ V} \rightarrow U_{eff} = 4.1231 * U_{hf} = 2.886\text{ V (without interferer)}$$

Formula:

$$U_{eff} = \sqrt{17 \cdot U_{hf}^2 + U_{stör}^2} \quad \text{with} \quad U_{stör} = U_{RMS} \text{ from } U_3 \ldots U_6$$

Measurement: Set the UPV analyzer and generator according to the test report.

- Set the voltages
- Set f_{hf}; Vary f_{nf}
- Set a new f_{hf}; Vary f_{nf}
- Set the next voltages …

Read off mod dist in dB in the numeric display.

DFD difference-frequency distortion

Formulas for the parameters "Mean frequency", "Upper frequency" and "Difference frequency" used below for the test:

For Meas Mode IEC 268:

$$f_{Mean} = \frac{f_1 + f_2}{2} \qquad f_1 = f_{Mean} - \frac{f_{Diff}}{2}$$

$$f_{Diff} = f_2 - f_1 \qquad f_2 = f_{Mean} + \frac{f_{Diff}}{2}$$

For Meas Mode IEC 118:

$$f_{Upper} = f_2$$

$$f_{Diff} = f_2 - f_1$$

DFD d2 inherent distortion

The DFD d2 function routine in precision mode automatically switches to fast mode under the following conditions: For d2 $\leq$ 50 dB and / or if the lower difference-frequency carrier is < 6.5 kHz. The test of the inherent distortion is described only for Meas Mode IEC 268 since the same device hardware is used for the other mode from IEC 118 and there is a difference only in terms of the firmware functioning.

The following test conditions are structured so that both dynamic modes (Prec/Fast) are tested.

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	1
Output Type	Unbal
Bandwidth	***)**

Generator Function	
Function	Sine
Low Dist	***)**
Frequency	f_1 ***)**
Voltage	U_1 ***)**

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	***)**
Input	Bal
Common	Ground
Range	Fix: ***)**

Analyzer Function	
Function	DFD
Meas Mode	d2 (IEC
Dynamic	
	Prec

*) according to test report

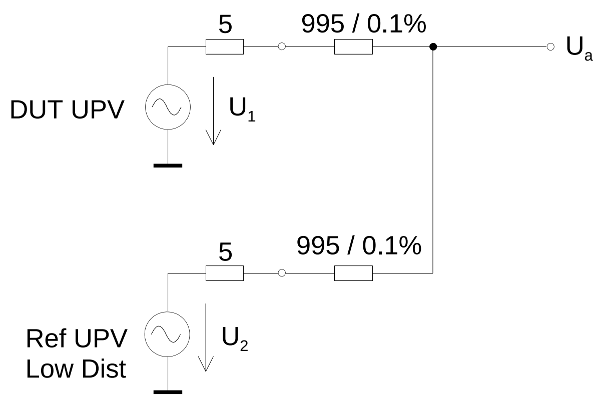
Set Ref R&S UPV:

Generator	Anlg, Bandwidth 80 kHz
Channel(s)	1
Output	Unbal
Impedance	5 Ω
Common	Float
Function	Sine
Low Dist	On
Frequency	f2
Voltage	U2

<u>Signal generation</u>: Addition of two signals using the resistor network:

Gen1 (DUT R&S UPV): Generates U_1 with f_1 = 7 kHz to 100 kHz (Low Dist for > 80 kHz)

Gen2 (Ref R&S UPV Low Dist): Generates U_2 with f_2 = 7 kHz to 100 kHz
Both signals are attenuated by the resistor network by a value of 6.02 dB.



We have:	$U_1 = U_2$	
in Meas Mode	Mean_Freq = 0.5 · ($f_1 + f_2$)	Mean frequency
IEC 268:	Diff_Freq = $f_2 - f_1$	Difference freq
	→ f_1 = Mean_Freq - Diff_Freq / 2	
	→ f_2 = Mean_Freq + Diff_Freq / 2	
Total signal U_a:	RMS value = 1.4142 · U_1 / 2 = 0.7071 · U_1	
	Peak value = 1.4142 · U_1 = 2 · RMS value	

<u>Measurement:</u> Connect the output signal U_a from the resistor network to the R&S UPV inputs under test with a BNC cable using an XLR/BNC adapter.

Set the R&S UPV according to the test report.

$$\boxed{U_1 = U_2 = U_{eff} \cdot \sqrt{2}}$$

- Set voltages U1 and U2
- Set Mean_Freq, vary Diff_Freq
- Set a new Mean_Freq, vary Diff_Freq
- Set the next voltage …

Read off the DFD d2 inherent distortion in the numeric display.

DFD d3 inherent distortion

Set DUT R&S UPV:

Generator Config	
Instrument	Analog
Channel	1
Output Type	Unbal
Bandwidth	***)**

Generator Function	
Function	Sine
Low Dist	***)**
Frequency	f_1 ***)**
Voltage	U_1 ***)**

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	***)**
Input	Bal
Common	Ground
Range	Fix: ***)**

Analyzer Function	
Function	DFD
Meas Mode	d3 ***)**

*) according to test report

Set Ref R&S UPV: (see "*DFD d2 inherent distortion*" and test report):

Signal generation: Addition of two signals using a resistor network (see "*DFD d2 inherent distortion*"):
Both signals are attenuated by the resistor network by a value of 6.02 dB. The generators are sufficiently decoupled by a total of 2 kΩ provided by the resistor network and do not produce an inherent d3 in the signal.

Measurement: Connect the output signal U_a from the resistor network to the R&S UPV inputs under test with a BNC cable using an XLR/BNC adapter.
Set the R&S UPV according to the test report.

- Set voltages U1 and U2
- Set Mean_Freq, vary Diff_Freq
- Set a new Mean_Freq, vary Diff_Freq
- Set the next voltage …

$$\boxed{U_1 = U_2 = U_{eff} \cdot \sqrt{2}}$$

Read off the DFD d2 inherent distortion in the numeric display.

DFD d2 / d3 measurement error

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	1
Output Type	Unbal
Bandwidth	80 kHz
Ref Voltage	2.0 V
	(= $U_1 = U_2$)

Generator Function	
Function	Multisine
No of sine	5
Freq No1	***)**
Volt No1	***)**
:	:
Volt No5	***)**
Freq No5	***)**

*) according to table below and test report

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	***)**
Input	Gen Ch1
Range	Fix: 3 V RMS

*) according to test report

Analyzer Function	
Function	DFD
Meas Mode	***)**
Dynamic Mode	Prec ***)**

Signal generation: DUT R&S UPV generates the complete signal with multisine:

No of Sine	Frequency	Level	Comment
1	f_1	U_1 = –6.0 dBr	Lower difference-frequency carrier
2	f_2	U_2 = –6.0 dBr	Upper difference-frequency carrier
3	f_3	U_3	d2: Difference-frequency intermodulation, 2nd order
4	$f_4 = f_1 - f_3$	U_4	d3u: Lower intermodulation, 3rd order
5	$f_5 = f_2 + f_3$	U_5	d3o: Upper intermodulation, 3rd order

U_1 to U_5 in dBr

The reference for dBr is the "Ref-Volt" in the generator panel.
Due to the –6.0 dBr at f1, f2, this reference also applies to d2 and d3.
If U3 = –xy dBr: Then d2 = –xy dB for Meas Mode IEC 268 and d2 = –xy + 6 dB for IEC 118.

DFD d2 measurement error

Formulas

For Meas Mode IEC 268:

$$\mathrm{DFD\,d2/dB} = 20 \cdot \lg \frac{U_{f2-f1}}{2 \cdot U_{ref}} = 20 \cdot \lg \frac{U_3}{2 \cdot U_{ref}}$$

For Meas Mode IEC 118:

$$\mathrm{DFD\,d2/dB} = 20 \cdot \lg \frac{U_{f2-f1}}{U_{ref}} = 20 \cdot \lg \frac{U_3}{U_{ref}}$$

Set R&S UPV:

Generator: U1 = U2 = –6.0 dBr, U4 = U5 = –140 dBr, Volt No. 3 according to table above and test report

Analyzer: DFD d2, Dynamic Mode Prec.

Measurement: Set the R&S UPV according to the test report.
The signal should be supplied via the R&S UPV's internal connection between the DUT generator and DUT analyzer.

Read off DFD d2 in the numeric display.

DFD d2 analog lowpass test

Note: *This test checks the analog DFD d2 lowpass filter which is automatically activated for precision mode of the DFD function in order to improve the dynamic range of the measurement function routine.*

Signal generation and setting as described above under section "*DFD d2 inherent distortion*".

Measurement: Set the R&S UPV according to the test report.
Read off DFD d2 in the numeric display.

DFD d3 measurement accuracy

Note: *This test item is not absolutely required since the measurement error is determined by the firmware functioning.*

Set R&S UPV:

Generator: U1 = U2 = –6.0 dBr, U3 = –140 dBr, Volt No. 3 and 5 according to the table above and test report

Analyzer: Function DFD, Meas Mode d3 (IEC 268).

Measurement: Read off DFD d3 in the numeric display.

DIM dynamic intermodulation factor

Note: *A test of the analyzer function can be performed only with the installed option R&S UPV-B3.*

DIM inherent distortion

Note: *The tolerances in the test report apply according to the data sheet for loop measurement*
R&S UPV generator/analyzer
with full drive: $U_{in} \equiv$ Range
with underdrive: Tolerance / dB = 100 + 20 $*$ log (Range / U_{in}).

Set R&S UPV:

Generator Config	
Instrument	Analog
Channel	2 ≡ 1
Output Type	Unbal

Generator Function	
Function	DIM
Square/ Sine	***)**
Bandwidth	***)**
Total Voltage	***)**

Analyzer Config	
Instrument	Analog
Channel	2 ≡ 1
Coupling	AC
Bandwidth	22 kHz
Input	Gen Ch1
Range	Fix: ***)**

Analyzer Function	
Function	DIM

*) according to test report

Measurement: Set the R&S UPV according to the test report.
The DIM signal is supplied by the Second Generator option and is fed to both analyzer channels via the internal connection of the generator/analyzer. Read off the DIM inherent distortion in the numeric display.

DIM measurement error

Note: *There is no need to separately perform this test during servicing since proper functioning is ensured by the inherent distortion test above and the firmware algorithm used by the R&S UPV*

Performance Test Audio Monitor

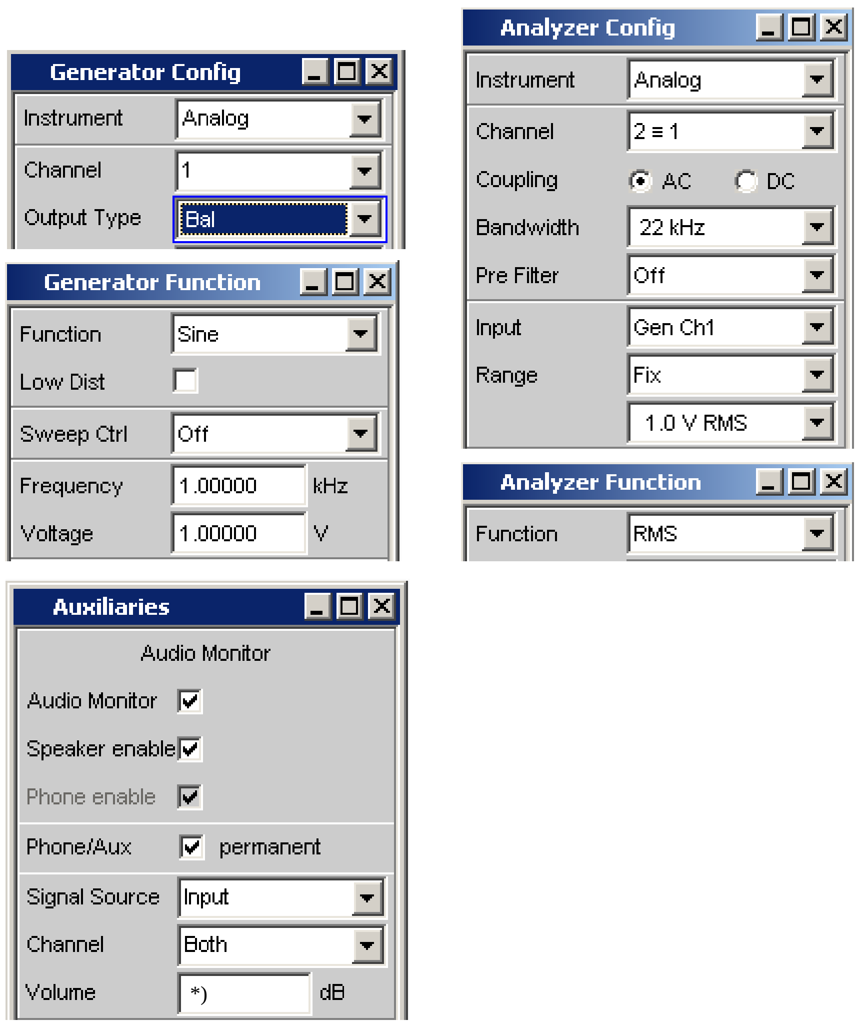
Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select "Preset (Load Default)" in the submenu.

Unless otherwise stated, the following settings apply to the R&S UPV:



*) according to test report

In order to measure the technical characteristics, we recommend that you use a suitable audio analyzer. When making sequential measurements of the two channels, you can connect the headphone output (Phone Out) to the inputs of your analyzer in order to use the other channel of the R&S UPV.

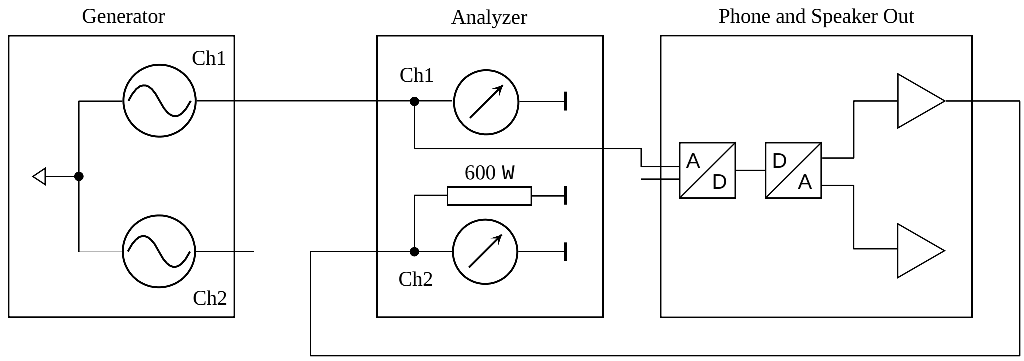


Fig. 1-1 Sequential measurement of Phone Out with your own analyzer

As can be seen in Fig. 1-1, you can use this circuit arrangement to use your own analyzer to measure the technical features of the headphone output. Analyzer channel 2 measures Phone Out channel 1 and vice versa. The connection between the generator and analyzer can run externally using an XLR cable or via an internal connection.

Functional test, internal speaker

This functional test involves a check of the sound and volume produced by the internal loudspeaker. There should not be any noticeable distortion and no clear difference in volume should be obvious when changing the frequency between 0.4 kHz, 1 kHz and 10 kHz.

You can switch the internal loudspeaker on and off using the tick box in the Auxiliaries Panel or with the button labeled with the loudspeaker icon and ON on the front panel of the R&S UPV.
You can set the level needed for the hearing test using the “Volume” input field in the Auxiliaries Panel or using the button on the front panel of the R&S UPV.

*) according to test report

Phone Out: source switching

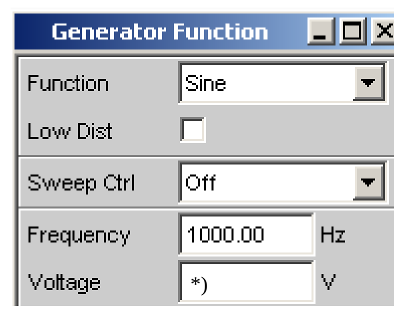
The R&S UPV offers various monitoring facilities:

- Input: You can directly monitor the input voltage to the analyzer.
- Monitor: You can monitor the input voltage to the analyzer after the prefilter.
- Function: You can monitor the input voltage which is supplied to the analyzer and digitally processed (e.g. filtered).
- Generator: You can monitor the output voltage produced by the generator.

Since the "Monitor" and "Function" signal sources involve purely digital processing of the signals fed to the input of the analog analyzer, it is not necessary to test or verify their technical characteristics.

Set R&S UPV:

*) according to test sequence



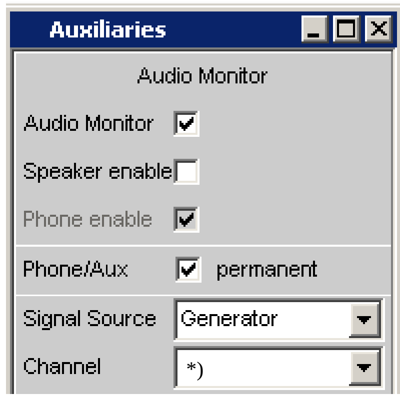
according to test sequence

Test sequence:

- ➢ Plug the headphones into the jack on the front panel of the R&S UPV.
- ➢ In the Auxiliaries Panel, set the signal source to "Generator".
- ➢ In the Generator Function Panel, change the setting for the voltage. The volume in the headphones should not change.
- ➢ In the Auxiliaries Panel, set the signal source to "Input".
- ➢ In the Generator Function Panel, change the setting for the voltage. The sound in the headphones should change.

Phone Out: channel switching

Set R&S UPV:



*) according to test sequence

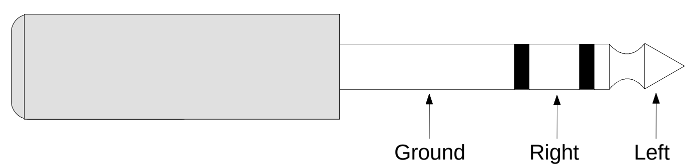
*) according to test sequence

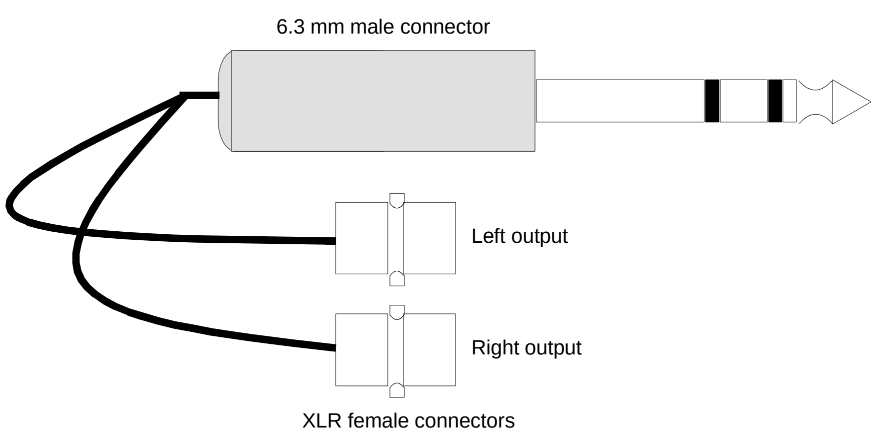
Test sequence:

- Plug the headphones into the jack on the front panel of the R&S UPV.
- In the Auxiliaries Panel, set the channel to "Both".
- In the Generator Config Panel, set the channel to "1".
  A tone may be heard only from the left earpiece of the headphones.
- In the Auxiliaries Panel, set the channel to "Channel 1".
  A tone of the same volume must be heard from both earpieces.
- In the Auxiliaries Panel, set the channel back to "Both".
- In the Generator Config Panel, set the channel to "2".
  A tone may be heard only from the right earpiece of the headphones.
- In the Generator Config Panel, set the channel to "2 = 1".
  A tone of the same volume must be heard from both earpieces.

Phone Out: output level and offset

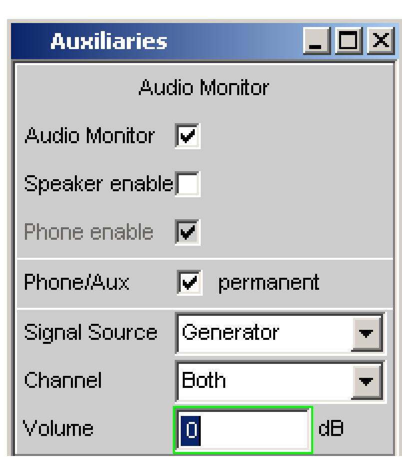
If the R&S UPV does not have the option R&S UPV-U2 (BNC Phone Out) installed, we recommend using an adapter cable to access the measurement results from the monitoring output. This cable should convert from the jack on the front panel of the R&S UPV to 2 * BNC or XLR jacks.



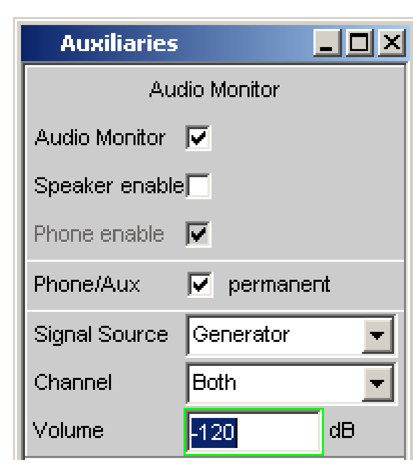


Set the input impedance of the audio analyzer you are using to 600 Ω. This will place a load of 600 Ω on the monitoring output.

Set R&S UPV:



for level measurement



for offset measurement

Meas. instrument: R&S UPV analyzer (RMS [level] and DC [offset] measurement)

Measurement: Operate the analog generator 1 V output level at 1 kHz). Set the "Signal Source" in the Auxiliaries Panel to "Generator" and the "Volume" to 0 dB for level measurement and -120 dB for offset measurement respectively.

Phone Out: frequency response

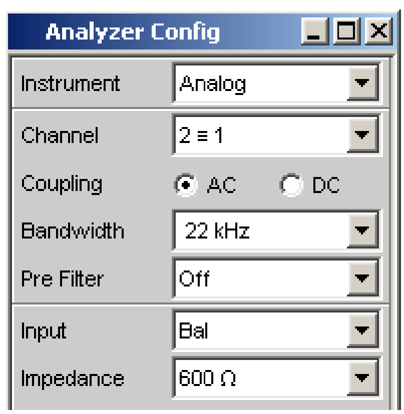
Set R&S UPV: Same as above.

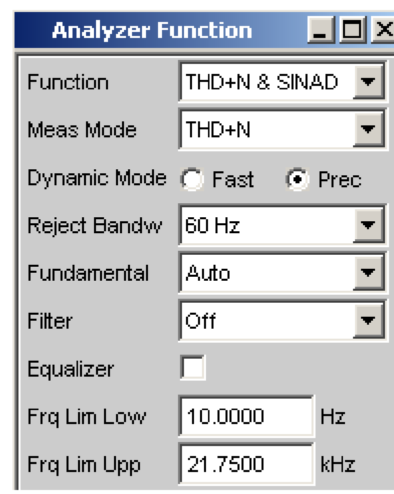
Meas. instrument: AC voltmeter or R&S UPV analyzer

Measurement: Measure the frequency response for the left and right channels. Set the "Volume" to 0 dB (=max). The reference is the voltage measured at 1 kHz. The output voltage should be approx. 3.5 V.

Phone Out: inherent distortion

Set R&S R&S UPV: Same as above.



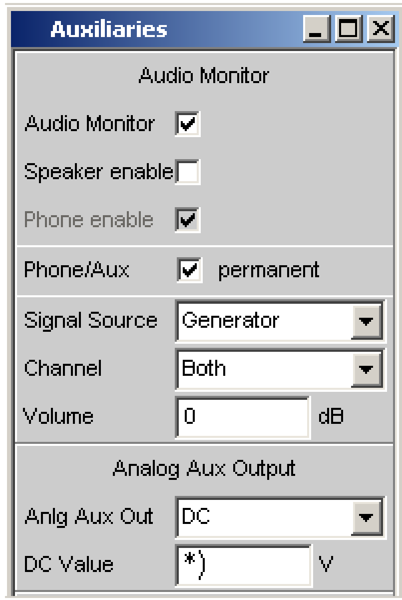


Meas. instrument: R&S UPV analyzer

Measurement: Measure the inherent distortion for the left and right channels. Set the "Volume" to 0 dB (=max).
Connect the R&S UPV generator's channel 1 output to the analyzer's channel 1 input.
Connect Phone Out's channel 1 output to the analyzer's channel 2 input.
You will need an adapter from the 6.3 mm male connector to 2 * XLR male connector.

Aux Out: DC level

Set R&S UPV:



*) Set DC value according to test report

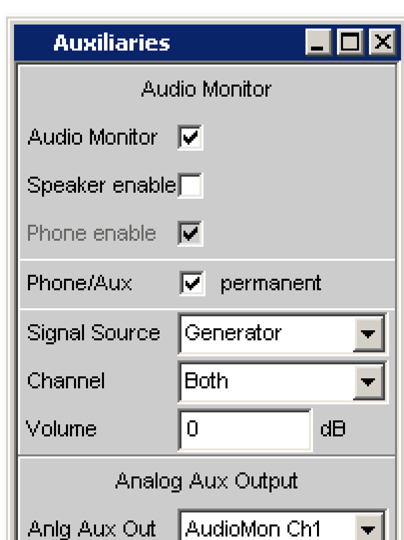
Meas. instrument: R&S UPV analyzer

Measurement:

- Set the DC value according to the test report.
- Connect the BNC jack for Aux Out on the back panel of the R&S UPV to the analyzer input.
- Set the R&S UPV analyzer in the Analyzer Function Panel to “DC”.
- You will need an adapter from BNC to XLR.

Aux Out: frequency response

Set R&S UPV:



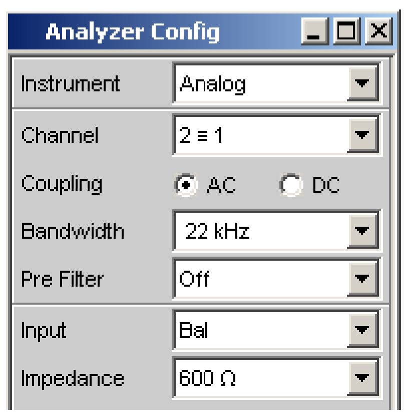
<u>Meas. instrument</u>: R&S UPV analyzer

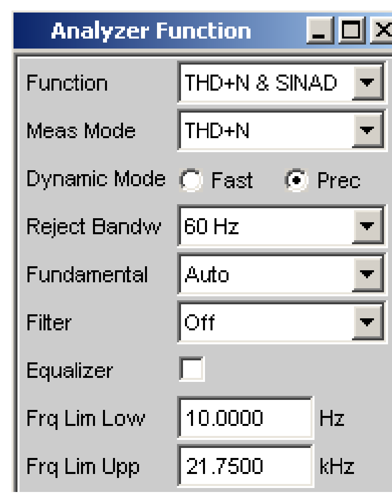
<u>Test setup</u>: Connect Aux Out to an analyzer input.
You will need an adapter from BNC to XLR.

<u>Measurement</u>: In the Generator Config Panel, set the channel to "2 = 1".
Set the frequency value according to the test report.
In the Analyzer Function Panel, select the measurement function RMS.

Aux Out: inherent distortion

<u>Set R&S UPV</u>: Same as above.





<u>Meas. instrument</u>: R&S UPV analyzer

<u>Test setup</u>: Connect Aux Out to an analyzer input.
You will need an adapter from BNC to XLR.

<u>Measurement</u>: Measure the inherent distortion only for the left channel. Set the "Volume" to 0 dB (=max).

Performance Test R&S UPV-B1 (Low Distortion Generator)

Before starting the test, set the R&S UPV to a defined initial status. To this end, call up the default setting:

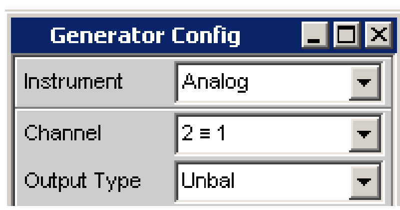
Press the PRESET key and confirm your input request with "↵"

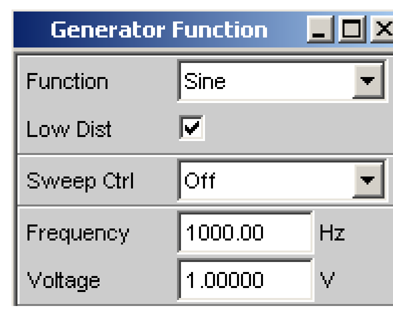
or

Press the MENU key and select "Preset (Load Default)" in the submenu.

Level error at 1 kHz

<u>Set R&S UPV</u>:





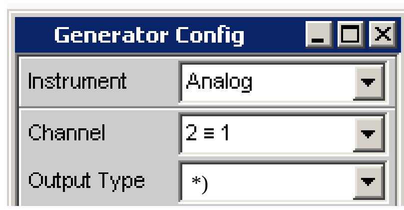
<u>Meas. instrument</u>: AC voltmeter

<u>Measurement</u>: Connect the AC voltmeter to the output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. For the remaining R&S UPV settings and measurement procedure, see the test report.

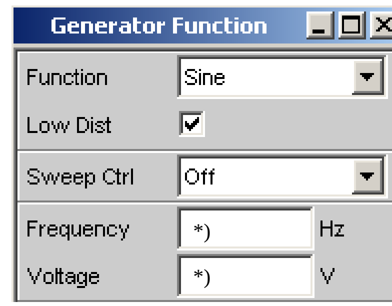
<u>Note</u>: This test item is affected by the automatic adjustment of the low distortion generator.

Frequency response

Set R&S UPV:



*) according to test report



*) according to test report

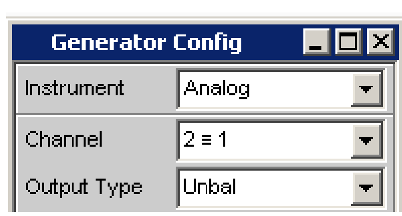
Meas. instrument: AC voltmeter

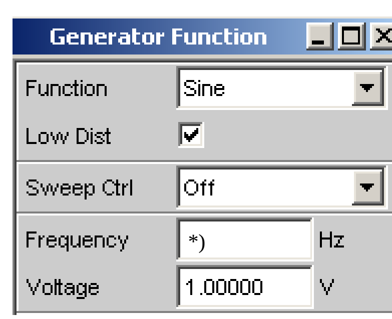
Measurement: Connect the frequency counter to the output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. Relative display in dB, reference is the voltage measured at 1 kHz. For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: This test item is affected by the 100 kHz adjustment of the low distortion generator.

Frequency error

Set R&S UPV:





*) according to test report

Meas. instrument: Frequency counter

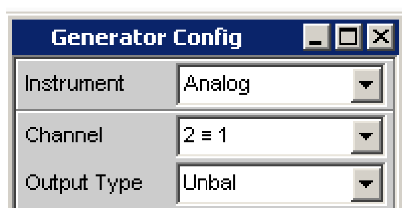
Measurement: Connect the frequency counter to the output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. For the remaining R&S UPV settings and measurement procedure, see the test report.

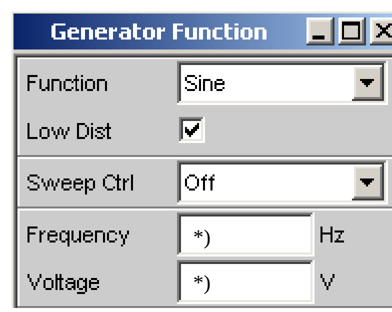
Note: This test item is affected by the automatic adjustment of the low distortion generator.

THD inherent distortion

Test method: In the audio frequency range, the harmonics suppression of the R&S UPV generator is typ. 115 dB to 125 dB, depending on the set frequency. The R&S UPV analyzer features about the same harmonics suppression so that the inherent distortions of the generator cannot be directly checked using the R&S UPV analyzer or any other audio analyzer currently available on the market.
With the measurement function FFT: The R&S Ref UPV analyzer features a dynamic range of > 100 dB. For measuring the harmonics suppression of the R&S UPV generator, a passive notch filter is used, suppressing the fundamental by more than 60 dB, but attenuating the harmonics by less than 10 dB. This results in an increase in the dynamic range by 50 dB from 100 dB to 150 dB, referred to the non-suppressed fundamental. The attenuation of the harmonics by the notch filter must be taken into account in the measurement. The attenuation factors are indicated when connecting the notch filter; see section "*Notch filter NOTCH THD, for THD measurement of generator*" on page 1.3.

Set R&S UPV:





*) according to test report

Meas. instrument: FFT Analyzer Ref R&S UPV

Setup: Connect the output of the R&S UPV generator to the input of the Ref R&S UPV analyzer.

Preparation:

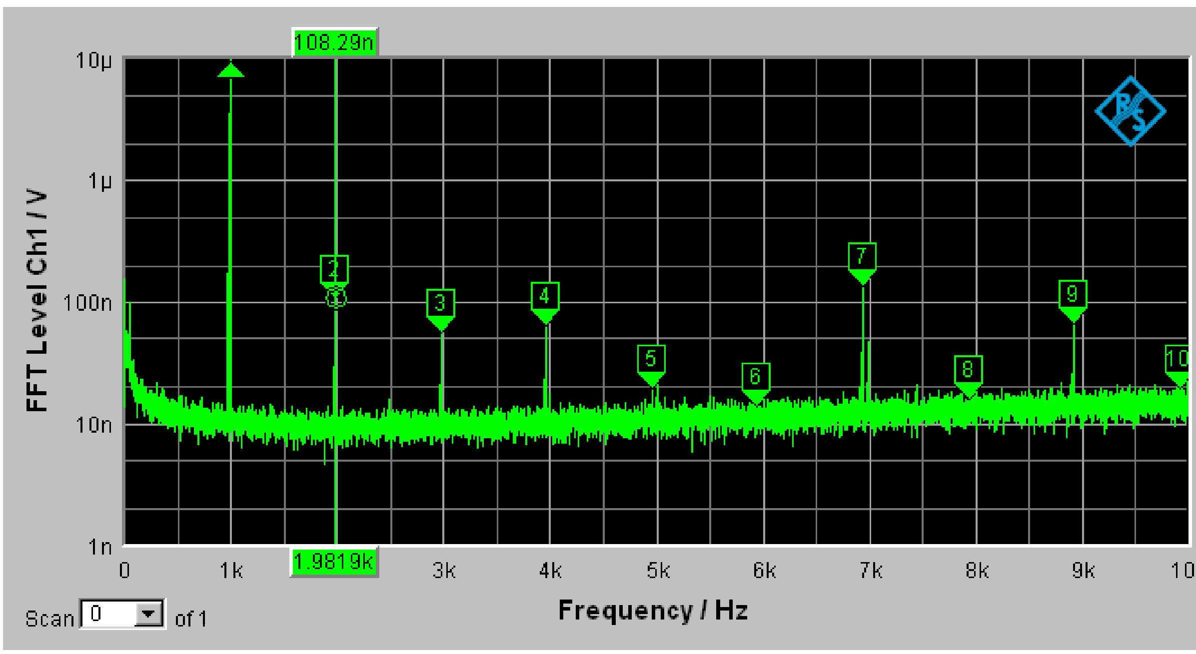
- Press the START key to restart the measurement.
- The measured value displayed under RMS via FFT must be about 0 dBr. open the “Config Panel” with the right button of the mouse inside the numeric display, take measurement value as reference value by “Store Ch1” in line “Reference Voltage”.
  To suppress any disturbances set commen to „Ground“ in the Analyzer Config Panel
- Connect the notch filter between the output of the R&S UPV generator and input of the Ref R&S UPV analyzer.
  You will need two adapters XLR female / BNC female for this purpose.
- In order to achieve suppression of the fundamental of greater than 60 dB, it may be necessary to slightly readjust the generator frequency until the measured value RMS via FFT is < -60 dBr.

Measurement:

- Select „FFT“ in the Analyzer Function Panel and activate graphic at “Post FFT” by pressing the “Show” button
- Scale “graphic display” so that only 9 markers are visible.
  (for example scale the X axis at 1 kHz from 0 to 10 kHz)
- Select “Precision” for frequency measurement
- FFT settings (Analyzer Function Panel):
  Windows: Flat Top
  Avg. Mode: Exponential

Avg. Count: 8
- Modify the FFT Graph1 display to full-screen.
- Press the Single key to end the measurement. This is indicated by a dark Single LED
- In the FFT Graph 1 Panel (Softkeys):
  click “Marker” → “Trace A” → “Harm” (The harmonics d_2 to d_9 are now marked by small triangles with numbers) from 2 to 9)
  Back → Back → Cursor → o Cursor Movement (…) → Next Harmonic
  The o CURSOR is positioned at the fundamental (about 1 kHz).

The screen should now look roughly like this:



- To select one harmonic after the other use the rotary knob or the tab button. Read the measurement value above cursor position of the diagram.
- Measure the voltage of each harmonic d_n with the cursor (→ U_{nd}) and correct it with the attenuation of the notch filter (the attenuation values are indicated when connecting the notch filter; see section "*Notch filter NOTCH THD, for THD measurement of generator*" on page 1.3). You will obtain the following as the voltage of the n-th harmonic:

$$U_n = U_{dn} \cdot a_n$$

- Computation of the THD value:
  Squarelaw addition of the individual harmonics:

$$U_{THD} = \sqrt{\sum_{n=2}^{5} U_n^2}$$

Reference to the fundamental:

$$THD = 20 \cdot \log \frac{U_{THD}}{U_1} \quad (\text{in dB})$$

where U_1 is the voltage set in the R&S UPV generator (in this example, 2.5 V).

Evaluation of the measurement for this example:

- Read off the values for U_{nd} in the above figure. Multiplication by a_n results in the real value of the harmonics U_n.

n	U_{nd} [nV]	a_n	U_n [µV]
2	108,3	2.85	0,309
3	57,6	1.8	0,104
4	64,4	1.5	0,097
5	19,7	1.3	0,026
6	14	1.2	0,017
7	138	1.16	0,166

$$U_{THD} = \sqrt{\sum_{n=2}^{7} U_n^2} = 0{,}38\mu V$$

$$THD = 20 \cdot \log \frac{U_{THD}}{U_1} = 20 \cdot \log \frac{0{,}38\mu V}{2.5V} = -136{,}4dB$$

- If we take into account d_9 additionally with U_n = 0,095 µV,

  then we obtain: U_{THD} = 0,39 µV

  and thus

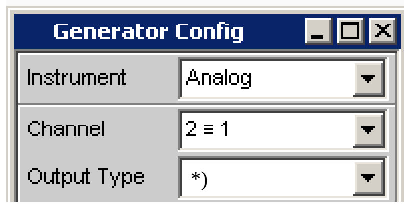
$$THD = 20 \cdot \log \frac{0{,}39\mu V}{2{,}5V} = -136.1dB$$

Settings of the Ref R&S UPV analyzer for other frequencies:

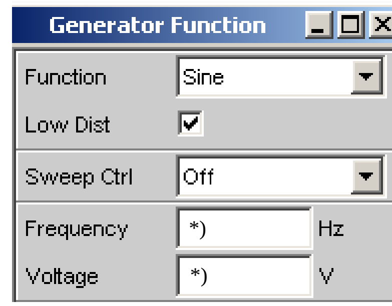
Freq	Analyzer		Display		
20 Hz	Instrument	Analog 22 kHz	X-Axis	Right	200 Hz
1 kHz	Instrument	Analog 22 kHz	X-Axis	Right	10 kHz
7 kHz	Instrument	Analog 80 kHz	X-Axis	Right	70 kHz
20 kHz	Instrument	Analog 250 kHz	X-Axis	Right	200 kHz

THD+N inherent distortion

Set R&S UPV:



*) according to test report



*) according to test report

Measuring instrument: Analyzer for THD+N: Ref R&S UPV

Settings of the Ref R&S UPV analyzer for:

Instrument	Analog 22 kHz	Analog 250 kHz
Channel	1	1
Ch1 Input	*)	*)
Ch1 Range	Auto	Auto
Function	THD+N & SINAD	THD+N & SINAD
Dyn Mode	Precision	Precision
Unit	dB	dB
FrqLim Low	20.00 Hz	150.00 Hz
FrqLim Upp	21.90 kHz	100.00 kHz

*) set according to R&S UPV generator

Input Bal with impedance 200 kΩ

Test setup: Connect the Ref R&S UPV analyzer to the output of the DUT R&S UPV generator.
Output Bal: Use a balanced cable (XLR).
Output Unbal: Use an adapter XLR female / BNC female and an unbalanced cable (BNC) and an adapter XLR male / BNC female.

Measurement: For the remaining DUT R&S UPV settings and measurement procedure, see the test report.
Measurement in channel 1 is sufficient.

Performance Test R&S UPV-B2 (Digital Audio I/O 192 kHz)

Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with "↵"

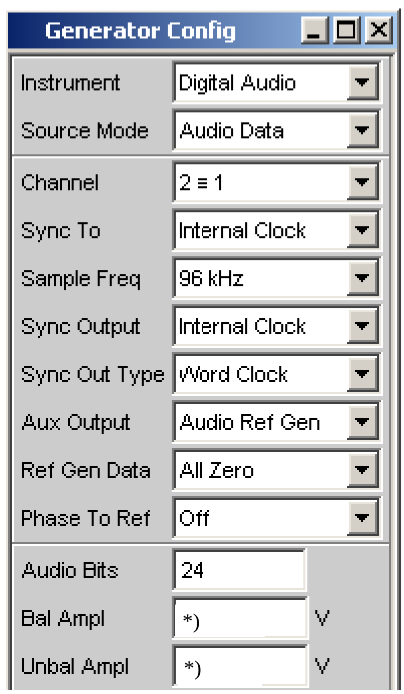
or

Press the MENU key and select "Preset (Load Default)" in the submenu.

Digital Audio Generator

Level error, Unbal output

Set R&S UPV:



*) set according to test report

Meas. instrument: Oscilloscope (or Ref R&S UPV with option R&S UPV-K22)

Measurement: Connect the oscilloscope using a 75 Ω cable and 75 Ω terminating impedance to the Unbal output of the R&S UPV.
Set the level and make the measurement according to the test report.

Note: This test item is influenced by the adjustment of the digital amplitude on the digital front panel (DFP).

Level error, Bal output

Set R&S UPV: Same as above.

Meas. instrument: Oscilloscope with 10:1 probe (or DUT R&S UPV with option R&S UPV-K22)

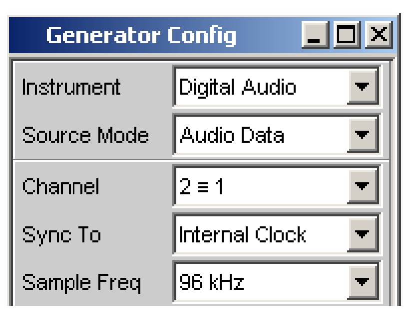
Measurement: To save the cost of adapting the balanced output to the unbalanced input of the oscilloscope in this measurement, use a high-impedance probe without a terminating impedance to measure the open-circuit voltage of the Bal output.

For a correct measurement the voltage of the balanced output must be measured differentially. Therefore the use of a XLR/BNC adapter is recommended to be able to connect the differential voltage to the unbalanced input.
Because of the unterminated measurement the value must be divided by 2 before written in the performance test protocol.

Note: If the option R&S UPV-K22 is available, it is possible to directly measure the input pulse amplitude of the digital signals. It is easiest to check the level accuracy in the corresponding section for the option R&S UPV-K22.

Error of internal clock rate

Set R&S UPV:

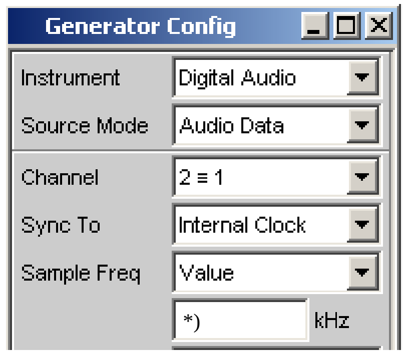


Meas. instrument: Frequency counter (or for an internal connection with a digital audio analyzer)

Measurement: Measurement of the 96 kHz sampling rate
Connect the frequency counter to Sync Out to measure the clock rate.
Set a sampling rate of 96 kHz on the generator and compare it to the displayed value on the frequency counter.
For the maximum frequency error, see the test report.

Sampling rate measurement

Set R&S UPV:



*) set according to test report

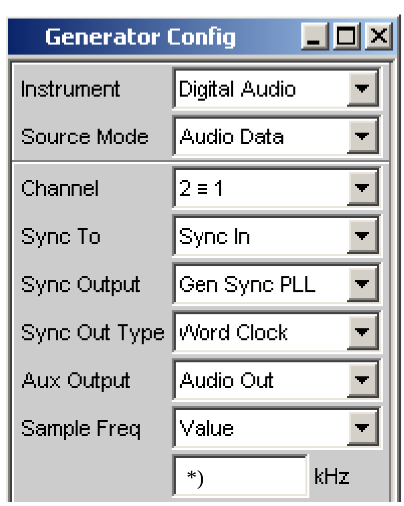
Meas. instrument: Frequency counter

Measurement:

- Measurement from 30 kHz to 200 kHz
- Connect the frequency counter to Sync Out to measure the clock rate.
- Set a sampling rate on the generator as described in the test report and compare it to the displayed values on the frequency counter.
- For the maximum frequency offset, see the test report.

External synchronisation

Set R&S UPV:



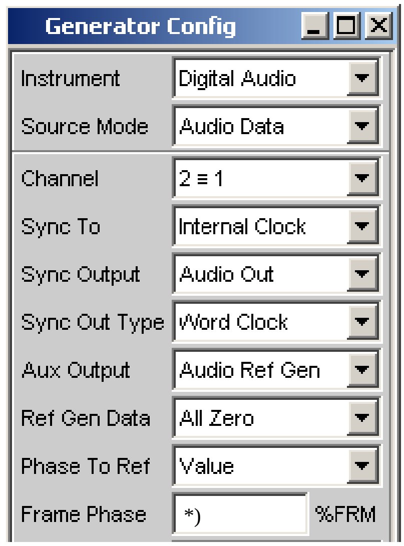
*) 48 kHz for 30 kHz and 64 kHz ext. clock (base rate)
96 kHz for 65 kHz and 128 kHz ext. clock (high rate)
192 kHz for 129 kHz and 200 kHz ext. clock (extended rate)

Meas. instrument: Frequency counter
TTL clock generator 30 – 200 kHz

Measurement: Connect the frequency counter to the sync output of the R&S UPV.
Clock the TTL clock generator to Sync In.
Compare the clock rate set on the external generator with the value displayed on the frequency counter.

Phase To Ref

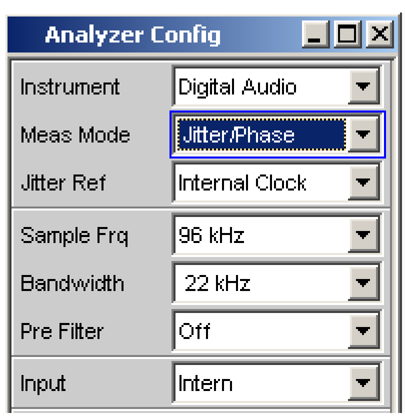
Set R&S UPV:

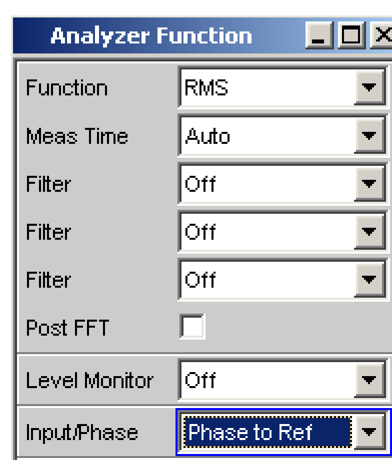


*) set according to test report

Test setup: Connect the XLR connector "Ref In" to "Aux Out" on the rear panel of the R&S UPV.
If the option R&S UPV-K22 is not installed, you must verify the data only using the Ref R&S UPV with the option R&S UPV-K22. The figure below shows the settings for the UPV analyzer.

Analyzer settings:



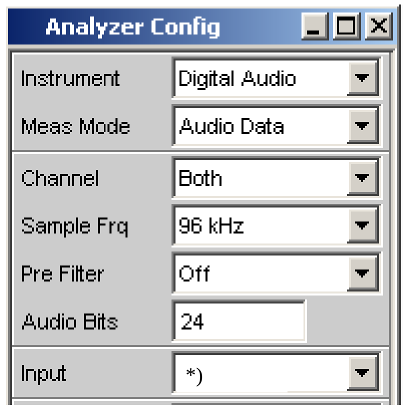


Measurement: Read off the measured value in the center numeric display.

Digital Audio Analyzer

Digital inputs

Set R&S UPV:

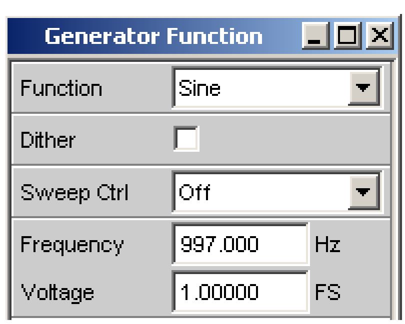


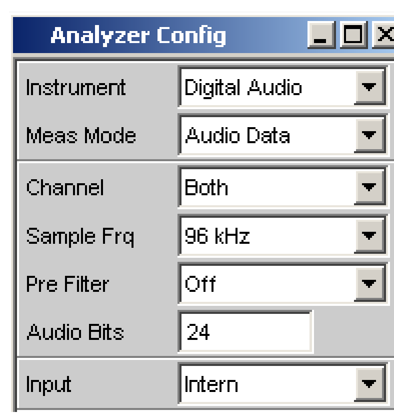
*) set according to test report

Test: Connect the individual digital inputs of the R&S UPV (Bal, Unbal, Optical) one after another to the corresponding digital output of the R&S UPV. Select the input to be tested on the analyzer. Compare the values displayed on the analyzer for input peak and frequency (in the numeric display) with the settings on the generator. Make the settings and perform the measurement according to the test report.

Measurement functions

Set R&S UPV:





Note: The digital signal is generated based on the programming of the signal processor. The easiest way to check for proper functioning is by making a loop measurement with the digital analyzer.

Test setup: Connect the digital analyzer input to the digital generator output (either Intern, Bal, Unbal or Optical).

Measurement: Make the THD+N measurement (function THD+N/SINAD in the analyzer function panel) and compare the results in the numeric display with the test report.

Performance Test R&S UPV-B3 (Second Analog Generator)

Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

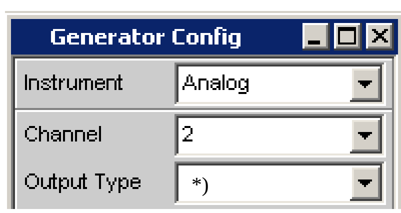
Press the PRESET key and confirm your input request with "↵"

or

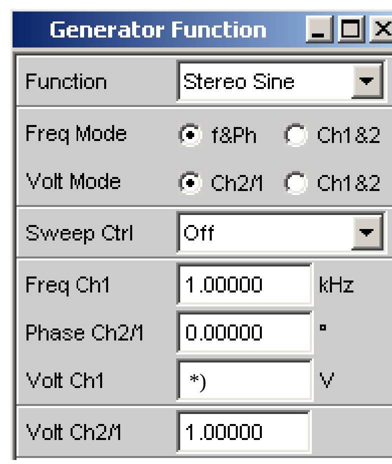
Press the MENU key and select "Preset (Load Default)" in the submenu.

Sinewave level error at 1 kHz

Set R&S UPV:



*) according to test report



*) according to test report

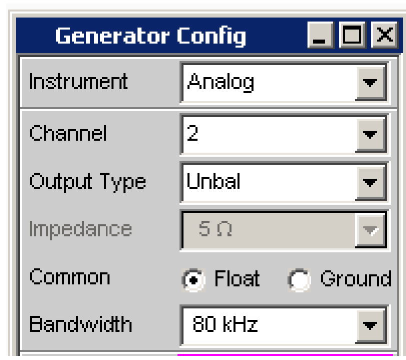
Meas. instrument: AC voltmeter

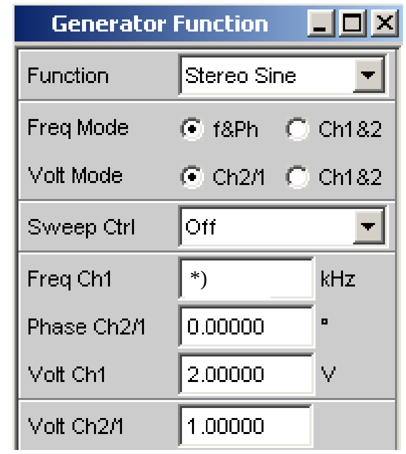
Measurement: Connect the AC voltmeter to the output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: This test item is affected by the level adjustment of the analog generator.

Sinewave frequency response

Set R&S UPV:





*) according to test report

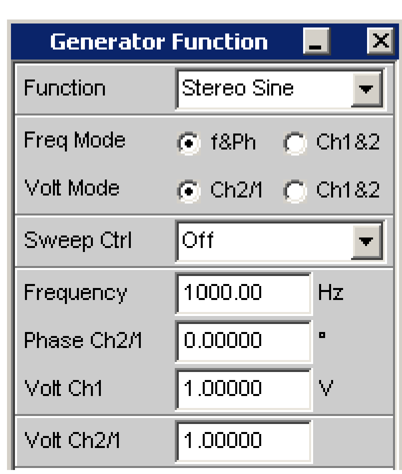
Meas. instrument: AC voltmeter

Measurement: Connect the frequency counter to the output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. Relative display in dB, reference is the voltage measured at 1 kHz. For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: This test item is affected by the adjustment of the lowpass filter after the main DAC of the analog generator.

Sinewave frequency error (Ch2)

Set R&S UPV:

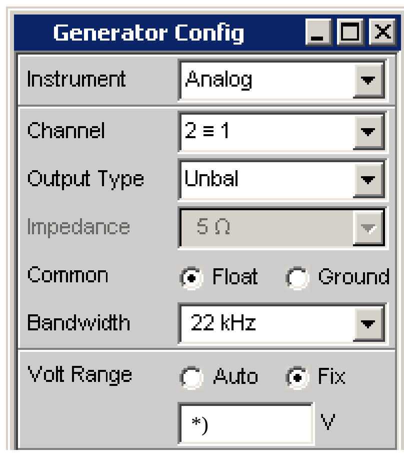


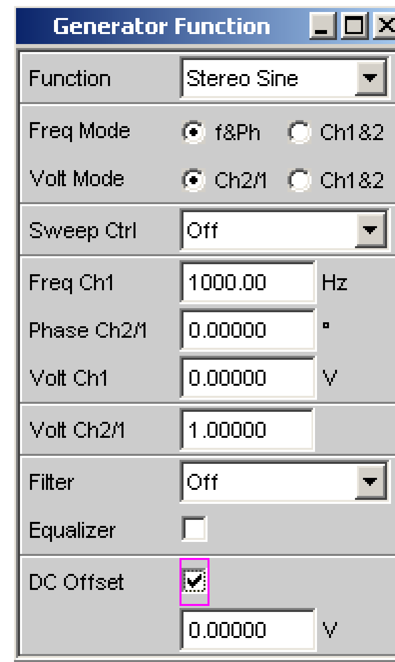
Meas. instrument: Frequency counter

Measurement: Connect the frequency counter to the output Channel 2 of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose.

DC offset 0 V: residual DC (Ch2)

Set R&S UPV:





*) according to test report

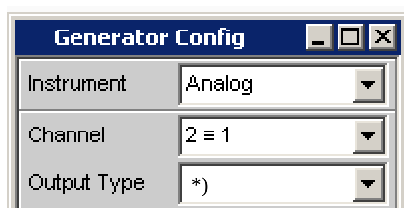
Meas. instrument: DC voltmeter

Measurement: To enable measurement of the small DC offset, the AC level of the generator must be switched off (set voltage in generator function panel to 0 V).
To set the generator hardware according to the levels specified in the performance test report, select Volt Range = Fix in the Generator Config Panel and choose the desired voltages.

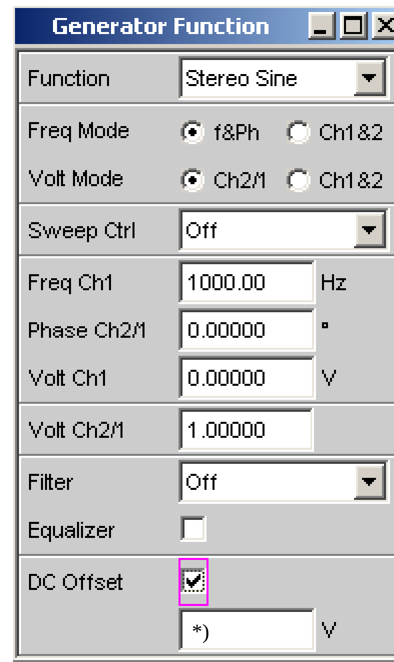
Note: This test item is affected by the DC offset adjustment.

DC offset: setting error (Ch2)

Set R&S UPV:



*) according to test report



*) according to test report

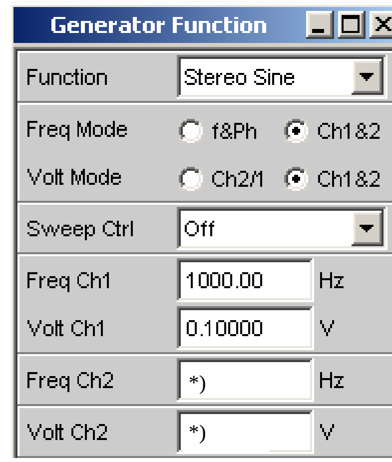
Meas. instrument: DC voltmeter

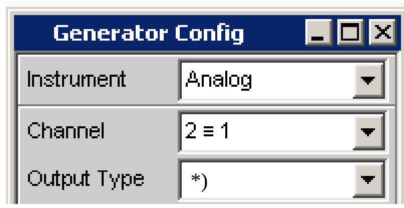
Measurement: Connect the DC voltmeter to the Ch2 output of R&S UPV generator and measure the DC voltage at the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.
For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: This test item is affected by the following adjustments.
- Level adjustment analog generator
- DC offset adjustment

THD+N inherent distortion (Ch2)

Set R&S UPV:





*) according to test report

*) according to test report

Measuring instrument: Analyzer for THD+N: Ref R&S UPV

Settings of the Ref R&S UPV analyzer for:

INSTRUMENT	ANLG 22 kHz	ANLG 80 kHz
Channel(s)	1	1
Ch1 Input	*)	*)
Ch1 Range	AUTO	AUTO
FUNCTION	THD+N/SINAD	THD+N/SINAD
Dyn Mode	PRECISION	PRECISION
Unit	dB	dB
FrqLim Low	20.00 Hz	150.00 Hz
FrqLim Upp	21.90 kHz	100.00 kHz

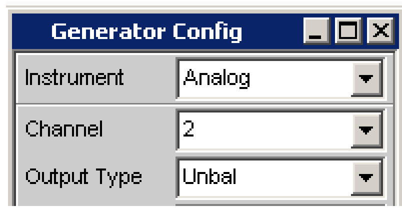
*) set according to R&S UPV generator

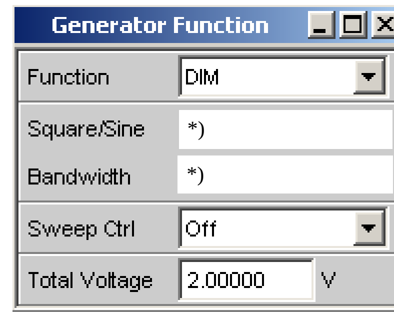
Test setup: Connect the Ref-UPV analyzer to the output of the R&S UPV generator.
Output Bal: Use a balanced cable (XLR).
Output Unbal: Use an adapter XLR female / BNC female and an unbalanced cable (BNC).

Measurement: For the remaining R&S UPV settings and measurement procedure, see the test report.

DIM level error (Ch2)

Set R&S UPV:

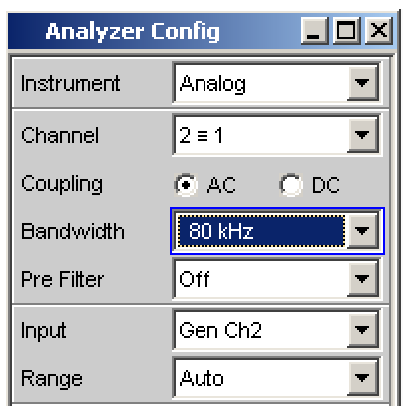


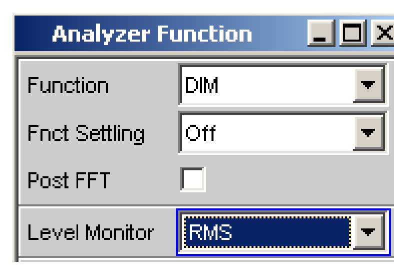


*) according to test report

Meas. instrument: Analyzer for DIM: R&S UPV

Analyzer settings:





Measurement: Connect the R&S UPV analyzer internally to the R&S UPV generator. For the remaining R&S UPV settings and measurement procedure, see the test report.

Note: The generator function DIM is enabled only in conjunction with the option R&S UPV-B3 (Second Analog Generator).

DIM inherent distortion (Ch2)

Set R&S UPV: As before during measurement of the DIM level accuracy

Meas. instrument: Analyzer for DIM: R&S UPV

Analyzer settings: As before during measurement of the DIM level accuracy

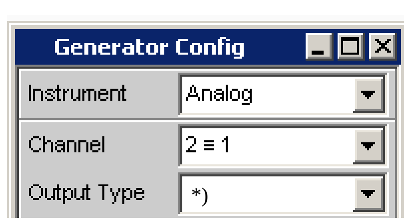
Measurement: Connect the R&S UPV analyzer internally to the R&S UPV generator.
For the remaining R&S UPV settings and measurement procedure, see the test report.

Caution: The tolerances in the test report refer to loop measurement with the R&S UPV generator and the R&S UPV analyzer and include the inherent distortions of both.

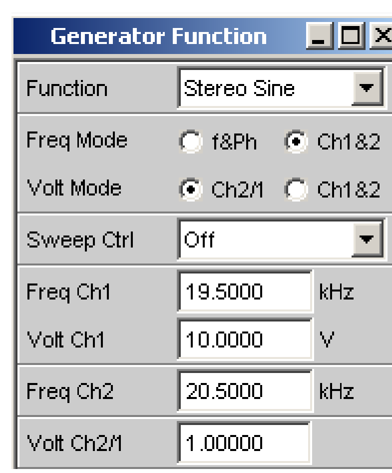
Crosstalk

Due to the high crosstalk attenuation of typ. 120 dB, a very small voltage of only a few µV must be measured on the other channel. For this purpose, a selective voltmeter like the one provided in the Ref R&S UPV analyzer, for example, is required.
Unlike the crosstalk measurement for the analog generator (which supplies both outputs) with one output switched off in each case and measurement of the residual voltage, both outputs remain active here. Output Ch1 is supplied by the universal generator and output Ch2 by the option R&S UPV-B3 (only for the "Stereo Sine" function).
To allow determination of the cross coupling between the two active generators, they need to be set to different frequencies.

Set R&S UPV:



*) according to test report



Meas. instrument: Audio analyzer: Ref R&S UPV

Set R&S UPV:

Instrument	Analog, Bandwidth 22 kHz
Channel(s)	1
Ch1 Input	Set according to R&S UPV generator Common Float
Ch1 Range	Auto
Function	FFT
Unit	dBr
Reference	Value: 10.00 V

Test setup

Connect the Ref R&S UPV analyzer to the output of the R&S UPV generator via a shielded cable.
Output Bal: Use a balanced cable (XLR).
Output Unbal: Use an adapter XLR female / BNC female and an unbalanced cable (BNC).

Measurement:

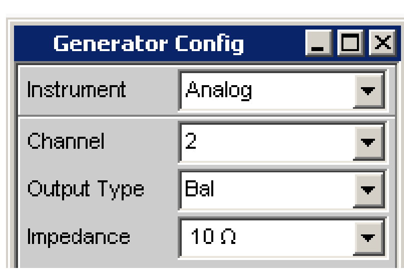
- Set the R&S UPV generator according to the test report.
- For improved legibility, scale the graphics panel from 19 kHz to 21 kHz.
- FFT measurement on a channel. Read off the lines using the cursor. The cursor must indicate a value of about 0 dBr (= 10 V). Set the other cursor to the frequency of the other channel and the crosstalk will be displayed directly.
- Repeat the same measurement on the other channel.

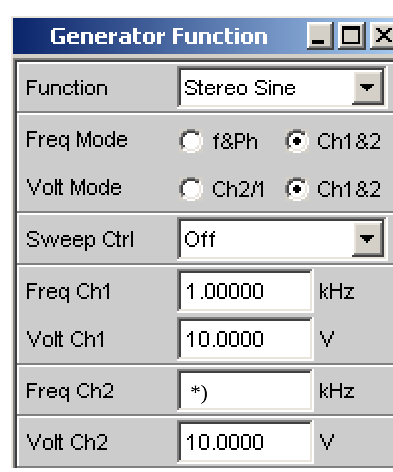
Note:

To avoid having the measurement result corrupted due to the internal coupling of the channels in the Ref R&S UPV, we recommend measuring the crosstalk in a single-channel fashion one after another.

Unbalance rejection (Ch2)

Set R&S UPV:





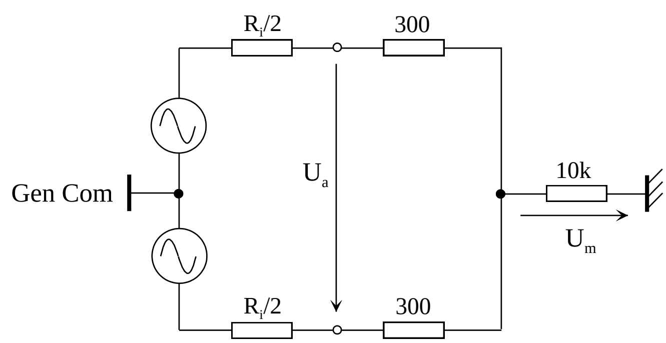
*) according to test report

Measuring instrument: Selective voltmeter: R&S UPV

Set Ref R&S UPV:

Instrument	Analog, Bandwidth 22 kHz (Analyzer)
Channel	1
Ch1 Input	Bal
Common	Float
Ch1 Range	Auto
Function	RMS Selective
Unit Ch1	dBr
Reference	Value: 10.00 V
Bandwidth	BP 3 %
Freq Mode	Fix: Set according to the frequency of the R&S UPV generator

Test setup:



The two 300 Ω resistors must be matched to an accuracy of at least 0.01 % in order to achieve a measurement limit of <-90 dB. The absolute value is not critical, but it should be in the range between 295 Ω and 305 Ω.

The three resistors must be installed in an XLR cable jack. The signal U_m is fed out with a BNC cable and connected to the balanced input of the analyzer via an XLR/BNC adapter.

The configuration of an appropriate cable is described on page 1.4.

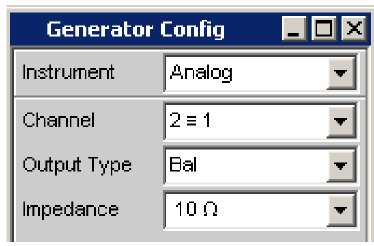
Measurement:

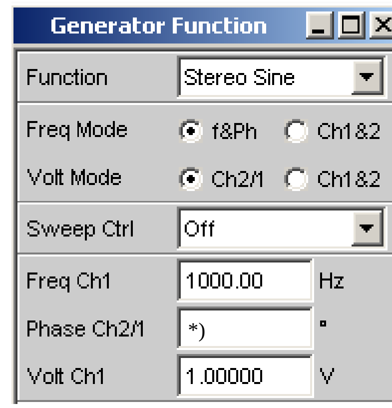
- Set the R&S UPV generator according to the test report.
- Selective RMS measurement on the activated channel.
  The displayed measured value (in dBr) is negative.
- Enter the measured value with a positive sign as the unbalance rejection (with units of dB) into the report.

Note: This test item is affected by the adjustment of the unbalance rejection.

Phase coincidence

Set R&S UPV:

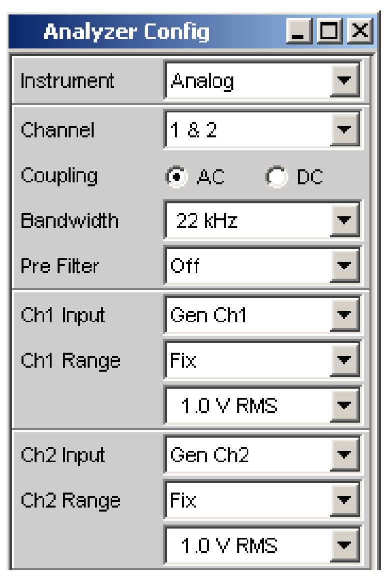


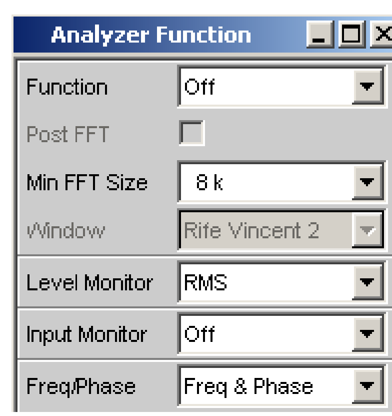


*) according to test report

Meas. instrument: Phase meter: R&S UPV

Analyzer settings:





Test setup: Connect the R&S UPV analyzer inputs internally to the outputs of the R&S UPV generator.

Measurement:
- ➢ Set the R&S UPV generator according to the test report.
- ➢ Phase measurement.

Note: According to the data sheet, the R&S UPV analyzer has a larger measurement error than is stipulated in this check. However, the accuracy is much better if both input channels have the same drive conditions at a frequency of 1 kHz.
To check the measurement accuracy under the conditions present here, the R&S UPV analyzer can set the Ch2 Input to Gen Ch1 in the Analyzer Config Panel. With this setting, both analyzer channels will receive an identical input signal from generator Ch1. The display of the phase in the numeric display under Ch2 will now show the intrinsic error of the analyzer under the current conditions for the settings.

Performance Test R&S UPV-B20 (Digital Audio I/O 48 kHz)

Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

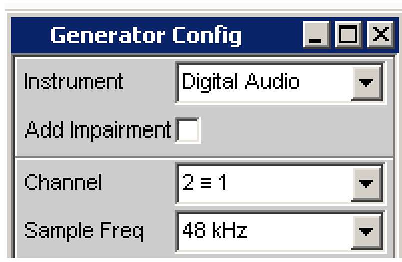
Press the PRESET key and confirm your input request with "↵"

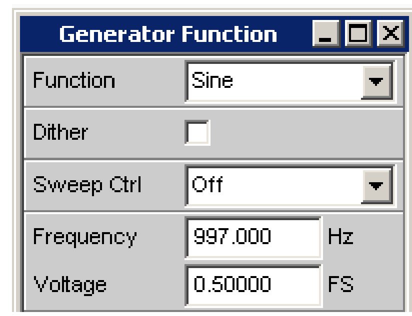
or

Press the MENU key and select "Preset (Load Default)" in the submenu.

Level Error

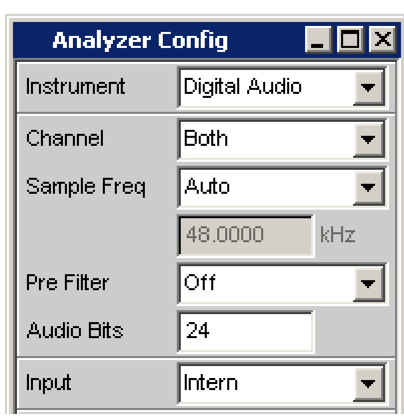
Set R&S UPV:

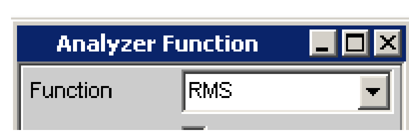




Meas. instrument: Device under test R&S UPV

Analyzer settings:





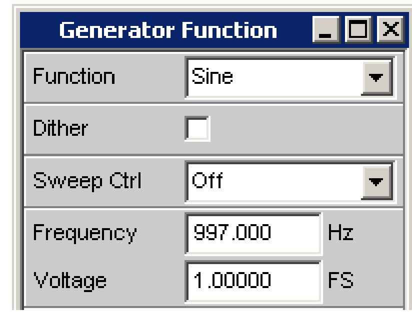
Test setup: Connect the R&S UPV analyzer inputs internally to the outputs of the R&S UPV generator.

Measurement:

- ➢ Set the R&S UPV generator according to the test report.

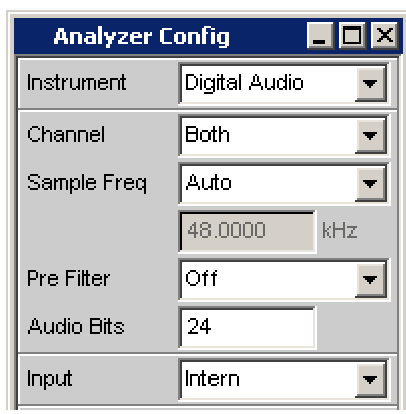
THD + N

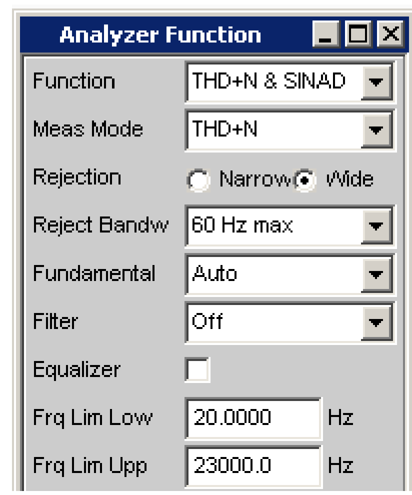
Set R&S UPV:



Meas. instrument: Device under test R&S UPV

Analyzer settings:

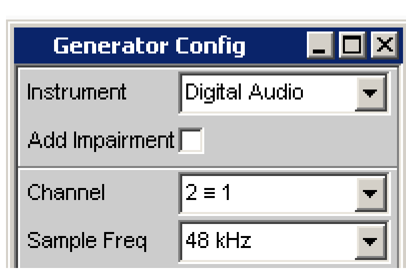


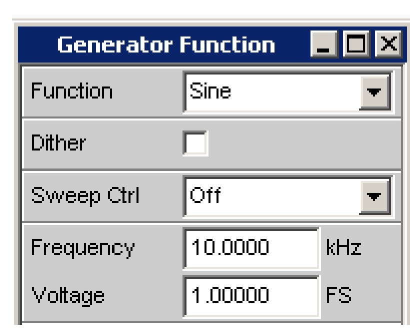


Total inherent distortion of analyzer and generator together as specified in data sheet.

Error of internal Sample Frequency

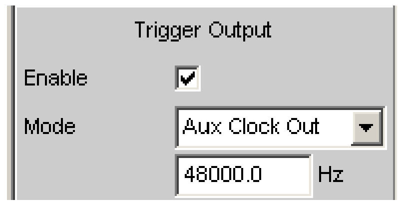
Set R&S UPV:





Meas. instrument: Frequency counter

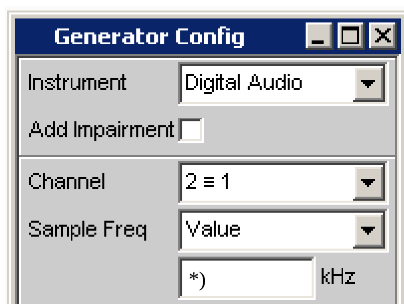
Measurement: Measurement of the 48 kHz sampling rate
Connect the frequency counter to Trigger Output to measure the clock rate.
Set a sampling rate of 48 kHz on the generator and compare it to the displayed value on the frequency counter



For the maximum frequency offset, see test report.

Range of Sampling Rate

Set R&S UPV:



*) set according to test report

Meas. instrument: Frequency counter

Measurement:

- Measurement from 32 kHz to 55 kHz
- Connect the frequency counter to Trigger Output to measure the clock rate.
- Set a sampling rate on the generator as described in the test report and compare it to the displayed value on the frequency counter.
- For the maximum frequency offset, see test report.

Performance Test R&S UPV-B41 (I²S Interface)

Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

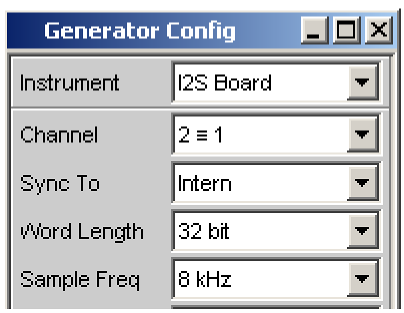
Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select "Preset (Load Default)" in the submenu.

DDS

Set R&S UPV:

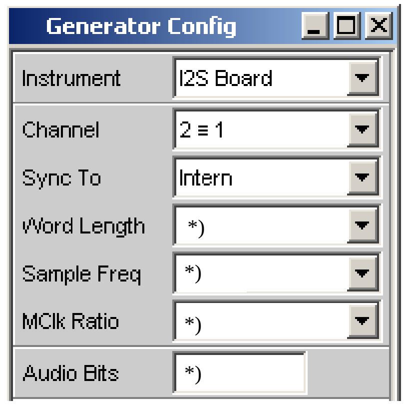


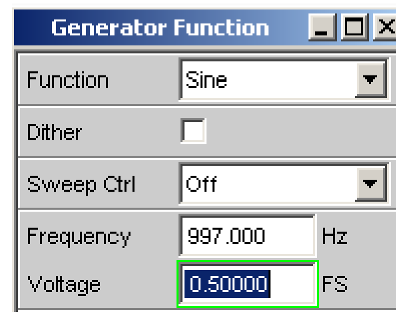
Test setup: Connect an external frequency counter using a diagnostics cable to the D-Sub connector on the option R&S UPV-B41.

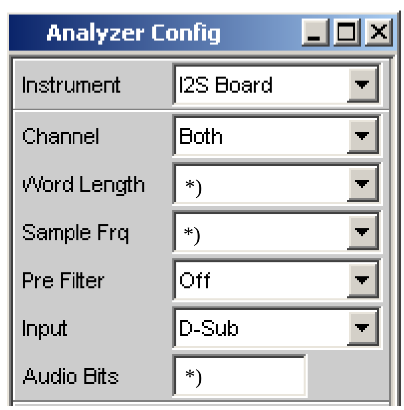
Measurement: Check the frequency of the clock signal TX_MCLK (pin 25) on the I²S connector using a frequency counter.

Analyzer PLL

<u>Set R&S UPV</u>:







*) as shown in the table below

In the Function Config Panel, set the unit to FS.

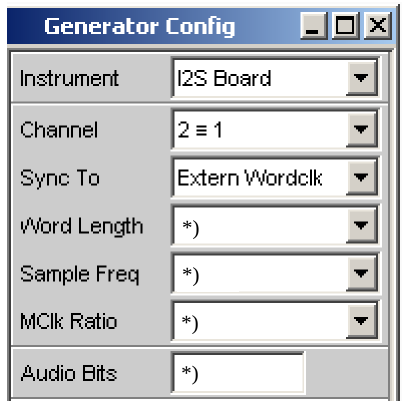
Table 1-1 Settings for testing the analyzer PLL

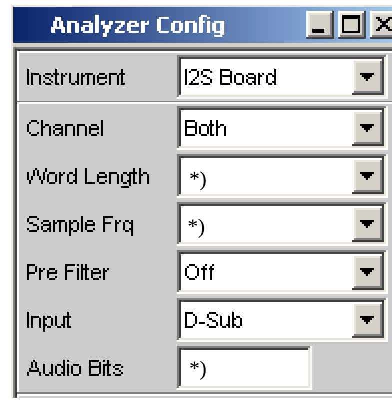
Meas #	Word Length	Sample Freq	MClk Ratio	Audio Bits
1	32 bit	410 kHz	128	32
2	16 bit	6.75 kHz	64	16
3	24 bit	6.75 kHz	96	24
4	24 bit	216 kHz	192	24

<u>Measurement</u>: To do this, you will need to make four loop measurements with the settings shown above. Use the generator to transmit a sinewave signal and verify it with the analyzer.

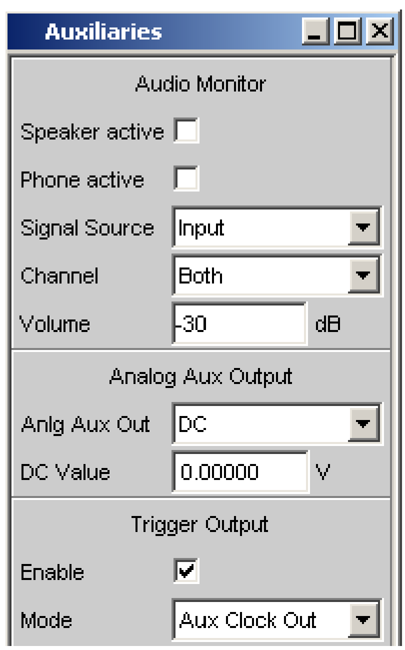
Generator PLL

Set R&S UPV:





*) as shown in the table below



In the analyzer function panel, set Freq/Phase to Sample Freq.

Table 1-2 Settings for testing the generator PLL

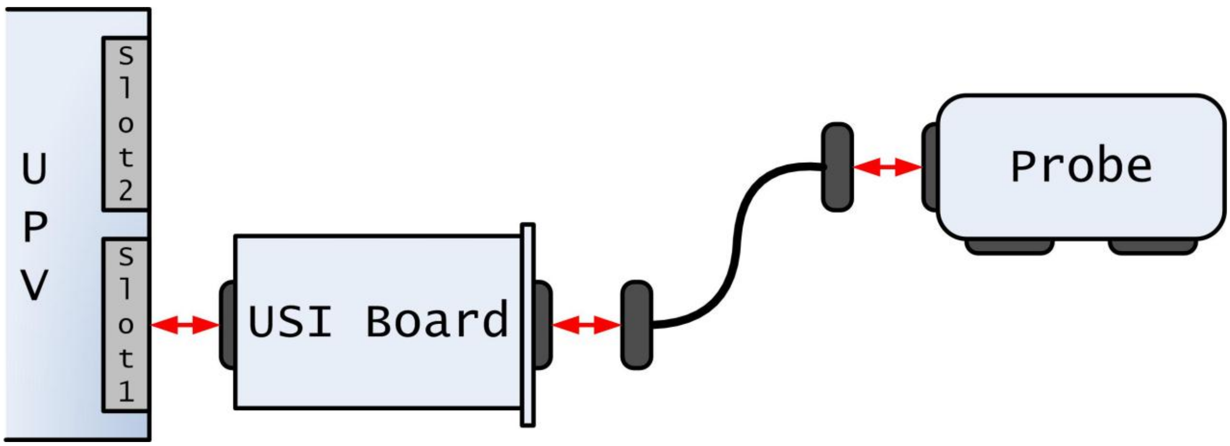
Meas #	Word Length	Sample Freq	MClk Ratio	Audio Bits
1	32 bit	410 kHz	128	32
2	24 bit	216 kHz	192	24
3	24 bit	6.75 kHz	96	24
4	16 bit	6.75 kHz	64	16

Test setup: Connect the BNC output TRIG OUT (R&S UPV) to the BNC input TX CLK IN (option I^2S interface).

Measurement: The generator is operated using external word clock synchronization. The clock generator in the R&S UPV is used as the clock source.
This test needs to be performed using four different frequencies.

Performance Test R&S UPV-B42 (Universal Serial Interface)

Switch off the R&S UPV and disconnect the power plug. Remove the cover of the left extension slot (slot 1) on the rear by using a TORX TX 8 screwdriver then insert the B42 option and screw down. Connect the B42 board with the external probe according to the following draft.



Reconnect power plug, switch on R&S UPV, the board will be automatically recognized

Test of synchronization modes

The following performance tests depend on each other, because in some cases analyzer signals will be used to synchronize the generator and vice versa to save an external signal generator. Follow the given order of the following steps. If one of the tests fails, subsequent steps are no longer significant! The table below specifies the mutual connections of analyzer and generator I/Os on the probe plugs.

Connections between analyzer und generator				
Generator			Analyzer	
PIN Plug X11	Signal		PIN Plug X10	Signal
<21>	TX_DATA4_OUT	Connect with	<19>	RX_DATA4_IN
<19>	TX_DATA3_OUT	Connect with	<17>	RX_DATA3_IN
<17>	TX_DATA2_OUT	Connect with	<15>	RX_DATA2_IN
<15>	TX_DATA1_OUT	Connect with	<13>	RX_DATA1_IN
<13>	TX_CHCLK_OUT	Not used		
<9>	TX_FSYNC_OUT	Connect with	<11>	RX_FSYNC_IN
<5>	TX_SCK_OUT	Connect with	<7>	RX_SCK_IN
<11>	TX_FSYNC_IN	Connect with	<9>	RX_FSYNC_OUT
<7>	TX_SCK_IN	Connect with	<5>	RX_SCK_OUT
<1>	TX_MCLK_OUT	Connect with	<3>	RX_MCLK_IN
<3>	TX_MCLK_IN	Connect with	<1>	RX_MCLK_OUT

Your measurement system should contain a prefabricated „short circuit“ adapter to connect those pins accordingly as well as a the “final inspection” ACS remote software program to perform the following tests. By starting this software procedure, the B-42 option will be automatically configured and tested. A successful measurement protocol is displayed on the following page. A summary of the performed tests is listed on the following pages to give you a better understanding about the performed actions. In addition, operating instructions for manual configuration of the necessary settings to perform those tests are provided in case you don’t have an ACS at your service branch.

1. UPV-B42: Universal Serial Interface

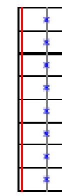
200,1,4/1

Remark:
1 Measured with original probe from costumer.
2
3

Generator: Sync to intern

200,1,4/2

	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	TX_MCLK_OUT	X11	806.4	768.0	729.6	768.0
2	TX_SCK_OUT	X11	403.2	384.0	364.8	384.0
3	TX_FSYNC_OUT	X11	50.4	48.0	45.6	48.0
4	TX_CHCLK_OUT	X11	50.4	48.0	45.6	48.0
5	TX_DATA1	X11	50.4	48.0	45.6	48.0
6	TX_DATA2	X11	50.4	48.0	45.6	48.0
7	TX_DATA3	X11	50.4	48.0	45.6	48.0
8	TX_DATA4	X11	50.4	48.0	45.6	48.0



Generator: Extern Output Enable Control

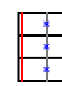
200,1,4/3

	Signal	Plug	Nominal	
1	TX_DATA1	X11	pass	pass
2	TX_DATA2	X11	pass	pass
3	TX_DATA3	X11	pass	pass
4	TX_DATA4	X11	pass	pass

Analyzer: Sync to intern

200,1,4/4

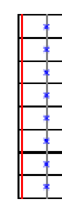
	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	RX_MCLK_OUT	X10	806.4	768.0	729.6	768.0
2	RX_SCK_OUT	X10	403.2	384.0	364.8	384.0
3	RX_FSYNC_OUT	X10	50.4	48.0	45.6	48.0



Generator: Sync to extern Wordclock

200,1,4/5

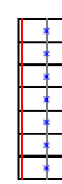
	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	TX_MCLK_OUT	X11	806.4	768.0	729.6	768.0
2	TX_SCK_OUT	X11	403.2	384.0	364.8	384.0
3	TX_FSYNC_OUT	X11	50.4	48.0	45.6	48.0
4	TX_CHCLK_OUT	X11	50.4	48.0	45.6	48.0
5	TX_DATA1	X11	50.4	48.0	45.6	48.0
6	TX_DATA2	X11	50.4	48.0	45.6	48.0
7	TX_DATA3	X11	50.4	48.0	45.6	48.0
8	TX_DATA4	X11	50.4	48.0	45.6	48.0



Generator: Sync to extern Wordclock AM

200,1,4/6

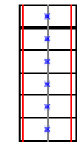
	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	TX_SCK_OUT	X11	403.2	384.0	364.8	384.0
2	TX_FSYNC_OUT	X11	50.4	48.0	45.6	48.0
3	TX_CHCLK_OUT	X11	50.4	48.0	45.6	48.0
4	TX_DATA1	X11	50.4	48.0	45.6	48.0
5	TX_DATA2	X11	50.4	48.0	45.6	48.0
6	TX_DATA3	X11	50.4	48.0	45.6	48.0
7	TX_DATA4	X11	50.4	48.0	45.6	48.0



Generator: Sync to extern Wordclock / Bitclock

200,1,4/7

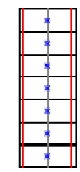
	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	TX_MCLK_OUT	X11	806.4	768.0	729.6	768.0
2	TX_CHCLK_OUT	X11	50.4	48.0	45.6	48.0
3	TX_DATA1	X11	50.4	48.0	45.6	48.0
4	TX_DATA2	X11	50.4	48.0	45.6	48.0
5	TX_DATA3	X11	50.4	48.0	45.6	48.0
6	TX_DATA4	X11	50.4	48.0	45.6	48.0



Generator: Sync to extern Masterclock

200,1,4/8

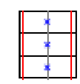
	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	TX_SCK_OUT	X11	403.2	384.0	364.8	384.0
2	TX_FSYNC_OUT	X11	50.4	48.0	45.6	48.0
3	TX_CHCLK_OUT	X11	50.4	48.0	45.6	48.0
4	TX_DATA1	X11	50.4	48.0	45.6	48.0
5	TX_DATA2	X11	50.4	48.0	45.6	48.0
6	TX_DATA3	X11	50.4	48.0	45.6	48.0
7	TX_DATA4	X11	50.4	48.0	45.6	48.0



Analyzer: Sync to extern Wordclock

200,1,4/9

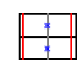
	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	RX_MCLK_OUT	X10	806.4	768.0	729.6	768.0
2	RX_SCK_OUT	X10	403.2	384.0	364.8	384.0
3	RX_FSYNC_OUT	X10	50.4	48.0	45.6	48.0



Analyzer: Sync to extern Wordclock AM

200,1,4/10

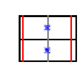
	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	RX_SCK_OUT	X10	403.2	384.0	364.8	384.0
2	RX_FSYNC_OUT	X10	50.4	48.0	45.6	48.0



Analyzer: Sync to extern Masterclock

200,1,4/11

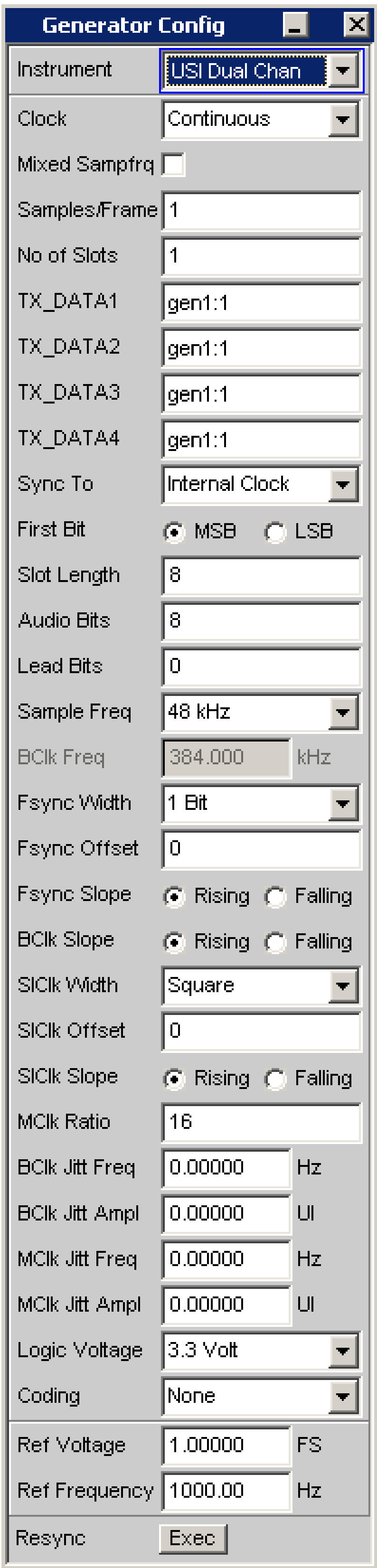
	Signal	Plug	DUL /kHz	Freq /kHz	DLL /kHz	Actual /kHz
1	RX_SCK_OUT	X10	403.2	384.0	364.8	384.0
2	RX_FSYNC_OUT	X10	50.4	48.0	45.6	48.0

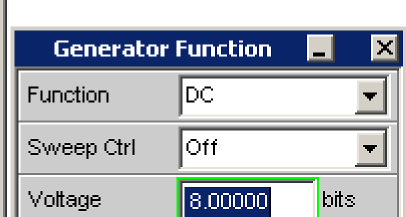


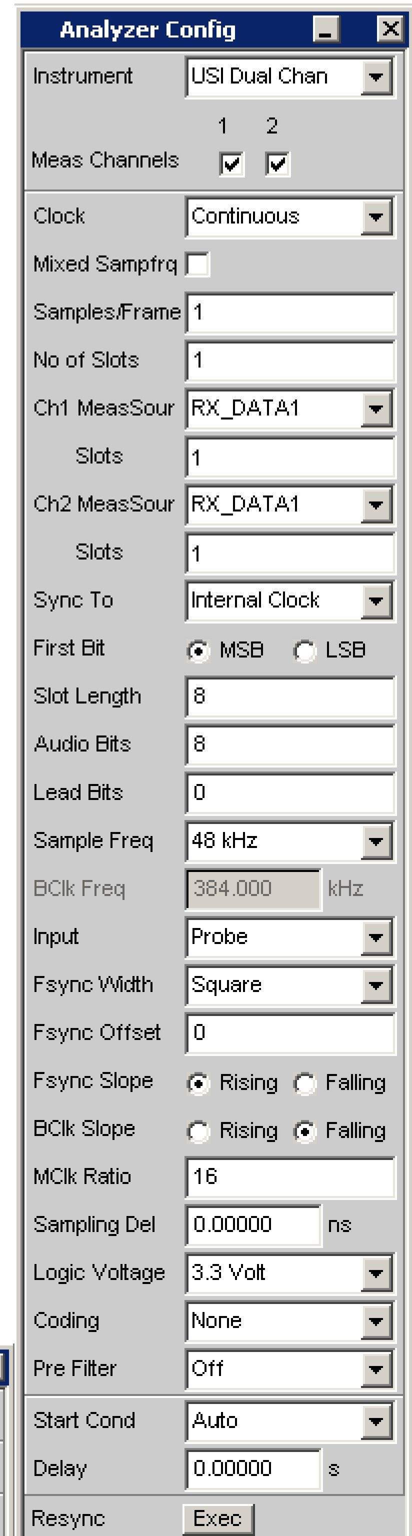
Generator: Sync to intern

Manual Instructions:

Preset the R&S UPV and make the following settings:







The first synchronization test should result in the following frequency values on the pins listed below:

Interface to DUT [Generator]					
PIN Plug X11	**Signal**	**Frequency**	**PIN Plug X11**	**Signal**	**Frequency**
1	TX_MCLK_OUT	768 kHz ± 5%	15	TX_DATA1	48 kHz ± 5%
5	TX_SCK_OUT	384 kHz ± 5%	17	TX_DATA2	48 kHz ± 5%
9	TX_FSYNC_OUT	48 kHz ± 5%	19	TX_DATA3	48 kHz ± 5%
13	TX_CHCLK_OUT	48 kHz ± 5%	21	TX_DATA4	48 kHz ± 5%

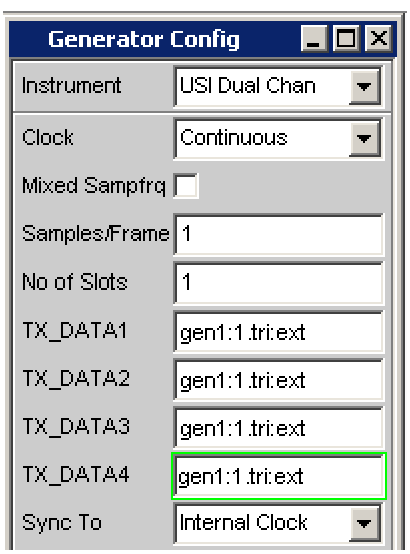
Generator: External Output Enable

To verify the external output enable feature, the test program will first apply a constant low level on pin **23** of plug **X11** and measure all data lines which should be set to tristate accordingly. After setting the external output enable pin to 3V3, the measurement will be repeated, expecting the following results:

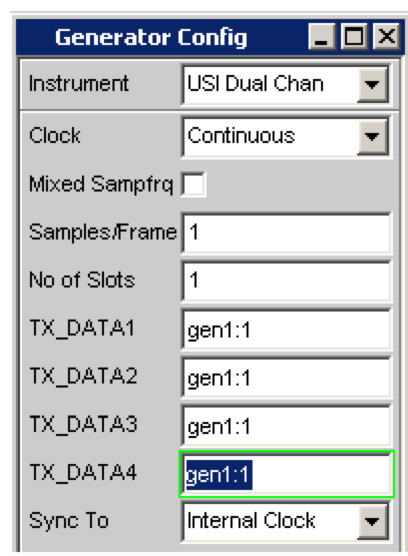
Manual Instructions:

Make the following settings: After completing the test, reset the strings according to right screenshot.

Enable external OE:



Disable external OE:



External Output Enable Control [Generator]			
PIN Plug X11	**Signal**	**3.3V PIN 23**	**0V PIN 23**
15, 17, 19, 21	TX_DATA1-4	48 kHz ± 5%	Output is tristated. Frequency should be 0 Hz

Analyzer: Sync to intern

Manual Instructions:

–

The second test will verify the internal synchronization mode of the analyzer, yielding following results:

Interface to DUT [Analyzer]					
PIN Plug X10	**Signal**	**Frequency**	**PIN Plug X10**	**Signal**	**Frequency**
1	RX_MCLK_OUT	768 kHz ± 5%	9	RX_FSYNC_OUT	48 kHz ± 5%
5	RX_SCK_OUT	384 kHz ± 5%			

Generator: Sync to extern Wordclock

Manual Instructions:

Make the following settings in the “Generator Config” Panel:

To save an external signal source, the generator will be synchronized by signals of the analyzer. The displayed measurement results in the R&S UPV firmware are not meaningful, since a vice versa synchronization by an external wordclock between analyzer and generator is not supported. Typically this external wordclock signal will be generated by a DUT. Nevertheless this setup should force the generator to output the following signals.

Interface to DUT [Generator]					
PIN Plug X11	**Signal**	**Frequency**	**PIN Plug X11**	**Signal**	**Frequency**
1	TX_MCLK_OUT	768 kHz ± 5%	15	TX_DATA1	48 kHz ± 5%
5	TX_SCK_OUT	384 kHz ± 5%	17	TX_DATA2	48 kHz ± 5%
9	TX_FSYNC_OUT	48 kHz ± 5%	19	TX_DATA3	48 kHz ± 5%
13	TX_CHCLK_OUT	48 kHz ± 5%	21	TX_DATA4	48 kHz ± 5%

Generator: Sync to extern Wordclock (AM)

Manual Instructions:

Make the following settings in the “Generator Config” Panel:

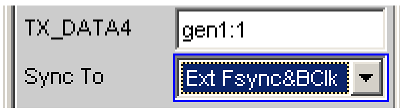
To save an external signal source, the generator will be synchronized by signals of the analyzer in this mode. The displayed measurement results in the R&S UPV firmware are not meaningful, since a vice versa synchronization by an external wordclock between analyzer and generator is not supported. Typically this external wordclock signal will be generated by a DUT.

Interface to DUT [Generator]					
PIN Plug X11	**Signal**	**Frequency**	**PIN Plug X11**	**Signal**	**Frequency**
5	TX_SCK_OUT	384 kHz ± 5%	15	TX_DATA1	48 kHz ± 5%
9	TX_FSYNC_OUT	48 kHz ± 5%	17	TX_DATA2	48 kHz ± 5%
13	TX_CHCLK_OUT	48 kHz ± 5%	19	TX_DATA3	48 kHz ± 5%
			21	TX_DATA4	48 kHz ± 5%

Generator: Sync to extern Wordclock / Bitclock

Manual Instructions:

Make the following settings in the “Generator Config” Panel:



The external wordclock and bitclock signals will be generated by the anylazer again. This operation mode is aczually a valid operation mode and the R&S UPV firmware measurement results can be used as a means of functionality check. Waveform and FFT Graphs should measure a full scale DC signal. In this mode the generator should output the following signals.

Interface to DUT [Generator]					
PIN Plug X11	**Signal**	**Frequency**	**PIN Plug X11**	**Signal**	**Frequency**
1	TX_MCLK_OUT	768 kHz ±5%	17	TX_DATA2	48 kHz ±5%
13	TX_CHCLK_OUT	48 kHz ±5%	19	TX_DATA3	48 kHz ±5%
15	TX_DATA1	48 kHz ±5%	21	TX_DATA4	48 kHz ±5%

Generator: Sync to extern Masterclock

Manual Instructions:

Make the following settings in the “Generator Config” Panel:

The synchronization is again performed by the analyzer. Mesurement results displayed in the firmware are not valid, since an external masterclock will be provided by a DUT in a real measurement setup. Yet the following signals should be generated by the generator.

Interface to DUT [Generator]					
PIN Plug X11	**Signal**	**Frequency**	**PIN Plug X11**	**Signal**	**Frequency**
5	TX_SCK_OUT	384 kHz ± 5%	17	TX_DATA2	48 kHz ± 5%
9	TX_FSYNC_OUT	48 kHz ± 5%	19	TX_DATA3	48 kHz ± 5%
13	TX_CHCLK_OUT	48 kHz ± 5%	21	TX_DATA4	48 kHz ± 5%
15	TX_DATA1	48 kHz ± 5%			

This concludes the generator function tests. Before the analyzer synchronization modes can be performed, the generator will be set to internal synchronization since its generated signals are now used to synchronize the analyzer.

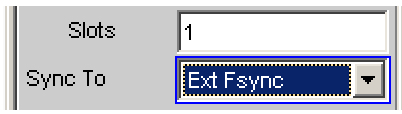
Manual Instructions:

Make the following settings in the “Generator Config” Panel:

Analyzer: Sync to extern Wordclock

Manual Instructions:

Make the following settings in the “Analyzer Config” Panel:



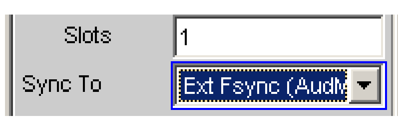
Like in the generator tests, now the analyzer is synchronized by its counterpart in order to save an external signal generator. This operation setup produces no meaningful measurement results by the firmware and is only used to check whether the following signals are generated by the analyzer.

Interface to DUT [Analyzer]					
PIN Plug X10	**Signal**	**Frequency**	**PIN Plug X10**	**Signal**	**Frequency**
1	RX_MCLK_OUT	768 kHz ± 5%	9	RX_FSYNC_OUT	48 kHz ± 5%
5	RX_SCK_OUT	384 kHz ± 5%			

Analyzer: Sync to extern Wordclock (AM)

Manual Instructions:

Make the following settings in the “Analyzer Config” Panel:



The firmware results in this setup are not valid as well since the analyzer would normally be synchronized by an external DUT. A short circuit measurement with the generator is not specified. Nevertheless the analyzer part of the B-42 should generate the following signals.

Interface to DUT [Analyzer]					
PIN Plug X10	**Signal**	**Frequency**	**PIN Plug X10**	**Signal**	**Frequency**
5	RX_SCK_OUT	384 kHz ± 5%	9	RX_FSYNC_OUT	48 kHz ± 5%

Analyzer: Sync to extern Masterclock

Manual Instructions:

Make the following settings in the “Analyzer Config” Panel:

The final synchronization test feeds the masterclock signal of the generator into the analyzer. This type of synchronization setup is also not valid and will not produce meaningful measurement results by the R&S UPV firmware as well, yet the following frequencies should be generated by the analyzer.

Interface to DUT [Analyzer]					
PIN Plug X10	**Signal**	**Frequency**	**PIN Plug X10**	**Signal**	**Frequency**
5	RX_SCK_OUT	384 kHz	9	RX_FSYNC_OUT	48 kHz

Performance Test R&S UPV-B48 (8 Channel Analyzer)

Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select "Preset (Load Default)" in the submenu.

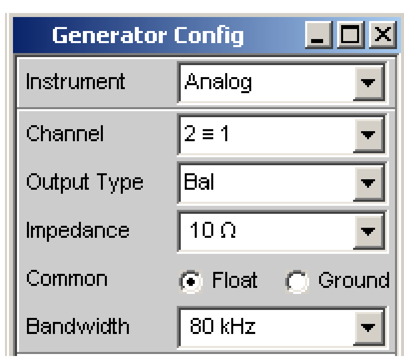
Note: *The test equipment is listed in section "Measuring Equipment and Accessories" on page 1.1.*
In the following section, the abbreviation "DL" is used to refer to the limits in the data sheet.

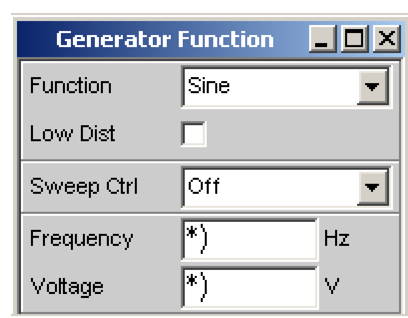
Adaptation of the measuring instruments to the analyzer inputs

The option R&S UPV-B48 has its inputs on the rear of R&S UPV via a 25 pole D sub jack. To get the common XLR connectors use a multicore cable (e.g. Rohde & Schwarz 1401.7709.02)

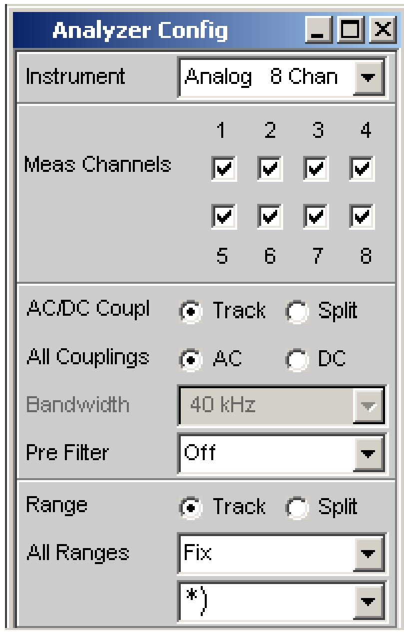
Level Error at 1 kHz and Frequency Response

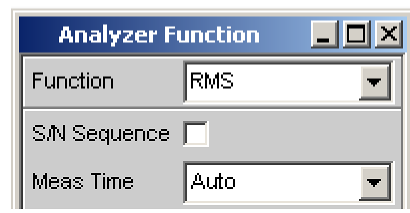
Set R&S UPV:





*) according to test report





*) according to test report

Meas. instrument: AC voltmeter

Test setup: Connect the AC voltmeter to a balanced output of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose. Connect the other balanced output of the R&S UPV generator to the output switcher R&S UPZ via an XLR cable. The inputs under test are connected to the RS& UPZ by using a multicore cable. By using the output switcher the measurements can be made simultaneously for all 8 channels. The second generator output is connected to the voltmeter.

Measurement: For the remaining R&S UPV settings and measurement procedure, see the test report.

Level error at 1 kHz

Tolerance: DL = ±0.05 dB

Range V	Input Divider dB	Range amplifier dB
0.2	0	+24
0.8	0	+12
3.0	0	0
12.0	–24	+12
50.0	–24	0

Measurement: Input voltage = 0.75 ∗ range nominal value (according to test report)

Note: *This test item is influenced by the level software adjustment for the 8 channel analyzer (see section "Software Adjustment" in chapter 2 "Adjustment").*

Frequency response

Set R&S UPV: same as before

R&S UPV Ref Gen: Level and frequency according to test report.
Ranges 0.2 V / 3.0 V / 12.0 V Fix
Reference frequency is 1 kHz

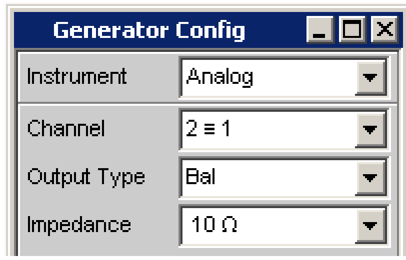
Meas. instrument: AC voltmeter

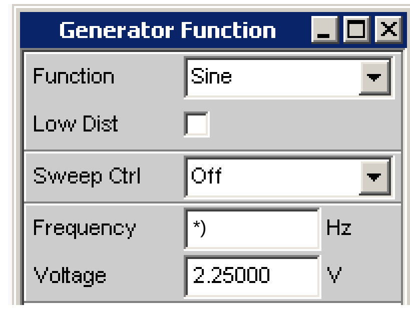
Test setup: same as before. The R&S UPV Ref Generator generates the signal which is measured using the AC voltmeter.

Measurement: Remaining R&S UPV settings and measurement procedure according to test report.

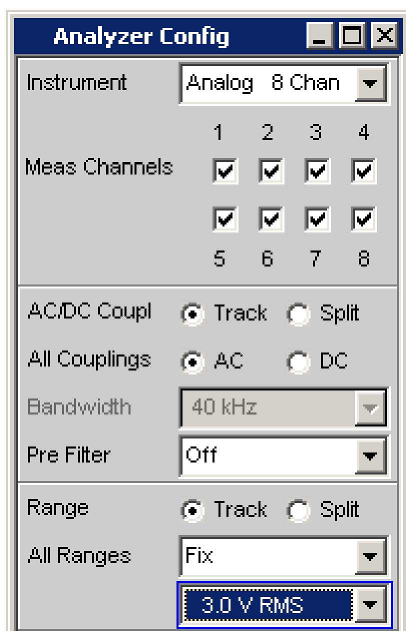
Phase synchronism

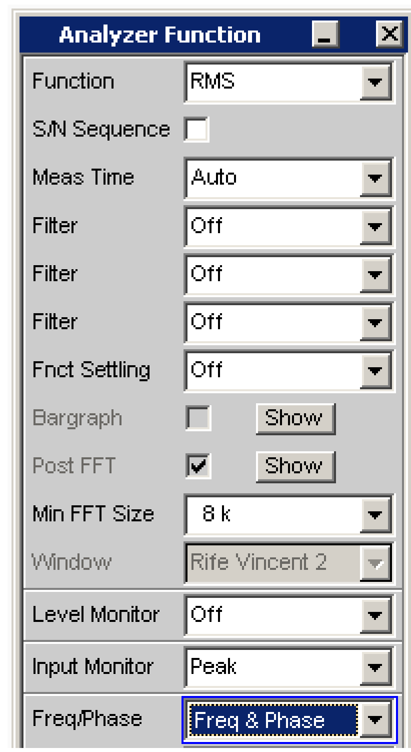
Set R&S UPV:





*) according to test report





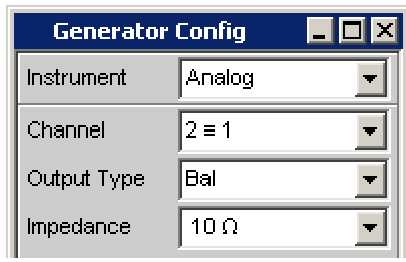
Test setup: The R&S UPV Ref Generator provides the signal to all 8 channels simultaneously via the R&S UPZ.

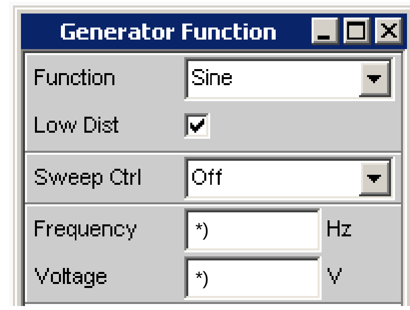
Measurement: Remaining R&S UPV settings and measurement procedure according to test report.
Only the phase coincidence between the 8 channels is determined since the actual functioning of the phase measurement is handled by the firmware.
Read off the phase in the frequency & phase nukeric display in ° (degrees).
Use channel 1 as reference channel.

THD+N inherent distortion

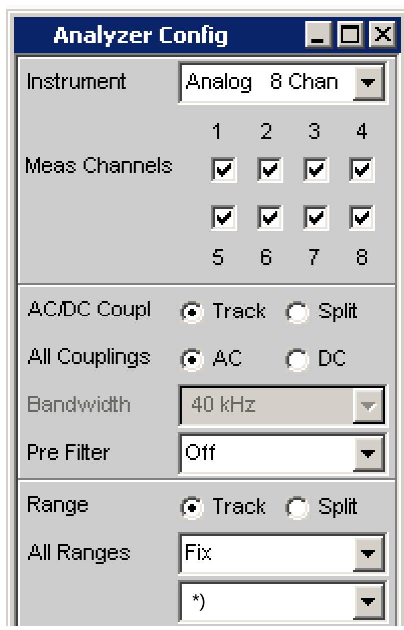
Note: This test is made as a loop measurement along with the R&S UPV low distortion generator.

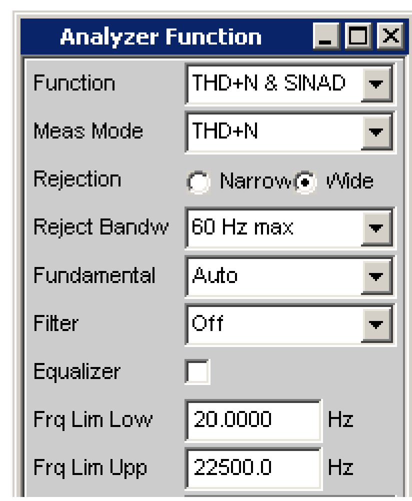
Set R&S UPV:





*) according to test report



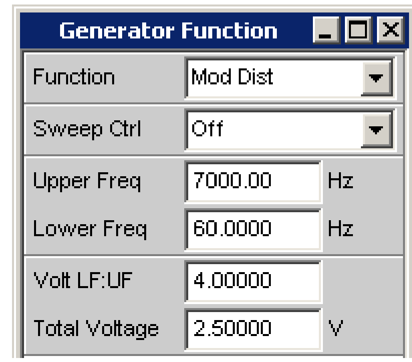


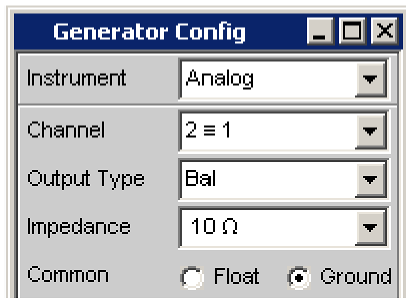
*) according to test report

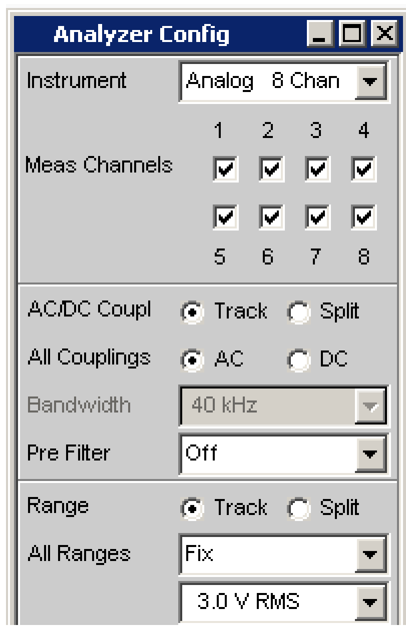
Measurement: Set the R&S UPV analyzer and generator according to test report. The signal should be supplied via multicore cable and R&S UPZ.
Read off the THD+N value in dB in the numeric display.

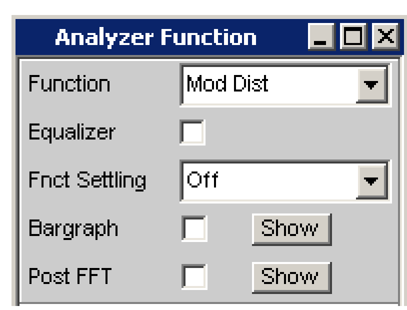
MOD DIST inherent distortion

Set R&S UPV:





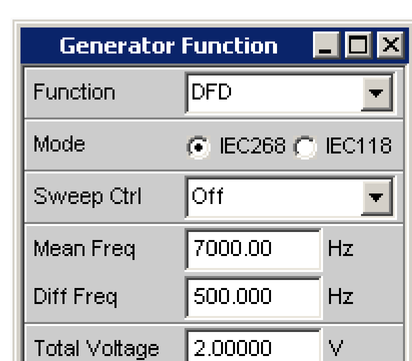


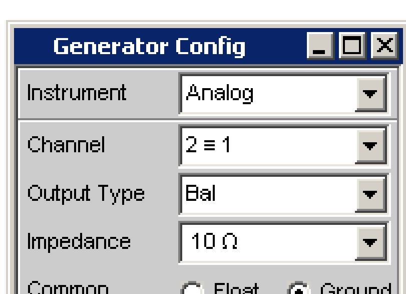


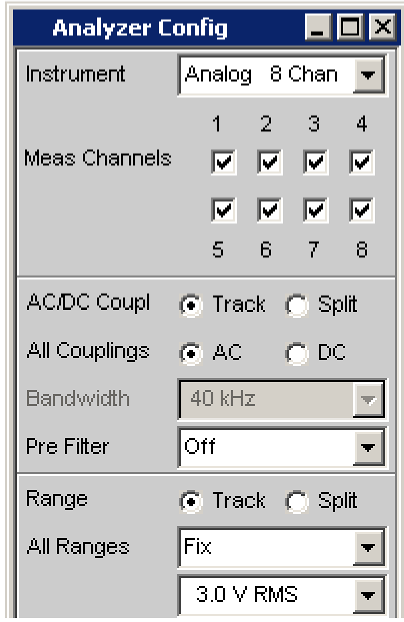
Measurement: Read off the mod dist value in dB in the numeric display.

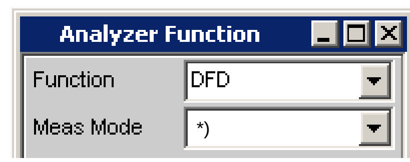
DFD inherent distortion

Set R&S UPV:







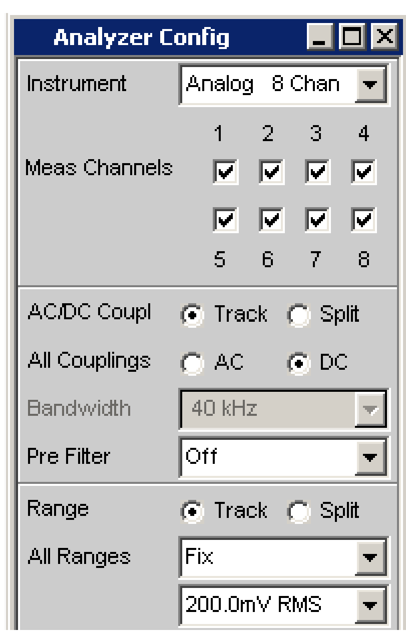


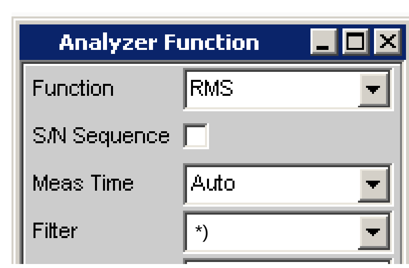
*) according to test report

Measurement: Read off the mod dist value in dB in the numeric display.

Inherent noise

Set R&S UPV:





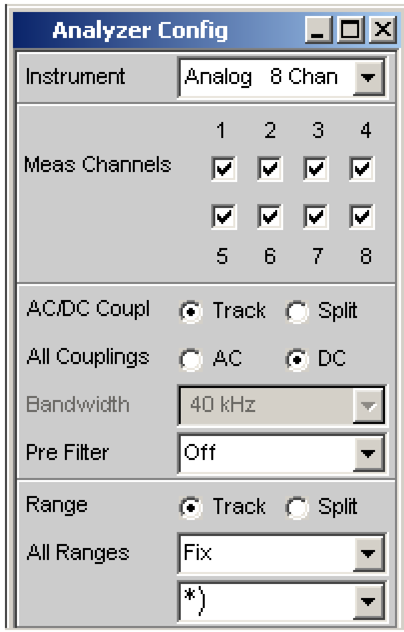
*) according to test report

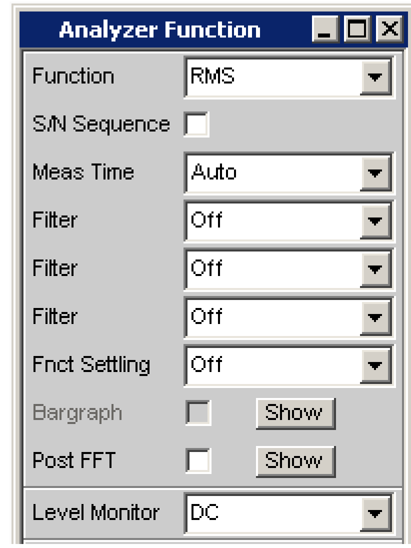
Test setup: Terminate input externally with ≤ 50 Ω. Use the multicore cable, an R&S UPZ, an XLR/BNC adapter and 50 Ω coaxial termination for this purpose.

Measurement: Set the R&S UPV analyzer and generator according to test report.
Read off the inherent noise in the numeric display.

Offset voltage

Set R&S UPV:





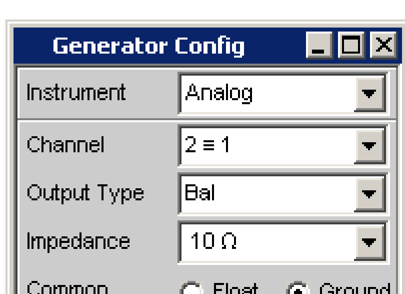
*) according to test report

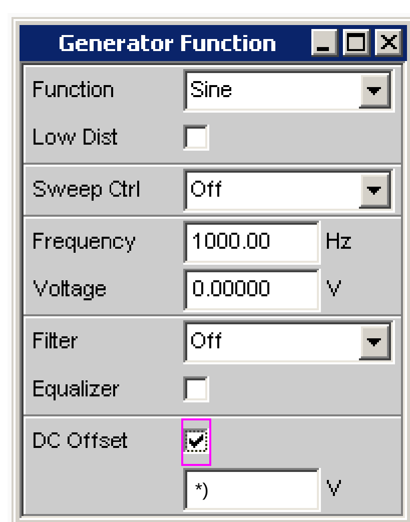
Analyzer input: Short-circuit the input to the analog 8 channel analyzer or terminate it into 10 Ω. To do this use the multicore cable, an R&S UPZ and an XLR cable. Connect the XLR cable from busbar “B” to the generator output which is switched off (Bal and 10 Ω output impedance). The busbar “B” must be set from number 1 to 8 to link the selected channel to the generator output.

Measurement: Set the UPV analyzer and generator according to the test report. Read off the value of the DC offset in the numeric display.

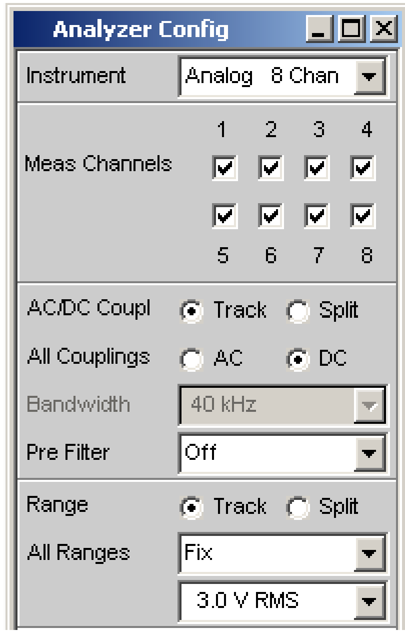
DC Measurement error

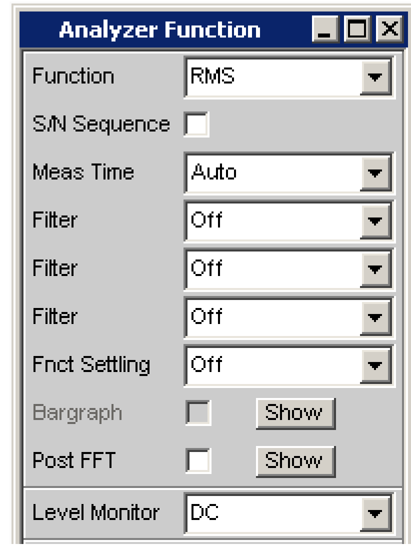
Set R&S UPV:





*) according to test report



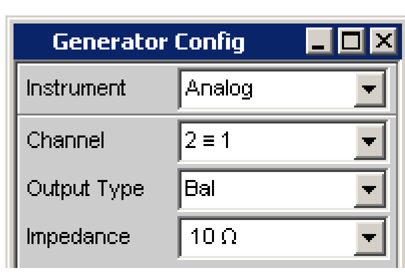


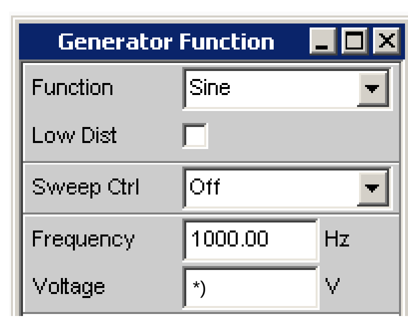
Measurement: Read off the DC measurement value in V in the numeric display.

Peak detector

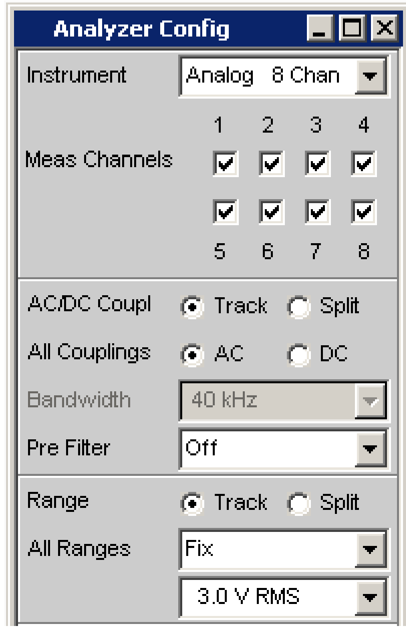
Note: Each of the 8 channels has its own peak detector, which can detect an overrange or an underrange condition.

Set R&S UPV:





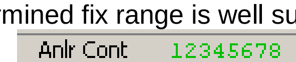
*) according to test report



<u>Measurement</u>: Set the generator signal according to test report, launch a single measurement and evaluate the result.

With an input signal of 0.4 V the determined fix range is underranged and the status line must show:

With an input signal of 3.0 V the determined fix range is well supplied and the status line must show:

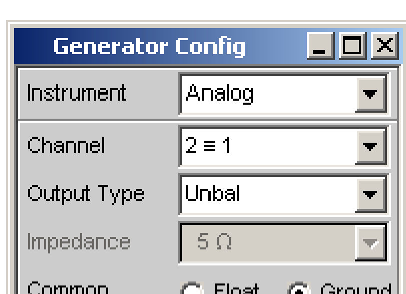


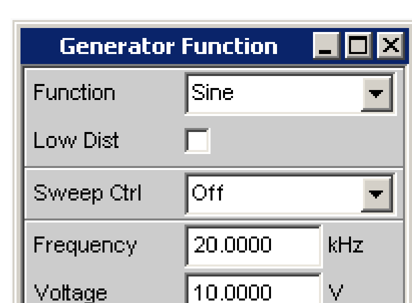
With an input signal of 4.0 V the determined fix range is overranged and the status line must show:

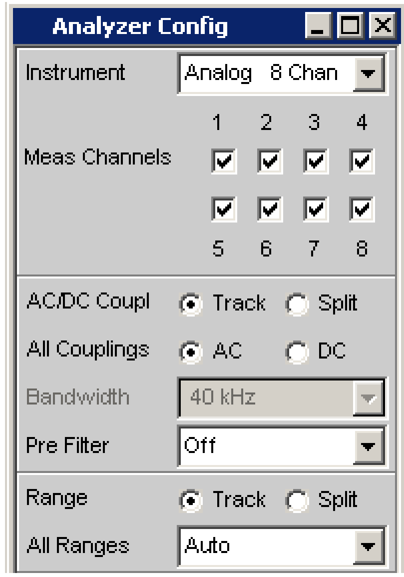
Cross Talk attenuation

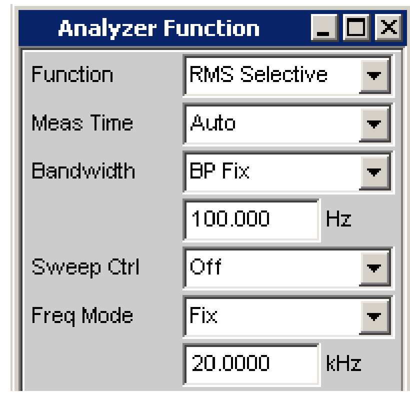
<u>Note</u>: The measurement is made in mode “all but one”. This means that all channels are supplied with a sine signal except the measurement channel. So the maximum cross talk is measured.
Make the entry in the test report with a positive sign as the actual crosstalk attenuation. The data sheet limits (DL) represents positive values.

<u>Set R&S UPV</u>:









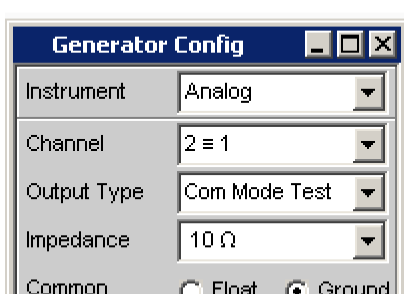
Test setup: Connect the signal generator to the R&S UPV-B48 inputs via the multicore cable and the R&S UPZ output switcher. The output of signal generator must connected to busbar “B” of R&S UPZ. The busbar “A” is terminated by a resistor with a value of 100 Ω or less.

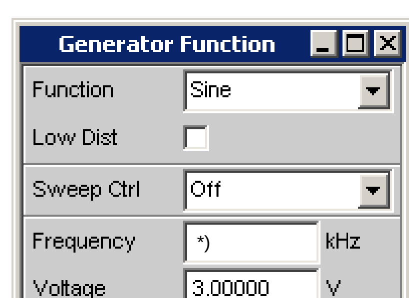
Measurement: Due to the high crosstalk attenuation a very small voltage of only a few µV must be measured on the measured channel. Therefore a selective RMS measurement is made.
The measurement channel is selected in busbar “A” and is connected to ground via the termination resistor. Busbar “B” is set to “-1”, so all other channels are connected to the generator output.
Relative display in dBr: The reference for each channel is 10 V.

Common mode rejection CMRR

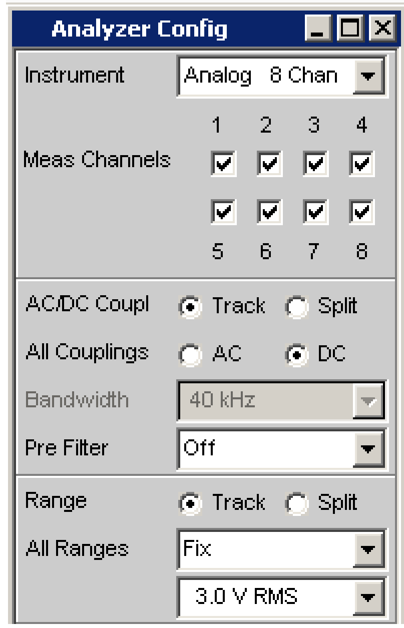
Note: *Make the entry in the test report with a positive sign as the actual crosstalk attenuation. The data sheet limits (DL) represents positive values.*

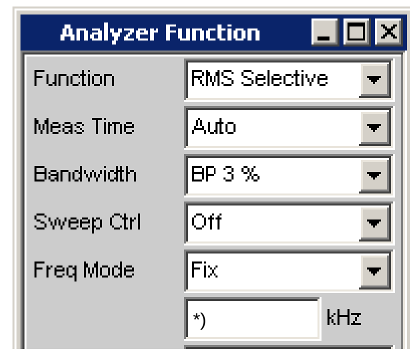
Set R&S UPV:





*) according to test report





*) according to test report

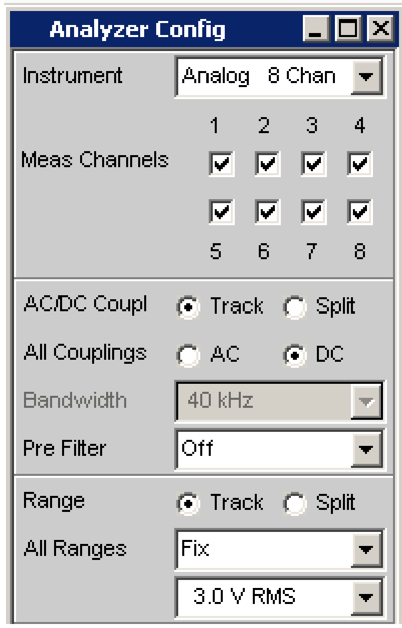
Test setup: Connect the signal generator to the R&S UPV-B48 inputs via the multicore cable and the R&S UPZ output switcher. The output of signal generator must connected to busbar “A” of R&S UPZ. The busbar “B” is terminated by a resistor with a value of 100 Ω or less.

Measurement: The measurement channel is selected in busbar “A” and is connected to the generator output. Busbar “B” is set to “-1”, so all other channels are connected to ground via the termination resistor.
Relative display in dBr: The reference is the generator output level.

Note: The CMRR value of test generator must be taken into account!

Input Impedance

Set R&S UPV:



Meas. instrument: ohmmeter

Test setup: Plug in the multicore cable into the 25 pole D sub jack.

Measurement: The input impedance of each channel 1 to 8 can be measured by an ohmmeter between pins 2 and 3 of XLR cable jacks.

Performance Test R&S UPV-K22 (Jitter and Interface Test)

Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with "↵"

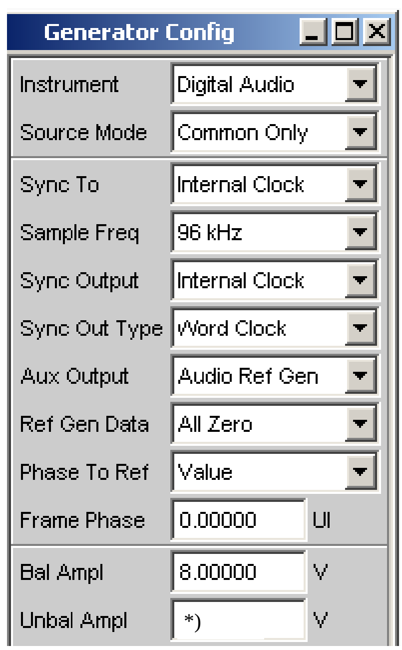
or

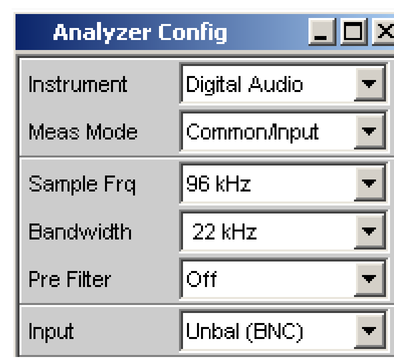
Press the MENU key and select "Preset (Load Default)" in the submenu.

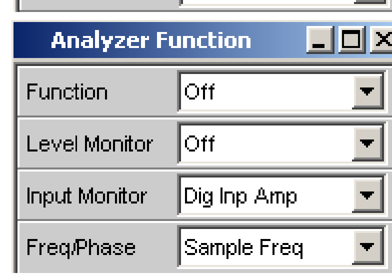
Note: For testing the individual functions of the generator as well as the measurement functions of the analyzer, a loop measurement is performed. Thus, the number of measuring instruments required for testing is reduced.

Common-Mode

Set R&S UPV:







*) according to test report

Level Measurement, Unbal Input

Measurement: Set the analyzer input to Unbal (BNC).
Connect the Unbal output of the R&S UPV to the Unbal input (75 Ω cable) and compare the measured level which is displayed on the R&S UPV with the set generator level.
Set the level and make the measurement according to the test report.

Level Measurement, Bal Input

Measurement: Set the input to Bal (XLR) in the Analyzer Config Panel.
Connect the Bal output of the R&S UPV to the Bal input (XLR cable) and compare the measured level which is displayed on the R&S UPV with the set generator level.
Set the level and make the measurement according to the test report.

Common-Mode Amplitude

Measurement: Set the analyzer input to Bal (XLR).
Connect the Bal output of the R&S UPV to the Bal input (XLR cable) and compare the displayed value for the common-mode amplitude measured at 1 kHz with the value set on the generator.
Set the common-mode amplitude and make the measurement according to the test report.

Common-Mode Frequency Response

Measurement: Set the analyzer input to Bal (XLR).
Connect the Bal output of the R&S UPV to the Bal input (XLR cable).
Set the common-mode frequencies and make the amplitude measurement according to the test report.

Cable Simulator

Measuring instrument: Oscilloscope

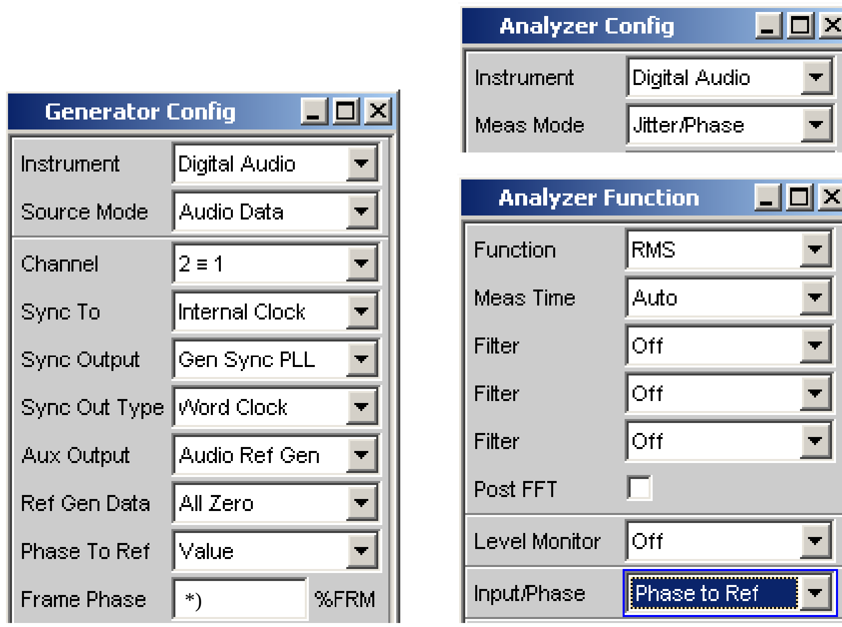
Test setup: Connect the oscilloscope using a 75 Ω cable and 75 Ω terminating impedance to the Unbal output of the R&S UPV.
Connect the Bal output of the R&S UPV to the Bal input (XLR cable).

Measurement: Unbal output:
Switch on the cable simulator in the Generator Config Panel and check the pulse shape of the digital signal at the output.
When the cable simulator is switched on, the rise time of the digital signal at the Unbal output is reduced considerably.
The rise is very flat in the 90% range so that a large measurement tolerance needs to be taken into account here.
Compare the rise time with the values listed in the test report.

Bal output:
Set the Unbal Output in the Generator Config Panel to "Audio In".
This causes the R&S UPV input signal (Bal) to be output at the Unbal output so it can be observed on the oscilloscope.
When the cable simulator is switched on, the rise time of the digital signal at the Bal output (now present on the oscilloscope via the Unbal output) is reduced considerably.
The rise is very flat in the 90 % range so that a large measurement tolerance needs to be taken into account here.
Compare the rise time with the values listed in the test report.

Input to Ref Phase Deviation

Set R&S UPV:



*) according to test report

Test setup: Connect the digital analyzer input to the digital generator output (either Intern, Bal, Unbal or Optical).
Connect Aux In to Aux Out on the back panel of the R&S UPV.

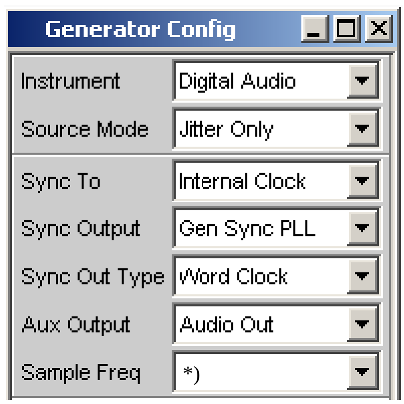
Measurement: Modify the frame phase in the Generator Config Panel and compare it with the value measured on the R&S UPV analyzer (numeric display).
Set the phase and make the measurement according to the test report.

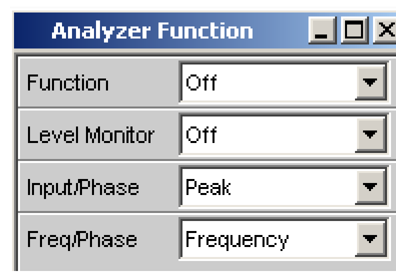
Note: If you use long cable connections between the inputs and outputs, there will be an additional measurement uncertainty. We suggest you use XLR cables of the same length between the digital input/output and the reference input/output. The maximum length should be about 5 m.
Measured values for ± 50 % frame phase are not clear so that a positive or negative value can be displayed here.

Jitter Generation and Measurement

Note: For testing the individual functions of the generator as well as the measurement functions of the analyzer, a loop measurement is performed. Thus, the number of measuring instruments required for testing is reduced. You can use an existing modulation analyzer for phase modulation to check the measurement results produced by the jitter analyzer. It must be capable of measuring a phase deviation (peak value) at 6.144 MHz of at least $\pm 1\pi$ ($\pm$3.14 rad).

Set R&S UPV:





*) according to test report

Jitter Amplitude

Meas. instruments: Modulation analyzer for phase modulation (for checking the measured values).

Test setup: Connect the digital analyzer input to the digital generator output (either Intern, Bal, Unbal or Optical).
Connect the modulation analyzer to Sync Out.

Measurement: Vary the jitter amplitude in the Generator Function Panel and compare it with the displayed "Input Peak" in the numeric display.
Measure at the standard scanning rates (48 kHz, 96 kHz and 192 kHz) using the appropriate sync PLL of the analyzer as the jitter reference.
Measure with variable scanning rates (27 kHz – 55 kHz) with the internal generator (Ref Gen as the jitter reference).
Switch off the weighting filter for the jitter measurement.
Set the generator and make the measurement according to the test report.

Note: A jitter amplitude of 0.5 UI (peak) corresponds to a modulation deviation of 3.14 rad (peak) for the biphase clock which is present on Sync Out and can be measured using the modulation analyzer.
In the Generator Config Panel, set the sync output to "Audio In" and the sync out type to "Biphase Clock".

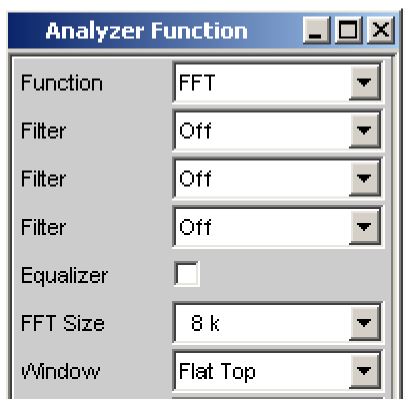
Jitter Frequency Response

Measurement: Vary the jitter frequency in the Generator Function Panel and compare it with the displayed "Input Peak" in the numeric display.
In the Analyzer Config Panel, you will need to set a bandwidth of 80 kHz so that the upper test frequency can be measured.

Note: When using the Ref PLL as the jitter reference for the analyzer, it is necessary to take into account the additional jitter component in the measurement which occurs due to the inherent jitter and the greater PLL bandwidth.
We recommend using this PLL only if the test object cannot be operated with the R&S UPV's generator and with a variable scanning rate.

Jitter Spurious

Set R&S UPV:



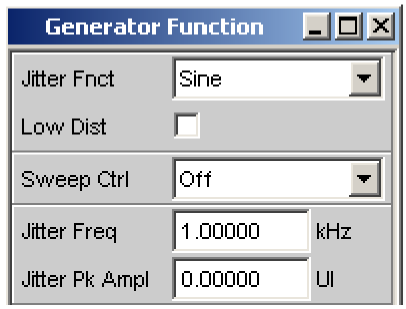
Test setup: Connect the digital analyzer input to the digital generator output (either Intern, Bal, Unbal or Optical).

Measurement: In the menu under DispConfig, call up the "FFT Graph1 Config" submenu and select "FFT Level Ch1" in the line Y-Source. Then, click on the "Display Show" button in the same panel at the very top.
The FFT graphics for the jitter spurious measurement should appear. Using the cursor, you can now determine the level of the individual interferers.

Note: Loop measurement using the R&S UPV digital analyzer

Inherent Jitter

Set R&S UPV:



Test setup: Connect the digital analyzer input to the digital generator output (either Intern, Bal, Unbal or Optical).

Measurement: In the numeric display, read off the RMS or Inp Peak value.

Note: Loop measurement using the R&S UPV digital analyzer

Performance Test R&S UPV-U2 (BNC Phone Out)

Before starting the test, set the R&S UPV to a defined initial status. To do this, call up the default setting:

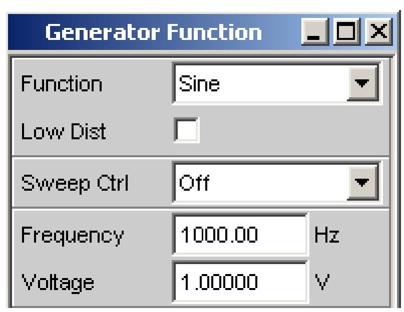
Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select "Preset (Load Default)" in the submenu.

The audio signals available at the 6.3 mm jack on the R&S UPV front panel are also routed to two female BNC connectors on the R&S UPV rear panel when the R&S UPV-U2 option is installed.

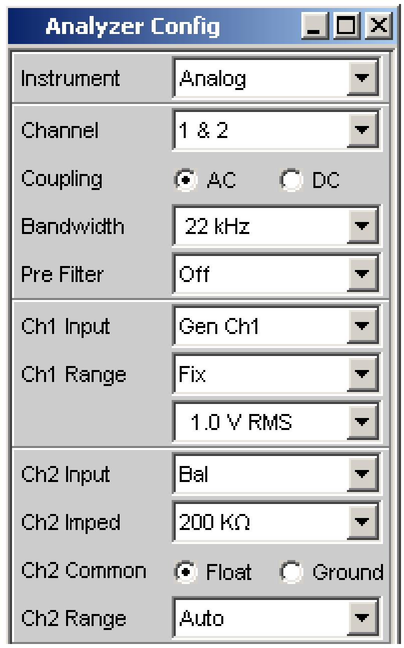
Set R&S UPV:



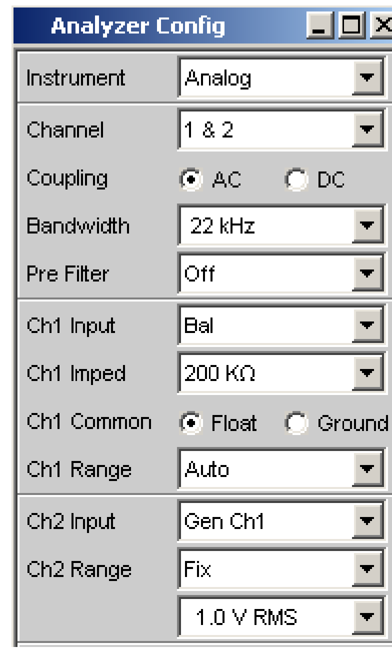
Meas. instrument: UPV analyzer

Measurement of the output level

Analyzer settings:



Measurement of Phone Out Ch1



Measurement of Phone Out Ch2

Test setup

Similar to the “Monitoring” performance test, the R&S UPV-U2 option can be checked sequentially using a R&S UPV analyzer channel. This saves the cost of additional test equipment.

Measurement:

BNC Phone Out Ch1:

- Set the R&S UPV analyzer as shown in the figure at the top left.
- Connect BNC Phone Out Ch1 to the input of R&S UPV analyzer Ch2 using a shielded cable.
- Measure the level of Phone Out Ch1 using R&S UPV analyzer Ch2. Read off the measured value in the numeric panel under RMS (lower line).

BNC Phone Out Ch2:

- Set the R&S UPV analyzer as shown in the figure at the top right.
- Connect BNC Phone Out Ch2 to the input of R&S UPV analyzer Ch1 using a shielded cable.
- Measure the level of Phone Out Ch2 using R&S UPV analyzer Ch1. Read off the measured value in the numeric panel under RMS (upper line).

To connect Phone Out to the analyzer inputs, you will need an XLR to BNC adapter.

Channel assignment

A check is made whether the assignment of the Phone Out channels to the generator or analyzer channels (and thus the internal cabling with the BNC female connectors on the back panel of the R&S UPV) is correct.

Test setup Same as above.

Measurement: BNC Phone Out Ch1:

- Set the R&S UPV analyzer as shown in the figure at the top left.
- Connect BNC Phone Out Ch1 to the input of R&S UPV analyzer Ch2 using a shielded cable.
- Set analyzer Ch1 range to 3.0 RMS.
- Measure the level of Phone Out Ch1 using R&S UPV analyzer Ch2. Read off the measured value in the numeric panel under RMS (lower line).

BNC Phone Out Ch2:

- Set the R&S UPV analyzer as shown in the figure at the top right.
- Connect BNC Phone Out Ch2 to the input of R&S UPV analyzer Ch1 using a shielded cable.
- Set analyzer Ch2 range to 3.0 RMS.
- Measure the level of Phone Out Ch2 using R&S UPV analyzer Ch1. Read off the measured value in the numeric panel under RMS (upper line).

To connect Phone Out to the analyzer inputs, you will need an XLR to BNC adapter.

Performance Test Report

Performance Test Report of Analog Generator

Audio Analyzer R&S UPV
R&S UPV / Analog Generator
Order No. 1146.2003.02
Serial-No.: . . . .

Rohde & Schwarz

Date: . . . .
Name: . . . .

Measurement		Min	Act.	Max	Unit
Sinewave Level Error at 1 kHz					
Channel	1				
Output	Unbal				
Voltage	8.000 V	7.9600		8.0400	V
	4.000 V	3.9800		4.0200	V
	2.000 V	1.9900		2.0100	V
	1.000 V	0.9950		1.0050	V
	0.500 V	0.4975		0.5025	V
	0.250 V	0.2487		0.2513	V
	15.00 mV	14.925		15.075	mV
Channel	1				
Output	Bal				
Impedance	10 Ω				
Voltage	16.000 V	15.920		16.080	V
	2.0000 V	1.9900		2.0100	V
	0.5000 V	0.4975		0.5025	V
Channel	2				
Output	Unbal				
Voltage	2.0000 V	1.9900		2.0100	V
Channel	2				
Output	Bal				
Impedance	10 Ω				
Voltage	4.0000 V	3.9800		4.0200	V
Sinewave Frequency Response Unbal					
Voltage	2.000 V				
Channel	1				
Frequency	10 Hz	-0.02		+0.02	dB
	20 Hz	-0.01		+0.01	dB
	50 Hz	-0.01		+0.01	dB
	100 Hz	-0.01		+0.01	dB
	500 Hz	-0.01		+0.01	dB
	1 kHz	-0.01		+0.01	dB
	5 kHz	-0.01		+0.01	dB
	10 kHz	-0.01		+0.01	dB
	15 kHz	-0.01		+0.01	dB
	20 kHz	-0.01		+0.01	dB
	25 kHz	-0.05		+0.05	dB
	50 kHz	-0.05		+0.05	dB
	80 kHz	-0.10		+0.10	dB
Channel	2				
Frequency	10 Hz	-0.02		+0.02	dB
	1 kHz	-0.01		+0.01	dB
	20 kHz	-0.01		+0.01	dB
	80 kHz	-0.10		+0.10	dB

Measurement		Min	Act.	Max	Unit
Sinewave Frequency Error					
Frequency	1.00000 kHz	0.99999		1.00001	kHz
DC Offset 0 V: Residual DC					
Output	Unbal				
Voltage Range	8.0000 V	-80		+80	mV
	4.0000 V	-40		+40	mV
	0.5000 V	-5		+5	mV
Output	Bal				
Impedance	10 Ω				
Voltage	1.0000 V	-10		+10	mV
DC Offset: Setting Error					
Output	Unbal				
DC Offset	+1.0000 V	+0.98		+1.02	V
	-1.0000 V	-1.02		-0.98	V
Output	Bal				
Impedance	10 Ω				
DC Offset	+2.0000 V	+1.96		+2.04	V
	-2.0000 V	-2.04		-1.96	V
THD+N Inherent Distortion					
Output	Unbal				
Analyzer Bandwidth	22 kHz				
Voltage	10.000 V				
Frequency	20 Hz			-103	dB
	1 kHz			-103	dB
	10 kHz			-103	dB
	20 kHz			-103	dB
Voltage	2.5000 V				
Frequency	1 kHz			-103	dB
Analyzer Bandwidth	80 kHz				
Voltage	10.000 V				
Frequency	1 kHz			-90	dB
	10 kHz			-90	dB
	20 kHz			-90	dB
Voltage	2.5000 V				
Frequency	1 kHz			-90	dB
Output	Bal				
Impedance	10 Ω				
Analyzer Bandwidth	22 kHz				
Voltage	20.000 V				
Frequency	20 Hz			-103	dB
	1 kHz			-103	dB
	10 kHz			-103	dB
	20 kHz			-103	dB
Voltage	5.0000 V				
Frequency	1 kHz			-103	dB
Analyzer Bandwidth	80 kHz				
Voltage	20.000 V				
Frequency	1 kHz			-90	dB
	10 kHz			-90	dB
	20 kHz			-90	dB
Voltage	5.0000 V				
Frequency	1 kHz			-90	dB

Measurement		Min	Act.	Max	Unit
Mod Dist Inherent Distortion					
Lower Frequency	60 Hz				
Upper Frequency	4 kHz			-90	dB
	7 kHz			-96	dB
	10 kHz			-90	dB
	20 kHz			-90	dB
DFD Level Error					
Mean Frequency	5 kHz	0.95		1.05	V
	10 kHz	0.95		1.05	V
	15 kHz	0.95		1.05	V
	20 kHz	0.95		1.05	V
DFD d2 Inherent Distortion					
Diff Freq	425 Hz				
Mean Freq	5 kHz			-115	dB
	20 kHz			-115	dB
DFD d3 Inherent Distortion					
Diff Freq	425 Hz				
Mean Freq	5 kHz			-94	dB
	20 kHz			-94	dB
Output Impedance					
Output	Bal				
Channel	Off				
Impedance Ch1	10 Ω	9.0		10.25	Ω
	150 Ω *)	149		151	Ω
	200 Ω	199		201	Ω
	600 Ω	597		603	Ω
Impedance Ch2	10 Ω	8.0		10.0	Ω
	150 Ω *)	149		151	Ω
	200 Ω	199		201	Ω
	600 Ω	597		603	Ω
Output	Unbal				
Channel	Off				
Impedance Ch1	5 Ω	4.5		5.5	Ω
Impedance Ch2	5 Ω	4.5		5.5	Ω
Output	Bal				
Channel	1				
Impedance Ch1	10 Ω	9.0		10.25	Ω
Channel	2				
Impedance Ch2	10 Ω	9.0		10.25	Ω
Output	Unbal				
Channel	1				
Impedance	Ch1	4.75		5.25	Ω
Channel	2				
Impedance	Ch2	4.75		5.25	Ω
Crosstalk					
Output	Unbal				
Crosstalk	Channel 1 → 2			-115	dB
	Channel 2 → 1			-115	dB
Output	Bal				
Impedance	10 Ω				
Crosstalk	Channel 1 → 2			-115	dB

Measurement		Min	Act.	Max	Unit
	Channel 2 → 1			-115	dB
Unbalance Rejection					
Channel	1				
Frequency	1 kHz	75			dB
	20 kHz	60			dB
Channel	2				
Frequency	1 kHz	75			dB
	20 kHz	60			dB

*) If the option R&S UPV-U1 is built in, the output impedance must be 150 Ω instead of 200 Ω.

Performance Test Report of Analog Analyzer

Audio Analyzer R&S UPV
Analog Analyzer
Order No. 1146.2003.02
Serial No.: . . . .

Rohde & Schwarz

Date: . . . .
Name: . . . .

Measurement		Min.	Actual	Max.	Unit
Level Measurement RMS					
Level Error at 1 kHz					
Analyzer Bandwidth **22 kHz**					
Channel **1**					
Range Fix	Input Voltage				
100 mV RMS	75 mV	–0.05		0.05	dB
300 mV RMS	225 mV	–0.05		0.05	dB
0.6 V RMS	0.45 V	–0.05		0.05	dB
1.8 V RMS	1.35 V	–0.05		0.05	dB
3.0 V RMS	2.25 V	–0.05		0.05	dB
6.0 V RMS	4.5 V	–0.05		0.05	dB
30.0 V RMS	22.5 V	–0.05		0.05	dB
Analyzer Bandwidth **22 kHz**					
Channel **2**					
Range Fix	Input Voltage				
100 mV RMS	75 mV	–0.05		0.05	dB
300 mV RMS	225 mV	–0.05		0.05	dB
0.6 V RMS	0.45 V	–0.05		0.05	dB
1.8 V RMS	1.35 V	–0.05		0.05	dB
3.0 V RMS	2.25 V	–0.05		0.05	dB
6.0 V RMS	4.5 V	–0.05		0.05	dB
30.0 V RMS	22.5 V	–0.05		0.05	dB
Analyzer Bandwidth **80 kHz**					
Channel **1**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V	–0.05		0.05	dB
Analyzer Bandwidth **80 kHz**					
Channel **2**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V	–0.05		0.05	dB
Analyzer Bandwidth **250 kHz**					
Channel **1**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V	–0.05		0.05	dB
Analyzer Bandwidth **250 kHz**					
Channel **2**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V	–0.05		0.05	dB

Measurement		Min.	Actual	Max.	Unit
Frequency Response					
Analyzer Bandwidth **22 kHz**					
Channel **1**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	10 Hz	–0.1		0.1	dB
	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.01		0.01	dB
	5 kHz	–0.01		0.01	dB
	8 kHz	–0.01		0.01	dB
	10 kHz	–0.01		0.01	dB
	15 kHz	–0.01		0.01	dB
	18 kHz	–0.01		0.01	dB
	20 kHz	–0.01		0.01	dB
	22 kHz	–0.02		0.02	dB
Analyzer Bandwidth **22 kHz**					
Channel **2**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	10 Hz	–0.1		0.1	dB
	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 KHz	0		0	dB
	2 kHz	–0.01		0.01	dB
	5 kHz	–0.01		0.01	dB
	8 kHz	–0.01		0.01	dB
	10 kHz	–0.01		0.01	dB
	15 kHz	–0.01		0.01	dB
	18 kHz	–0.01		0.01	dB
	20 kHz	–0.01		0.01	dB
	22 kHz	–0.02		0.02	dB

Measurement		Min.	Actual	Max.	Unit
Analyzer Bandwidth **22 kHz**					
Channel **1**					
Range Fix	Input Voltage				
6.0 V RMS	4.5 V				
Frequency	10 Hz	–0.1		0.1	dB
	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.03		0.03	dB
	5 kHz	–0.03		0.03	dB
	8 kHz	–0.03		0.03	dB
	10 kHz	–0.03		0.03	dB
	15 kHz	–0.03		0.03	dB
	18 kHz	–0.03		0.03	dB
	20 kHz	–0.03		0.03	dB
	22 kHz	–0.05		0.05	dB
Analyzer Bandwidth **22 kHz**					
Channel **2**					
Range Fix	Input Voltage				
6.0 V RMS	4.5 V				
Frequency	10 Hz	–0.1		0.1	dB
	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.03		0.03	dB
	5 kHz	–0.03		0.03	dB
	8 kHz	–0.03		0.03	dB
	10 kHz	–0.03		0.03	dB
	15 kHz	–0.03		0.03	dB
	18 kHz	–0.03		0.03	dB
	20 kHz	–0.03		0.03	dB
	22 kHz	–0.05		0.05	dB
Analyzer Bandwidth **40 kHz**					
Channel **1**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	100 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB

Measurement		Min.	Actual	Max.	Unit
	5 kHz	−0.01		0.01	dB
	10 kHz	−0.01		0.01	dB
	22 kHz	−0.02		0.02	dB
	40 kHz	−0.03		0.03	dB
Analyzer Bandwidth **40 kHz**					
Channel **2**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	100 Hz	−0.01		0.01	dB
	1 kHz	0		0	dB
	5 kHz	−0.01		0.01	dB
	10 kHz	−0.01		0.01	dB
	22 kHz	−0.02		0.02	dB
	40 kHz	−0.03		0.03	dB
Analyzer Bandwidth **80 kHz**					
Channel **1**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	100 Hz	−0.01		0.01	dB
	1 kHz	0		0	dB
	5 kHz	−0.01		0.01	dB
	10 kHz	−0.01		0.01	dB
	22 kHz	−0.02		0.02	dB
	50 kHz	−0.03		0.03	dB
	80 kHz	−0.1		0.1	dB
Analyzer Bandwidth **80 kHz**					
Channel **2**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	100 Hz	−0.01		0.01	dB
	1 kHz	0		0	dB
	5 kHz	−0.01		0.01	dB
	10 kHz	−0.01		0.01	dB
	22 kHz	−0.02		0.02	dB
	50 kHz	−0.03		0.03	dB
	80 kHz	−0.1		0.1	dB
Analyzer Bandwidth **250 kHz**					
Channel **1**					
Range Fix	Input Voltage				
100 mV RMS	75 mV				
Frequency	1 kHz	0		0	dB
	2 kHz	−0.01		0.01	dB
	5 kHz	−0.01		0.01	dB
	10 kHz	−0.01		0.01	dB
	20 kHz	−0.01		0.01	dB
	50 kHz	−0.03		0.03	dB
	80 kHz	−0.1		0.1	dB
	100 kHz	−0.1		0.1	dB

Measurement		Min.	Actual	Max.	Unit
	120 kHz	−0.3		0.3	dB
	150 kHz	−0.3		0.3	dB
	180 kHz	−0.3		0.3	dB
	200 kHz	−0.3		0.3	dB
	250 kHz	−0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **2**					
Range Fix	Input Voltage				
100 mV RMS	75 mV				
Frequency	1 kHz	0		0	dB
	2 kHz	−0.01		0.01	dB
	5 kHz	−0.01		0.01	dB
	10 kHz	−0.01		0.01	dB
	20 kHz	−0.01		0.01	dB
	50 kHz	−0.03		0.03	dB
	80 kHz	−0.1		0.1	dB
	100 kHz	−0.1		0.1	dB
	120 kHz	−0.3		0.3	dB
	150 kHz	−0.3		0.3	dB
	180 kHz	−0.3		0.3	dB
	200 kHz	−0.3		0.3	dB
	250 kHz	−0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **1**					
Range Fix	Input Voltage				
300 mV RMS	225 mV				
Frequency	1 kHz	0		0	dB
	2 kHz	−0.01		0.01	dB
	5 kHz	−0.01		0.01	dB
	10 kHz	−0.01		0.01	dB
	20 kHz	−0.01		0.01	dB
	50 kHz	−0.03		0.03	dB
	80 kHz	−0.1		0.1	dB
	100 kHz	−0.1		0.1	dB
	120 kHz	−0.3		0.3	dB
	150 kHz	−0.3		0.3	dB
	180 kHz	−0.3		0.3	dB
	200 kHz	−0.3		0.3	dB
	250 kHz	−0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **2**					
Range Fix	Input Voltage				
300 mV RMS	225 mV				
Frequency	1 kHz	0		0	dB
	2 kHz	−0.01		0.01	dB
	5 kHz	−0.01		0.01	dB
	10 kHz	−0.01		0.01	dB
	20 kHz	−0.01		0.01	dB

Measurement		Min.	Actual	Max.	Unit
	50 kHz	–0.03		0.03	dB
	80 kHz	–0.1		0.1	dB
	100 kHz	–0.1		0.1	dB
	120 kHz	–0.3		0.3	dB
	150 kHz	–0.3		0.3	dB
	180 kHz	–0.3		0.3	dB
	200 kHz	–0.3		0.3	dB
	250 kHz	–0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **1**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.01		0.01	dB
	5 kHz	–0.01		0.01	dB
	10 kHz	–0.01		0.01	dB
	20 kHz	–0.01		0.01	dB
	50 kHz	–0.03		0.03	dB
	80 kHz	–0.1		0.1	dB
	100 kHz	–0.1		0.1	dB
	120 kHz	–0.3		0.3	dB
	150 kHz	–0.3		0.3	dB
	180 kHz	–0.3		0.3	dB
	200 kHz	–0.3		0.3	dB
	250 kHz	–0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **2**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.01		0.01	dB
	5 kHz	–0.01		0.01	dB
	10 kHz	–0.01		0.01	dB
	20 kHz	–0.01		0.01	dB

Measurement		Min.	Actual	Max.	Unit
	50 kHz	–0.03		0.03	dB
	80 kHz	–0.1		0.1	dB
	100 kHz	–0.1		0.1	dB
	120 kHz	–0.3		0.3	dB
	150 kHz	–0.3		0.3	dB
	180 kHz	–0.3		0.3	dB
	200 kHz	–0.3		0.3	dB
	250 kHz	–0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **1**					
Range Fix	Input Voltage				
6.0 V RMS	4.5 V				
Frequency	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.01		0.01	dB
	5 kHz	–0.03		0.03	dB
	10 kHz	–0.03		0.03	dB
	20 kHz	–0.03		0.03	dB
	50 kHz	–0.05		0.05	dB
	80 kHz	–0.1		0.1	dB
	100 kHz	–0.1		0.1	dB
	120 kHz	–0.3		0.3	dB
	150 kHz	–0.3		0.3	dB
	180 kHz	–0.3		0.3	dB
	200 kHz	–0.3		0.3	dB
	250 kHz	–0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **2**					
Range Fix	Input Voltage				
6.0 V RMS	4.5 V				
Frequency	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.01		0.01	dB
	5 kHz	–0.03		0.03	dB
	10 kHz	–0.03		0.03	dB
	20 kHz	–0.03		0.03	dB

Measurement		Min.	Actual	Max.	Unit
	50 kHz	–0.05		0.05	dB
	80 kHz	–0.1		0.1	dB
	100 kHz	–0.1		0.1	dB
	120 kHz	–0.3		0.3	dB
	150 kHz	–0.3		0.3	dB
	180 kHz	–0.3		0.3	dB
	200 kHz	–0.3		0.3	dB
	250 kHz	–0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **1**					
Range Fix	Input Voltage				
30.0 V RMS	7 V				
Frequency	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.01		0.01	dB
	5 kHz	–0.03		0.03	dB
	10 kHz	–0.03		0.03	dB
	20 kHz	–0.03		0.03	dB
	50 kHz	–0.05		0.05	dB
	80 kHz	–0.1		0.1	dB
	100 kHz	–0.1		0.1	dB
	120 kHz	–0.3		0.3	dB
	150 kHz	–0.3		0.3	dB
	180 kHz	–0.3		0.3	dB
	200 kHz	–0.3		0.3	dB
	250 kHz	–0.3		0.3	dB
Analyzer Bandwidth **250 kHz**					
Channel **2**					
Range Fix	Input Voltage				
30.0 V RMS	7 V				
Frequency	20 Hz	–0.01		0.01	dB
	50 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	100 Hz	–0.01		0.01	dB
	300 Hz	–0.01		0.01	dB
	500 Hz	–0.01		0.01	dB
	800 Hz	–0.01		0.01	dB
	1 kHz	0		0	dB
	2 kHz	–0.01		0.01	dB
	5 kHz	–0.03		0.03	dB
	10 kHz	–0.03		0.03	dB
	20 kHz	–0.03		0.03	dB

Measurement		Min.	Actual	Max.	Unit
	50 kHz	–0.05		0.05	dB
	80 kHz	–0.1		0.1	dB
	100 kHz	–0.1		0.1	dB
	120 kHz	–0.3		0.3	dB
	150 kHz	–0.3		0.3	dB
	180 kHz	–0.3		0.3	dB
	200 kHz	–0.3		0.3	dB
	250 kHz	–0.3		0.3	dB
Overrange Test					
Channel **1**					
Range Fix	Input Voltage				
3.0 V RMS	3.7 V, Freq 1 kHz	---		---	
	Status	Over		Over	
Channel **2**					
Range Fix	Input Voltage				
3.0 V RMS	3.7 V, Freq 1 kHz	---		---	
	Status	Over		Over	
Channel **1**					
Range Fix	Input Voltage				
6.0 V RMS	3.7 V, Freq 1 kHz	3.7		3.7	V
	Status	Term		Term	
Channel **2**					
Range Fix	Input Voltage				
6.0 V RMS	3.7 V, Freq 1 kHz	3.7		3.7	V
	Status	Term		Term	
Inherent Noise					
Channel **1**					
Analyzer Bandwidth	**22 kHz**				
Function RMS	Filter A weighting			1	µV
	Filter CCIR unwtd			1.4	µV
Function QPEAK	Filter CCIR1k wtd			5	µV
Analyzer Bandwidth	**40 kHz**				
Function RMS	Filter CCIR unwtd			1.4	µV
Analyzer Bandwidth	**80 kHz**				
Function RMS	Filter CCIR unwtd			1.4	µV
	Filter Off			2.8	µV
Analyzer Bandwidth	**250 kHz**				
Function RMS	Filter Off			7	µV
Channel **2**					
Analyzer Bandwidth	**22 kHz**				
Function RMS	Filter A weighting			1	µV
	Filter CCIR unwtd			1.4	µV
Function QPEAK	Filter CCIR1k wtd			5	µV
Analyzer Bandwidth	**40 kHz**				
Function RMS	Filter CCIR unwtd			1.4	µV
Analyzer Bandwidth	**80 kHz**				
Function RMS	Filter CCIR unwtd			1.4	µV

Measurement		Min.	Actual	Max.	Unit
	Filter Off			2.8	µV
Analyzer Bandwidth	**250 kHz**				
Function RMS	Filter Off			7	µV
Input Impedances					
Channel **1**					
Impedance	200 kΩ	198		202	kΩ
	600 Ω	597		603	Ω
	300 Ω	298.5		301.5	Ω
Channel **2**					
Impedance	200 kΩ	198		202	kΩ
	600 Ω	597		603	Ω
	300 Ω	298.5		301.5	Ω
Crosstalk Attenuation					
Input Signal Ch1 10 V, 20 kHz Crosstalk	Channel 1 → 2	120			dB
Input Signal Ch2 10 V, 20 kHz Crosstalk	Channel 2 → 1	120			dB
Common Mode Rejection CMR					
Channel **1**					
Range 18 mV, Input 3 V,	50 Hz	90			dB
	1 kHz	86			dB
	20 kHz	80			dB
Range 3 V, Input 3 V,	50 Hz	90			dB
	1 kHz	86			dB
	20 kHz	80			dB
Channel **2**					
Range 18 mV, Input 3 V,	50 Hz	90			dB
	1 kHz	86			dB
	20 kHz	80			dB
Range 3 V, Input 3 V,	50 Hz	90			dB
	1 kHz	86			dB
	20 kHz	80			dB
Frequency Error					
Analyzer Bandwidth	**22 kHz**				
Channel **1**					
Range Fix 3.0 VRMS					
Input 3 V, Frequency	10 Hz	-10		10	ppm
	1 kHz	-10		10	ppm
	22 kHz	-10		10	ppm
Input 0,3 V	10 Hz	-10		10	ppm
	1 kHz	-10		10	ppm
	22 kHz	-10		10	ppm

Measurement		Min.	Actual	Max.	Unit
Analyzer Bandwidth	**22 kHz**				
Channel **2**					
Range Fix 3.0 VRMS					
Input 3 V, Frequency	10 Hz	-10		10	ppm
	1 kHz	-10		10	ppm
	22 kHz	-10		10	ppm
Input 0,3 V	10 Hz	-10		10	ppm
	1 kHz	-10		10	ppm
	22 kHz	-10		10	ppm
Analyzer Bandwidth	**250 kHz**				
Channel **1**					
Range Fix 3.0 VRMS					
Input 3 V, Frequency	20 Hz	-10		10	ppm
	1 kHz	-10		10	ppm
	200 kHz	-10		10	ppm
Analyzer Bandwidth	**250 kHz**				
Channel **2**					
Range Fix 3.0 VRMS					
Input 3 V, Frequency	20 Hz	-10		10	ppm
	1 kHz	-10		10	ppm
	200 kHz	-10		10	ppm
Phase Coincidence					
Analyzer Bandwidth **22 kHz**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	20 Hz	–0.4		0.4	°
	100 Hz	–0.4		0.4	°
	500 Hz	–0.4		0.4	°
	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	22 kHz	–0.4		0.4	°
Analyzer Bandwidth **22 kHz**					
Range Fix	Input Voltage				
6.0 V RMS	4.5 V				
Frequency	20 Hz	–0.4		0.4	°
	100 Hz	–0.4		0.4	°
	500 Hz	–0.4		0.4	°
	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	22 kHz	–0.4		0.4	°
Analyzer Bandwidth **80 kHz**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	20 Hz	–0.4		0.4	°

Measurement		Min.	Actual	Max.	Unit
	100 Hz	–0.4		0.4	°
	500 Hz	–0.4		0.4	°
	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	40 kHz	–0.6		0.6	°
	60 kHz	–1.0		1.0	°
	80 kHz	–1.0		1.0	°
Analyzer Bandwidth **250 kHz**					
Range Fix	Input Voltage				
0.1 V RMS	75 mV				
Frequency	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	40 kHz	–0.6		0.6	°
	60 kHz	–1.0		1.0	°
	80 kHz	–1.0		1.0	°
	100 kHz	–1.0		1.0	°
	150 kHz	–1.5		1.5	°
	185 kHz	–1.5		1.5	°
Analyzer Bandwidth **250 kHz**					
Range Fix	Input Voltage				
0.3 V RMS	225 mV				
Frequency	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	40 kHz	–0.6		0.6	°
	60 kHz	–1.0		1.0	°
	80 kHz	–1.0		1.0	°
	100 kHz	–1.0		1.0	°
	150 kHz	–1.5		1.5	°
	185 kHz	–1.5		1.5	°
Analyzer Bandwidth **250 kHz**					
Range Fix	Input Voltage				
0.6 V RMS	450 mV				
Frequency	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	40 kHz	–0.6		0.6	°
	60 kHz	–1.0		1.0	°
	80 kHz	–1.0		1.0	°
	100 kHz	–1.0		1.0	°
	150 kHz	–1.5		1.5	°
	185 kHz	–1.5		1.5	°
Analyzer Bandwidth **250 kHz**					
Range Fix	Input Voltage				
1.8 V RMS	1.35 V				

Measurement		Min.	Actual	Max.	Unit
Frequency	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	40 kHz	–0.6		0.6	°
	60 kHz	–1.0		1.0	°
	80 kHz	–1.0		1.0	°
	100 kHz	–1.0		1.0	°
	150 kHz	–1.5		1.5	°
	185 kHz	–1.5		1.5	°
Analyzer Bandwidth **250 kHz**					
Range Fix	Input Voltage				
3.0 V RMS	2.25 V				
Frequency	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	40 kHz	–0.6		0.6	°
	60 kHz	–1.0		1.0	°
	80 kHz	–1.0		1.0	°
	100 kHz	–1.0		1.0	°
	150 kHz	–1.5		1.5	°
	185 kHz	–1.5		1.5	°
Analyzer Bandwidth **250 kHz**					
Range Fix	Input Voltage				
6.0 V RMS	4.5 V				
Frequency	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	40 kHz	–0.6		0.6	°
	60 kHz	–1.0		1.0	°
	80 kHz	–1.0		1.0	°
	100 kHz	–1.0		1.0	°
	150 kHz	–1.5		1.5	°
	185 kHz	–1.5		1.5	°
Analyzer Bandwidth **250 kHz**					
Range Fix	Input Voltage				
30.0 V RMS	20 V				
Frequency	1 kHz	–0.4		0.4	°
	10 kHz	–0.4		0.4	°
	15 kHz	–0.4		0.4	°
	20 kHz	–0.4		0.4	°
	40 kHz	–0.6		0.6	°
	60 kHz	–1.0		1.0	°
	80 kHz	–1.0		1.0	°
	100 kHz	–1.0		1.0	°
	150 kHz	–1.5		1.5	°
	185 kHz	–1.5		1.5	°
DC Measurement					

Measurement		Min.	Actual	Max.	Unit
DC Offset					
Analyzer Bandwidth **22 kHz** Level Monitor DC Channel **1** Range Fix	100 mV	–0.1		+0.1	mV
	300 mV	–0.3		+0.3	mV
	1.0 V	–1		+1	mV
	3.0 V	–3		+3	mV
	10.0 V	–10		+10	mV
	30.0 V	–30		+30	mV
Analyzer Bandwidth **22 kHz** Level Monitor DC Channel **2** Range Fix	100 mV	–0.1		+0.1	mV
	300 mV	–0.3		+0.3	mV
	1.0 V	–1		+1	mV
	3.0 V	–3		+3	mV
	10.0 V	–10		+10	mV
	30.0 V	–30		+30	mV
DC Measurement Error					
Analyzer Bandwidth **22 kHz** Level Monitor DC Channel **1** Range Fix 3.0 V Input Voltage	+4.5 V	–1.07		1.07	%
	–4.5 V	–1.07		1.07	%
	+3.0 V	–1.10		1.10	%
	–3.0 V	–1.10		1.10	%
	+2.5 V	–1.12		1.12	%
	–2.5 V	–1.12		1.12	%
	+2.0 V	–1.15		1.15	%
	–2.0 V	–1.15		1.15	%
	+1.5 V	–1.20		1.20	%
	–1.5 V	–1.20		1.20	%
	+1.0 V	–1.30		1.30	%
	–1.0 V	–1.30		1.30	%
	+0.5 V	–1.60		1.60	%
	–0.5 V	–1.60		1.60	%
	+0.3 V	–2.00		2.00	%
	–0.3 V	–2.00		2.00	%
Analyzer Bandwidth **22 kHz** Level Monitor DC Channel **2** Range Fix 3.0 V Input Voltage	+4.5 V	-1.07		1.07	%
	-4.5 V	-1.07		1.07	%
	+3.0 V	-1.10		1.10	%
	-3.0 V	-1.10		1.10	%
	+2.5 V	-1.12		1.12	%
	-2.5 V	-1.12		1.12	%
	+2.0 V	-1.15		1.15	%
	-2.0 V	-1.15		1.15	%
	+1.5 V	-1.20		1.20	%
	-1.5 V	-1.20		1.20	%
	+1.0 V	-1.30		1.30	%
	-1.0 V	-1.30		1.30	%

Measurement				Min.	Actual	Max.	Unit
	+0.5 V			-1.60		1.60	%
	-0.5 V			-1.60		1.60	%
	+0.3 V			-2.00		2.00	%
	-0.3 V			-2.00		2.00	%
THD Total Harmonic Distortion							
THD Inherent Distortion – with Low Distortion Generator							
Function THD all di Prec							
Analyzer Bandwidth **22 kHz**							
Channel **1**							
Freq	Range Fix	Input	Gen Out				
10 Hz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
20 Hz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
50 Hz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
100 Hz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
450 Hz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
1 kHz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
3 kHz	10.0 V	10 V	Bal			-110	dB
	10.0 V	10 V	Unbal			-106	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-106	dB
	1.0 V	1 V	Unbal			-106	dB
7 kHz	10.0 V	10 V	Bal			-110	dB
	10.0 V	10 V	Unbal			-100	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-106	dB
	1.0 V	1 V	Unbal			-106	dB
10 kHz	10.0 V	10 V	Bal			-110	dB
	10.0 V	10 V	Unbal			-100	dB
	3.0 V	2 V	Bal			-110	dB

Measurement				Min.	Actual	Max.	Unit
	3.0 V	2 V	Unbal			-106	dB
	1.0 V	1 V	Unbal			-106	dB
Function THD all di Prec							
Analyzer Bandwidth **22 kHz**							
Channel **2**							
Freq	Range Fix	Input	Gen Out				
10 Hz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
20 Hz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
50 Hz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
100 Hz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
450 Hz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
1 kHz	10.0 V	10 V	Bal			-110	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-110	dB
	1.0 V	1 V	Unbal			-110	dB
3 kHz	10.0 V	10 V	Bal			-110	dB
	10.0 V	10 V	Unbal			-106	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-106	dB
	1.0 V	1 V	Unbal			-106	dB
7 kHz	10.0 V	10 V	Bal			-110	dB
	10.0 V	10 V	Unbal			-100	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-106	dB
	1.0 V	1 V	Unbal			-106	dB
10 kHz	10.0 V	10 V	Bal			-110	dB
	10.0 V	10 V	Unbal			-100	dB
	3.0 V	2 V	Bal			-110	dB
	3.0 V	2 V	Unbal			-106	dB
	1.0 V	1 V	Unbal			-106	dB
Function THD all di Prec							
Analyzer Bandwidth **250 kHz**							
Channel **1**							

Measurement				Min.	Actual	Max.	Unit
Freq	Range Fix	Input	Gen Out				
50 Hz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
100 Hz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
450 Hz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
1 kHz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
3 kHz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
7 kHz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
22 kHz	10.0 V	10 V	Bal			-100	dB
	10.0 V	10 V	Unbal			-90	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
50 kHz	10.0 V	10 V	Bal			-90	dB
	10.0 V	10 V	Unbal			-80	dB
	3.0 V	2 V	Bal			-90	dB
	3.0 V	2 V	Unbal			-90	dB
	1.0 V	1 V	Unbal			-90	dB
100 kHz	10.0 V	10 V	Bal			-80	dB
	10.0 V	10 V	Unbal			-75	dB
	3.0 V	2 V	Bal			-80	dB
	3.0 V	2 V	Unbal			-80	dB
	1.0 V	1 V	Unbal			-80	dB
Function THD all di Prec Analyzer Bandwidth **250 kHz** Channel **2**							
Freq	Range Fix	Input	Gen Out				
50 Hz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB

Measurement				Min.	Actual	Max.	Unit
100 Hz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
450 Hz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
1 kHz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
3 kHz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
7 kHz	10.0 V	10 V	Bal			-100	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
22 kHz	10.0 V	10 V	Bal			-100	dB
	10.0 V	10 V	Unbal			-90	dB
	3.0 V	2 V	Bal			-100	dB
	3.0 V	2 V	Unbal			-100	dB
	1.0 V	1 V	Unbal			-100	dB
50 kHz	10.0 V	10 V	Bal			-90	dB
	10.0 V	10 V	Unbal			-80	dB
	3.0 V	2 V	Bal			-90	dB
	3.0 V	2 V	Unbal			-90	dB
	1.0 V	1 V	Unbal			-90	dB
100 kHz	10.0 V	10 V	Bal			-80	dB
	10.0 V	10 V	Unbal			-75	dB
	3.0 V	2 V	Bal			-80	dB
	3.0 V	2 V	Unbal			-80	dB
	1.0 V	1 V	Unbal			-80	dB
THD Measurement Error							
Function THD Select di, Even Harmonics 2 Dynamic Mode Prec Analyzer Bandwidth **22kHz** Channel **1**							
Range Fix	Fund. Freq.	THD Nom.					
3.0 V RMS	9 kHz	–10 dB		–0.5		0.5	dB
		–20 dB		–0.5		0.5	dB
		–30 dB		–0.5		0.5	dB
		–40 dB		–0.5		0.5	dB
		–50 dB		–0.5		0.5	dB
		–55 dB		–0.5		0.5	dB

Measurement			Min.	Actual	Max.	Unit
		–60 dB	–0.5		0.5	dB
		–65 dB	–0.5		0.5	dB
		–70 dB	–0.5		0.5	dB
Function THD Select di, Even Harmonics 2 Dynamic Mode Prec Analyzer Bandwidth **22kHz** Channel **2**						
Range Fix	Fund. Freq.	THD Nom.				
3.0 V RMS	9 kHz	–10 dB	–0.5		0.5	dB
		–20 dB	–0.5		0.5	dB
		–30 dB	–0.5		0.5	dB
		–40 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
		–55 dB	–0.5		0.5	dB
		–60 dB	–0.5		0.5	dB
		–65 dB	–0.5		0.5	dB
		–70 dB	–0.5		0.5	dB
Function THD Select di, Even Harmonics 2 Dynamic Mode Prec Analyzer Bandwidth **250kHz** Channel **1**						
Range Fix	Fund. Freq.	THD Nom.				
3.0 V RMS	21 kHz	–10 dB	–0.5		0.5	dB
		–20 dB	–0.5		0.5	dB
		–30 dB	–0.5		0.5	dB
		–40 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
		–55 dB	–0.5		0.5	dB
		–60 dB	–0.5		0.5	dB
		–65 dB	–0.5		0.5	dB
		–70 dB	–0.5		0.5	dB
Function THD Select di, Even Harmonics 2 Dynamic Mode Prec Analyzer Bandwidth **250kHz** Channel **2**						
Range Fix	Fund. Freq.	THD Nom.				
3.0 V RMS	21 kHz	–10 dB	–0.5		0.5	dB
		–20 dB	–0.5		0.5	dB
		–30 dB	–0.5		0.5	dB
		–40 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
		–55 dB	–0.5		0.5	dB
		–60 dB	–0.5		0.5	dB
		–65 dB	–0.5		0.5	dB
		–70 dB	–0.5		0.5	dB
THD+N Total Harmonic Distortion + Noise						

Measurement	Min.	Actual	Max.	Unit
THD+N Inherent Distortion – with Low Distortion Generator				
Function THD+N, Dynamic Mode Prec Relection Bandw. **60 Hz**, Frq. Lim. **20 Hz to 22 kHz** Analyzer Bandwidth **22 kHz** Channel **1**				
Freq Range Fix Input Gen Out				
20 Hz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB
1.0 V 1 V Bal			-103.5	dB
50 Hz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB
1.0 V 1 V Bal			-103.5	dB
100 Hz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB
1.0 V 1 V Bal			-103.5	dB
450 Hz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB
1.0 V 1 V Bal			-103.5	dB
1 kHz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB
1.0 V 1 V Bal			-103.5	dB
3 kHz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB
1.0 V 1 V Bal			-103.5	dB
7 kHz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB
1.0 V 1 V Bal			-103.5	dB
20 kHz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB
1.0 V 1 V Bal			-103.5	dB
Function THD+N, Dynamic Mode Prec Relection Bandw. **60 Hz**, Frq. Lim. **20 Hz to 22 kHz** Analyzer Bandwidth **22 kHz** Channel **2**				
Freq Range Fix Input Gen Out				
20 Hz 10.0 V 10 V Bal			-100	dB
6.0 V 3 V Bal			-100	dB
3.0 V 2 V Bal			-103.5	dB

Measurement				Min.	Actual	Max.	Unit
	1.0 V	1 V	Bal			-103.5	dB
50 Hz	10.0 V	10 V	Bal			-100	dB
	6.0 V	3 V	Bal			-100	dB
	3.0 V	2 V	Bal			-103.5	dB
	1.0 V	1 V	Bal			-103.5	dB
100 Hz	10.0 V	10 V	Bal			-100	dB
	6.0 V	3 V	Bal			-100	dB
	3.0 V	2 V	Bal			-103.5	dB
	1.0 V	1 V	Bal			-103.5	dB
450 Hz	10.0 V	10 V	Bal			-100	dB
	6.0 V	3 V	Bal			-100	dB
	3.0 V	2 V	Bal			-103.5	dB
	1.0 V	1 V	Bal			-103.5	dB
1 kHz	10.0 V	10 V	Bal			-100	dB
	6.0 V	3 V	Bal			-100	dB
	3.0 V	2 V	Bal			-103.5	dB
	1.0 V	1 V	Bal			-103.5	dB
3 kHz	10.0 V	10 V	Bal			-100	dB
	6.0 V	3 V	Bal			-100	dB
	3.0 V	2 V	Bal			-103.5	dB
	1.0 V	1 V	Bal			-103.5	dB
7 kHz	10.0 V	10 V	Bal			-100	dB
	6.0 V	3 V	Bal			-100	dB
	3.0 V	2 V	Bal			-103.5	dB
	1.0 V	1 V	Bal			-103.5	dB
20 kHz	10.0 V	10 V	Bal			-100	dB
	6.0 V	3 V	Bal			-100	dB
	3.0 V	2 V	Bal			-103.5	dB
	1.0 V	1 V	Bal			-103.5	dB
THD+N Inherent Distortion – without Low Distortion Generator							
Function THD+N, Dynamic Mode Prec Relection Bandw. **60 Hz**, Frq. Lim. **20 Hz to 22 kHz** Analyzer Bandwidth **22 kHz** Analyzer Channel **1** Generator Bandwidth **22 kHz**							
Freq.	Range Fix	Input	Gen Out				
20 Hz	3.0 V	2.5 V	Ch**1** Unbal			-103	dB
1 kHz						-103	dB
3 kHz						-103	dB
6 kHz						-103	dB
8 kHz						-103	dB
10 kHz						-103	dB
20 kHz						-103	dB
Function THD+N, Dynamic Mode Prec Relection Bandw. **240 Hz**, Frq. Lim. **20 Hz to 80 kHz** Analyzer Bandwidth **80 kHz** Analyzer Channel **1** Generator Bandwidth **40 kHz**							

Measurement	Min.	Actual	Max.	Unit
Freq. Range Fix Input Gen Out				
20 Hz 3.0 V 2.5 V Ch**1** Unbal			-90	dB
1 kHz			-90	dB
3 kHz			-90	dB
6 kHz			-90	dB
8 kHz			-90	dB
10 kHz			-90	dB
20 kHz			-90	dB
Function THD+N, Dynamic Mode Prec				
Relection Bandw. **60 Hz**,				
Frq. Lim. **20 Hz to 22 kHz**				
Analyzer Bandwidth **22 kHz**				
Analyzer Channel **1**				
Generator Bandwidth **22 kHz**				
Freq. Range Fix Input Gen Out			-103	dB
1 kHz 1.0 V 1 V Ch**1** Unbal			-103	dB
3.0 V 2 V			-103	dB
6.0 V 5 V			-103	dB
10.0 V 8 V			-103	dB
If R&S UPV-B3 installed:				
Generator Function **Stereo Sine**				
Function THD+N, Dynamic Mode Prec				
Relection Bandw. **60 Hz**,				
Frq. Lim. **20 Hz to 22 kHz**				
Analyzer Bandwidth **22 kHz**				
Analyzer Channel **2**				
Generator Bandwidth **22 kHz**				
Freq. Range Fix Input Gen Out				
20 Hz 3.0 V 2.5 V Ch**2** Unbal			-103	dB
1 kHz			-103	dB
3 kHz			-103	dB
6 kHz			-103	dB
8 kHz			-103	dB
10 kHz			-103	dB
20 kHz			-103	dB
If R&S UPV-B3 installed:				
Generator Function **Stereo Sine**				
Function THD+N, Dynamic Mode Prec				
Relection Bandw. **240 Hz**,				
Frq. Lim. **20 Hz to 80 kHz**				
Analyzer Bandwidth **80 kHz**				
Analyzer Channel **1**				
Generator Bandwidth **40 kHz**				
Freq. Range Fix Input Gen Out				
20 Hz 3.0 V 2.5 V Ch**2** Unbal			-90	dB
1 kHz			-90	dB
3 kHz			-90	dB
6 kHz			-90	dB

Measurement	Min.	Actual	Max.	Unit
8 kHz 10 kHz 20 kHz			-90 -90 -90	dB dB dB
If R&S UPV-B3 installed: Generator Function **Stereo Sine** Function THD+N, Dynamic Mode Prec Relection Bandw. **60 Hz**, Frq. Lim. **20 Hz to 22 kHz** Analyzer Bandwidth **22 kHz** Analyzer Channel **2** Generator Bandwidth **22 kHz** Freq. Range Fix Input Gen Out 1 kHz 1.0 V 1 V Ch**2** Unbal 3.0 V 2 V 6.0 V 5 V 10.0 V 8 V			-103 -103 -103 -103	dB dB dB dB
THD+N Measurement Error				
Function THD+N Analyzer Bandwidth **22kHz** Channel **1,** Range Fix 3.0 V RMS Fund. Freq. 1 kHz 2nd Harm Freq. 2 kHz THD Nom. Dynamic Mode Prec –50 dB Dynamic Mode Fast –50 dB with Rejection Bandw. Narrow Dynamic Mode Fast –50 dB with Rejection Bandw.Narrow	–0.5 –0.5 –0.5		0.5 0.5 0.5	dB dB dB dB
Function THD+N Analyzer Bandwidth **22kHz** Channel **2,** Range Fix 3.0 V RMS Fund. Freq. 1 kHz 2nd Harm Freq. 2 kHz THD Nom. Dynamic Mode Prec –50 dB Dynamic Mode Fast –50 dB with Rejection Bandw. Narrow Dynamic Mode Fast –50 dB with Rejection Bandw.Narrow	–0.5 –0.5 –0.5		0.5 0.5 0.5	dB dB dB dB
Notch Filter Frequency Response Test				
Function THD+N Dynamic Mode Prec Analyzer Bandwidth **22kHz** Channel **1,** Range Fix 3.0 V RMS Fund. Freq. 2nd Harm Freq THD+N Nom. 10 Hz 20 Hz –30 dB –50 dB 15 Hz 30 Hz –30 dB –50 dB 20 Hz 40 Hz –30 dB –50 dB 30 Hz 60 Hz –30 dB	–0.5 –0.5 –0.5 –0.5 –0.5 –0.5 –0.5		0.5 0.5 0.5 0.5 0.5 0.5 0.5	dB dB dB dB dB dB dB

Measurement			Min.	Actual	Max.	Unit
		–50 dB	–0.5		0.5	dB
50 Hz	100 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
200 Hz	400 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
450 Hz	900 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
500 Hz	1 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
1 kHz	2 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
3 kHz	6 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
3.5 kHz	7 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
5 kHz	10 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
20 kHz	40 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
22 kHz	44 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
25 kHz	50 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
Function THD+N Dynamic Mode Prec Analyzer Bandwidth **22 kHz** Channel **2,** Range Fix 3.0 V RMS						
Fund. Freq.	2nd Harm Freq	THD+N Nom.				
10 Hz	20 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
15 Hz	30 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
20 Hz	40 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
30 Hz	60 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
50 Hz	100 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
200 Hz	400 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
450 Hz	900 Hz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
500 Hz	1 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
1 kHz	2 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
3 kHz	6 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
3.5 kHz	7 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
5 kHz	10 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
20 kHz	40 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
22 kHz	44 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB

Measurement			Min.	Actual	Max.	Unit
25 kHz	50 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
Function THD+N Dynamic Mode Prec Analyzer Bandwidth **250 kHz** Channel **1,** Range Fix 3.0 V RMS Fund. Freq.	2^{nd} Harm Freq	THD+N Nom.				
10 kHz	20 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
20 kHz	40 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
25 kHz	50 kHz	–30 dB	–0.7		0.7	dB
		–50 dB	–0.7		0.7	dB
30 kHz	60 kHz	–30 dB	–0.7		0.7	dB
		–50 dB	–0.7		0.7	dB
40 kHz	80 kHz	–30 dB	–0.7		0.7	dB
		–50 dB	–0.7		0.7	dB
49.9 kHz	99.8 kHz	–30 dB	–0.7		0.7	dB
		–50 dB	–0.7		0.7	dB
50 kHz	100 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
60 kHz	120 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
70 kHz	140 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
80 kHz	160 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
90 kHz	180 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
Function THD+N Dynamic Mode Prec Analyzer Bandwidth **250 kHz** Channel **2,** Range Fix 3.0 V RMS Fund. Freq.	2^{nd} Harm Freq	THD+N Nom.				
10 kHz	20 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
20 kHz	40 kHz	–30 dB	–0.5		0.5	dB
		–50 dB	–0.5		0.5	dB
25 kHz	50 kHz	–30 dB	–0.7		0.7	dB
		–50 dB	–0.7		0.7	dB
30 kHz	60 kHz	–30 dB	–0.7		0.7	dB
		–50 dB	–0.7		0.7	dB
40 kHz	80 kHz	–30 dB	–0.7		0.7	dB
		–50 dB	–0.7		0.7	dB
49.9 kHz	99.8 kHz	–30 dB	–0.7		0.7	dB
		–50 dB	–0.7		0.7	dB
50 kHz	100 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
60 kHz	120 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
70 kHz	140 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
80 kHz	160 kHz	–30 dB	–1.0		1.0	dB
		–50 dB	–1.0		1.0	dB
90 kHz	180 kHz	–30 dB	–1.0		1.0	dB

Measurement				Min.	Actual	Max.	Unit
			–50 dB	–1.0		1.0	dB
Mod Dist Modulation Factor							
Mod Dist Inherent Distortion							
Function Mod Dist, Dynamic Mode Prec Analyzer Bandwidth **22 kHz** Channel **1** Gen Bandwidth **22 kHz,** Low Dist **Off**							
Upper Frq	Lower Frq	Range Fix	Input				
4 kHz	30 Hz	6.0 V	5.0 V			-100	dB
	200 Hz	6.0 V	5.0 V			-100	dB
	500 Hz	6.0 V	5.0 V			-100	dB
7 kHz	60 Hz	6.0 V	5.0 V			-100	dB
	200 Hz	6.0 V	5.0 V			-100	dB
	500 Hz	6.0 V	5.0 V			-100	dB
15 kHz	30 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
20 kHz	60 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
4 kHz	30 Hz	3.0 V	2.5 V			-100	dB
	200 Hz	3.0 V	2.5 V			-100	dB
	500 Hz	3.0 V	2.5 V			-100	dB
7 kHz	60 Hz	3.0 V	2.5 V			-100	dB
	200 Hz	3.0 V	2.5 V			-100	dB
	500 Hz	3.0 V	2.5 V			-100	dB
15 kHz	30 Hz	3.0 V	2.5 V			-96	dB
	200 Hz	3.0 V	2.5 V			-96	dB
	500 Hz	3.0 V	2.5 V			-96	dB
20 kHz	60 Hz	3.0 V	2.5 V			-96	dB
	200 Hz	3.0 V	2.5 V			-96	dB
	500 Hz	3.0 V	2.5 V			-96	dB
Function Mod Dist, Dynamic Mode Prec Analyzer Bandwidth **22 kHz,** Channel **2** Generator Bandwidth **22 kHz,** Low Dist **Off**							
Upper Frq	Lower Frq	Range Fix	Input				
4 kHz	30 Hz	6.0 V	5.0 V			-100	dB
	200 Hz	6.0 V	5.0 V			-100	dB
	500 Hz	6.0 V	5.0 V			-100	dB
7 kHz	60 Hz	6.0 V	5.0 V			-100	dB
	200 Hz	6.0 V	5.0 V			-100	dB
	500 Hz	6.0 V	5.0 V			-100	dB
15 kHz	30 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
20 kHz	60 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
4 kHz	30 Hz	3.0 V	2.5 V			-100	dB
	200 Hz	3.0 V	2.5 V			-100	dB
	500 Hz	3.0 V	2.5 V			-100	dB
7 kHz	60 Hz	3.0 V	2.5 V			-100	dB
	200 Hz	3.0 V	2.5 V			-100	dB

Measurement				Min.	Actual	Max.	Unit
	500 Hz	3.0 V	2.5 V			-100	dB
15 kHz	30 Hz	3.0 V	2.5 V			-96	dB
	200 Hz	3.0 V	2.5 V			-96	dB
	500 Hz	3.0 V	2.5 V			-96	dB
20 kHz	60 Hz	3.0 V	2.5 V			-96	dB
	200 Hz	3.0 V	2.5 V			-96	dB
	500 Hz	3.0 V	2.5 V			-96	dB
Function Mod Dist, Dynamic Mode Prec Analyzer Bandwidth **250 kHz** Channel **1** Low Dist **Off,** Gen Bandwidth **80 kHz**							
Upper Frq	Lower Frq	Range Fix	Input				
4 kHz	30 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
7 kHz	60 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
15 kHz	30 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
20 kHz	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
50 kHz	200 Hz	6.0 V	5.0 V			-90	dB
	500 Hz	6.0 V	5.0 V			-90	dB
Low Dist **On**							
100 kHz	500 Hz	6.0 V	5.0 V			-80	dB
Low Dist **Off**							
4 kHz	200 Hz	3.0 V	2.5 V			-96	dB
	500 Hz	3.0 V	2.5 V			-96	dB
7 kHz	200 Hz	3.0 V	2.5 V			-96	dB
	500 Hz	3.0 V	2.5 V			-96	dB
20 kHz	200 Hz	3.0 V	2.5 V			-96	dB
	500 Hz	3.0 V	2.5 V			-96	dB
50 kHz	200 Hz	3.0 V	2.5 V			-90	dB
	500 Hz	3.0 V	2.5 V			-90	dB
Low Dist **On**							
100 kHz	500 Hz	3.0 V	2.5 V			-80	dB
Function Mod Dist, Dynamic Mode Prec Analyzer Bandwidth **250 kHz,** Channel **2** Low Dist **Off,** Gen Bandwidth **80 kHz**							
Upper Frq	Lower Frq	Range Fix	Input				
4 kHz	30 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
7 kHz	60 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
15 kHz	30 Hz	6.0 V	5.0 V			-96	dB
	200 Hz	6.0 V	5.0 V			-96	dB
20 kHz	200 Hz	6.0 V	5.0 V			-96	dB
	500 Hz	6.0 V	5.0 V			-96	dB
50 kHz	200 Hz	6.0 V	5.0 V			-90	dB
	500 Hz	6.0 V	5.0 V			-90	dB
Low Dist **On**							
100 kHz	500 Hz	6.0 V	5.0 V			-80	dB

Measurement							Min.	Actual	Max.	Unit
Low Dist **Off**										
4 kHz	200 Hz	3.0 V	2.5 V						-96	dB
	500 Hz	3.0 V	2.5 V						-96	dB
7 kHz	200 Hz	3.0 V	2.5 V						-96	dB
	500 Hz	3.0 V	2.5 V						-96	dB
20 kHz	200 Hz	3.0 V	2.5 V						-96	dB
	500 Hz	3.0 V	2.5 V						-96	dB
50 kHz	200 Hz	3.0 V	2.5 V						-90	dB
	500 Hz	3.0 V	2.5 V						-90	dB
Low Dist **On**										
100 kHz	500 Hz	3.0 V	2.5 V						-80	dB
Mod Dist Measurement Error										
Function Mod Dist, Dynamic Mode Prec										
Analyzer Bandwidth **22 kHz**										
Channel **1,** Range Fix 3.0 V										
f_{Upper}	f_{Lower}	U_3	U_4	U_5	U_6	ModDist				
kHz	Hz	dBr	dBr	dBr	dBr	nom.				
4	500	–40	–140	–140	–140	–40	–0.5		0.5	dB
		–60	–60	–60	–60	–51	–0.5		0.5	dB
		–140	–66	–66	–140	–60	–0.5		0.5	dB
		–60	–140	–140	–140	–60	–0.5		0.5	dB
		–70	–140	–140	–140	–70	–0.5		0.5	dB
7	60	–74	–80	–80	–140	–71	–0.5		0.5	dB
7	60	–140	–66	–66	–140	–60	–0.5		0.5	dB
15	200	–60	–60	–60	–60	–51	–0.5		0.5	dB
15	200	–80	–80	–80	–80	–71	–0.5		0.5	dB
20	500	–140	–140	–140	–70	–70	–0.5		0.5	dB
Function Mod Dist, Dynamic Mode Prec										
Analyzer Bandwidth **22 kHz**										
Channel **2,** Range Fix 3.0 V										
f_{Upper}	f_{Lower}	U_3	U_4	U_5	U_6	ModDist				
kHz	Hz	dBr	dBr	dBr	dBr	nom.				
4	500	–40	–140	–140	–140	–40	–0.5		0.5	dB
		–60	–60	–60	–60	–51	–0.5		0.5	dB
		–140	–66	–66	–140	–60	–0.5		0.5	dB
		–60	–140	–140	–140	–60	–0.5		0.5	dB
		–70	–140	–140	–140	–70	–0.5		0.5	dB
7	60	–74	–80	–80	–140	–71	–0.5		0.5	dB
7	60	–140	–66	–66	–140	–60	–0.5		0.5	dB
15	200	–60	–60	–60	–60	–51	–0.5		0.5	dB
15	200	–80	–80	–80	–80	–71	–0.5		0.5	dB
20	500	–140	–140	–140	–70	–70	–0.5		0.5	dB
Function Mod Dist, Dynamic Mode Prec										
Analyzer Bandwidth **250 kHz**										
Channel **1,** Range Fix 3.0 V										
f_{Upper}	f_{Lower}	U_3	U_4	U_5	U_6	ModDist				
kHz	Hz	dBr	dBr	dBr	dBr	nom.				
4	500	–20	–140	–140	–140	–20	–0.5		0.5	dB
7	200	–60	–60	–60	–60	–51	–0.5		0.5	dB
15	300	–140	–140	–60	–140	–60	–0.5		0.5	dB

Measurement	Min.	Actual	Max.	Unit
20 500 –30 –30 –140 –140 –27	–0.5		0.5	dB
50 400 –30 –30 –140 –140 –27	–0.5		0.5	dB
75 500 –50 –140 –140 –50 –44	–0.75		0.75	dB
Function Mod Dist, Dynamic Mode Prec Analyzer Bandwidth **250 kHz** Channel **2,** Range Fix 3.0 V f_{Upper} f_{Lower} U_3 U_4 U_5 U_6 ModDist kHz Hz dBr dBr dBr dBr nom.				
4 500 –20 –140 –140 –140 –20	–0.5		0.5	dB
7 200 –60 –60 –60 –60 –51	–0.5		0.5	dB
15 300 –140 –140 –60 –140 –60	–0.5		0.5	dB
20 500 –30 –30 –140 –140 –27	–0.5		0.5	dB
50 400 –30 –30 –140 –140 –27	–0.5		0.5	dB
75 500 –50 –140 –140 –50 –44	–0.75		0.75	dB
DFD Difference Frequency Distortion				
DFD-d2 Inherent Distortion				
Function DFD, Meas Mode d2 (IEC 268) Dynamic Mode Prec Analyzer Bandwidth **22 kHz** Channel **1** Mean Freq Diff Freq Range Fix Input				
7 kHz 80 Hz 6.0 V 4.0 V			-112	dB
225 Hz 6.0 V 4.0 V			-112	dB
525 Hz 6.0 V 4.0 V			-112	dB
975 Hz 6.0 V 4.0 V			-112	dB
2 kHz 6.0 V 4.0 V			-112	dB
15 kHz 80 Hz 6.0 V 4.0 V			-112	dB
225 Hz 6.0 V 4.0 V			-112	dB
525 Hz 6.0 V 4.0 V			-112	dB
975 Hz 6.0 V 4.0 V			-112	dB
2 kHz 6.0 V 4.0 V			-112	dB
20 kHz 80 Hz 6.0 V 4.0 V			-112	dB
225 Hz 6.0 V 4.0 V			-112	dB
525 Hz 6.0 V 4.0 V			-112	dB
975 Hz 6.0 V 4.0 V			-112	dB
2 kHz 6.0 V 4.0 V			-112	dB
7 kHz 80 Hz 3.0 V 2.3 V			-112	dB
80 Hz 6.0 V 2.3 V			-112	dB
225 Hz 6.0 V 2.3 V			-112	dB
525 Hz 6.0 V 2.3 V			-112	dB
975 Hz 6.0 V 2.3 V			-112	dB
2 kHz 6.0 V 2.3 V			-112	dB
15 kHz 80 Hz 6.0 V 2.3 V			-112	dB
225 Hz 6.0 V 2.3 V			-112	dB
525 Hz 6.0 V 2.3 V			-112	dB
975 Hz 6.0 V 2.3 V			-112	dB
2 kHz 6.0 V 2.3 V			-112	dB

Measurement				Min.	Actual	Max.	Unit
20 kHz	80 Hz	6.0 V	2.3 V			-112	dB
	225 Hz	6.0 V	2.3 V			-112	dB
	525 Hz	6.0 V	2.3 V			-112	dB
	975 Hz	6.0 V	2.3 V			-112	dB
	2 kHz	6.0 V	2.3 V			-112	dB
Function DFD, Meas Mode d2 (IEC 268)							
Dynamic Mode Prec							
Analyzer Bandwidth **22 kHz**							
Channel **2**							
Mean Freq	Diff Freq	Range Fix	Input				
7 kHz	80 Hz	6.0 V	4.0 V			-112	dB
	225 Hz	6.0 V	4.0 V			-112	dB
	525 Hz	6.0 V	4.0 V			-112	dB
	975 Hz	6.0 V	4.0 V			-112	dB
	2 kHz	6.0 V	4.0 V			-112	dB
15 kHz	80 Hz	6.0 V	4.0 V			-112	dB
	225 Hz	6.0 V	4.0 V			-112	dB
	525 Hz	6.0 V	4.0 V			-112	dB
	975 Hz	6.0 V	4.0 V			-112	dB
	2 kHz	6.0 V	4.0 V			-112	dB
20 kHz	80 Hz	6.0 V	4.0 V			-112	dB
	225 Hz	6.0 V	4.0 V			-112	dB
	525 Hz	6.0 V	4.0 V			-112	dB
	975 Hz	6.0 V	4.0 V			-112	dB
	2 kHz	6.0 V	4.0 V			-112	dB
7 kHz	80 Hz	3.0 V	2.3 V			-112	dB
	225 Hz	3.0 V	2.3 V			-112	dB
	525 Hz	3.0 V	2.3 V			-112	dB
	975 Hz	3.0 V	2.3 V			-112	dB
	2 kHz	3.0 V	2.3 V			-112	dB
15 kHz	80 Hz	3.0 V	2.3 V			-112	dB
	225 Hz	3.0 V	2.3 V			-112	dB
	525 Hz	3.0 V	2.3 V			-112	dB
	975 Hz	3.0 V	2.3 V			-112	dB
	2 kHz	3.0 V	2.3 V			-112	dB
20 kHz	80 Hz	3.0 V	2.3 V			-112	dB
	225 Hz	3.0 V	2.3 V			-112	dB
	525 Hz	3.0 V	2.3 V			-112	dB
	975 Hz	3.0 V	2.3 V			-112	dB
	2 kHz	3.0 V	2.3 V			-112	dB
Function DFD, Meas Mode d2 (IEC 268)							
Dynamic Mode Prec							
Analyzer Bandwidth **250 kHz**							
Channel **1**							
Mean Freq	Diff Freq	Range Fix	Input				
7 kHz	225 Hz	6.0 V	4.0 V			-110	dB
	525 Hz	6.0 V	4.0 V			-110	dB
	975 Hz	6.0 V	4.0 V			-110	dB

Measurement				Min.	Actual	Max.	Unit
	2 kHz	6.0 V	4.0 V			-110	dB
20 kHz	225 Hz	6.0 V	4.0 V			-110	dB
	525 Hz	6.0 V	4.0 V			-110	dB
	975 Hz	6.0 V	4.0 V			-110	dB
	2 kHz	6.0 V	4.0 V			-110	dB
50 kHz	225 Hz	6.0 V	4.0 V			-95	dB
	525 Hz	6.0 V	4.0 V			-95	dB
	975 Hz	6.0 V	4.0 V			-95	dB
	2 kHz	6.0 V	4.0 V			-95	dB
100 kHz	225 Hz	6.0 V	4.0 V			-80	dB
	525 Hz	6.0 V	4.0 V			-80	dB
	975 Hz	6.0 V	4.0 V			-80	dB
	2 kHz	6.0 V	4.0 V			-80	dB
7 kHz	225 Hz	3.0 V	2.3 V			-110	dB
	525 Hz	3.0 V	2.3 V			-110	dB
	975 Hz	3.0 V	2.3 V			-110	dB
	2 kHz	3.0 V	2.3 V			-110	dB
20 kHz	225 Hz	3.0 V	2.3 V			-110	dB
	525 Hz	3.0 V	2.3 V			-110	dB
	975 Hz	3.0 V	2.3 V			-110	dB
	2 kHz	3.0 V	2.3 V			-110	dB
50 kHz	225 Hz	3.0 V	2.3 V			-95	dB
	525 Hz	3.0 V	2.3 V			-95	dB
	975 Hz	3.0 V	2.3 V			-95	dB
	2 kHz	3.0 V	2.3 V			-95	dB
100 kHz	225 Hz	3.0 V	2.3 V			-80	dB
	525 Hz	3.0 V	2.3 V			-80	dB
	975 Hz	3.0 V	2.3 V			-80	dB
	2 kHz	3.0 V	2.3 V			-80	dB
Function DFD, Meas Mode d2 (IEC 268) Dynamic Mode Prec Analyzer Bandwidth **250 kHz** Channel **2**							
Mean Freq	Diff Freq	Range Fix	Input				
7 kHz	225 Hz	6.0 V	4.0 V			-110	dB
	525 Hz	6.0 V	4.0 V			-110	dB
	975 Hz	6.0 V	4.0 V			-110	dB
	2 kHz	6.0 V	4.0 V			-110	dB
20 kHz	225 Hz	6.0 V	4.0 V			-110	dB
	525 Hz	6.0 V	4.0 V			-110	dB
	975 Hz	6.0 V	4.0 V			-110	dB
	2 kHz	6.0 V	4.0 V			-110	dB
50 kHz	225 Hz	6.0 V	4.0 V			-95	dB
	525 Hz	6.0 V	4.0 V			-95	dB
	975 Hz	6.0 V	4.0 V			-95	dB
	2 kHz	6.0 V	4.0 V			-95	dB
100 kHz	225 Hz	6.0 V	4.0 V			-80	dB
	525 Hz	6.0 V	4.0 V			-80	dB

Measurement				Min.	Actual	Max.	Unit
	975 Hz	6.0 V	4.0 V			-80	dB
	2 kHz	6.0 V	4.0 V			-80	dB
7 kHz	225 Hz	3.0 V	2.3 V			-110	dB
	525 Hz	3.0 V	2.3 V			-110	dB
	975 Hz	3.0 V	2.3 V			-110	dB
	2 kHz	3.0 V	2.3 V			-110	dB
20 kHz	225 Hz	3.0 V	2.3 V			-110	dB
	525 Hz	3.0 V	2.3 V			-110	dB
	975 Hz	3.0 V	2.3 V			-110	dB
	2 kHz	3.0 V	2.3 V			-110	dB
50 kHz	225 Hz	3.0 V	2.3 V			-110	dB
	525 Hz	3.0 V	2.3 V			-95	dB
	975 Hz	3.0 V	2.3 V			-95	dB
	2 kHz	3.0 V	2.3 V			-95	dB
100 kHz	225 Hz	3.0 V	2.3 V			-95	dB
	525 Hz	3.0 V	2.3 V			-80	dB
	975 Hz	3.0 V	2.3 V			-80	dB
	2 kHz	3.0 V	2.3 V			-80	dB
DFD-d3 Inherent Distortion							
Function DFD, Meas Mode d3 (IEC 268)							
Analyzer Bandwidth **22 kHz**							
Channel **1**							
Mean Freq	Diff Freq	Range Fix	Input				
7 kHz	80 Hz	6.0 V	4.0 V			-96	dB
	225 Hz	6.0 V	4.0 V			-96	dB
	525 Hz	6.0 V	4.0 V			-96	dB
	975 Hz	6.0 V	4.0 V			-96	dB
	2 kHz	6.0 V	4.0 V			-96	dB
15 kHz	80 Hz	6.0 V	4.0 V			-96	dB
	225 Hz	6.0 V	4.0 V			-96	dB
	525 Hz	6.0 V	4.0 V			-96	dB
	975 Hz	6.0 V	4.0 V			-96	dB
	2 kHz	6.0 V	4.0 V			-96	dB
20 kHz	80 Hz	6.0 V	4.0 V			-96	dB
	225 Hz	6.0 V	4.0 V			-96	dB
	525 Hz	6.0 V	4.0 V			-96	dB
	975 Hz	6.0 V	4.0 V			-96	dB
	2 kHz	6.0 V	4.0 V			-96	dB
7 kHz	80 Hz	3.0 V	2.3 V			-96	dB
	80 Hz	3.0 V	2.3 V			-96	dB
	225 Hz	3.0 V	2.3 V			-96	dB
	525 Hz	3.0 V	2.3 V			-96	dB
	975 Hz	3.0 V	2.3 V			-96	dB
	2 kHz	3.0 V	2.3 V			-96	dB
15 kHz	80 Hz	3.0 V	2.3 V			-96	dB
	225 Hz	3.0 V	2.3 V			-96	dB
	525 Hz	3.0 V	2.3 V			-96	dB
	975 Hz	3.0 V	2.3 V			-96	dB

Measurement				Min.	Actual	Max.	Unit
	2 kHz	3.0 V	2.3 V			-96	dB
20 kHz	80 Hz	3.0 V	2.3 V			-96	dB
	225 Hz	3.0 V	2.3 V			-96	dB
	525 Hz	3.0 V	2.3 V			-96	dB
	975 Hz	3.0 V	2.3 V			-96	dB
	2 kHz	3.0 V	2.3 V			-96	dB
Function DFD, Meas Mode d3 (IEC 268)							
Analyzer Bandwidth **22 kHz**							
Channel **2**							
Mean Freq	Diff Freq	Range Fix	Input				
7 kHz	80 Hz	6.0 V	4.0 V			-96	dB
	225 Hz	6.0 V	4.0 V			-96	dB
	525 Hz	6.0 V	4.0 V			-96	dB
	975 Hz	6.0 V	4.0 V			-96	dB
	2 kHz	6.0 V	4.0 V			-96	dB
15 kHz	80 Hz	6.0 V	4.0 V			-96	dB
	225 Hz	6.0 V	4.0 V			-96	dB
	525 Hz	6.0 V	4.0 V			-96	dB
	975 Hz	6.0 V	4.0 V			-96	dB
	2 kHz	6.0 V	4.0 V			-96	dB
20 kHz	80 Hz	6.0 V	4.0 V			-96	dB
	225 Hz	6.0 V	4.0 V			-96	dB
	525 Hz	6.0 V	4.0 V			-96	dB
	975 Hz	6.0 V	4.0 V			-96	dB
	2 kHz	6.0 V	4.0 V			-96	dB
7 kHz	80 Hz	3.0 V	2.3 V			-96	dB
	80 Hz	3.0 V	2.3 V			-96	dB
	225 Hz	3.0 V	2.3 V			-96	dB
	525 Hz	3.0 V	2.3 V			-96	dB
	975 Hz	3.0 V	2.3 V			-96	dB
	2 kHz	3.0 V	2.3 V			-96	dB
15 kHz	80 Hz	3.0 V	2.3 V			-96	dB
	225 Hz	3.0 V	2.3 V			-96	dB
	525 Hz	3.0 V	2.3 V			-96	dB
	975 Hz	3.0 V	2.3 V			-96	dB
	2 kHz	3.0 V	2.3 V			-96	dB
20 kHz	80 Hz	3.0 V	2.3 V			-96	dB
	225 Hz	3.0 V	2.3 V			-96	dB
	525 Hz	3.0 V	2.3 V			-96	dB
	975 Hz	3.0 V	2.3 V			-96	dB
	2 kHz	3.0 V	2.3 V			-96	dB
Function DFD, Meas Mode d3 (IEC 268)							
Analyzer Bandwidth **250 kHz**							
Channel **1**							
Mean Freq	Diff Freq	Range Fix	Input				
7 kHz	225 Hz	6.0 V	4.0 V			-80	dB
	525 Hz	6.0 V	4.0 V			-80	dB
	975 Hz	6.0 V	4.0 V			-80	dB

Measurement				Min.	Actual	Max.	Unit
	2 kHz	6.0 V	4.0 V			-80	dB
20 kHz	225 Hz	6.0 V	4.0 V			-80	dB
	525 Hz	6.0 V	4.0 V			-80	dB
	975 Hz	6.0 V	4.0 V			-80	dB
	2 kHz	6.0 V	4.0 V			-80	dB
50 kHz	225 Hz	6.0 V	4.0 V			-75	dB
	525 Hz	6.0 V	4.0 V			-75	dB
	975 Hz	6.0 V	4.0 V			-75	dB
	2 kHz	6.0 V	4.0 V			-75	dB
100 kHz	225 Hz	6.0 V	4.0 V			-70	dB
	525 Hz	6.0 V	4.0 V			-70	dB
	975 Hz	6.0 V	4.0 V			-70	dB
	2 kHz	6.0 V	4.0 V			-70	dB
7 kHz	225 Hz	3.0 V	2.3 V			-80	dB
	525 Hz	3.0 V	2.3 V			-80	dB
	975 Hz	3.0 V	2.3 V			-80	dB
	2 kHz	3.0 V	2.3 V			-80	dB
20 kHz	225 Hz	3.0 V	2.3 V			-80	dB
	525 Hz	3.0 V	2.3 V			-80	dB
	975 Hz	3.0 V	2.3 V			-80	dB
	2 kHz	3.0 V	2.3 V			-80	dB
50 kHz	225 Hz	3.0 V	2.3 V			-75	dB
	525 Hz	3.0 V	2.3 V			-75	dB
	975 Hz	3.0 V	2.3 V			-75	dB
	2 kHz	3.0 V	2.3 V			-75	dB
100 kHz	225 Hz	3.0 V	2.3 V			-70	dB
	525 Hz	3.0 V	2.3 V			-70	dB
	975 Hz	3.0 V	2.3 V			-70	dB
	2 kHz	3.0 V	2.3 V			-70	dB
Function DFD, Meas Mode d3 (IEC 268)							
Analyzer Bandwidth **250 kHz**							
Channel **2**							
Mean Freq	Diff Freq	Range Fix	Input				
7 kHz	225 Hz	6.0 V	4.0 V			-80	dB
	525 Hz	6.0 V	4.0 V			-80	dB
	975 Hz	6.0 V	4.0 V			-80	dB
	2 kHz	6.0 V	4.0 V			-80	dB
20 kHz	225 Hz	6.0 V	4.0 V			-80	dB
	525 Hz	6.0 V	4.0 V			-80	dB
	975 Hz	6.0 V	4.0 V			-80	dB
	2 kHz	6.0 V	4.0 V			-80	dB
50 kHz	225 Hz	6.0 V	4.0 V			-75	dB
	525 Hz	6.0 V	4.0 V			-75	dB
	975 Hz	6.0 V	4.0 V			-75	dB
	2 kHz	6.0 V	4.0 V			-75	dB
100 kHz	225 Hz	6.0 V	4.0 V			-70	dB
	525 Hz	6.0 V	4.0 V			-70	dB
	975 Hz	6.0 V	4.0 V			-70	dB

Measurement				Min.	Actual	Max.	Unit
	2 kHz	6.0 V	4.0 V			-70	dB
7 kHz	225 Hz	3.0 V	2.3 V			-80	dB
	525 Hz	3.0 V	2.3 V			-80	dB
	975 Hz	3.0 V	2.3 V			-80	dB
	2 kHz	3.0 V	2.3 V			-80	dB
20 kHz	225 Hz	3.0 V	2.3 V			-80	dB
	525 Hz	3.0 V	2.3 V			-80	dB
	975 Hz	3.0 V	2.3 V			-80	dB
	2 kHz	3.0 V	2.3 V			-80	dB
50 kHz	225 Hz	3.0 V	2.3 V			-75	dB
	525 Hz	3.0 V	2.3 V			-75	dB
	975 Hz	3.0 V	2.3 V			-75	dB
	2 kHz	3.0 V	2.3 V			-75	dB
100 kHz	225 Hz	3.0 V	2.3 V			-70	dB
	525 Hz	3.0 V	2.3 V			-70	dB
	975 Hz	3.0 V	2.3 V			-70	dB
	2 kHz	3.0 V	2.3 V			-70	dB
DFD-d2 Measurement Error							
Function DFD, Meas Mode d2 (IEC 268) Dynamic Mode Prec Analyzer Bandwidth **22 kHz** Channel **1,** Range Fix 3.0 V Generator Bandwidth **22 kHz**							
Mean Freq	Diff Freq	U_3	DFD-d2 nom.				
7 kHz	400 Hz	-20 dB	-20 dB	-0.5		+0.5	dB
	400 Hz	-50 dB	-50 dB	-0.5		+0.5	dB
	400 Hz	-60 dB	-60 dB	-0.5		+0.5	dB
Function DFD, Meas Mode d2 (IEC 268) Dynamic Mode Prec Analyzer Bandwidth **22 kHz** Channel **2,** Range Fix 3.0 V Generator Bandwidth **22 kHz**							
Mean Freq	Diff Freq	U_3	DFD-d2 nom.				
7 kHz	400 Hz	-20 dB	-20 dB	−0.5		+0.5	dB
	400 Hz	-50 dB	-50 dB	−0.5		+0.5	dB
	400 Hz	-60 dB	-60 dB	−0.5		+0.5	dB
Function DFD, Meas Mode d2 (IEC 118) Dynamic Mode Prec Analyzer Bandwidth **22 kHz** Channel **1,** Range Fix 3.0 V Generator Bandwidth **22 kHz**							
Mean Freq	Diff Freq	U_3	DFD-d2 nom.				
5 kHz	125 Hz	-40 dB	-34 dB	−0.5		+0.5	dB
7 kHz	125 Hz	-60 dB	-54 dB	−0.5		+0.5	dB
Function DFD, Meas Mode d2 (IEC 118)							

Measurement	Min.	Actual	Max.	Unit
Dynamic Mode Prec				
Analyzer Bandwidth **22 kHz**				
Channel **2,** Range Fix 3.0 V				
Generator Bandwidth **22 kHz**				
Mean Freq / Diff Freq / U_3 / DFD-d2 nom.				
5 kHz / 125 Hz / -40 dB / -34 dB	–0.5		+0.5	dB
7 kHz / 125 Hz / -60 dB / -54 dB	–0.5		+0.5	dB
Function DFD, Meas Mode d2 (IEC 268)				
Dynamic Mode Prec				
Analyzer Bandwidth **250 kHz**				
Channel **1**				
Generator Bandwidth **22 kHz**				
Mean Freq / Diff Freq / U_3 / DFD-d2 nom.				
5 kHz / 200 Hz / -40 dB / -40 dB	–0.5		+0.5	dB
20 kHz / 300 Hz / -60 dB / -60 dB	–0.5		+0.5	dB
Generator Bandwidth **80 kHz**				
Mean Freq / Diff Freq / U_3 / DFD-d2 nom.				
50 kHz / 500 Hz / -50 dB / -50 dB	–0.5		+0.5	dB
75 kHz / 1 kHz / -60 dB / -60 dB	–0.5		+0.5	dB
75 kHz / 2 kHz / -60 dB / -60 dB	–0.5		+0.5	dB
Function DFD, Meas Mode d2 (IEC 268)				
Dynamic Mode Prec				
Analyzer Bandwidth **250 kHz**				
Channel **2**				
Generator Bandwidth **22 kHz**				
Mean Freq / Diff Freq / U_3 / DFD-d2 nom.				
5 kHz / 200 Hz / -40 dB / -40 dB	–0.5		+0.5	dB
20 kHz / 300 Hz / -60 dB / -60 dB	–0.5		+0.5	dB
Generator Bandwidth **80 kHz**				
Mean Freq / Diff Freq / U_3 / DFD-d2 nom.				
50 kHz / 500 Hz / -50 dB / -50 dB	–0.75		+0.75	dB
75 kHz / 1 kHz / -60 dB / -60 dB	–1		+1	dB
75 kHz / 2 kHz / -60 dB / -60 dB	–1		+1	dB
DFD-d2 Analog Lowpass test				
Function DFD, Meas Mode d2 (IEC 268)				
Dynamic Mode Prec				
Analyzer Bandwidth **22 kHz**				
Channel **1,** Range Fix 3.0 V				
Generator Bandwidth **22 kHz**				
Mean Freq / Diff Freq / U_3 / DFD-d2 nom.				

Measurement				**Min.**	**Actual**	**Max.**	**Unit**
15 kHz	100 Hz	-60 dB	-60 dB	–0.5		+0.5	dB
	200 Hz	-60 dB	-60 dB	–0.5		+0.5	dB
	500 Hz	-60 dB	-60 dB	–0.5		+0.5	dB
	1 kHz	-60 dB	-60 dB	–0.5		+0.5	dB
	2 kHz	-60 dB	-60 dB	–0.5		+0.5	dB
Function DFD, Meas Mode d2 (IEC 268) Dynamic Mode Prec Analyzer Bandwidth **22 kHz** Channel **2,** Range Fix 3.0 V Generator Bandwidth **22 kHz**							
Mean Freq	Diff Freq	U_3	DFD-d2 nom.				
15 kHz	100 Hz	-60 dB	-60 dB	–0.5		+0.5	dB
	200 Hz	-60 dB	-60 dB	–0.5		+0.5	dB
	500 Hz	-60 dB	-60 dB	–0.5		+0.5	dB
	1 kHz	-60 dB	-60 dB	–0.5		+0.5	dB
	2 kHz	-60 dB	-60 dB	–0.5		+0.5	dB
DIM Dynamic Intermodulation Factor							
DIM Inherent Distortion							
Function DIM Analyzer Bandwidth **22 kHz** Channel **1** Generator Function DIM							
Square/Sin Fix	DIM Bandw.	Total Volt	Range				
3.15/15 kHz	100 kHz	10.0 V	10.0 V			-90	dB
		6.0 V	6.0 V			-90	dB
	100 kHz	3.0 V	3.0 V			-95	dB
	30 kHz	3.0 V	3.0 V			-95	dB
	100 kHz	1.5 V	3.0 V			-95	dB
	30 kHz	1.5 V	3.0 V			-95	dB
	100 kHz	1.5 V	1.8 V			-95	dB
		1.0 V	1.0 V			-95	dB
		0.25	300.0 mV			-95	dB
2.96/14 kHz	100 kHz	3.0 V	3.0 V			-95	dB
	30 kHz					-95	dB
Function DIM Analyzer Bandwidth **22 kHz** Channel **2** Generator Function DIM							
Square/Sin Fix	DIM Bandw.	Total Volt	Range				
3.15/15 kHz	100 kHz	10.0 V	10.0 V			-90	dB
		6.0 V	6.0 V			-90	dB
	100 kHz	3.0 V	3.0 V			-95	dB

Measurement				Min.	Actual	Max.	Unit
	30 kHz	3.0 V	3.0 V			-95	dB
	100 kHz	1.5 V	3.0 V			-95	dB
	30 kHz	1.5 V	3.0 V			-95	dB
	100 kHz	1.5 V	1.8 V			-95	dB
		1.0 V	1.0 V			-95	dB
		0.25	300.0 mV			-95	dB
2.96/14 kHz	100 kHz	3.0 V	3.0 V			-95	dB
	30 kHz					-95	dB

Performance Test Report of Audio Monitor

Audio Analyzer R&S UPV
Order No. 1146.2003.02
Serial No.: . . . .

Rohde & Schwarz
Date: . . . .
Name: . . . .

Measurement		Min	Act.	Max	Unit
Functional Test, internal Speaker					
Acoustic Loudspeaker Check		–		–	o.k.
Phone Out: Source Switching					
Signal Source	Generator				o.k.
	Input				o.k.
Phone Out: Channel Switching					
Phone Channel	Both				
Generator Channel	1				o.k.
Phone Channel	Channel 1				o.k.
	Both				o.k.
Generator Channel	2				o.k.
	2 ≡ 1				o.k.
Phone Out: Output Level and Offset					
Channel	Both				
Pegel	links	3.15		3.85	V
	rechts	3.15		3.85	V
Offset	links	-100		+100	mV
	rechts	-100		+100	mV
Phone Out: Frequency Response					
Frequency	100 Hz	-0.2		+0.2	dB
	1.000 kHz	-0.2		+0.2	dB
	10.000 kHz	-0.2		+0.2	dB
	20.000 kHz	-0.2		+0.2	dB
Phone Out: Inherent Distortion					
Frequency	1 kHz				
Volume	0 dB				
THD+N	links			-70	dB
	rechts			-70	dB
Aux Out: DC Level					
Anlg Aux Out	DC				
Voltage	-2.5 V	-2.6		-2.4	V
	0 V	-20		+20	mV
	+2.5 V	+2.4		+2.6	V
Aux Out: Frequency Response					
Frequency	100 Hz	-0.2		+0.2	dB
	1.000 kHz	-0.2		+0.2	dB
	10.000 kHz	-0.2		+0.2	dB
	20.000 kHz	-0.2		+0.2	dB
Aux Out: Inherent Distortion					
Frequency	1 kHz				
Volume	0 dB				
THD+N				-70	dB

Performance Test Report of R&S UPV-B1

Audio Analyzer R&S UPV
Option R&S UPV-B1 (Low Distortion Generator)
Order No. 1146.5202.02
Serial No.: . . . .

Rohde & Schwarz

Date: . . . .
Name: . . . .

Measurement		Min	Act.	Max	Unit
Level Error at 1 kHz					
Voltage	1.000 V	0.9900		1.0100	V
Frequency Response (Unbal)					
Channel	1				
Voltage	2.000 V				
Frequency	10 Hz	-0.02		+0.02	dB
	20 Hz	-0.01		+0.01	dB
	50 Hz	-0.01		+0.01	dB
	100 Hz	-0.01		+0.01	dB
	500 Hz	-0.01		+0.01	dB
	1 kHz	0		0	dB
	5 kHz	-0.01		+0.01	dB
	10 kHz	-0.01		+0.01	dB
	15 kHz	-0.01		+0.01	dB
	20 kHz	-0.01		+0.01	dB
	50 kHz	-0.05		+0.05	dB
	100 kHz	-0.15		+0.15	dB
	125 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
	185 kHz	-0.25		+0.25	dB
Voltage	0.250 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Voltage	0.500 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Voltage	1.000 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Voltage	4.000 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Voltage	8.000 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Channel	2				

Measurement		Min	Act.	Max	Unit
Voltage	2.000 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Frequency Response (Bal)					
Channel	1				
Impedance	10 Ω				
Voltage	2.000 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Voltage	0.500 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Channel	2				
Impedance	10 Ω				
Voltage	2.000 V				
Frequency	1 kHz	0		0	dB
	20 kHz	-0.01		+0.01	dB
	100 kHz	-0.15		+0.15	dB
	150 kHz	-0.25		+0.25	dB
Frequency Error					
Frequency	10 Hz	9.95		10.05	Hz
	100 Hz	99.5		100.5	Hz
	1.000 kHz	0.95		1.05	kHz
	10.000 kHz	9.95		10.05	kHz
	20.000 kHz	19.90		20.10	kHz
	50.000 kHz	49.75		50.25	kHz
	100.000 kHz	99.5		100.5	kHz
	150.000 kHz	149.25		150.75	kHz
	185.000 kHz	184.075		185.925	kHz
THD Inherent Distortion					
Channel	1				
Output	Unbal				
Voltage	10.000 V				
Frequency	20 Hz			-112	dB
	1 kHz			-112	dB
	7 kHz			-110	dB
	20 kHz			-105	dB
Voltage	2.5000 V				
Frequency	20 Hz			-112	dB
	1 kHz			-112	dB
	7 kHz			-110	dB
	20 kHz			-105	dB
THD+N Inherent Distortion					
Channel	1				
Output	Unbal				
Analyzer Bandwidth	22 kHz				
Voltage	10.000 V				

Measurement		Min	Act.	Max	Unit
Frequency	20 Hz			-104	dB
	1 kHz			-104	dB
	10 kHz			-104	dB
	20 kHz			-104	dB
Voltage	2.5000 V				
Frequency	1 kHz			-104	dB
Analyzer Bandwidth	80 kHz				
Voltage	10.000 V				
Frequency	1 kHz			-90	dB
	20 kHz			-90	dB
Voltage	2.5000 V				
Frequency	1 kHz			-90	dB
Channel	1				
Output	Bal				
Impedance	10 Ω				
Analyzer Bandwidth	22 kHz				
Voltage	20.000 V				
Frequency	20 Hz			-104	dB
	1 kHz			-104	dB
	10 kHz			-104	dB
	20 kHz			-104	dB
Voltage	5.0000 V				
Frequency	1 kHz			-104	dB
Analyzer Bandwidth	80 kHz				
Voltage	20.000 V				
Frequency	1 kHz			-90	dB
	20 kHz			-90	dB
Voltage	5.0000 V				
Frequency	1 kHz			-90	dB

Performance Test Report of R&S UPV-B2

Audio Analyzer R&S UPV
Option R&S UPV-B2 (Digital Audio I/O 192kHz)
Order No. 1146.4306.02
Serial No.: . . . .

Rohde & Schwarz

Date: . . . .
Name: . . . .

Measurement		Min	Act.	Max	Unit
Digital Audio Generator					
Level Error, Unbal Output					
Unbal Vpp	2.0000 V	1.80		2.20	Vpp
into 75 Ω load	1.0000 V	0.90		1.10	Vpp
at 96 kHz	0.5000 V	0.45		0.55	Vpp
Level Error, Bal Output					
Bal Vpp	8.0000 V	7.20		8.80	Vpp
without load resistor	4.0000 V	3.60		4.40	Vpp
	2.0000 V	1.80		2.20	Vpp
Error of internal Clock Rate					
Sample Freq	96.0000 kHz	95.99904		96.00096	kHz
Sampling Rate Measurement					
Sample Freq	30.000 kHz	-10		+10	ppm
	200.00 kHz	-10		+10	ppm
External Synchronisation					
SYNC IN FRQ					
Base Rate	30 kHz	—		—	o.k.
	64 kHz	—		—	o.k.
High Rate	65 kHz	—		—	o.k.
	128 kHz	—		—	o.k.
Extended Rate	129 kHz	—		—	o.k.
	200 kHz	—		—	o.k.
Digital Aux In	96 kHz	—		—	o.k.
Phase To Ref					
Sample Freq	96 kHz				
Phase To Ref	0.000 %	-3.000		+3.000	%FRM
	-45.00 %	-50.00		-40.00	%FRM
Digital Aux In	+45.00 %	+40.00		+50.00	%FRM
Digital Audio Analyzer (Audio Data)					
Digital Inputs					
Sample Freq	192 kHz				
Input	Bal	—		—	o.k.
	Unbal	—		—	o.k.
	Optical	—		—	o.k.
	Intern	—		—	o.k.
Measurement Functions					
Digital Audio Generator:					
Frequency	997 Hz				
Level	1 FS				

Measurement		Min	Act.	Max	Unit
Sample Rate	32 kHz				
Function	THD+N	—		-142	dB
	Input Peak	-0.01		+0.01	dBFS
	Frequency	996.95		997.05	Hz
	Phase	-0.01		+0.01	grd
Sample Rate	48 kHz				
Function	THD+N	—		-142	dB
	Input Peak	-0.01		+0.01	dBFS
	Frequency	996.95		997.05	Hz
	Phase	-0.01		+0.01	grd
Sample Rate	96 kHz				
Function	THD+N	—		-142	dB
	Input Peak	-0.01		+0.01	dBFS
	Frequency	996.95		997.05	Hz
	Phase	-0.01		+0.01	grd
Sample Rate	192 kHz				
Function	THD+N	—		-142	dB
	Input Peak	-0.01		+0.01	dBFS
	Frequency	996.95		997.05	Hz
	Phase	-0.01		+0.01	grd

Performance Test Report of R&S UPV-B3

Audio Analyzer R&S UPV — Rohde & Schwarz
Option R&S UPV-B3 (Second Analog Generator)
Order No. 1146.4806.02 — Date: . . . .
Serial No.: . . . . — Name: . . . .

Measurement		Min	Act.	Max	Unit
Sinewave Level Error at 1 kHz					
Channel	2				
Output	Unbal				
Voltage	8.000 V	7.9600		8.0400	V
	4.000 V	3.9800		4.0200	V
	2.000 V	1.9900		2.0100	V
	1.000 V	0.9950		1.0050	V
	0.500 V	0.4975		0.5025	V
	0.250 V	0.2487		0.2513	V
	15.00 mV	14.925		15.075	mV
Channel	2				
Output	Bal				
Impedance	10 Ω				
Voltage	16.000 V	15.920		16.080	V
	2.0000 V	1.9900		2.0100	V
	0.5000 V	0.4975		0.5025	V
Sinewave Frequency Response					
Channel	2				
Output	Unbal				
Voltage	2.000 V				
Frequency	10 Hz	-0.02		+0.02	dB
	20 Hz	-0.01		+0.01	dB
	50 Hz	-0.01		+0.01	dB
	100 Hz	-0.01		+0.01	dB
	500 Hz	-0.01		+0.01	dB
	1 kHz	-0.01		+0.01	dB
	5 kHz	-0.01		+0.01	dB
	10 kHz	-0.01		+0.01	dB
	15 kHz	-0.01		+0.01	dB
	20 kHz	-0.01		+0.01	dB
	25 kHz	-0.05		+0.05	dB
	50 kHz	-0.05		+0.05	dB
	80 kHz	-0.10		+0.10	dB
Sinewave Frequency Error (Ch2)					
Frequency	1.00000 kHz	0.99999		1.00001	kHz
DC Offset 0 V: Residual DC Ch2					
Output	Unbal				
Voltage	8.0000 V	-80		+80	mV
	4.0000 V	-40		+40	mV
	0.5000 V	-5		+5	mV
Output	Bal				
Impedance	10 Ω				
Voltage	1.0000 V	-10		+10	mV
DC Offset: Setting Error (Ch2)					
Output	Unbal				

Measurement		Min	Act.	Max	Unit
DC Offset	+1.0000 V	+0.98		+1.02	V
	-1.0000 V	-1.02		-0.98	V
Output	Bal				
Impedance	10 Ω				
DC Offset	+2.0000 V	+1.96		+2.04	V
	-2.0000 V	-2.04		-1.96	V
THD+N Inherent Distortion (Ch2)					
Output	Unbal				
Analyzer Bandwidth	22 kHz				
Voltage	10.000 V				
Frequency	20 Hz			-103	dB
	1 kHz			-103	dB
	10 kHz			-103	dB
	20 kHz			-103	dB
Voltage	2.5000 V				
Frequency	1 kHz			-103	dB
Analyzer Bandwidth	100 kHz				
Voltage	10.000 V				
Frequency	1 kHz			-90	dB
	10 kHz			-90	dB
	20 kHz			-90	dB
Voltage	2.5000 V				
Frequency	1 kHz			-90	dB
Output	Bal				
Impedance	10 Ω				
Analyzer Bandwidth	22 kHz				
Voltage	20.000 V				
Frequency	20 Hz			-103	dB
	1 kHz			-103	dB
	10 kHz			-103	dB
	20 kHz			-103	dB
Voltage	5.0000 V				
Frequency	1 kHz			-103	dB
Analyzer Bandwidth	100 kHz				
Voltage	20.000 V				
Frequency	1 kHz			-90	dB
	10 kHz			-90	dB
	20 kHz			-90	dB
Voltage	5.0000 V				
Frequency	1 kHz			-90	dB
DIM Level Error (Ch2)					
Total Volt	2.000 V				
Square/Sine	2.96/14 kHz				
Bandwidth	30 kHz	1.89		2.12	V
	100 kHz	1.89		2.12	V
Square/Sine	3.15/15 kHz				
Bandwidth	30 kHz	1.89		2.12	V
	100 kHz	1.89		2.12	V
DIM Inherent Distortion (Ch2)					
Total Volt	2.000 V				
Square/Sine	2.96/14 kHz				
Bandwidth	30 kHz			-95	dB
	100 kHz			-95	dB

Measurement		Min	Act.	Max	Unit
Square/Sine Bandwidth	3.15/15 kHz 30 kHz 100 kHz			 -95 -95	 dB dB
Crosstalk					
Output Crosstalk	Unbal Kanal 1 → 2 Kanal 2 → 1			 -105 -105	 dB dB
Output Crosstalk	Bal Kanal 1 → 2 Kanal 2 → 1			 -105 -105	 dB dB
Unbalance Rejection (Ch2)					
Channel Frequency	2 1 kHz 20 kHz	 75 60			 dB dB
Phase Coincidence					
Phase	0 ° -30 ° +30 °	-0.25 -30.25 +29.75		+0.25 -29.75 +30.25	grd grd grd

Performance Test Report of R&S UPV-B20

Audio Analyzer R&S UPV Rohde & Schwarz
Option R&S UPV-B20 (Digital Audio I/O 48kHz)
Order No. 1402.2100.02 Date: . . . .
Serial No.: . . . . Name: . . . .

Measurement		Min	Act.	Max	Unit
Level Error					
Audio Frequency Level	997 Hz 0.5 FS	0.4995		0.5005	FS
THD + N					
Audio Frequency Level	997 Hz 1.0 FS	-142		- - -	dB
Error of internal Sample Frequency					
Sample Freq	48.0000 kHz	47.99952		48.00048	kHz
Range of Sampling Rate					
Sample Freq	32.000 kHz 55.000 kHz	-10 -10		+10 +10	ppm ppm

Performance Test Report of R&S UPV-B41

Audio Analyzer R&S UPV
Option R&S UPV-B41 (I^2S Interface)
Order No. 1146.5402.02
Serial-No.: . . . .

Rohde & Schwarz

Date: . . . .
Name: . . . .

Measurement		Min	Act.	Max	Unit
DDS					
CLK Freq	1.024 MHz	1.02398		1.02402	MHz
Analyzer PLL					
Measurement # 1:					
Frequency	997 Hz	996		998	Hz
Voltage	0.5000 FS	0.4995		0.5005	FS
Measurement # 2:					
Frequency	997 Hz	996		998	Hz
Voltage	0.5000 FS	0.4995		0.5005	FS
Measurement # 3:					
Frequency	997 Hz	996		998	Hz
Voltage	0.5000 FS	0.4995		0.5005	FS
Measurement # 4:					
Frequency	997 Hz	996		998	Hz
Voltage	0.5000 FS	0.4995		0.5005	FS
Generator PLL					
Measurement # 1:					
Sample Freq	410 kHz	409.959		410.041	kHz
	216 kHz	215.9784		216.0216	kHz
	6.75 kHz	6.749325		6.750675	kHz
	6.75 kHz	6.749325		6.750675	kHz
Measurement # 2:					
Sample Freq	410 kHz	409.959		410.041	kHz
	216 kHz	215.9784		216.0216	kHz
	6.75 kHz	6.749325		6.750675	kHz
	6.75 kHz	6.749325		6.750675	kHz
Measurement # 3:					
Sample Freq	410 kHz	409.959		410.041	kHz
	216 kHz	215.9784		216.0216	kHz
	6.75 kHz	6.749325		6.750675	kHz
	6.75 kHz	6.749325		6.750675	kHz
Measurement # 4:					
Sample Freq	410 kHz	409.959		410.041	kHz
	216 kHz	215.9784		216.0216	kHz
	6.75 kHz	6.749325		6.750675	kHz
	6.75 kHz	6.749325		6.750675	kHz

Performance Test Report of R&S UPV-B42

Audio Analyzer R&S UPV | Rohde & Schwarz
Option R&S UPV-B42 (Universal Serial Interface)
Order No. 1146.5802.02 | Date: . . . .
Serial-No.: . . . . | Name: . . . .

Measurement	Min	Act.	Max	Unit
Generator: Sync to intern				
TX_MCLK_OUT	729,6		806,4	kHz
TX_SCK_OUT	364,8		403,2	kHz
TX_FSYNC_OUT	45,6		50,4	kHz
TX_CHCLK_OUT	45,6		50,4	kHz
TX_DATA1	45,6		50,4	kHz
TX_DATA2	45,6		50,4	kHz
TX_DATA3	45,6		50,4	kHz
TX_DATA4	45,6		50,4	kHz
Generator: Ext. Output Enable Control				
TX_DATA1	—		—	o.k.
TX_DATA2	—		—	o.k.
TX_DATA3	—		—	o.k.
TX_DATA4	—		—	o.k.
Analyzer: Sync to intern				
RX_MCLK_OUT	729,6		806,4	kHz
RX_SCK_OUT	364,8		403,2	kHz
RX_FSYNC_OUT	45,6		50,4	kHz
Generator: Sync to extern Wordclock				
TX_MCLK_OUT	729,6		806,4	kHz
TX_SCK_OUT	364,8		403,2	kHz
TX_FSYNC_OUT	45,6		50,4	kHz
TX_CHCLK_OUT	45,6		50,4	kHz
TX_DATA1	45,6		50,4	kHz
TX_DATA2	45,6		50,4	kHz
TX_DATA3	45,6		50,4	kHz
TX_DATA4	45,6		50,4	kHz
Generator: Sync to extern Wordclock (AM)				
TX_SCK_OUT	364,8		403,2	kHz
TX_FSYNC_OUT	45,6		50,4	kHz
TX_CHCLK_OUT	45,6		50,4	kHz
TX_DATA1	45,6		50,4	kHz
TX_DATA2	45,6		50,4	kHz
TX_DATA3	45,6		50,4	kHz
TX_DATA4	45,6		50,4	kHz
Generator: Sync to extern Wordclock/Bitclock				
TX_MCLK_OUT	729,6		806,4	kHz
TX_CHCLK_OUT	45,6		50,4	kHz
TX_DATA1	45,6		50,4	kHz
TX_DATA2	45,6		50,4	kHz
TX_DATA3	45,6		50,4	kHz
TX_DATA4	45,6		50,4	kHz

Measurement	Min	Actual	Max	Unit
Generator: Sync to extern Masterclock				
TX_SCK_OUT	364,8		403,2	kHz
TX_FSYNC_OUT	45,6		50,4	kHz
TX_CHCLK_OUT	45,6		50,4	kHz
TX_DATA1	45,6		50,4	kHz
TX_DATA2	45,6		50,4	kHz
TX_DATA3	45,6		50,4	kHz
TX_DATA4	45,6		50,4	kHz
Analyzer: Sync to extern Wordclock				
RX_MCLK_OUT	729,6		806,4	kHz
RX_SCK_OUT	364,8		403,2	kHz
RX_FSYNC_OUT	45,6		50,4	kHz
Analyzer: Sync to extern Wordclock (AM)				
RX_SCK_OUT	364,8		403,2	kHz
RX_FSYNC_OUT	45,6		50,4	kHz
Analyzer: Sync to extern Masterclock				
RX_SCK_OUT	364,8		403,2	kHz
RX_FSYNC_OUT	45,6		50,4	kHz

Performance Test Report of R&S UPV-B48

Audio Analyzer R&S UPV
Option R&S UPV-B48 (8 channel analyzer)
Order No. 1402.2200.02
Serial-No.: . . . .

Rohde & Schwarz

Date: . . . .
Name: . . . .

Measurement		Min	Act.	Max	Unit
Level Error at 1 kHz					
Channel	**1**				
Range Fix	Input Voltage				
0.2 V	0.15 V	0.1491		0.1508	V
0.8 V	0.60 V	0.5965		0.6034	V
3.0 V	2.25 V	2.2370		2.2629	V
12.0 V	9.00 V	8.9483		9.0519	V
50.0 V	20.0 V	19.885		20.115	V
Channel	**2**				
Range Fix	Input Voltage				
0.2 V	0.15 V	0.1491		0.1508	V
0.8 V	0.60 V	0.5965		0.6034	V
3.0 V	2.25 V	2.2370		2.2629	V
12.0 V	9.00 V	8.9483		9.0519	V
50.0 V	20.0 V	19.885		20.115	V
Channel	**3**				
Range Fix	Input Voltage				
0.2 V	0.15 V	0.1491		0.1508	V
0.8 V	0.60 V	0.5965		0.6034	V
3.0 V	2.25 V	2.2370		2.2629	V
12.0 V	9.00 V	8.9483		9.0519	V
50.0 V	20.0 V	19.885		20.115	V
Channel	**4**				
Range Fix	Input Voltage				
0.2 V	0.15 V	0.1491		0.1508	V
0.8 V	0.60 V	0.5965		0.6034	V
3.0 V	2.25 V	2.2370		2.2629	V
12.0 V	9.00 V	8.9483		9.0519	V
50.0 V	20.0 V	19.885		20.115	V
Channel	**5**				
Range Fix	Input Voltage				
0.2 V	0.15 V	0.1491		0.1508	V
0.8 V	0.60 V	0.5965		0.6034	V
3.0 V	2.25 V	2.2370		2.2629	V
12.0 V	9.00 V	8.9483		9.0519	V
50.0 V	20.0 V	19.885		20.115	V
Channel	**6**				
Range Fix	Input Voltage				
0.2 V	0.15 V	0.1491		0.1508	V
0.8 V	0.60 V	0.5965		0.6034	V
3.0 V	2.25 V	2.2370		2.2629	V
12.0 V	9.00 V	8.9483		9.0519	V
50.0 V	20.0 V	19.885		20.115	V

Measurement		Min	Act.	Max	Unit
Channel	**7**				
Range Fix	Input Voltage				
0.2 V	0.15 V	0.1491		0.1508	V
0.8 V	0.60 V	0.5965		0.6034	V
3.0 V	2.25 V	2.2370		2.2629	V
12.0 V	9.00 V	8.9483		9.0519	V
50.0 V	20.0 V	19.885		20.115	V
Channel	**8**				
Range Fix	Input Voltage				
0.2 V	0.15 V	0.1491		0.1508	V
0.8 V	0.60 V	0.5965		0.6034	V
3.0 V	2.25 V	2.2370		2.2629	V
12.0 V	9.00 V	8.9483		9.0519	V
50.0 V	20.0 V	19.885		20.115	V
Frequency Response					
Range Fix	0.2 V				
Input voltage	0.15 V				
Channel	**1**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**2**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**3**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**4**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**5**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB

Measurement		Min	Act.	Max	Unit
Channel	**6**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**7**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**8**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Range Fix	3.0 V				
Input voltage	2.25 V				
Channel	**1**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**2**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**3**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**4**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**5**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB

Measurement		Min	Act.	Max	Unit
Channel	**6**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**7**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**8**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Range Fix	12.0 V				
Input voltage	9.00V				
Channel	**1**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**2**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**3**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**4**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**5**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB

Measurement		Min	Act.	Max	Unit
Channel	**6**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**7**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Channel	**8**				
Frequency	20 Hz	-0.1		+0.1	dB
	100 Hz	-0.1		+0.1	dB
	1 kHz	0		0	dB
	20 kHz	-0.1		+0.1	dB
	40 kHz	-0.2		+0.2	dB
Phase Synchronism					
Channel	**1**				
Frequency	20 Hz	-0.5		+0.5	°
	1 kHz	-0.5		+0.5	°
	20 kHz	-0.5		+0.5	°
	40 kHz	-1.0		+1.0	°
Channel	**2**				
Frequency	20 Hz	-0.5		+0.5	°
	1 kHz	-0.5		+0.5	°
	20 kHz	-0.5		+0.5	°
	40 kHz	-1.0		+1.0	°
Channel	**3**				
Frequency	20 Hz	-0.5		+0.5	°
	1 kHz	-0.5		+0.5	°
	20 kHz	-0.5		+0.5	°
	40 kHz	-1.0		+1.0	°
Channel	**4**				
Frequency	20 Hz	-0.5		+0.5	°
	1 kHz	-0.5		+0.5	°
	20 kHz	-0.5		+0.5	°
	40 kHz	-1.0		+1.0	°
Channel	**5**				
Frequency	20 Hz	-0.5		+0.5	°
	1 kHz	-0.5		+0.5	°
	20 kHz	-0.5		+0.5	°
	40 kHz	-1.0		+1.0	°
Channel	**6**				
Frequency	20 Hz	-0.5		+0.5	°
	1 kHz	-0.5		+0.5	°
	20 kHz	-0.5		+0.5	°
	40 kHz	-1.0		+1.0	°

Measurement			Min	Act.	Max	Unit
Channel	**7**					
Frequency	20 Hz		-0.5		+0.5	°
	1 kHz		-0.5		+0.5	°
	20 kHz		-0.5		+0.5	°
	40 kHz		-1.0		+1.0	°
Channel	**8**					
Frequency	20 Hz		-0.5		+0.5	°
	1 kHz		-0.5		+0.5	°
	20 kHz		-0.5		+0.5	°
	40 kHz		-1.0		+1.0	°
THD+N Inherent Distortion						
Channel	**1**					
Frequency	Range Fix	Input Voltage				
20 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
100 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
1 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
7 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
20 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
Channel	**2**					
Frequency	Range Fix	Input Voltage				
20 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
100 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
1 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
7 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
20 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB

Measurement			Min	Act.	Max	Unit
Channel	**3**					
Frequency	Range Fix	Input Voltage				
20 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
100 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
1 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
7 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
20 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
Channel	**4**					
Frequency	Range Fix	Input Voltage				
20 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
100 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
1 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
7 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
20 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
Channel	**5**					
Frequency	Range Fix	Input Voltage				
20 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
100 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
1 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
7 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
20 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB

Measurement			Min	Act.	Max	Unit
Channel	**6**					
Frequency	Range Fix	Input Voltage				
20 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
100 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
1 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
7 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
20 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
Channel	**7**					
Frequency	Range Fix	Input Voltage				
20 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
100 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
1 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
7 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
20 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
Channel	**8**					
Frequency	Range Fix	Input Voltage				
20 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
100 Hz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
1 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
7 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB
20 kHz	12.0 V	10 V			-94	dB
	3.0 V	2.5 V			-94	dB
	0.8 V	0.6 V			-94	dB

Measurement		Min	Act.	Max	Unit
MOD DIST Inherent Distortion					
Channel	1			-80	dB
	2			-80	dB
	3			-80	dB
	4			-80	dB
	5			-80	dB
	6			-80	dB
	7			-80	dB
	8			-80	dB
DFD Difference Frequency Distortion					
DFD-d2 Inherent Distortion					
Channel	1			-100	dB
	2			-100	dB
	3			-100	dB
	4			-100	dB
	5			-100	dB
	6			-100	dB
	7			-100	dB
	8			-100	dB
DFD-d3 Inherent Distortion					
Channel	1			-90	dB
	2			-90	dB
	3			-90	dB
	4			-90	dB
	5			-90	dB
	6			-90	dB
	7			-90	dB
	8			-90	dB
Inherent Noise					
Channel	**1**				
Function RMS	Filter CCIR unwtd	-		2.0	µV
	Filter A weighting	-		1.5	µV
Channel	**2**				
Function RMS	Filter CCIR unwtd	-		2.0	µV
	Filter A weighting	-		1.5	µV
Channel	**3**				
Function RMS	Filter CCIR unwtd	-		2.0	µV
	Filter A weighting	-		1.5	µV
Channel	**4**				
Function RMS	Filter CCIR unwtd	-		2.0	µV
	Filter A weighting	-		1.5	µV
Channel	**5**				
Function RMS	Filter CCIR unwtd	-		2.0	µV
	Filter A weighting	-		1.5	µV

Measurement		Min	Act.	Max	Unit
Channel	**6**				
Function RMS	Filter CCIR unwtd	-		2.0	µV
	Filter A weighting	-		1.5	µV
Channel	**7**				
Function RMS	Filter CCIR unwtd	-		2.0	µV
	Filter A weighting	-		1.5	µV
Channel	**8**				
Function RMS	Filter CCIR unwtd	-		2.0	µV
	Filter A weighting	-		1.5	µV
DC Measurement					
Offset Voltage					
Channel	**1**				
Range Fix	0.2 V	-0.4		+0.4	mV
	3.0 V	-5.0		+5.0	mV
	12.0 V	-12.0		+12.0	mV
Channel	**2**				
Range Fix	0.2 V	-0.4		+0.4	mV
	3.0 V	-5.0		+5.0	mV
	12.0 V	-12.0		+12.0	mV
Channel	**3**				
Range Fix	0.2 V	-0.4		+0.4	mV
	3.0 V	-5.0		+5.0	mV
	12.0 V	-12.0		+12.0	mV
Channel	**4**				
Range Fix	0.2 V	-0.4		+0.4	mV
	3.0 V	-5.0		+5.0	mV
	12.0 V	-12.0		+12.0	mV
Channel	**5**				
Range Fix	0.2 V	-0.4		+0.4	mV
	3.0 V	-5.0		+5.0	mV
	12.0 V	-12.0		+12.0	mV
Channel	**6**				
Range Fix	0.2 V	-0.4		+0.4	mV
	3.0 V	-5.0		+5.0	mV
	12.0 V	-12.0		+12.0	mV
Channel	**7**				
Range Fix	0.2 V	-0.4		+0.4	mV
	3.0 V	-5.0		+5.0	mV
	12.0 V	-12.0		+12.0	mV
Channel	**8**				
Range Fix	0.2 V	-0.4		+0.4	mV
	3.0 V	-5.0		+5.0	mV
	12.0 V	-12.0		+12.0	mV

Measurement			Min	Act.	Max	Unit
DC Measurement Error						
Channel	**1**	+3.0 V	-1.20		+1.20	%
		-3.0 V	-1.20		+1.20	%
		+0.3 V	-3.00		+3.00	%
		-0.3 V	-3.00		+3.00	%
Channel	**2**	+3.0 V	-1.20		+1.20	%
		-3.0 V	-1.20		+1.20	%
		+0.3 V	-3.00		+3.00	%
		-0.3 V	-3.00		+3.00	%
Channel	**3**	+3.0 V	-1.20		+1.20	%
			-1.20		+1.20	%
			-3.00		+3.00	%
			-3.00		+3.00	%
Channel	**4**	+3.0 V	-1.20		+1.20	%
		-3.0 V	-1.20		+1.20	%
		+0.3 V	-3.00		+3.00	%
		-0.3 V	-3.00		+3.00	%
Channel	**5**	+3.0 V	-1.20		+1.20	%
		-3.0 V	-1.20		+1.20	%
		+0.3 V	-3.00		+3.00	%
		-0.3 V	-3.00		+3.00	%
Channel	**6**	+3.0 V	-1.20		+1.20	%
		-3.0 V	-1.20		+1.20	%
		+0.3 V	-3.00		+3.00	%
		-0.3 V	-3.00		+3.00	%
Channel	**7**	+3.0 V	-1.20		+1.20	%
		-3.0 V	-1.20		+1.20	%
		+0.3 V	-3.00		+3.00	%
		-0.3 V	-3.00		+3.00	%
Channel	**8**	+3.0 V	-1.20		+1.20	%
		-3.0 V	-1.20		+1.20	%
		+0.3 V	-3.00		+3.00	%
		-0.3 V	-3.00		+3.00	%
Peak Detector						
Channel	**1**	0.4 VRMS	grey		grey	
		3.0 VRMS	green		green	
		4.0 VRMS	red		red	
Channel	**2**	0.4 VRMS	grey		grey	
		3.0 VRMS	green		green	
		4.0 VRMS	red		red	
Channel	**3**	0.4 VRMS	grey		grey	
		3.0 VRMS	green		green	
		4.0 VRMS	red		red	
Channel	**4**	0.4 VRMS	grey		grey	
		3.0 VRMS	green		green	
		4.0 VRMS	red		red	
Channel	**5**	0.4 VRMS	grey		grey	
		3.0 VRMS	green		green	
		4.0 VRMS	red		red	

Measurement			Min	Act.	Max	Unit
Channel	**6**	0.4 VRMS 3.0 VRMS 4.0 VRMS	grey green red		grey green red	
Channel	**7**	0.4 VRMS 3.0 VRMS 4.0 VRMS	grey green red		grey green red	
Channel	**8**	0.4 VRMS 3.0 VRMS 4.0 VRMS	grey green red		grey green red	
Crosstalk Attenuation						
Channel	1 2 3 4 5 6 7 8		100 100 100 100 100 100 100 100		- - - - - - - -	dB dB dB dB dB dB dB dB
Common Mode Rejection CMRR						
Channel Frequency	**1** 50 Hz 1 kHz 20 kHz		 60 60 50		 - - -	 dB dB dB
Channel Frequency	**2** 50 Hz 1 kHz 20 kHz		 60 60 50		 - - -	 dB dB dB
Channel Frequency	**3** 50 Hz 1 kHz 20 kHz		 60 60 50		 - - -	 dB dB dB
Channel Frequency	**4** 50 Hz 1 kHz 20 kHz		 60 60 50		 - - -	 dB dB dB
Channel Frequency	**5** 50 Hz 1 kHz 20 kHz		 60 60 50		 - - -	 dB dB dB
Channel Frequency	**6** 50 Hz 1 kHz 20 kHz		 60 60 50		 - - -	 dB dB dB
Channel Frequency	**7** 50 Hz 1 kHz 20 kHz		 60 60 50		 - - -	 dB dB dB

Measurement		Min	Act.	Max	Unit
Channel	**8**				
Frequency	50 Hz	60		-	dB
	1 kHz	60		-	dB
	20 kHz	50		-	dB
Input Impedance					
Channel	1	198		202	kΩ
	2	198		202	kΩ
	3	198		202	kΩ
	4	198		202	kΩ
	5	198		202	kΩ
	6	198		202	kΩ
	7	198		202	kΩ
	8	198		202	kΩ

Performance Test Report of R&S UPV-K22

Audio Analyzer R&S UPV — Rohde & Schwarz
Option R&S UPV-K22 (Jitter und Interface Test)
Order No. 1401.7909.02 — Date: . . . .
Serial-No.: . . . . — Name: . . . .

Measurement		Min	Act.	Max	Unit
Common Mode					
Level Measurement, Unbal Input					
Sample Freq	96 kHz				
Unbal	2.0000 V	1.7000		2.3000	Vpp
	1.0000 V	0.8500		1.1500	Vpp
	0.5000 V	0.4250		0.5750	Vpp
Level Measurement, Bal Input					
Sample Freq	96 kHz				
Bal Ampl	8.0000 V	6.8000		9.2000	Vpp
	4.0000 V	3.4000		4.6000	Vpp
	2.0000 V	1.7000		2.3000	Vpp
Bal Ampl	4.0000 V				
Sample Freq	32 kHz	3.4000		4.6000	Vpp
	192 kHz	3.4000		4.6000	Vpp
Common Mode Amplitude					
Analyzer Function	RMS & S/N				
Common Freq	1 kHz				
Common Volt	0.0000 V	0.0000		5.0000	mV
	5.0000 V	4.5000		5.5000	V
	7.0000 V	6.3000		7.7000	V
Common Mode Frequency Respone					
Common Volt	1.0000 V				
Analyzer Function	RMS & S/N				
Common Freq	10 Hz	0,9000		1.1000	V
	10 kHz	0.9000		1.1000	V
	80 kHz	0.9000		1.1000	V
Cable Simulator					
Generator	Output Unbal (BNC)				
Cable Sim	Off	15		30	ns
	Long	60		140	ns
Generator	Output Bal (XLR)				
	Off	15		30	ns
	Long	60		140	ns
Input to Ref Phase Deviation					
Phase Generation and Measurement					
Sample Freq	96 kHz				
Phase To Ref	0.000 %	-3.000		+3.000	%
	-45 %	-50.00		-40.00	%
	+45 %	+40.00		+50.00	%

Measurement		Min	Act.	Max	Unit
Jitter Generation and Measurement					
Jitter Amplitude					
Generator:					
Sample Freq	96.000 kHz				
Jitter Freq	1.0000 kHz				
Jitter Pk Ampl	0.1000 UI	0.090		0.110	UI
	0.5000 UI	0.450		0.550	UI
	1.0000 UI	0.900		1.100	UI
	2.5000 UI	2.250		2.750	UI
Sample Freq	48.000 kHz				
Jitter Freq	1.0000 kHz				
Jitter Pk Ampl	0.5000 UI	0.450		0.550	UI
Sample Freq	192.000 kHz				
Jitter Freq	1.0000 kHz				
Jitter Pk Ampl	0.5000 UI	0.450		0.550	UI
Jitter Frequency Response					
Generator:					
Sample Freq	96.000 kHz				
Jitter Pk Ampl	0.2500 UI				
Jitter Freq	1.000 kHz	0.225		0.275	UI
	10.000 kHz	0.225		0.275	UI
	80.000 kHz	0.200		0.300	UI
Jitter Spurious					
Sample Freq	96.000 kHz				
Jitter Pk Ampl	0.2500 UI				
Jitter Freq	1.000 kHz				
FFT	22 kHz			-35	dB
Inherent Jitter					
Sample Freq	96.000 kHz				
Jitter Pk Ampl	0.0000 UI			0.01	UI

Performance Test Report of R&S UPV-U2

Audio Analyzer R&S UPV — Rohde & Schwarz
Option R&S UPV-U2 (BNC Phone Out)
Order No. 1402.1704.02 — Date: . . . .
Serial No.: . . . . — Name: . . . .

Measurement		Min	Act.	Max	Unit
Measurement of the Output Level					
Phone Out Channel	1	3.65		4.50	V
	2	3.65		4.50	V
Channel Assignment					
Phone Out Channel	1				
Analyzer Ch2 Range	3.0 V RMS	1.16		1.42	V
Phone Out Channel	2				
Analyzer Ch1 Range	3.0 V RMS	1.16		1.42	V

Contents

2 Adjustment

Adjustment

The general meaning of adjustment is to set the actual value of a particular parameter such that the deviation of the actual value from the nominal value does not exceed a certain tolerance (e.g. with level or frequency accuracy), or that the actual value does not exceed or fall below a specified limit value (e.g. in the case of distortion factor or common-mode rejection).

This section describes which measuring equipment is required for adjusting the R&S UPV and the options, how the adjustment measurements are to be performed and how the correction factors are calculated and stored in the R&S UPV.

The R&S UPV uses two different methods of adjustment:

Manual adjustment with additional tools
By varying the value of appropriate components (e.g. potentiometers or C-trimmers) the actual value is set such that the deviation from the nominal value is within the tolerance.

Automatic (software) adjustment
The deviation of the actual value from the nominal value is measured. This deviation (referred to as the correction factor) is stored in the R&S UPV and taken into account by the measurement software when controlling the analyzer and generator so that the error of the actual value remains within the tolerance.

In both cases, precise measuring instruments are required, the measurement uncertainty of which must be significantly smaller than the tolerance to be achieved by means of the adjustment.

Ambient temperature: **23 -3/+7 °C**

Warm-up time for the R&S UPV: **1 hour**

Recommended Measuring Equipment

Measuring equipment	Characteristics	Recommendation
Digital multimeter as		
AC voltmeter	AC, DC measurement 15 mV to 20 V 2 Hz to 250 kHz, ±0.1 % 10 Hz to 20 kHz ±0.2 % 20 kHz to 100 kHz Input impedance > 1 MΩ	HP3458A
DC voltmeter	±0.05 % 100 mV to 100 V	
Frequency counter	±0.8 ppm 10 Hz to 20 Hz ±0.4 ppm 20 Hz to 250 kHz	PM6680 Including option PM9691/011, extremely stable oven oscillator for PM 668x
Audio analyzer	Selective RMS measurement, 20 Hz to 20 kHz 0.1 µV sensitivity	R&S UPV
Output Switcher	8 Channels	R&S UPZ 1120.8004.03
Multicore cable	25-pole D sub plug to 8 XLR cable jacks	1401.7709.02

Manual Adjustment with Additional Tools

Analog Generator

<u>Preparation</u>:

➢ Open the R&S UPV.

- Switch off the R&S UPV and disconnect the power cable.
- Place the R&S UPV on its handles and remove the rear housing feet (4 Torx screws at the corners of the instrument.
- Pull the casing upwards.
- Place the R&S UPV such that the analog audio board (AAB) points upward (place the R&S UPV upside down).

➢ All adjustment devices are to be found on the AAB unit. They are covered by the low distortion generator (option R&S UPV-B1) if it is installed. In this case, the option must be removed prior to the adjustment.

➢ Removing the low distortion generator:

- Loosen the two Torx screws on the restraining brackets.
- Slide the option in the direction of the R&S UPV rear panel.
- Disconnect cable W100 from the AAB.
- Remove the low-distortion generator:

➢ If installed, the second audio generator (option R&S UPV-B3) does not need to be removed since the R586 adjustment element for the balance adjustment can be reached through a hole in the board of the second audio generator.

➢ You should now have clear access to all of the adjustment elements.

➢ To simplify the operation of the R&S UPV in this position, we recommend that you connect an external monitor, external keyboard and a mouse.

➢ Switch on the R&S UPV.

For a description of how to adapt the measuring instruments to the output of the generator, see section "Analog Generator" in Chapter 1.

The position of the adjustment devices is shown in *Fig. 2-1* (page 2.17).

Before starting the adjustment process, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with "↵"

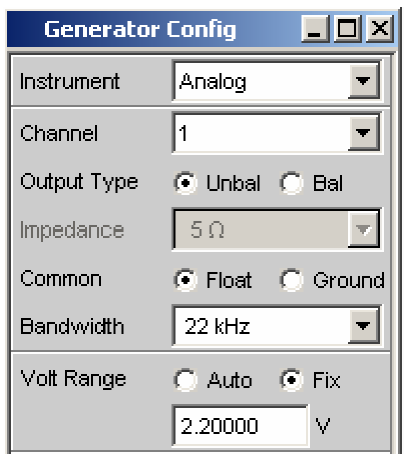
or

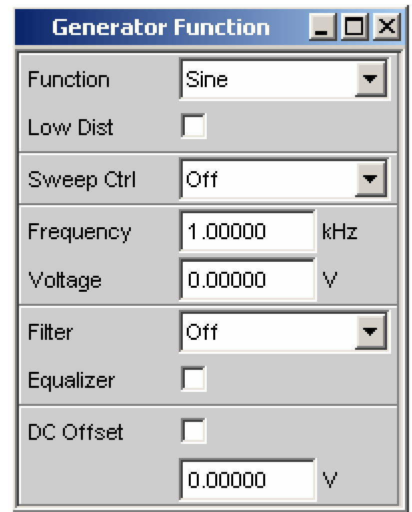
Press the MENU key and select "Preset (Load Default)" in the submenu.

Adjustment of the DC Offset

<u>Note</u>: Other adjustment procedures are not affected by this adjustment.

<u>Set R&S UPV</u>:





<u>Meas. instrument</u>: DC voltmeter

<u>Setup</u>: Connect the DC voltmeter to the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.

<u>AC level</u>: To measure the DC offset level, you will need to set the AC level to zero:
– In the Generator Config Panel, set Volt Range to Fix (2.2 V).
– In the Generator Function Panel, set Voltage to 0 V.

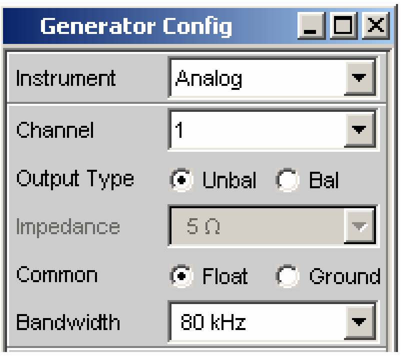
<u>Adjustment</u>: Measure the DC voltage and adjust it using R524 to 0 ± 0.5 mV.

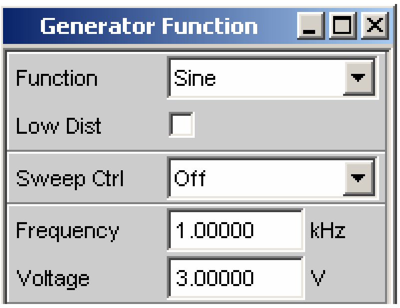
<u>Control</u>: Check the offset error as described under Performance Test.

Adjustment of the Frequency Response

Note: Other adjustment procedures are not affected by this adjustment.

Set R&S UPV:





Meas. instrument: AC voltmeter
Relative display in ΔdB, reference corresponding to adjustment instructions.

Setup: Connect the AC voltmeter to the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.

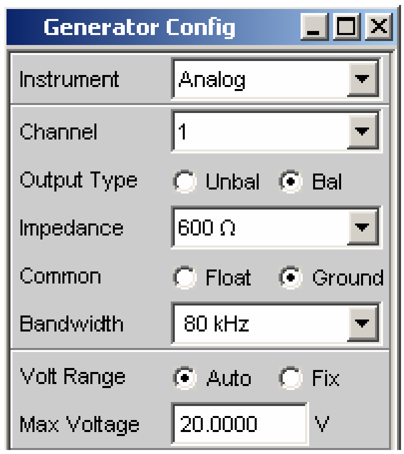
Adjustment:
- Set the frequency of the R&S UPV generator to 1 kHz.
- Measure the AC voltage and note the measured value as the reference.
- Set the frequency of the R&S UPV generator to 70 kHz.
- Use C117 to adjust to the reference, tolerance 0 dB ± 0.01 dB.

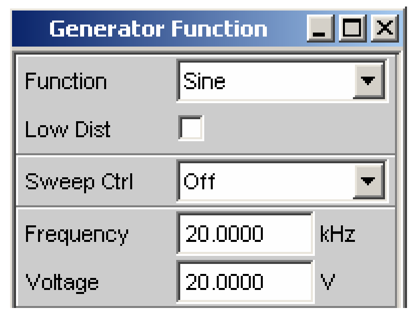
Control: Check frequency response at 2 V, output unbalance, channel 1 as described under Performance Test.

Adjustment of the Unbalance Rejection

Note: Other adjustment procedures are not affected by this adjustment.

Set R&S UPV:





Caution: To allow the necessary level to be set, it is necessary to set the Max Voltage to 20 V in the Generator Config Panel.

Setup: As described under Performance Test.

Adjustment: Use R586 to adjust for minimum (< -62 dB).

Control: Check the unbalance as described under Performance Test.

Analog Analyzer

Preparation:

- ➢ Open the R&S UPV.
  - Switch off the R&S UPV and disconnect the power cable.
  - Place the R&S UPV on its handles and remove the rear housing feet (4 Torx screws at the corners of the instrument.
  - Pull the casing upwards.
  - Place the R&S UPV such that the analog audio board (AAB) points upward (place the R&S UPV upside down).
  - All adjustment devices are to be found on the analog audio board (AAB).
  - You should now have clear access to all of the adjustment elements in the analog analyzer without any further disassembly required.
  - To simplify the operation of the R&S UPV in this position, we recommend that you connect an external monitor, external keyboard and a mouse.
  - Switch on the R&S UPV.

For a description of how to adapt the measuring instruments to the inputs of the analyzer, see section "Analog Analyzer" in Chapter 1.

The position of the adjustment devices is shown in *Fig. 2-2* (page 2.17).

When adjusting the ceramic C-trimmer, we recommend using a special trimming tool, e.g. type designation **145880 PH 0 spec.x15** from the company **Gebra**.

Before starting the adjustment process, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select "Preset (Load Default)" in the submenu.

In the specified R&S UPV settings for the generator and analyzer panels, the relevant parameters are shown with a normal black font (unlike "Preset"). For the sake of clarity, some important preset parameters are shown additionally in "gray".

Adjustment of the Frequency Response

In the case of the R&S UPV, only the frequency response of the two input dividers 15 dB and 30 dB is adjusted with an unbalanced input signal. Then, the common-mode rejection is adjusted while feeding in a common-mode signal based on the section "Adjustment of the Common-Mode Rejection".
Signals from the reference R&S UPD/R&S UPV generator via an unbalanced or balanced cable (balanced cable only in the case of the reference R&S UPV).

Set R&S UPV:

Generator Config

Instrument	Analog
Channel	1
Output Type	Unbal / Bal
Impedance	10 Ω (for Bal)
Common	Ground

Generator Function

Function	Sine
Low Dist	Off (no check in the tick box)
Frequency	see below
Voltage	3.000 V

Analyzer Config

Instrument	Analog
Bandwidth	80 kHz
Channel	1 or 2
Input	Bal
Impedance	200 kΩ
Range	Fix 10.0 V RMS, 30.0 V RMS

Analyzer Function

Function	RMS
Meas Time	Auto
Phase/Freq	Off

Function Config

Unit	V

Frequency = 100 Hz

Measure AC voltage with AC voltmeter → Ug1
Measure AC voltage with R&S UPV analyzer → Um1

Frequency = 20 kHz

Measure AC voltage with AC voltmeter → Ug2
Measure AC voltage with R&S UPV analyzer → Um2

15 dB divider

Adjust C173 in Ch1 or C176 in Ch2 so that:
Um2 = Um1∗ Ug2/Ug1, tolerance: ± 0.002 dB

30 dB divider

Adjust C253 in Ch1 or C258 in Ch2 so that:
Um2 = Um1∗ Ug2/Ug1, tolerance: ± 0.002 dB

Adjustment of the Common-Mode Rejection

Set R&S UPV:	Generator Config	
	Instrument	Analog
	Channel	2 = 1
	Output Type	Unbal
	Common	Ground
	Generator Function	
	Function	Sine
	Low Dist	Off (no check in the tick box)
	Frequency	according to table
	Voltage	according to table
	Analyzer Config	
	Instrument	Analog
	Bandwidth	22 kHz
	Channel	1 or 2
	Input	Bal
	Impedance	200 kΩ
	Range	Fix see below
	Analyzer Function	
	Function	RMS Selective or RMS with Post-FFT
	Bandwidth	BP 3 %
	Freq Mode	Fix: Gen (frequency according to table)
	Meas Time	Auto
	Function Config	
	Unit	dBr
	Reference	Value: Gen Voltage according to table

Adjustment: Test setup same as for Performance Test

Connect the reference generator and R&S UPV analyzer using a special cable.
BNC connector, unbalanced cable, 2 * 300 Ω precision resistors built into XLR male connector.

Adjust the measured value to minimum for each setting according to table.

Note: Due to the high rejection values, the adjustments of the common-mode rejection are particularly temperature sensitive especially at low frequencies. Prior to adjusting these points, it is important for the R&S UPV to have settled in with the housing casing closed in a warmed-up state. For adjustment purposes only, pull the housing casing back up to the level of the adjustment elements.

Table for hardware adjustment:

Range	Voltage	Frequency	Adjustment	Channel	Function
1.0 V RMS	3 V	100 Hz 20 kHz	R221 R850	1 1	Differential amplifier
		100 Hz 20 kHz	R222 R851	2 2	
18.0 mV RMS	3 V	100 Hz	R914	1	Input amplifier
			R915	2	
10.0 V RMS	10 V	100 Hz 20 kHz	R661 C174	1 1	15 dB input divider
		100 Hz 20 kHz	R662 C177	2 2	
30.0 V RMS	10 V	100 Hz 20 kHz	R294 C175	1 1	30 dB input divider
		100 Hz 20 kHz	R295 C178	2 2	

Use the following sequences during the adjustment process:

1. Either using the top table
2. Or first all of the Low Freq adjustment points, then the Upp Freq adjustment points
3. Always begin the adjustments with the 1.0 V range, then 18 mV, 10 V and the 30 V range

The adjustment procedures are largely independent of one another as long as you maintain the proper sequence. In the case of the C adjustments, it is possible that despite the low-capacitance ceramic trimming tool a small offset will arise which can be compensated with the right approach to the setting.

Option R&S UPV-B1 (Low Distortion Generator)

Preparation:

- Open the R&S UPV.
  - Switch off the R&S UPV and disconnect the power cable.
  - Place the R&S UPV on its handles and remove the rear housing feet (4 Torx screws at the corners of the instrument.
  - Pull the casing upwards.
  - Place the R&S UPV such that the analog audio board (AAB) points upward (place the R&S UPV upside down).
- Removing the low distortion generator:
  - Loosen the two Torx screws on the restraining brackets.
  - Slide the option in the direction of the R&S UPV rear panel.
  - Slide the low distortion generator upwards.
- You should now be able to access the adjustment element C500 through a hole in the shielding panel on the rear of the low distortion generator.
- To simplify the operation of the R&S UPV in this position, we recommend that you connect an external monitor, external keyboard and a mouse.
- Switch on the R&S UPV.

For a description of how to adapt the measuring instruments to the inputs of the analyzer, see Chapter 1 (Performance Test, Analog Analyzer).

Before starting the adjustment process, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with "↵"

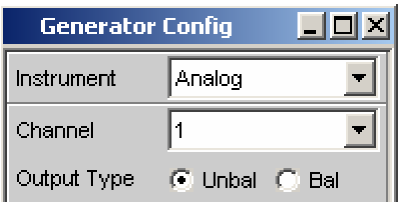
or

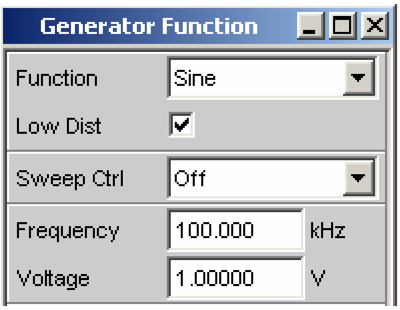
Press the MENU key and select "Preset (Load Default)" in the submenu.

Adjustment of the Frequency Response

Note: Other adjustment procedures are not affected by this adjustment.

Set R&S UPV:





Meas. instrument: AC voltmeter
Relative display in ΔdB, reference corresponding to adjustment instructions.

Setup: Connect the AC voltmeter to the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.

Adjustment:
- ➢ Switch on the Low Distortion Generator: Click on the Low Dist tick box.
- ➢ Set the frequency of the R&S UPV generator to 1 kHz.
- ➢ Measure the AC voltage and note the measured value as the reference.
- ➢ Set the frequency of the R&S UPV generator to 100 kHz.
- ➢ Use C500 to adjust to the reference, tolerance <± 0.004 dB.

Control: Check frequency response at 2 V, output unbalance, channel 1 as described under Performance Test.

Option R&S UPV-B2/B20 (Digital Audio I/O)

Preparation:

➢ Open the R&S UPV.

- Switch off the R&S UPV and disconnect the power cable.
- Place the R&S UPV on its handles and remove the rear housing feet (4 Torx screws at the corners of the instrument.
- Pull the casing upwards.
- Place the R&S UPV so that it is in its normal position of use.

➢ Adjustment element R13 is located on the digital front panel (DFP) unit and can be accessed from the left side of the instrument.

➢ Switch on the R&S UPV.

Before starting the adjustment process, set the R&S UPV to a defined initial status. To do this, call up the default setting:

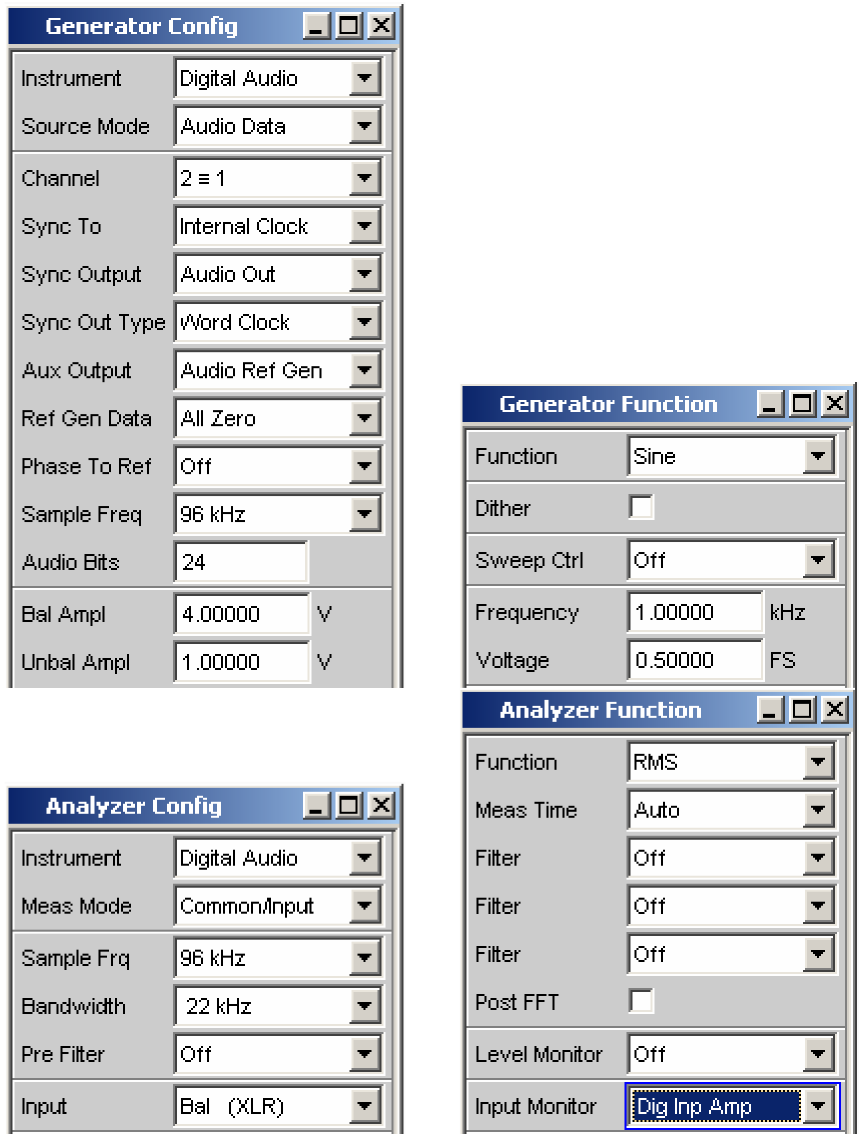
Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select "Preset (Load Default)" in the submenu.

Adjustment of the Digital Amplitude

Set R&S UPV:



Analyzer settings if option R&S UPV-K22 is installed

Measuring instrument: Oscilloscope

Test setup: Connect the oscilloscope using a 75 Ω cable and 75 Ω terminating impedance to the Unbal output of the R&S UPV.
If the option R&S UPV-K22 is installed, use a 75 Ω cable to connect the Unbal output of the R&S UPV to the Unbal input.
The oscilloscope is used to check the adjusted amplitude.

Adjustment:
- Set level Unbal of the Unbal digital output to 1.0000 V.
- Use R13 (TX AMPL ADJ) on the digital front panel (DFP) to adjust the output level on the oscilloscope to 1.00 V.
- Measure the AC voltage and note the measured value as the reference.
- If the option R&S UPV-K22 is installed, measure the level using the R&S UPV analyzer and adjust it with R13 to 1.00 V, tolerance ± 0.01 V.
- At this level, the measurement accuracy of the R&S UPV analyzer for the pulse amplitude is within the tolerance which is permissible for the output level of the digital generator.

Control: Check that the level of the Bal digital output is 4.0 V as described in chapter 1 "Performance Test".

Dieser Amplituden-Abgleich ist für das DFP der Option R&S UPV-B20 in gleichem Maße vorzunehmen. Da die Einstellung „Common/Input“ (Analyzer Config Panel unter *Meas Mode*) aber nicht möglich ist, ist für die Messung die Verwendung des Referenz-UPV erforderlich. Ein Ausgang des digitalen Generators des DUT muss dazu mit einem digitalen Analyzer-Eingang des Referenz-UPV (der mit der Option R&S UPV-B2 ausgestattet sein muss) verbunden werden.

Option R&S UPV-B3 (Second Generator)

Preparation:

- Open the R&S UPV.
  - Switch off the R&S UPV and disconnect the power cable.
  - Place the R&S UPV on its handles and remove the rear housing feet (4 Torx screws at the corners of the instrument.
  - Pull the casing upwards.
  - Place the R&S UPV such that the analog audio board (AAB) points upward (place the R&S UPV upside down).

- You should now have clear access to all of the adjustment elements on the second generator unit.

- To simplify the operation of the R&S UPV in this position, we recommend that you connect an external monitor, external keyboard and a mouse.

- Switch on the R&S UPV.

For a description of how to adapt the measuring instruments to the output of the generator, see section "Analog Generator" in Chapter 1.

The position of the adjustment devices is shown in *Fig. 2-4* (page 2.18).

Before starting the adjustment process, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with “↵”

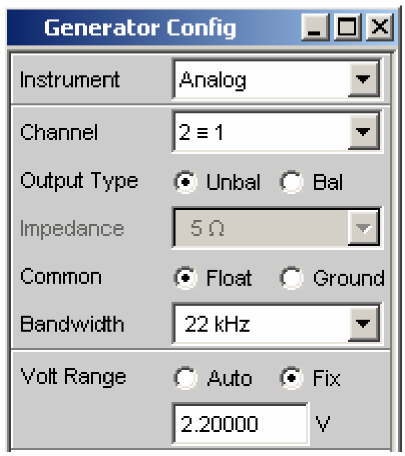
or

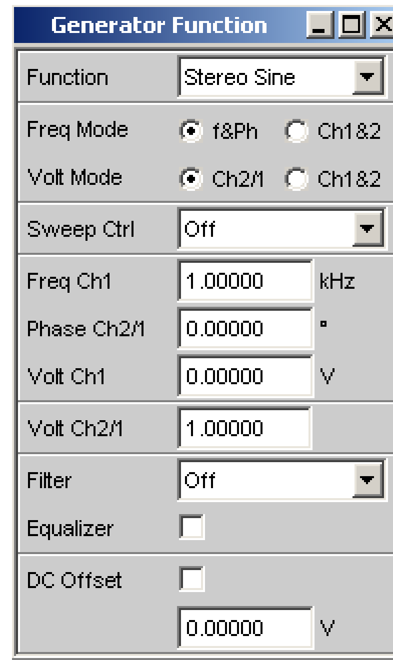
Press the MENU key and select “Preset (Load Default)” in the submenu.

All three of the adjustments which were described above under "Analog Generator" should be made in the same way for the second generator too. For the sake of simplicity, the adjustment elements have the same names except the trimmer for the frequency response adjustment.

Adjustment of the DC Offset

Set R&S UPV:



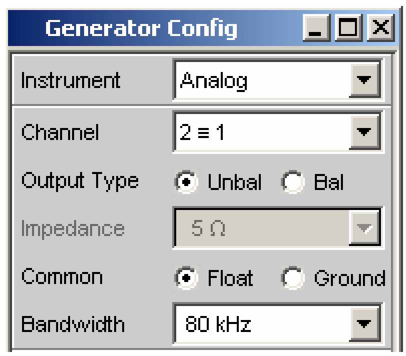


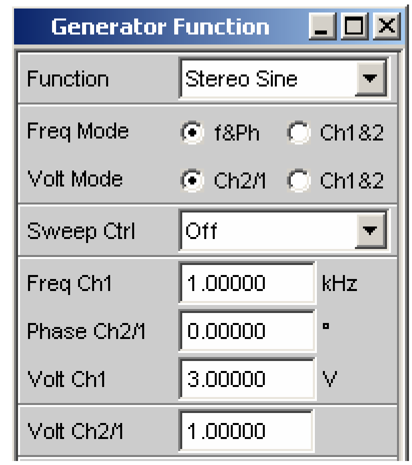
Meas. instrument:	DC voltmeter
Setup:	Connect the DC voltmeter to the output Ch2 of the R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose.
AC level:	To measure the DC offset level, you will need to set the AC level to zero: – In the Generator Config Panel, set Volt Range to Fix (2.2 V). – In the Generator Function Panel, set Voltage to 0 V.
Adjustment:	Measure the DC voltage and adjust it using R524 to 0 ± 0.5 mV.
Control:	Check the offset error as described under chapter 1 "Performance Test".

Adjustment of the Frequency Response

<u>Note</u>: Other adjustment procedures are not affected by this adjustment.

<u>Set R&S UPV</u>:





<u>Meas. instrument</u>: AC voltmeter
Relative display in ΔdB, reference corresponding to adjustment instructions.

<u>Setup</u>: Connect the AC voltmeter to the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.

<u>Adjustment</u>:

- Set the frequency of the R&S UPV generator to 1 kHz.
- Measure the AC voltage and note the measured value as the reference.
- Set the frequency of the R&S UPV generator to 70 kHz.
- Use C28 to adjust to the reference, tolerance 0 dB ± 0.01 dB.

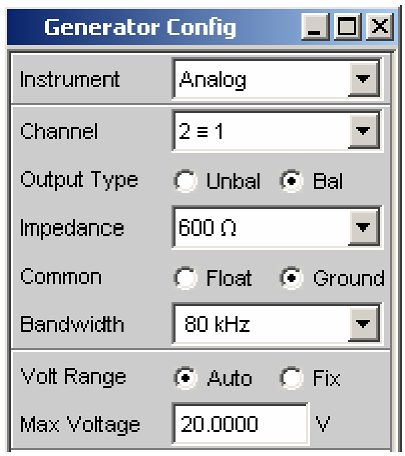
<u>Control</u>: Check frequency response at 2 V, output unbalance, channel 1 as described under chapter 1 "Performance Test".

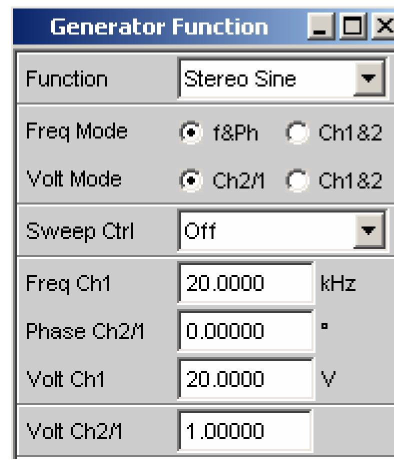
Adjustment of the Unbalance Rejection

This adjustment is the same as for the analog generator, but different settings are required.

Note: Other adjustment procedures are not affected by this adjustment.

Set R&S UPV:





Caution: To allow the necessary level to be set, it is necessary to set the Max Voltage to 20 V in the Generator Config Panel.

Setup: As described under Performance Test in section 1.

Adjustment: Use R586 to adjust to minimum (< -62 dB).

Control: Check the unbalance as described under chapter 1 "Performance Test".

Position of Adjustment Components

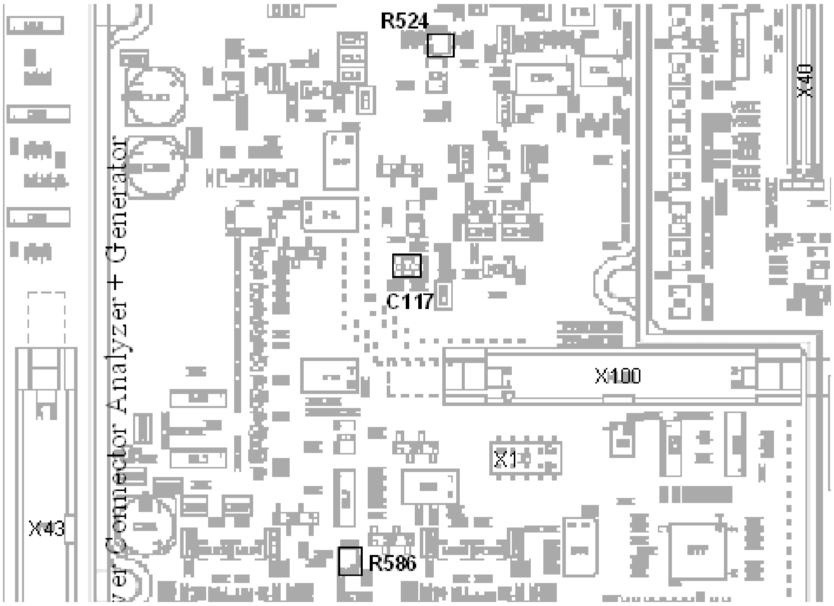


Fig. 2-1 Adjustment Components of Analog Generator

Fig. 2-2 Adjustment Components of Analog Analyzer

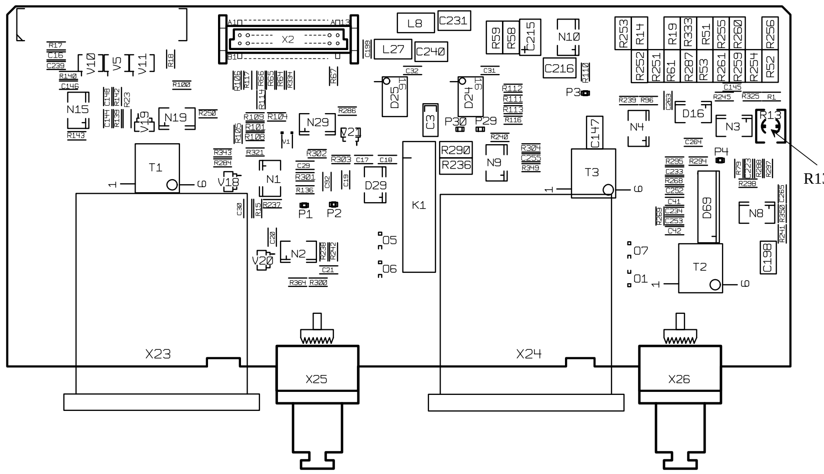


Fig. 2-3 Adjustment Component of Digital Front Panel

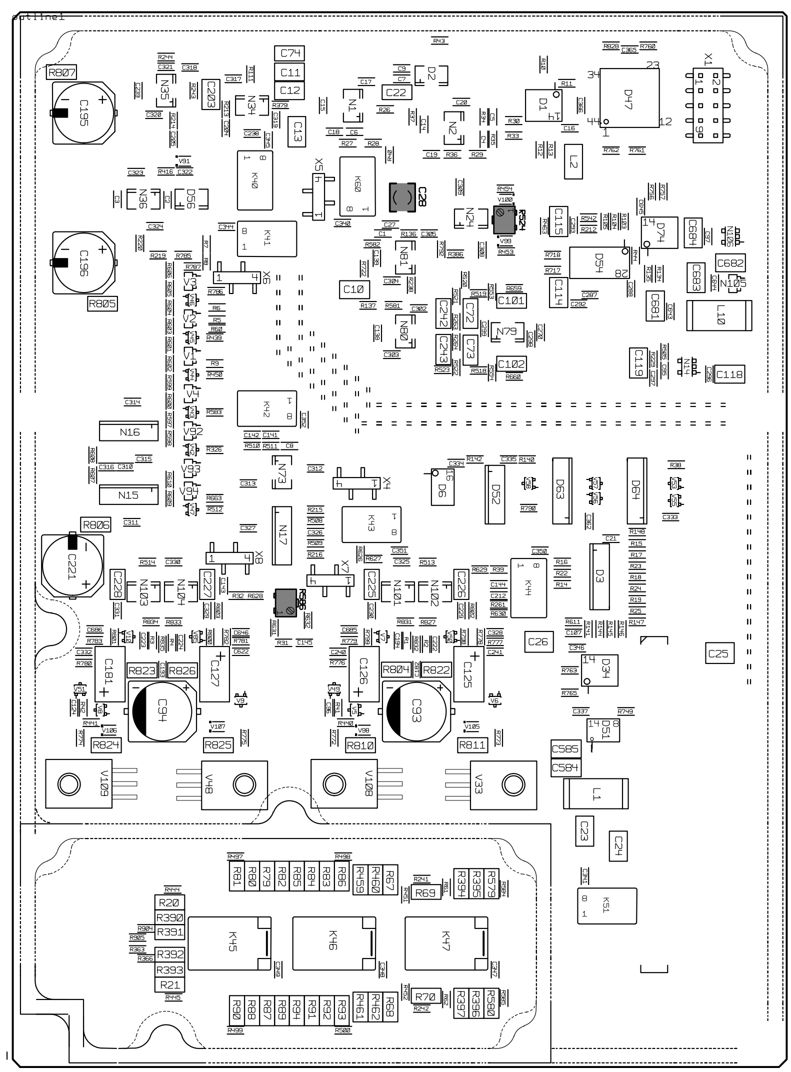


Fig. 2-4 Adjustment Components of Second Generator

Software Adjustment

Procedure

In the R&S UPV, a procedure is used that is referred to as **software adjustment**. The deviation of the actual value from the nominal value is measured. This deviation (referred to as correction factor) is stored in the R&S UPV and taken into account by the measurement software when controlling the analyzer and generator so that the error of the actual value remains within the tolerance.

The correction factors are stored in the R&S UPV on an E^2PROM and also on the hard disk for the sake of redundancy. The E^2PROMs are located on the analog audio board (AAB) and on the digital audio board (DAB, part of the option R&S UPV-B2). You can read and write these values in diagnostic mode in the "Adjustment" group (this is also possible via the IEC/IEEE bus).

You can enter diagnostic mode by calling up the Diagnostic panel and entering the **password 1.4142** (do not enter any spaces or zeroes).

When using the IEC/IEEE bus, you can enter the password with the IEC/IEEE bus command `DIAGnostic:PASSword "Password"`. Replace the argument in quotes with the character sequence indicated above.

Each time the R&S UPV is started, a backup copy of the correction data in the E^2PROM is made on the hard disk. The backup files are stored in the C:\ directory.

The file C:\eeprom_anaaudio.bin is the backup file which contains all of the above adjustment parameters for the audio board including the options R&S UPV-B1 and R&S UPV-B3.
For the binary file, a file C:\eepromdump.txt is also saved which can be used to check the entries in text format for the E^2PROM. This file is not updated when the adjustment values are changed until you close and reopen the R&S UPV software.

For the entries for the analog audio board, the dump file eepromdump.txt also contains the corresponding information for software adjustment of the option R&S UPV-B2, digital audio I/O 192 kHz. The associated binary file eeprom_digaudio.bin is also a backup of the E^2PROM in the R&S UPV-B2 unit.

CAUTION

Prior to switching on diagnostic mode, you need to halt all of the measurement functions. When the diagnostic panel is activated, measurements may not be restarted until you have exited diagnostic mode by entering an incorrect password (e.g. confirm the correct content "Passwrd ok", empty field or empty argument via the IEC/IEEE bus).

There are six groups of correction data:

Group	Correction data for	Backup file
Low Dist Gen.	R&S UPV-B1 Low Distortion Generator	eeprom_anaaudio.bin + eepromdump.txt
Anlg Generator	Analog Generator	
Anlg Analyzer	Analog Analyzer	
Digital Phase	R&S UPV-B2 Digital Audio I/O 192 kHz with R&S UPV-K22	eeprom_digaudio.bin + eepromdump.txt
B48 primary	R&S UPV-B48 If R&S UPV is fitted with two UPV-B48, then option in slot 1 else in slot 1 or slot 2	eeprom_eisslot1[2].bin + eepromdump.txt
B48 secondary	R&S UPV-B48 Only if R&S UPV is fitted with two UPV-B48	eeprom_eisslot2.bin + eepromdump.txt

You can select these groups in the Diagnostic Panel under "Adjustment". You can display and modify the value of each of the correction factors. If the cursor is on the "Value" input field, the permissible value range for the correction factor will be displayed in the status line at the bottom edge of the screen.

Computation of the correction data for the analog generator and the analog analyzer is described in the following sections. Automatically executed routines are available for the low distortion generator, the digital generator and the digital analyzer.

Diagnostic Mode

Diagnostic mode allows extensive intervention in the hardware of the R&S UPV. Its use should be reserved for personnel employed by R&S representatives who are trained in how to service the R&S UPV.

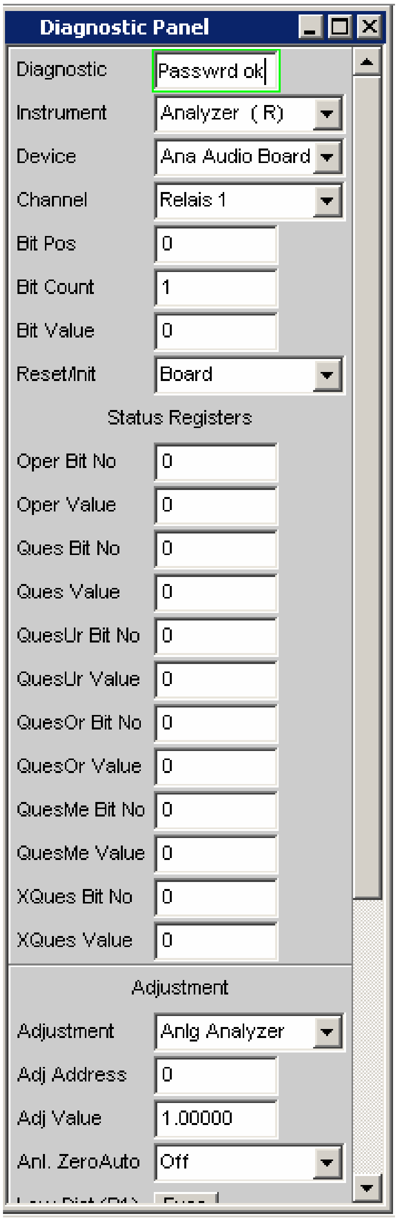
In addition to entering the correction factors for software adjustment, it is, for example, also possible to read out and **modify** the hardware settings for all of the R&S UPV modules. This also includes settings which are not used in normal measurement operation and which might cause damage to the hardware. In normal measurement operation of the R&S UPV, the diagnostic mode is protected by a password. The password is 1.4142. It is entered in the Diagnostic panel in the line "Diagnostic Passwrd ?".

<u>Open diagnostic mode:</u>

Enter the number 1.4142 in the Diagnostic panel in the line "Diagnostic" (no spaces or zeroes are allowed). The current setting for the R&S UPV is stored.

When using the IEC/IEEE bus, you can enter the password with the IEC/IEEE bus command `DIAGnostic:PASSword "Password"`. Replace the argument in quotes with the character sequence listed above.

When opened, the Diagnostic panel looks as shown here.



<u>Exit diagnostic mode:</u>

Enter an incorrect number in the Diagnostic panel in the line "Diagnostic" or just confirm the empty field
or
Confirm the existing text "Passwrd ok" again.

Software Adjustment Procedure

Analyzer and generator always use the currently valid correction factors stored in the E^2PROM. Before performing a correction measurement, the correction factor must be set to the value 1.
Before calling the automatic adjustment routines for the low distortion generator or the digital generator and analyzer, the respective correction factors need **not** be set to the value 1 (or 0 for DC offset correction of R&S UPV-B48)!

Software Adjustment Procedure:

1. Set old correction factor to 1 (0): *)
   - Open diagnostic mode
   - Select Board → E^2PROM
   - Select the desired CAL group for "Adjustment"
   - Enter the number of the correction factor for "Adj Address"
   - Enter a value of 1(0) *) for "Adj Value"

2. Perform the correction measurement and calculate the new correction factor cf_{new}. Prior to a correction measurement, the default setup of the R&S UPV is loaded in most cases, causing the diagnostic mode to be terminated.

3. Enter new correction factor $\mathbf{cf_{new}}$ into the E^2PROM:
   - Open diagnostic mode
   - Select the desired adjustment group for "Adjustment"
   - Enter the number of the correction factor for "Adj Address"
   - Enter the value $\mathbf{cf_{new}}$ for "Adj Value".
     The permissible value range is displayed in the status line at the lower edge of the screen.
   - Exit diagnostic mode

After a correction factor has been entered, it is **immediately** transferred to the E^2PROM and becomes effective for the hardware. The next time the R&S UPV is started, a backup copy of the correction data in the E^2PROM is made on the hard disk. The old, previously valid redundant correction data are overwritten on the hard drive.

Before carrying out a software adjustment, the backup files of the correction data should therefore be stored again under a different name. Thus, it is possible to compare the old and the new correction data with each other.

*) “0”: DC offset correction for R&S UPV-B48

Correction Factors in the E^2PROM

Adjustment = Low Dist Gen

Address	Value	Meaning
0	cf_ldg_sin	Sinus Level (at 1 V and 1 kHz)
1	cf_ldg_imd	IMD Level (at 1 V and 1 kHz) → No adjustment
2	cf_ldg_frq[0]	Frequency range 0 (at 50 kHz)
3	cf_ldg_frq[1]	Frequency range 1 (at 10 kHz)
4	cf_ldg_frq[2]	Frequency range 2 (at 1 kHz)
5	cf_ldg_frq[3]	Frequency range 3 (at 100 Hz)

Adjustment = Anlg Generator

Address	Value	Meaning
0	cf_agen_0	Analog Generator Level Ch1 (at 1 V and 1 kHz)
1	cf_agen_1	Analog Generator Level Ch2 (at 1 V and 1 kHz) (only with option R&S UPV-B3 installed)
2	cf_dim_level_sine DIM	Generator Level Sine (only with option R&S UPV-B3 installed, not in use)
3	cf_dim_total_gain DIM	Generator Total Gain (only with option R&S UPV-B3 installed, not in use)
4	cf_phase [0]	Generator Phase Offset @ 1 kHz (only with option R&S UPV-B3 installed)
5	cf_phase [1]	Generator Phase Offset @ 10 kHz (only with option R&S UPV-B3 installed)
6	cf_phase [2]	Generator Phase Offset @ 20 kHz (only with option R&S UPV-B3 installed)
7	cf_phase [3]	Generator Phase Offset @ 30 kHz (only with option R&S UPV-B3 installed)
8	cf_phase [4]	Generator Phase Offset @ 40 kHz (only with option R&S UPV-B3 installed)
9	cf_phase [5]	Generator Phase Offset @ 50 kHz (only with option R&S UPV-B3 installed)
10	cf_phase [6]	Generator Phase Offset @ 60 kHz (only with option R&S UPV-B3 installed)
11	cf_phase [7]	Generator Phase Offset @ 70 kHz (only with option R&S UPV-B3 installed)
12	cf_phase [7]	Generator Phase Offset @ 80 kHz (only with option R&S UPV-B3 installed)

Adjustment = Digital Phase

Address	Value	Meaning
0	cf_dig_phase_ana_slope	gradient of measurement straight line
1	cf_dig_phase_ana_offset	offset of measurement straight line
2	cf_dig_phase_gen_slope	gradient of adjust straight line
3	cf_dig_phase_gen_offset	offset of adjust straight line
4	cf_dig_phase_ana_slope_neg	gradient of measurement straight line for negative angles

Adjustment = Anlg Analyzer

Address	Value	Meaning
0	cal_notch[0][0]	Notch frequency range 0, Ch1 (at 75 kHz)
1	cal_notch[0][1]	Notch frequency range 1, Ch1 (at 20 kHz)
2	cal_notch[0][2]	Notch frequency range 2, Ch1 (at 3.2 kHz)
3	cal_notch[0][3]	Notch frequency range 3, Ch1 (at 470 Hz)
4	cal_notch[1][0]	Notch frequency range 0, Ch2 (at 75 kHz)
5	cal_notch[1][1]	Notch frequency range 1, Ch2 (at 75 kHz)
6	cal_notch[1][2]	Notch frequency range 2, Ch2 (at 75 kHz)
7	cal_notch[1][3]	Notch frequency range 3, Ch2 (at 75 kHz)
8	cal_range[0][0]	Level BW 22/40/80 kHz, Ch1 (at 3 V, 1 kHz)
9	cal_range[1][0]	Level BW 22/40/80 kHz, Ch2 (at 3 V, 1 kHz)
10	cal_ range[0][1]	Level BW 250 kHz, Ch1 (at 3 V, 1 kHz)
11	cal_ range[1][1]	Level BW 250 kHz, Ch2 (at 3 V, 1 kHz)
12	1 (fixed)	Frequency → No adjustment
13	1 (fixed)	Phase Factor → No adjustment
14	1 (fixed)	Phase Offset → No adjustment

Adjustment = B48 primary or secondary

Address	Value	Meaning
0	cal_range[0][2]	Level Ch1
1	cal_range[1][2]	Level Ch2
2	cal_range[2][2]	Level Ch3
3	cal_range[3][2]	Level Ch4
4	cal_range[4][2]	Level Ch5
5	cal_range[5][2]	Level Ch6
6	cal_range[6][2]	Level Ch7
7	cal_range[7][2]	Level Ch8
8	cal_dcoffset[0][2]	DC Offset Ch1
9	cal_dcoffset[1][2]	DC Offset Ch2
10	cal_dcoffset[2][2]	DC Offset Ch3
11	cal_dcoffset[3][2]	DC Offset Ch4
12	cal_dcoffset[4][2]	DC Offset Ch5
13	cal_dcoffset[5][2]	DC Offset Ch6
14	cal_dcoffset[6][2]	DC Offset Ch7
15	cal_dcoffset[7][2]	DC Offset Ch8

Explanation of the systematics:

All calibration factors of the generator have the name “cf”, all calibration factors of the analyzer have the name “cal”.

The first square bracket describes the channel, the second one the ADC in use:
0 Audio ADC
1 High Speed ADC
2 B48 ADC

Extension Notch: 1st Range
2nd Frequency

Analog Generator

Preparation: After performing the hardware adjustment, the R&S UPV must be reassembled:

- ➢ Switch off the R&S UPV.
- ➢ Reinstall the option R&S UPV-B1 (low distortion generator) if it was previously removed.
- ➢ Slide on the instrument casing.
- ➢ Screw on the rear panel feet (Torx screwdriver, size 20).
- ➢ Put the R&S UPV back into its normal operating position and power in on.

Caution: Prior to starting the measurement to determine the correction factors, the R&S UPV must warm up for at least one hour with the housing closed.

Software Adjustment, Sinewave Level

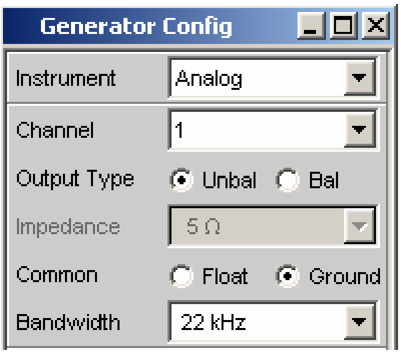
Before starting the correction measurement, set the R&S UPV to a defined initial status. To do this, call up the default setting:

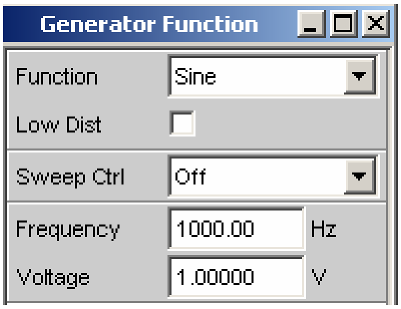
Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select "Preset (Load Default)" in the submenu.

Set R&S UPV:





Meas. instrument: AC voltmeter (e.g. calibrated R&S UPV analyzer)

Test setup: Connect the AC voltmeter to the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.
As an alternative, you can use an internal connection from the generator to the analyzer.

Measurement: Measure the AC level from Ch1. This is U_{act}(actual).

Adjustment: Compute the correction factor:

$$cf\_agen\_0 = \frac{1.000\ \mathrm{V}}{U_{a(act)}}$$

You can enter the value you determine directly into the corresponding field.
Use the following IEC/IEEE bus command to transfer the correction values to the R&S UPV:
"DIAG:CAL CAGEn"
"DIAG:CAL:ADDRess 0"
"DIAG:CAL:FDATa <n>" n = Correction factor

Tolerance: cf_agen_0 = 1 ± 0.04

Control: The AC voltmeter (numeric display on the R&S UPV analyzer) should now display a value of 1.000 ± 0.001 V.

Analog Analyzer

Preparation: After performing the hardware adjustment, the R&S UPV must be reassembled:

- ➢ Switch off the R&S UPV.
- ➢ Slide on the instrument casing.
- ➢ Screw the rear panel feet back on (Torx screwdriver, size 20).
- ➢ Put the R&S UPV back into its normal operating position and power in on.

Caution: Before carrying out a software adjustment, it is usually not necessary to perform a hardware adjustment.
Prior to starting the adjustment measurements to determine the correction factors, the R&S UPV must warm up for at least one hour with the housing closed.
The ambient temperature must be in the range 23 –3/+7°C.

Before starting the correction measurement, set the R&S UPV to a defined initial status. To do this, call up the default setting:

Press the PRESET key and confirm your input request with "↵"

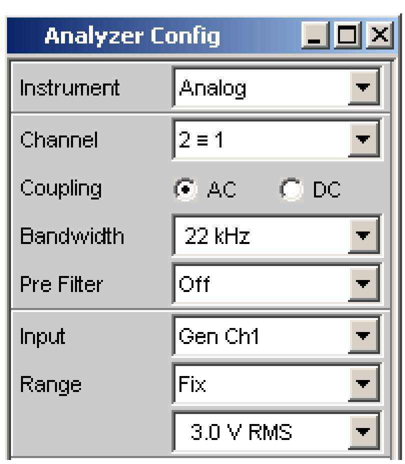
or

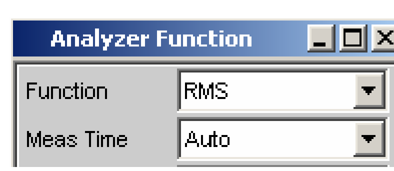
Press the MENU key and select "Preset (Load Default)" in the submenu.

Software Adjustment, Analyzer RMS Level Error (Bandwidth 22 kHz)

(Analog Analyzer adjustment group: Anlr0)

Set R&S UPV:





Generator Config

Instrument	Analog
Channel	2 ≡ 1
Output Type	Bal
Impedance	10 Ω
Common	Ground

Generator Function

Function	Sine
Low Dist	Off (no check in the tick box)
Frequency	1 kHz
Voltage	3.000 V

Test setup: Connect the AC voltmeter to an output of the DUT R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose.
The test signal from the DUT R&S UPV Gen is fed via the internal generator / analyzer connection to both analyzer channels.

Measurement: Measure the AC voltage on generator Ch1 with the AC voltmeter.
→ U_{nom}_Ch1
Measure the AC voltage with R&S UPV analyzer Ch1.
→ U_{act}_Ch1

Measure the AC voltage on generator Ch2 with the AC voltmeter.
→ U_{nom}_Ch2
Measure the AC voltage with R&S UPV analyzer Ch2.
→ U_{act}_Ch2

Determine the correction factors:

$$\textbf{cal\_range[0][0]} = \frac{\mathbf{U_{act}\_Ch1}}{\mathbf{U_{nom}\_Ch1}}$$ for channel 1

$$\textbf{cal\_range[1][0]} = \frac{\mathbf{U_{act}\_Ch2}}{\mathbf{U_{nom}\_Ch2}}$$ for channel 2

For an easy way to directly read off the correction factors from the numeric display, enter the nominal value of the voltage measured with the voltmeter for each channel as a reference value beforehand with the Config Panel function under the "Reference" parameter. Set the numeric display for relative display with units of "V/Vr".

Enter the correction factors you determined manually into the E^2PROM in the Diagnostic Panel under "Adjustment" for addresses 8 and 9 and transfer them: (for an explanation, see section "*Diagnostic Mode*", page 2.21).

Analyzer channel	Address	Value
1	8	cal_range[0][0]
2	9	cal_range[1][0]

Use the following IEC/IEEE bus command to transfer the correction values to the R&S UPV:

"DIAG:CAL CANLr0"	
"DIAG:CAL:ADDRess <n>"	n = 8 (Ch1), 9 (Ch2)
"DIAG:CAL:FDATa <n>"	n = cal_range[0][0 or cal_range[1][0]

Tolerance: cf_agen_0 = 1 ± 0.05

Software Adjustment, Analyzer RMS Level Error (Bandwidth 250 kHz)

(Analog Analyzer adjustment group: Anlr0)

Set R&S UPV:	Analyzer Config	
	Instrument	Analog
	Bandwidth	250 kHz

The further settings and signal supply are the same as for the 22 kHz bandwidth in section "*Software Adjustment, Analyzer RMS Level Error (Bandwidth 22 kHz)*", page 2.27.

Measurement: Measure the AC voltage on generator channel 1 with the AC voltmeter.
→ U_{nom}_Ch1
Measure the AC voltage with R&S UPV analyzer channel 1.
→ U_{act}_Ch1

Measure the AC voltage on generator channel 2 with the AC voltmeter.
→ U_{nom}_Ch2
Measure the AC voltage with R&S UPV analyzer channel 2.
→ U_{act}_Ch2

Determine the correction factor:

cf1_ac_250 = U_{act}_Ch1/U_{nom}_Ch1 for channel 1
cf2_ac_250 = U_{act}_Ch2/U_{nom}_Ch2 for channel 2

For an easy way to directly read off the correction factors from the numeric display, enter the nominal value of the voltage measured with the voltmeter for each channel as a reference value beforehand with the Config Panel function under the "Reference" parameter. Set the numeric display for relative display with units of "V/Vr" as was described above.

Permissible tolerance: cf = 1 ± 0.05

Transfer the correction values to the R&S UPV:

Enter the correction factors you determined manually into the E^2PROM in the Diagnostic Panel under "Adjustment" for addresses 10 and 11 and transfer them: (for an explanation, see section "*Diagnostic Mode*", page 2.21).

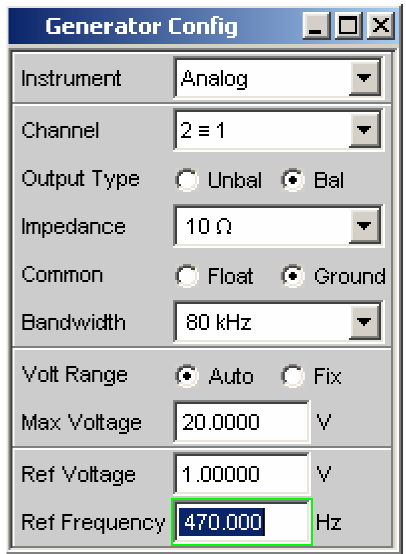
Analyzer channel	Address	Value
1	10	cf1_ac_250
2	11	cf2_ac_250

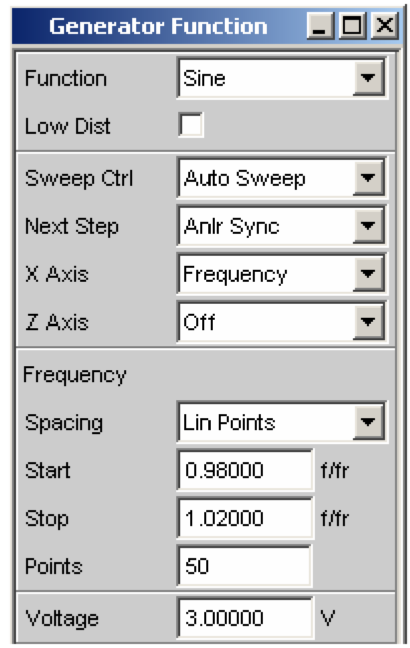
Use the following IEC/IEEE bus command to transfer the correction values to the R&S UPV:
"DIAG:CAL CANLr0"
"DIAG:CAL:ADDRess <n>" n = 10 (for channel 1), 11 (for channel 2)
"DIAG:CAL:FDATa <n>" n = cf1_ac_250 or cf2_ac_250

Software Adjustment, Analog Notch Filter

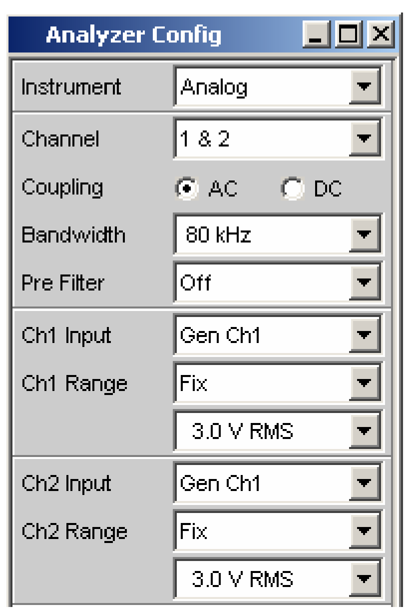
(Analog Analyzer adjustment group: Anlr0)

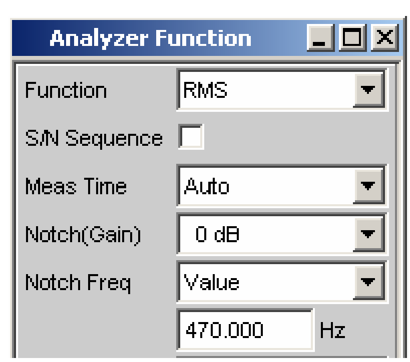
Set R&S UPV:





Set the following for Ref Frequency:
f_{nom} (= nominal frequency of the notch filter) according to the *Table 2-1*.





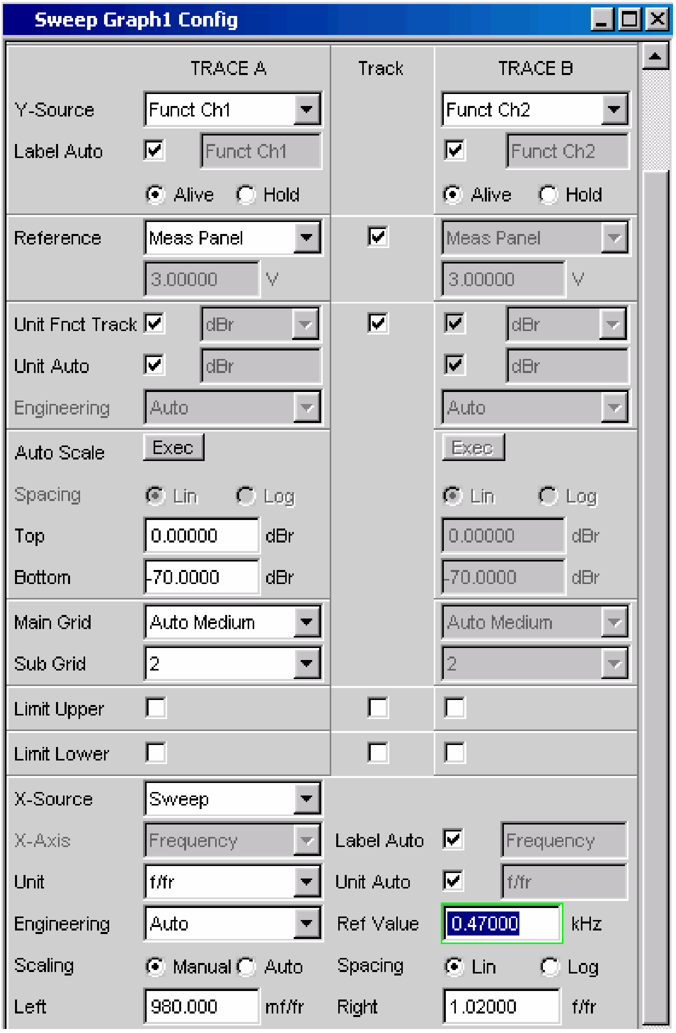
For Notch Freq value: f_{nom} (= nominal frequency of the notch filter) according to the *Table 2-1*.

Function Config

Unit	dBr
Reference	Value 3.00 V

Sweep Graph1 Config

Set the panel as shown – For X-Source under Ref Value, set the notch filter nominal frequency f_{nom} according to the *Table 2-1*.



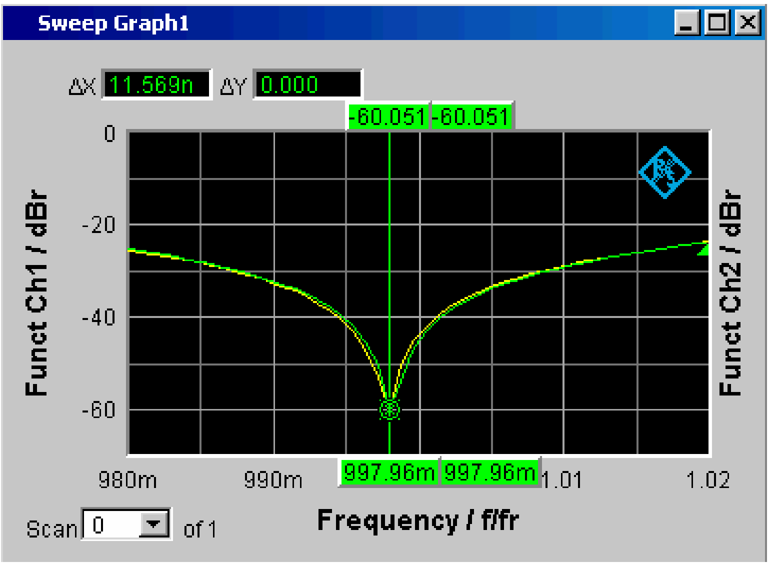
Test setup: The test signal from the DUT R&S UPV Gen is fed via the internal generator / analyzer connection to both analyzer channels.

Correction measurement: Channel 1 → f_{act}_Ch1
Channel 2 → f_{act}_Ch2

<u>Correction measurement procedure</u>:

- Set the nominal value of the notch filter notch frequency f_{nom} according to the table below in the three panels
- Launch a single sweep by pressing the SINGLE button or clicking on the button in the toolbar
- After this procedure is successfully completed, read off the cursor windows in the sweep graphics:
- Set O Cursor → Min A, Read off frequency → f_{act}_Ch1 for channel 1
- Set X Cursor → Min B, Read off frequency → f_{act}_Ch2 for channel 2

Example of a 2-channel sweep graph with a notch frequency of 470 Hz:



Take the cursor X values of the minimum for both channels from the graphics. They are already correctly scaled to the reference frequency (= nominal) and are entered into the Diagnostic Panel as shown in the example as 0.99796.

<u>Control</u>: Launch the corresponding generator sweep again. The minimum value of the respective notch filter should now be at 1.000 ± 0.001 f/fr of the nominal frequency and at an attenuation < –35 dBr!

<u>Determine the correction factors at the notch nominal frequencies:</u>

cf1_notch_rgx = f_{act}_Ch1 (relative frequency for channel 1)
cf2_notch_rgx = f_{act}_Ch2 (relative frequency for channel 2)
(where rgx … = Notch range 0 to 3 according to table below)

Permissible tolerance: cf = 1 ± 0.02

<u>Transfer the correction values to the R&S UPV</u>:

Enter the correction factors you determined manually into the E^2PROM in the Diagnostic Panel under "Adjustment" for addresses 10 and 11 and transfer them: (for an explanation, see section "*Diagnostic Mode*", page 2.21).

Analyzer channel	Address	Value
1	0 to 3	cf1_notch_rgx
2	4 to 7	cf2_notch_rgx

Use the following IEC/IEEE bus commands to transfer the correction values to the R&S UPV:

"DIAG:CAL CANLr0"

"DIAG:CAL:ADDRess <n>"	n = 0 to 3 (for channel 1) n = 4 to 7 (for channel 2)
"DIAG:CAL:FDATa <n>"	n = cf1_notch_rgx for channel 1 or n = cf2_notch_rgx (for channel 2)

Table 2-1 Overview for notch filter adjustment and input into the adjustment diagnostic panel:

Frequency	Correction factor CF = Adj Value		Adj Address	
f_{nom}	Channel 1	Channel 2	Channel 1	Channel 2
75 kHz	cf1_notch_rg0	cf2_notch_rg0	0	4
20 kHz	cf1_notch_rg1	cf2_notch_rg1	1	5
3.2 kHz	cf1_notch_rg2	cf2_notch_rg2	2	6
470 Hz	cf1_notch_rg3	cf2_notch_rg3	3	7

We recommend that you do another check after you enter the correction values by repeating the sweep to confirm each adjustment point of the notch frequency.

Software Adjustment, Frequency & Phase

(Analog Analyzer adjustment group: Anlr0)

Note: *No hardware or software adjustment is necessary.*
The default correction values = 1 must <u>not be modified</u>.

Option R&S UPV-B1 (Low Distortion Generator)

No test equipment is required to adjust the low distortion generator. Using an automatically executed routine (starting with firmware version 1.2.0), the generator output signal is measured from the R&S UPV analyzer by way of the internal connection from the generator to the analyzer. Then, the correction factors for the level and frequency accuracy are computed and, assuming they lie within the permissible tolerances, they are entered into the E^2PROM.

Level accuracy: Adjustment **relative** to the analog generator at 1.000 V, 1.000 kHz.

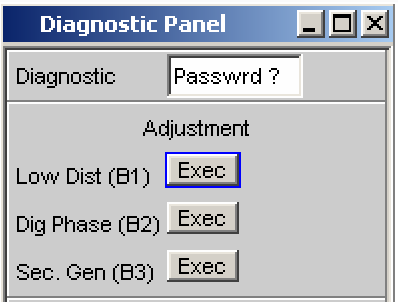
Frequency accuracy: **Absolute** adjustment at 100 Hz, 1 kHz, 10 kHz and 50 kHz.

CAUTION

The level accuracy of the R&S UPV generator must comply with specifications at 1.000 V, 1.000 kHz.
The frequency measurement of the R&S UPV analyzer must comply with specifications from 100 Hz to 50 kHz.

Note: The level measurement error of the R&S UPV analyzer does not influence the adjustment measurement. The frequency measurement in the R&S UPV analyzer is more accurate by a factor of 100 than the frequency accuracy of the low distortion generator.

From FW version 1.2.0 onward you can adjust the option R&S UPV-B1 automatically. To execute calibration, open the menu bar at the top of the screen and select diagnostic panel:



It is not necessary to enter a password in the diagnostic line. Pressing the first "Exec" button starts an automatic routine that calibrates the complete low distortion generator.

These "Exec" buttons appear only if the corresponding option is installed. The individual correction factors are stored in the file "eepromdump.bin" and in an E^2PROM.

If the R&S UPV is provided with an older FW version, the low distortion generator must be calibrated manually as described in the following sections.

Remote-control command: ADJust:LDG:AUTO ONCE

Software Adjustment, Sinewave Level

You can adjust the sinewave level directly via the R&S UPV application program.
Proceed as follows:
- Press the menu key on the R&S UPV front panel and select diagnostic panel below Utilities.
- Enter the password, i.e. **1.4142**.
- Select Low Dist Gen. in the Adjustment line.
- Select **0** as the address below Cal Address and enter **1.000** as the Cal Value in the line below.
- Select 1 kHz and 1.000 V and measure the output voltage of the low distortion generator using your own analyzer.
- Calculate the correction value: corr = 1/measurement value.
- Enter the calculated value in the Cal Value field.

After completing the adjustment has been completed, protect the Adjustment area in the Diagnostic panel against unintentional overwriting by entering, for example, a blank string in the Diagnostic line.

Software Adjustment, Frequency Accuracy

You can adjust the frequency accuracy directly via the R&S UPV application program.
Proceed as follows:
- Press the menu key on the R&S UPV front panel and select the diagnostic panel below Utilities.
- Enter the password, i.e. **1.4142,** in the first line.
- Select Low Dist Gen. in the Adjustment line.
- Select the addresses 2 to 5 below Cal Address one after the other and enter **1.000** as the Cal Value for each address in the line below.

- Select **50 kHz** and 1.000 V and measure the frequency of the low distortion generator using your own analyzer.
- Calculate the correction value: corr = f_{nom}/f_{act}.
- Select the Cal Address **2**.
- Enter the calculated value in the Cal Value field.

- Select **10 kHz** and 1.000 V and measure the frequency of the low distortion generator using your own analyzer.
- Calculate the correction value: corr = f_{nom}/f_{act}.
- Select the Cal Address **3**.
- Enter the calculated value in the Cal Value field.

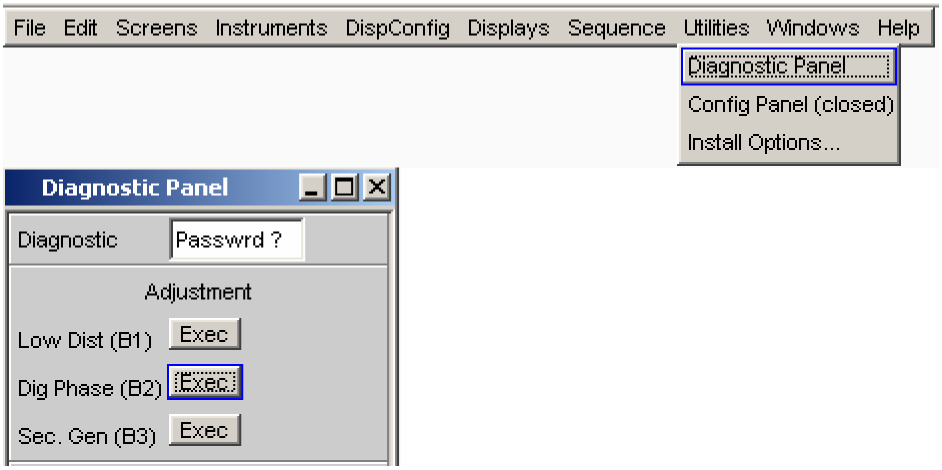
- Select **1 kHz** and 1.000 V and measure the frequency of the low distortion generator using yourown analyzer.
- Calculate the correction value: corr = f_{nom}/f_{act}.
- Select the Cal Address **4**.
- Enter the calculated value in the Cal Value field.

- Select **100 Hz** and 1.000 V and measure the frequency of the low distortion generator using your own analyzer.
- Calculate the correction value: corr = f_{nom}/f_{act}.
- Select the Cal Address **5**.
- Enter the calculated value in the Cal Value field.

After the adjustment has been completed, protect the Adjustment area in the Diagnostic panel against unintentional overwriting by entering, for example, a blank string in the diagnostic line.

Option R&S UPV-B2 (Digital Audio I/O 192 kHz)

From FW version 1.2.0 onward you can adjust the option R&S UPV-B2 automatically. To execute calibration, open the menu bar at the top of the screen and select diagnostic panel:



It is not necessary to enter a password in the diagnostic line. Pressing the second "Exec" button starts an automatic routine that calibrates the complete Digital Audio option.

These "Exec" buttons appear only if the corresponding option is installed.

In the PhaseTo Ref adjustment, both the phase meter and the phase generator are adjusted via the software for the frame phase shift between the digital signal at the front input/output and the AUX input/output at the rear of the R&S UPV. In the first step, the phase offset and the scaling factor for the phase meter are determined by applying a reference phase signal with 180° and one with 0°. In the second step, the phase generator is adjusted via the software in an internal loop measurement by scaling the D/A converter for the phase setting on the Digital Audio Board. The individual correction factors are stored in the file "eepromdump.bin" and in an E^2PROM.

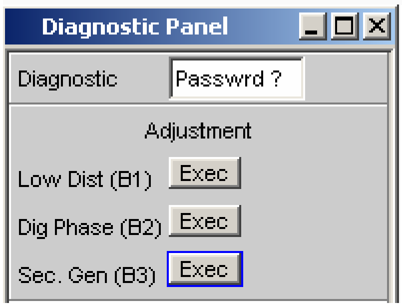
Manual adjustment is not advisable because the hardware has to be put in a state that will be not canceled by the firmware in the normal measurement mode. Therefore there is high risk of creating a corrupt hardware state.

If the measuring values seem to be inaccurate, you can execute the phase adjustment at any time.

Remote-control command: ADJust:JITTer:AUTO ONCE

Option R&S UPV-B3 (Second Generator)

From FW version 1.2.0 onward you can adjust the option R&S UPV-B3 automatically. To execute calibration, open the menu bar at the top of the screen and select diagnostic panel:



It is not necessary to enter a password in the diagnostic line. Pressing the third “Exec“ button starts an automatic routine that calibrates the complete second generator.

These “Exec“ buttons appear only if the corresponding option is installed.

The automatic routine adjusts not only the signal level but also the interchannel phase between channel 1 and channel 2 with the “Stereo Sine” generator function. The phase is adjusted via the software in an internal loop measurement. The internal analog analyzer is used to measure the phase values. The analog analyzer’s own inaccuracy is unimportant because it will be eliminated by the calibration routine. The individual correction factors are stored in the file “eepromdump.bin” and in an E^2PROM.

If the R&S UPV is provided with an older FW version, the second generator must be calibrated manually as described in the following section.

Remote-control command: ADJust:SECGen:AUTO ONCE

Software Adjustment, Sinewave Level

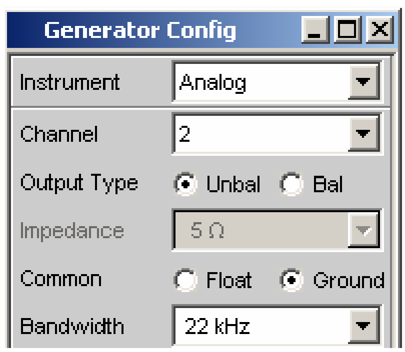
Before starting the correction measurement, set the R&S UPV to a defined initial status by calling up the default setting:

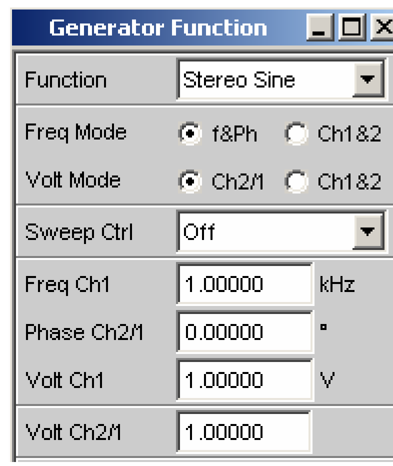
Press the PRESET key and confirm your input request with “↵”

or

Press the MENU key and select “Preset (Load Default)” in the submenu.

Set R&S UPV:





Meas. instrument: AC voltmeter (e.g. calibrated R&S UPV analyzer)

Test setup: Connect the AC voltmeter to the output of the R&S UPV generator.
You will need an adapter XLR female / 2 * banana plug for this purpose.
As an alternative, you can use an internal connection from the generator to the analyzer.

Measurement: Measure the AC level from Ch2. This is U_{act} (actual).

Adjustment: Compute the correction factor:

$$\mathrm{cf\_agen\_1} = \frac{1.000\ \mathrm{V}}{U_{a(act)}}$$

You can enter the value you determine directly into the corresponding field.
Use the following IEC/IEEE bus command to transfer the correction values to the R&S UPV:
"DIAG:CAL CAGEn"
"DIAG:CAL:ADDRess 1"
"DIAG:CAL:FDATa <n>" n = correction factor

Tolerance: cf_agen_1 = 1 ± 0.03

Software Adjustment, Interchannel Phase with Stereo Sine

A manual adjustment would only be necessary if there are no “Exec” buttons on screen because of an older FW version. But older FW versions also imply an older HW board. With these old versions of hardware you cannot adjust the phase between channel 1 and channel 2.

Option R&S UPV-B48 (8 Channel Analog Board)

Caution: Prior to starting the adjustment measurements to determine the correction factors, the R&S UPV must warm up for at least one hour with the housing closed.
The ambient temperature must be in the range 23 –3/+7°C.

Before starting the correction measurement, set the R&S UPV to a defined initial status. To do this, call up the default setting:

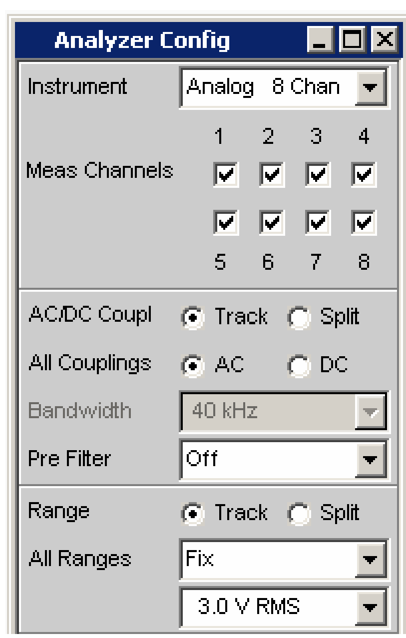
Press the PRESET key and confirm your input request with "↲"

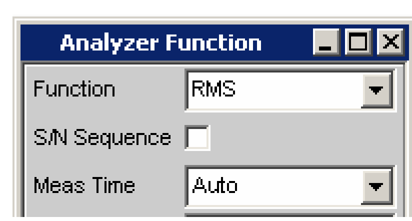
or

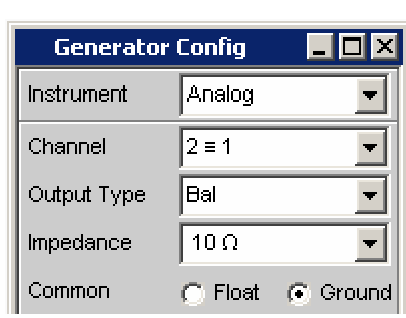
Press the MENU key and select "Preset (Load Default)" in the submenu.

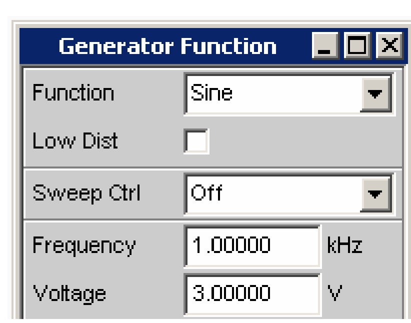
Software Adjustment, RMS Level Error

Set R&S UPV:









Meas. instrument: AC voltmeter

Test setup: Connect the AC voltmeter to an output of the DUT R&S UPV generator. You will need an adapter XLR female / 2 * banana plug for this purpose.
The test signal from the DUT R&S UPV Gen is fed via the multicore cable and the R&S UPZ to all 8 analyzer channels.

Measurement: Measure the AC voltage on generator Ch1 with the AC voltmeter.
→ U_{nom}_Ch1
Measure the AC voltage with R&S UPV analyzer Ch1.
→ U_{act}_Ch1

Do so for all other channels 2 to 8.

Determine the correction factors:

$$\text{cf1\_level} = \frac{U_{act}\text{\_Ch1}}{U_{nom}\text{\_Ch1}}$$ for channel 1

$$\text{cf2\_level} = \frac{U_{act}\text{\_Ch2}}{U_{nom}\text{\_Ch2}}$$ for channel 2

the same for channels 3 to 8.

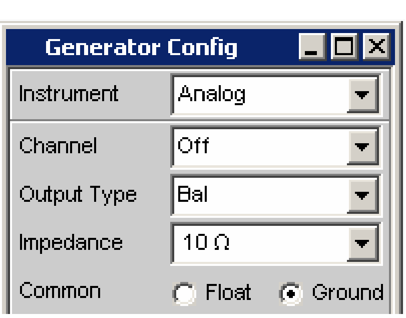
For an easy way to directly read off the correction factors from the numeric display, enter the nominal value of the voltage measured with the voltmeter for each channel as a reference value beforehand with the Config Panel function under the "Reference" parameter. Set the numeric display for relative display with units of "V/Vr".
Enter the correction factors you determined manually into the E^2PROM in the Diagnostic Panel under "Adjustment" for addresses 0 to 7 (for an explanation, see section " Software Adjustment Procedure", page 2.23).

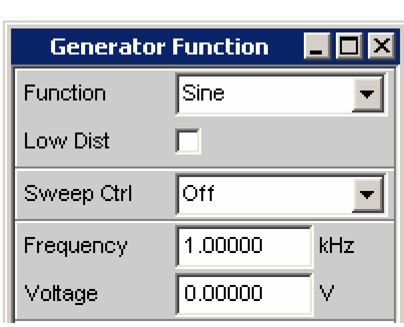
Use the following IEC/IEEE bus command to transfer the correction values to the R&S UPV:
"DIAGnostic:ADJustment B48P"
"DIAGnostic:ADJustment:ADDRess <n>" n = 0 (Ch1) … n = 7 (Ch8)
"DIAGnostic:ADJustment:FDATa <n>" n = cf<n>_level = Korrekturfaktor des jeweiligen Kanals

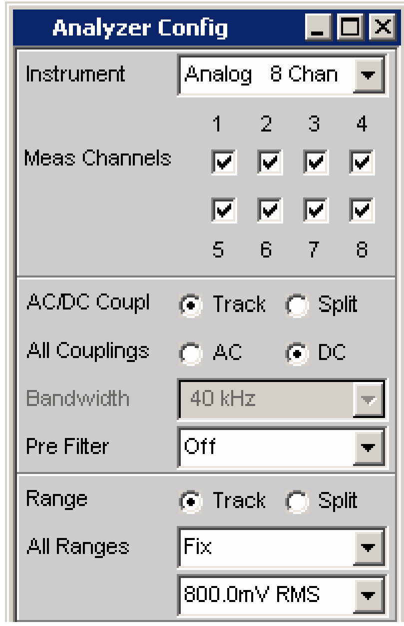
Tolerance: cf<n>_level = 1 ± 0.05

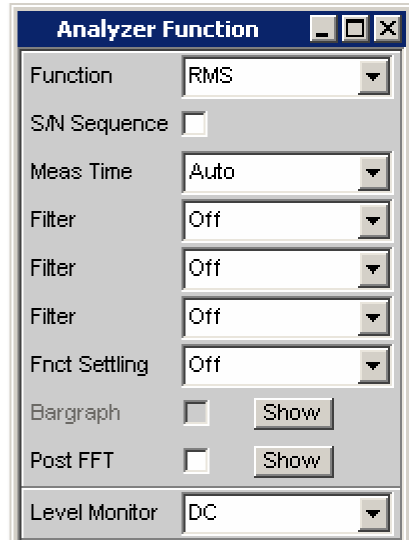
Software Adjustment, DC Offset

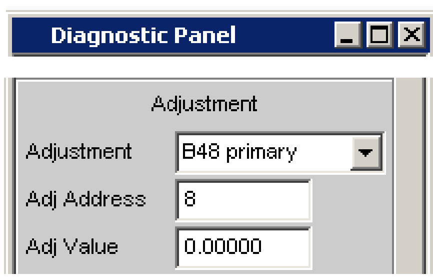
Set R&S UPV:











Test setup: The 8 inputs of UPV-B48 are terminated by the output resistance of the deactivated generator via the multicore cable and the output switcher R&S UPZ.

Measurement: Measure the DC voltage on Ch1 to Ch8 with the Level monitor.

Enter the measured dc value as correction factors manually into the E^2PROM in the Diagnostic Panel under "Adjustment" for addresses 8 to 15 (for an explanation, see section "Software Adjustment Procedure", page 2.23).

Use the following IEC/IEEE bus command to transfer the correction values to the R&S UPV:
"DIAGnostic:ADJustment B48Primary" oder "DIAGnostic:ADJustment B48Secondary"
"DIAGnostic:ADJustment:ADDRess <n>" n = 8 (Ch1) … n = 15 (Ch8)
"DIAGnostic:ADJustment:FDATa <n>" n = cf<n>_dcOffset = correction factor of particular channel

Tolerance: cf<n>_dcOffset = ± 0.01 V

After the adjustment the residual dc offset should be less than ±0,5 mV in the 800 mV range in each channel.

Contents

Figures

Tables

3 Repair

Instrument Design and Functional Description

In terms of the basic instrument, the R&S UPV is essentially a dual-channel audio analyzer for making measurements on analog interfaces. The frequency range of the analyzer is DC to 250 kHz. The frequency range of the generator is 0.1 Hz to 80 kHz.

The basic instrument consists of seven main subassemblies:

1. **Digital Main Board (DMB)**
   - DSP modules
   - PC peripherals for parallel printer port (LPT1), serial interface (COM) (both interfaces not with FMR9), External monitor (VGA)
   - Monitoring ADC and monitoring DAC
   - Analog AUX output
   - Trigger connectors
   - Connector for internal loudspeaker
   - interface for LED board (for R&S UPV66)

2. **Front Module Controller (FMR)**
   - IDE controller for hard disk (HDD), combo drive and USB interfaces
   - VGA controller for internal LC display
   - Keyboard controller for front-panel keypad and rollkey
   - USB interface and IEEE bus connector
   - USB device interface (not for FMR6)
   - Interface for LAN reset button (for R&S UPV66)
   - Digital DVI-D interface (FMR9 only)

3. **Power Connector Board (PCB)**
   - Contains the fuses for all of the digital voltages
   - Voltage connector for the hard disk (in use for FMR6 only)
   - Connector for addititional fan for the switching power supply (not for FMR6)

4. **Switching Power Supply (SPS)**
   - Power supply for the digital subassemblies
   - Power for the power connector board

5. **Analog Audio Board (AAB)**
   - Analog generator
   - Analog analyzer
   - E^2PROM with instrument data
   - Temperature sensor

6. **Analog Power Supply (APS)**
   - AC line input
   - AC line switch
   - Toroidal core transformer

7. **Front Module**
   - LC display with illumination
   - Keypad and rollkey
   - Analog inputs and outputs (XLR connectors)
   - Digital inputs and outputs (with options R&S UPV-B2/B20 only)
   - LED board (for R&S UPV66)

The digital subassemblies including the switching power supply are located in the upper part of the instrument. The analog audio board is located in the lower part and the power supply is by the left side panel.

The basic instrument can be extended by adding the following hardware options:

1. **R&S UPV-B1 (Low Distortion Generator)**
   - RC oscillator to extend the frequency range of the universal generator to 185 kHz (for sinewave only).
   - Installed on the analog audio board over the universal generator near the rear panel of the instrument.

2. **R&S UPV-B2 (Digital Audio I/O 192 kHz)**
   - Allows measurements and signal generation on digital interfaces
   - Consists of two subassemblies:
     – The digital audio board (with inputs and outputs for SYNC and AUX) is inserted on the digital main board.
     – The digital front panel (with inputs and outputs for the digital audio signal) is installed in the front module.

3. **R&S UPV-B3 (Second Generator)**
   - Second universal generator for generation of a stereo sinewave signal in conjunction with the first universal generator in the basic instrument and a DIM signal.
   - Installed on the analog audio board over the universal generator close to the instrument front panel.

4. **R&S UPV-B20 (Digital Audio I/O 48 kHz)**
   - Allows measurements and signal generation on digital interfaces (without generation and measurement of impair signals)
   - Consists of two subassemblies:
     – The digital audio board is inserted on the digital main board.
     – The digital front panel (with inputs and outputs for the digital audio signal) is installed in the front module.

5. **R&S UPV-B41 (I^2S Interface)**
   - Allows measurements and signal generation in conformity with the I^2S standard.
   - Installed using a slot on the instrument rear panel.

6. **R&S UPV-B42 (USI Board)**
   - Allows measurements and signal generation in conformity with almost any digital interfaces.
   - Installed using a slot on the instrument rear panel.
   - Consists of a slot board, a cable and a probe.

7. **R&S UPV-B48 (Analog 8 Channel Inputs)**
   - Allows simultaneous measurements on 8 analog channels (16 channels with two options).
   - Installed using a slot on the instrument rear panel.

8. **R&S UPV-U1 (150 Ω Generator-output impedance)**
   - The output impedance will be changed from 200 Ω to 150 Ω at output type Bal.
   - To do this the delivered SMD resistances must be soldered on the AAB.
     Parallel connection of additional resistances causes the decrease of generator output impedance.
   - To correct the reading at "Impedance" in the Generator Config Panels, an entry in the Diagnostic Panel must be done.

9. R&S UPV-U2 (BNC Phone Out)

- Feeds the monitoring signals from the headphone jack to two BNC jacks on the rear panel.
- Consists of two parts:
  – A subassembly which is installed on the digital main board.
  – BNC jacks which are installed on the rear panel of the instrument.
- To show the option by selecting „Install options …“ in the Utilities menu, an entry in the Diagnostic Panel must be done.

Complete Instrument

(See Fig. 3-14 **and** Fig. 3-15 Block diagram UPV parts 1 and 2)

The Audio Analyzer R&S UPV can be operated from an AC voltage from 90 V to 132 V and from 198 V to 264 V. Fig. 3-14 shows the AC line unit with the primary fuses and the facilities for switching the AC line voltages. This switching is needed for operation of the analog power supply with its toroidal core transformer. The AC line switch which provides true galvanic isolation from the power grid when it is in its OFF position also switches the switching power supply which is connected via the board for the analog power supply.

Part 2 of the block diagram of the R&S UPV shows how all of the boards in the instrument are interconnected. The central function of the digital main board (DMB) for digital signal processing is clear. It receives its supply voltage from the switching power supply via the power connector board, provides the connection to the front module controller and controls the analog and digital audio boards. It is equipped with two DSP modules as processing units for the digital data streams. The internal loudspeaker is also controlled via the DMB.

The instrument variant R&S UPV66 is different to the „normal" R&S UPV, because it is a so called "black box" without any display or internal keyboard. To know the actual conditions of the device it is provided with LEDs on the frontpanel. This LEDs show for example an active remote control, a single or continuous measurement etc.

The analog audio board (AAB) receives its supply voltages (separately for the generator and analyzer) from the analog power supply and is thus fully decoupled from the digital power supply. The generator outputs and analyzer inputs are fed to the AAB via the analog front panel (AFP). This AFP also contains the headphone jack for the monitoring output.

The fan for the analog unit is attached to the AAB, but it obtains its power via the control interface from the DMB and is thus not connected to the analog supply.

The two options R&S UPV-B1 (Low Distortion Generator) and R&S UPV-B3 (Second Generator) are installed directly on the AAB.

The digital audio board (DAB) is installed directly on the DMB. It is connected using a ribbon cable to the digital front panel (DFP) which is installed on the front module. The inputs and outputs on the rear panel of the instrument are integrated directly on the DAB (R&S UPV-B2 only).

Power Connector Board

(See Fig. 3-15 Block diagram UPV part 2)

The power connector board (PCB) is the central unit for supplying power to the digital subassemblies in the upper chamber of the R&S UPV. It is powered by the switching power supply. It receives +5 V via cable W18 and ±12 V and +24 V via cable W10. Each voltage has separate fuse protection and is filtered using chokes. The following parts are supplied:

<u>With +5 V:</u>

- The digital main board (DMB)
  The front module controller (FMR) and the options R&S UPV-B2/B20 are also powered via this.
  In addition, a voltage of +3.3 V for the DMB is generated on the PCB with a voltage regulator.
- The slot on the rear panel of the instrument for additional HW options
- The DC/AC converter for the TFT display (not with FMR9)
- The hard disk (FMR6 only)
- The combo drive

With +12 V:

- The slot on the rear panel of the instrument for the additional HW options
- The operational amplifier on the option R&S UPV-B2/B20 (Digital Audio I/O)
- The fans for the upper digital chamber
- The fan for the lower analog chamber
- The display adapter

With -12 V:

- The slot on the rear panel of the instrument for the additional HW options
- The operational amplifier on the option R&S UPV-B2/B20 (Digital Audio I/O)

With +24 V:

- The VCOs on the option R&S UPV-B2 (Digital Audio I/O 192 kHz)

Front module controller

The front module controller board contains a Pentium microprocessor with on-board CPU fan. It is plugged directly into the DMB, receiving its operating voltage from the switching power supply via these contacts, and is in the closest possible contact with the DMB for data and control purposes.

The front module controller is fitted with a 512 MB RAM (1 GB with FMR7, 4 GB with FMR9) and has the following ports and connectors:

- LAN connector
- Rotary knob pulses.
  The R&S UPV66 uses this interface to connect the LAN Reset-button.
- Control and data for the HDD and combo drive
- Control for instrument display and external monitor (via DMB)
- Front-panel USB ports (rear panel via DMB)
  FMR6: USB1.1
  FMR7, FMR9: USB2.0
- Front-panel keyboard
- If the R&S UPV is fitted with FMR7/FMR9, an additional USB Device connctor on the rear is available. About this interface the audio analyzer can be controlled alternatively to IEC/IEE Bus, RS232 (not with FMR9) and LAN.

The front module controller has on-board graphics and receives its supply voltages via the connector to the DMB.

Digital Main Board

The digital main board (abbreviated DMB in the following) is the central module of the digital circuit part in the R&S UPV. Fig. 3-1 shows this and also provides information about the interfaces via which the modules communicate with each other.

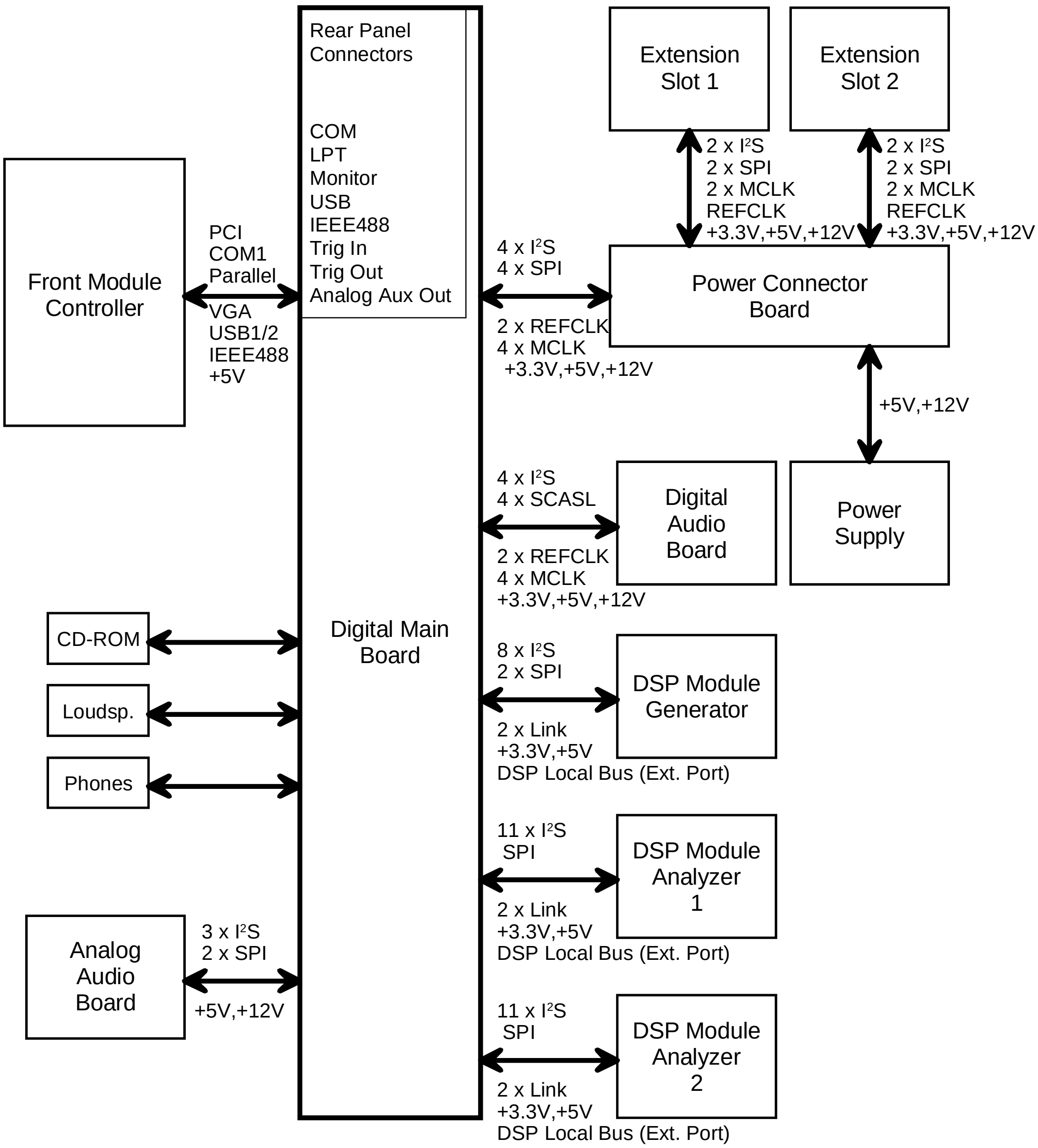


Fig. 3-1 DMB signal diagram

The DMB contains the following circuit parts:

- Field programmable gate array (FPGA)
- PCI bridge
- A/D converter (ADC) for the monitoring functionality
- D/A converter (DAC) for the monitoring functionality
- Power amplifier for loudspeaker, headphones and auxiliary output
- Clock generator for digital audio interfaces and audio converters

The DMB is connected with the front module controller via a PCI bus (33 MHz, 32 bit). From the front module controller's perspective, it acts like a peripheral card with bus master capability.

Audio data is transported between the modules via a serial interface. The protocol used is in line with the I^2S standard.

The peripheral circuit parts on the DMB or on the expansion modules are controlled via the SPI bus.

Standard PC interfaces are located at the rear of the instrument. The associated connectors are on the DMB, but the actual interface functionality is part of the front module controller and is only looped through on the DMB.

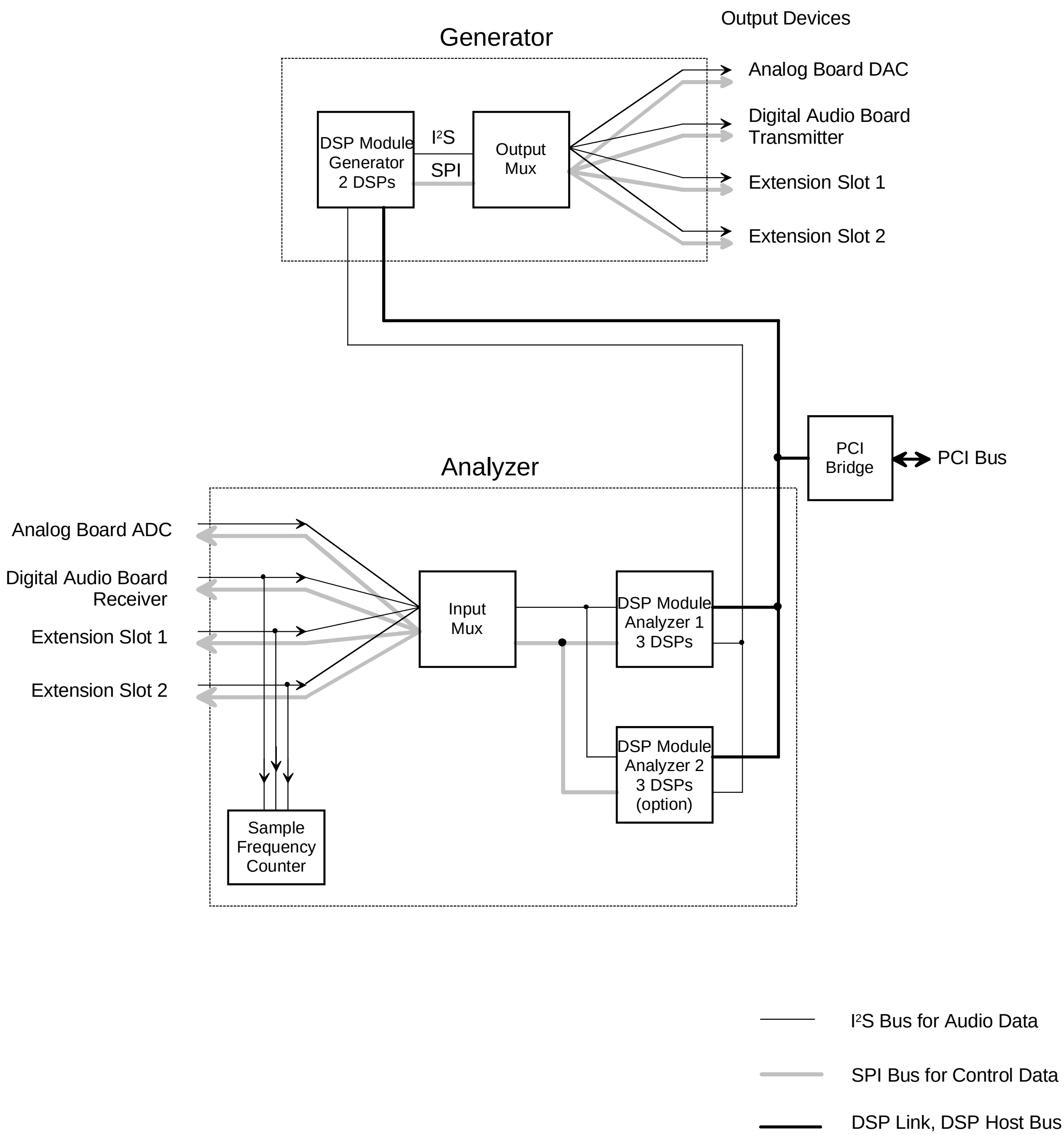
The DMB's central signal routing is implemented in the FPGA. All digital audio interfaces (I^2S) and control interfaces (SPI) of the DSPs, ADCs, DACs and other interface converters are connected with the FPGA. Since the FPGA is loaded via the front module controller, functionality can be changed or expanded at any time by updating the software.

Digital audio signals are processed partly in the FPGA, partly in the DSPs and on the front module controller. The DSPs are on modules. The DMB has three DSP module slots: one for the generator and two for the analyzer. The generator slot is designed for modules with two DSPs. The analyzer slots are used for modules with three DSPs. Analyzer slot 2 is intended for future expansions and is therefore not used in the base unit.

The DMB from Variante 05 and higher has the following differencies the older ones:

- one USB2.0 and one USB1.1 connector instead of two USB1.1
- The “Anlg Aux Out” output can deliver higher signal level:
  old: DC ±2,5 V, AC about 1,5 V, 200 mA max.
  new: DC ±2,5 V, AC about 3.0 V, 200 mA max.
- The circuit of option R&S UPV-U2 is integrated on the board, so the two BNC cables can be plugged on sockets X60 und X70 of DMB directly.

DSP Architecture

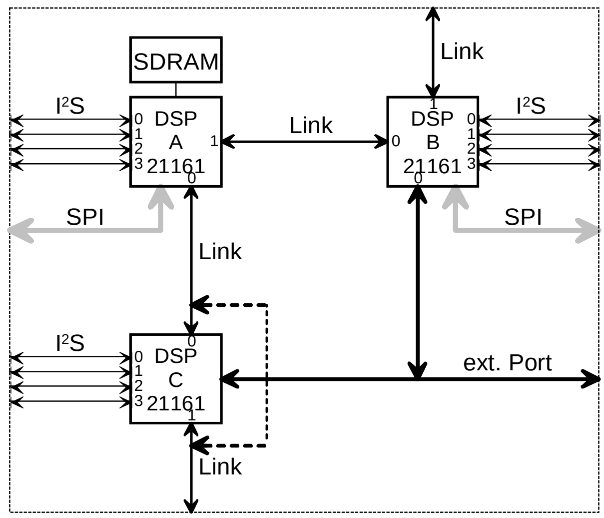


Clock generation

The DMB contains a number of crystal oscillators. The DSPs on the modules are clocked with 99 MHz. This clock is derived from a 33 MHz crystal oscillator and tripled in the DSPs. The system clock frequency of 100 MHz for the FPGA is generated by another crystal oscillator. All clocks relevant to the audio interfaces are derived from a reference oscillator with a 24.576 MHz clock frequency.

DSP Module

The DSPs in the R&S UPV are on modules. There are two types of DSP modules: the generator DSP module and the analyzer DSP module. A generator DSP module contains two DSPs (DSP A and DSP B); an analyzer DSP module contains three (DSP A, DSP B and DSP C).



To operate the digital main board, at least one generator DSP module and one analyzer DSP module (DSP module analyzer 1) are required.
A second analyzer DSP module (DSP module analyzer 2) can be optionally used. The following table shows the correlation between the designation of the DSPs in the complete system and the designation on the modules:

DSP designation in complete system	*DSP designation on module*	*DSP module*
A1	*A*	*Analyzer 1*
B1	*B*	*Analyzer 1*
C1	*C*	*Analyzer 1*
A2	*A*	*Analyzer 2*
B2	*B*	*Analyzer 2*
C2	*C*	*Analyzer 2*
G1	*B*	*Generator*
G2	*A*	*Generator*

Analog Generator

(See Fig. 3-16 Block diagram, analog generator parts 1 and 2)

The complete circuitry for the analog universal generator is housed on the analog audio board (AAB). It is powered by the analog power supply (APS) in a fully floating manner. This means the generator ground is not connected to the housing or analyzer ground so that all of the control signals from the DMB to AAB must be routed via optocouplers. The latest magnetocouplers are used to transmit the fast clock pulses.

All of the signals are generated by a ΣΔ D/A converter with a resolution of 24 bits. The balanced output of the DAC provides squarewave pulses with pulse-width modulation. The average value represents the audio signal. The DAC which is used is configured in what is known as "mono mode" which results in an improvement in the signal-to-noise ratio. A subsequent differential amplifier filters the signal and makes it unbalanced.
This DAC filter has a cutoff frequency of approx. 100 kHz (-3 dB), its frequency response can be adjusted and it allows supply of a DC voltage for compensation of all of the offset voltages which occur in the signal path.

A highpass filter which is switched on only when generating difference-tone signals is followed by the "Level Control" stage. Here, the output level of the generator is determined along with the amplifier setting for the final stage and the attenuator. In addition, the signal from option R&S UPV-B1 (Low Distortion Generator) is fed into the signal path at this point. The functioning of this free-running RC oscillator is described in a separate section.
Prior to the level stage, all of the signals have levels such that they exhibit a peak value of ~3.54 V (RMS value of 2.50 V for sinewaves). The overall circuit acts like a multiplicative D/A converter which attenuates the signal by up to 36 dB with a resolution of 18 bits. The maximum amplification can be switched in the range between 0 dB and 6 dB. The maximum level at the output of the circuit is thus equal to 5 V.

The final stage consists of an inverter with amplification which can be switched from -12 dB to +6 dB. For the balanced output, its output signal is fed to a second inverter with g = 0 dB.
A monitoring circuit which is wired as a window comparator detects states of the generator output which are not permitted. Such states can occur, for example, if an improper signal is fed in or if a permanent short-circuit occurs. The monitoring circuit triggers an interrupt and automatically switches off the generator output.
The generator output is protected against short-circuits. The maximum output current is limited in the final stages to about 200 mA.

The final stage is followed by a balanced two-stage attenuator which is switched on from approx. 0.3 V. The output divider attenuates the signal by 24 dB or 48 dB and exhibits an output impedance of 5 Ω unbalanced or 10 Ω balanced.

To carry out tests at symmetrical inputs the analog generator can create a so called „Common Mode Signal“. Pins 2 and 3 of XLR output connectors lead identical signals with equal level and phase.
If „Stereo Sine“ is selected in „Generator Function“ panel, both output connenctors can carry different common mode signals (level and frequency).

See the following table for details on how to set the hardware for the level setting for **Unbal**. The voltages specified in the first two columns should be doubled for the **Bal** setting since the output voltage is twice as large for the same hardware setting.
Except for the range marked with *), the levels are the same for the universal generator and the low distortion generator.

Table 3-1 Level table

Output voltage		Hardware setting		
Peak to peak	**V_{rms} (for sinewave)**	**Level control**	**Final stage**	**Attenuator**
28.28 V – 14.14 V	10.0 - 5.0 V	6 – 0 dB	6 dB	0 dB
14.14 V – 7.07 V	5.0 V – 2.5 V	6 – 0 dB	0 dB	0 dB
7.07 V – 3.535 V	2.5 V – 1.25 V	6 – 0 dB	-6 dB	0 dB
3.535 V – 1.77 V	1.25 V – 625 mV	6 – 0 dB	-12 dB	0 dB
1.77 V – 884 mV	625 mV – 312.5 mV	0 – -6 dB	-12 dB	0 dB
884 mV – 442 mV	312.5 mV – 156.25 mV	6 – 0 dB	0 dB	-24 dB
442 mV – 221 mV	156.25 mV – 78.13 mV	6 – 0 dB	-6 dB	-24 dB
221 mV – 110 mV	78.13 mV – 39.06 mV	6 – 0 dB	-12 dB	-24 dB
110 mV – 55 mV	39.06 mV – 19.53 mV	0 – -6 dB	-12 dB	-24 dB
55 mV – 27.5 mV	19.53 mV – 9.77 mV	6 – 0 dB	0 dB	-48 dB
27.5 mV – 13.8 mV	9.77 mV – 4.88 mV	6 – 0 dB	-6 dB	-48 dB
13.8 mV – 6.9 mV	4.88 mV – 2.44 mV	6 – 0 dB	-12 dB	-48 dB
6.9 mV – 3.45 mV	2.44 mV – 1.22 mV	0 – -6 dB	-12 dB	-48 dB
3.45 mV – 108 µV	1.22 mV – 38 µV	-6 – -36 dB	-12 dB	-48 dB
108 µV – 0 µV	38 µV – 0 µV	-36 dB	-12 dB	-48 dB *)

*) Level adjustment with Low Dist OFF:
The output voltage of the DAC is adjusted down (by the DSP)
Level adjustment with Low Dist ON:
The output voltage of the low distortion generator is adjusted down (the IMD ATTEN circuit is switched on and the voltage is attenuated).

As can be seen from part 1 of the generator block diagram, when the option R&S UPV-B3 (Second Generator) is installed, the output signal from the second analog generator is fed in here and output on Ch2. Without this option, the universal generator supplies both XLR outputs. The output configuration which is selected in the "Generator Config" panel (Ch1, Ch2 or Ch 2 = 1) is made here using relays (Output Channel Select).
After this attenuator, the voltage for the option R&S UPV-B2 is also decoupled. The analog voltage is used to superimpose the digital signal with a common mode voltage or with option R&S UPV-K22 as a voltage for jitter generation.

On the attenuator, the switching of the generator output impedance occurs as the last circuit part prior to the output connectors. In the case of an unbalanced output, the output impedance is always 5 Ω. If the balanced output configuration is selected, output impedances of 10 Ω, 200 Ω and 600 Ω can be selected. When the option R&S UPV-U1 is installed, an output impedance of 150 Ω is available instead of 200 Ω.
Regardless of whether option R&S UPV-B3 is installed, the output impedance is always set the same for both outputs.

The entire generator has DC coupling from the D/A converter to the output so that there is no lower cutoff frequency. This means the circuit can also output a DC voltage which is generated like the other signals in the DAC. In addition, each of the other signal shapes can also have a DC offset voltage superimposed on it. Since the AC component must be reduced due to the DC voltage, the signal-to-noise ratio is degraded somewhat.

As can be seen from part 2 of the generator block diagram, the temperature sensor is also read out via the generator's read line. This makes it possible, for example, to compensate the output frequency of option R&S UPV-B1 (Low Distortion Generator) as a function of the measured temperature.
In addition, the board's own E^2PROM is also connected to this read line. It contains all of the important data for the board such as the board ID and the calibration data for the generator and analyzer.

Analog Analyzer

Analog audio board (AAB) analyzer
(see UPV block diagram in Fig. 3-18)

The R&S UPV is equipped with an analog analyzer with four selectable bandwidths (22 kHz, 40 kHz, 80 kHz and 250 kHz). The analog analyzer has a dual-channel structure in all its functions.

The input signals at the XLR front connectors run via direct plug connectors from the analog front panel (AFP) to the input sections of the two analog analyzer channels.
Depending on the magnitude of the measurement signals, the signals are suitably scaled into different range increments in the input sections of both measurement channels, either by default or fully automatically.

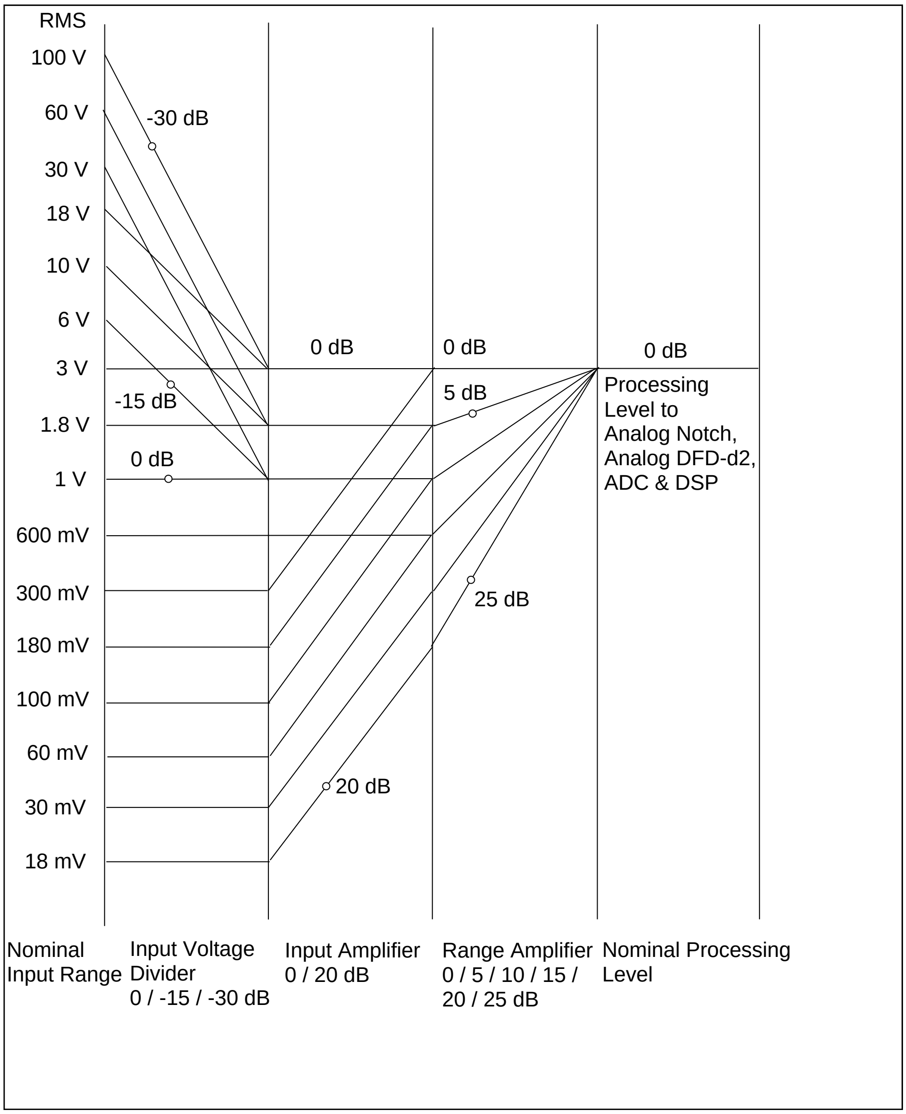
The following table shows range nominal values from 18 mV to 100 V, divided into 5 dB increments.

Table 3-2 Level table for each analyzer channel

Range No.	Nominal value	Input divider	Input amplifier	Range amplifier
0	18 mV	0 dB	20 dB	25 dB
1	30 mV	0 dB	20 dB	20 dB
2	60 mV	0 dB	20 dB	15 dB
3	100 mV	0 dB	20 dB	10 dB
4	180 mV	0 dB	20 dB	5 dB
5	300 mV	0 dB	20 dB	0 dB
6	600 mV	0 dB	0 dB	15 dB
7	1 V	0 dB	0 dB	10 dB
8	1.8 V	0 dB	0 dB	5 dB
9	3 V	0 dB	0 dB	0 dB
10	6 V	–15 dB	0 dB	5 dB
11	10 V	–15 dB	0 dB	0 dB
12	18 V	–15 dB	0 dB	5 dB
13	30 V	–30 dB	0 dB	10 dB
14	60 V	–30 dB	0 dB	5 dB
15	100 V	–30 dB	0 dB	0 dB

Overview of measurement ranges based on a level plan

UPV Analog Analyzer - Level Diagram



Analog bandwidths 22 kHz / 40 kHz / 80 kHz

Data is acquired after analog signal processing in the two channels with a dual-channel audio A/D converter at different sampling rates:

Bandwidth	Effective sampling rate	Bit clock rate	Oversampling
22 kHz	48 kHz	6.144 MHz	128 times
40 kHz	96 kHz	6.144 MHz	64 times
80 kHz	192 kHz	12.288 MHz	64 times

Aliasing problems are avoided by an analog lowpass filter of the 2nd order before each A/D converter channel together with the steep-edged digital lowpass filter integrated in the A/D converter. At the same time, data is reduced in the A/D converter via the digital lowpass filter to the effective sampling rate of 48 kHz, 96 kHz or 192 kHz, depending on the selected setting in the Analyzer Config panel. The A/D converter operates according to the deltasigma principle ($\Delta\Sigma$) with a resulting resolution of 24 bits. It runs in the master mode, where the bit clock and data frame signals are generated from the converter component synchronously to the data bits and supplied to the digital logic. The digital dual-channel data stream in I^2S format is serially read in to the FPGAs of the digital mainboard (DMB) in line with the bit clock rate for further digital signal processing in the DSPs.

Analog bandwidth 250 kHz

Data is acquired after analog signal processing in the two channels, each equipped with a fast A/D converter (ADC) with a resolution of 16 bits, at an effective sampling rate of 768 kHz. Due to the ADCs' oversampling technique in line with the $\Delta\Sigma$ method at a 16-fold oversampling rate and digital filtering, a 2nd-order analog lowpass filter preceding each ADC channel suffices for avoiding aliasing problems.

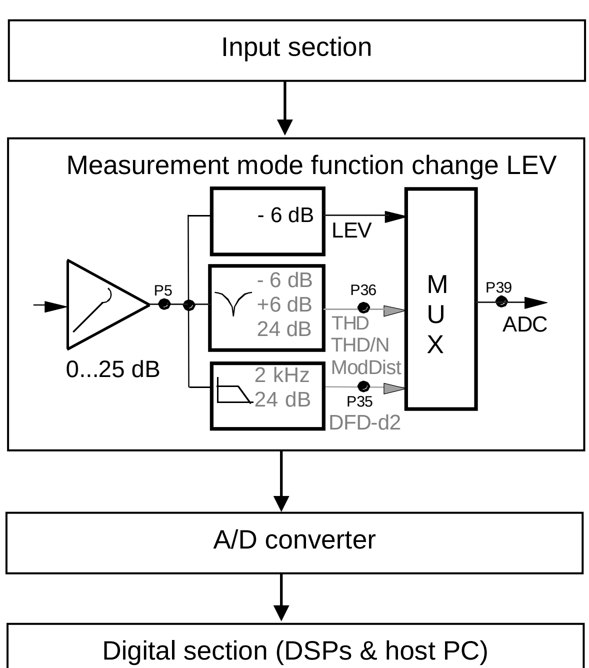
The two ADCs in the upper bandwidth mode operate like the audio ADC in the master mode, where the bit clock and data frame signals are generated from the converter components synchronously to the data bits and supplied to the digital logic. The digital data streams are serially read in to the FPGAs of the digital mainboard (DMB) at 12.288 MHz at a 16-fold sampling rate for further digital signal processing in the DSPs. As with the bandwidths of the audio ADC, the A/D conversions and the further digital processing are processed in parallel.

Direct measurement with A/D converter

After input level processing, without further analog preprocessing an immediate A/D conversion occurs (see signal flow below) during the measurement of level, FFT, THD in fast dynamic mode, THD+N in fast dynamic mode, Mod Dist in fast dynamic mode, DFD-d2 in fast dynamic mode, DFD-d3, DC, DIM, wow & flutter, polarity test, frequency, phase and group delay, etc.

After the measurement signal has been scaled into different range increments, the analog signals are limited in band by analog aliasing filters or by additional digital filters in the ADCs. After A/D conversion, signals are further processed to the above measurement modes by direct digital signal processing in the DSPs of the digital mainboard (DMB) and the host PC (FMRx).

Signal flow:



Measurement of THD, THD+N, Mod Dist with analog prefiltering and A/D converter

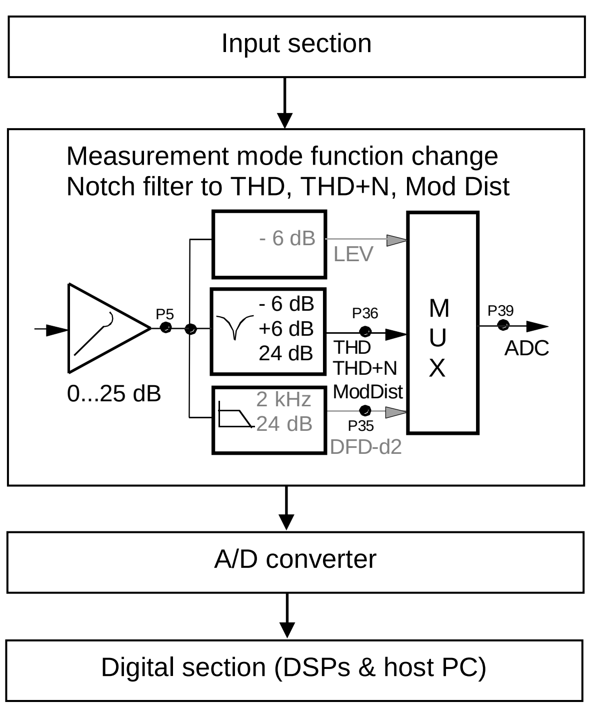
For each of these measurement functions, there is a fast and a precision mode. In fast mode, analog signal processing is followed by direct digital signal processing in the DSP with the relevant measurement routines, as in the case of level measurement. The precision modes operate with subsequent preprocessing by an analog notch filter and rescaling of the analog signal to improve the signal's dynamic range for the A/D converter. The precision modes with two consecutive measurement routines thus considerably improve the dynamic measurement range but have longer measurement times than the fast modes.

THD, THD+N:

- Fast dynamic mode: Cycle similar to the level measurement, where the RMS value in the DSP and, parallel to that, the fundamental frequency of the total harmonic distortions of the signal to be analyzed are determined. Measurement is completed, and the measured value is output.
  Signal flow of fast cycle: like that of the direct measurement with A/D converter.
- Precision dynamic mode: In this case, the first cycle (equivalent to fast mode) is automatically followed by a second cycle with the analog notch filter switched on. The notch filter is set to the fundamental frequency and has a post-gain of 30 dB (automatic incrementing to 30 dB, 12 dB or 0 dB depends on the magnitude of the distortion signal).

  Refer to the block diagram in Fig. 3-18 and the following signal flow diagram with the increments of 30 dB, 12 dB or 0 dB, relative to the measurement path LEV(el) of -6 dB.
  In the subsequently processed signal, the fundamental is less than or equal to that of the original signal, but the THD and noise components increase up to 30 dB.

Signal flow of second measurement cycle (precision):



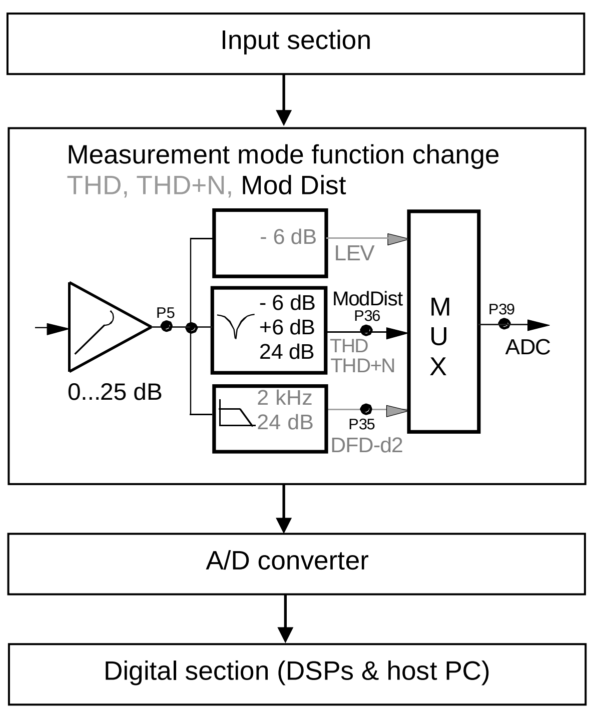
Result of second cycle:
The DSP redetermines the total harmonic distortions from the analog-analyzed signal.
In this case THD and THD+N, rescaled up to 30 dB by the analog post-gain, are output as measured values.

Mod Dist:

- Fast dynamic mode: Cycle similar to the direct measurement with A/D converter, where the DSP determines the levels and frequencies of the AF interfering carrier as well as the higher-frequency carrier and, in parallel, the intermodulation distortion of the signal to be analyzed. Measurement is completed, and the measured value is output.
  Signal flow of fast cycle: like that of the level measurement above.

- Precision dynamic mode: There are two possibilities now, depending on the measurement result of the first cycle (equivalent to fast mode):
  Mod Dist is worse than -50 dB or ≥ 0.316 %: Measurement is completed, and the measured value is output.
  Mod Dist is better than -50 dB or < 0.316 %: In this case, the first cycle (equivalent to fast mode) is automatically followed by a second cycle with the analog notch filter switched on. The notch filter is set to the frequency of the AF interfering carrier and with a post-gain of +12 dB or 0 dB, depending on the ratio of the interference level to the RF level.
  With notch filter post-gain: 0 dB for interference/RF level ratio < 3.5
  12 dB for all other ratios.
  In the subsequently processed signal, the interference level of the intermodulation signal is less than that of the original, but the modulated RF carrier increases up to 12 dB (applies to level ratios of 4:1).

Signal flow of second measurement cycle (precision):



Result of second cycle:
The DSP redetermines the intermodulation distortion from the analog-analyzed signal.
Mod Dist is output as measured value.

Measurement of DFD-d2

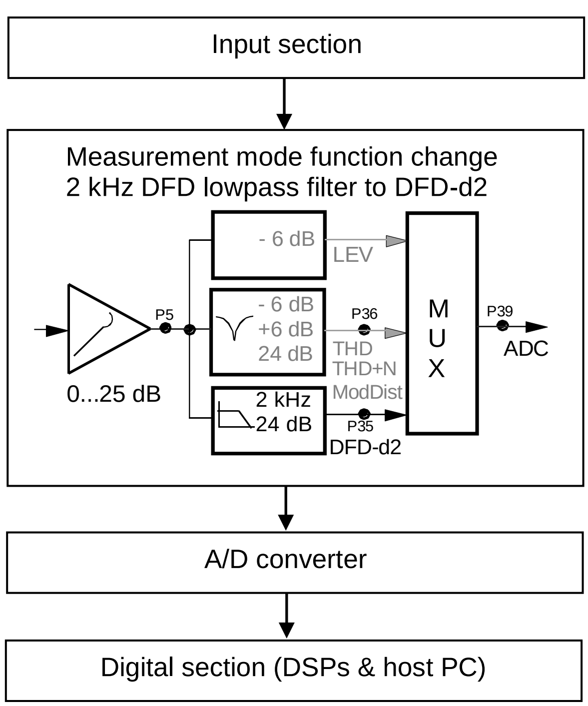
As with the distortion measurements described in the previous sections, the fast and precision dynamic modes are available for the 2nd-order difference-frequency distortion measurement mode. In fast mode, analog signal processing is followed by direct digital signal processing via the relevant measurement routines, as in the case of level measurement.

The precision mode operates with subsequent preprocessing by an analog lowpass filter and a 30 dB post-gain of the analog signal to improve the signal's dynamic range for the A/D converter. The precision mode with two consecutive measurement routines thus considerably improves the dynamic measurement range but has a longer measurement time than the fast mode.

- Fast dynamic mode: Cycle similar to the level measurement, where the DSP determines the levels and frequencies of the two difference-frequency carriers of the signal to be analyzed. Measurement is completed, and the measured value is output.
  Signal flow of fast cycle: like that of the direct measurement with A/D converter.

- Precision dynamic mode: There are two possibilities now, depending on the measurement result of the first cycle (equivalent to fast mode):
  DFD-d2 is worse than -49.5 dB or ≥ 0.335 %: In this case, the measurement is completed and the measured value of the first measurement cycle is output.
  DFD-d2 is better than –49.5 dB or < 0.335 %: In this case, the first cycle is automatically followed by a second cycle with the 2 kHz d2 lowpass filter switched on at a post-gain of 30 dB (relative to mode LEVel). In the subsequently processed signal, the difference-frequency carriers are less than or equal to those in the original signal, but the 2nd-order difference-frequency distortion and other noise components increase by 30 dB.

Signal flow of second measurement cycle (precision):



Result of second cycle:
The DSP redetermines the difference-frequency distortion from the analog-analyzed signal.
In this case DFD-d2, rescaled 30 dB by the analog post-gain, is output as the measured value.

Level indicator (peak control in analog analyzer block diagram)

To monitor the correct analog signal level, each analyzer channel has peak-hold detectors at several important signal points. During each measurement cycle, these detectors are evaluated by means of the firmware and are automatically reset via reset lines.
In the autorange mode of the analog analyzer, the information from these detectors is used to optimize automatic range leveling of the analyzer channels.

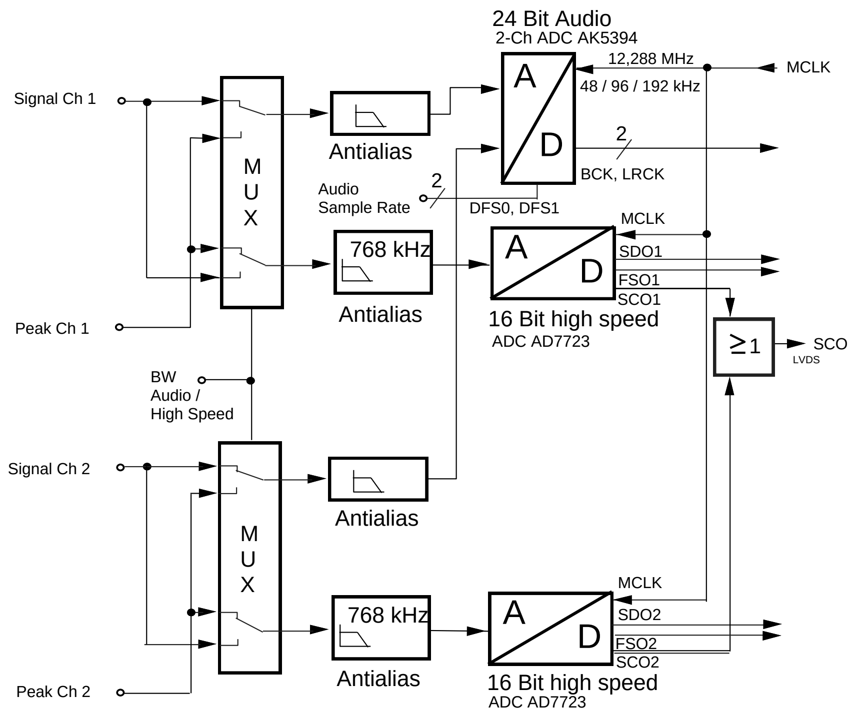


Fig. 3-2 Simultaneous signal function processing and signal monitoring of both channels.

Signal paths via two A/D converters each

The output voltage of each peak-hold detector is acquired separately for each channel and simultaneously with the ADC that is currently not being used for function analysis in the relevant bandwidth modes, i.e. either with the high-speed ADC or the audio ADC.
In the case of the high-speed ADC function with a bandwidth of 250 kHz, the audio ADC is set to a 48 kHz sample rate for peak evaluation and its internal highpass filter must be off.

Additional inputs and outputs on the analyzer of the analog audio board

The two analyzer channels contain the following additional inputs and outputs so that analog functions can also be used in connection with R&S UPV options:

- Dual-channel input for the instrument's internal connection to the XLR outputs of the analog generator. These connections allow the generator signal to be acquired at high impedance and evaluated with all analyzer functions. In the case of the analog analyzer the full level range is available, also with the autorange function.

- Dual-channel input for measurement signals from the Digital Audio I/O 192 kHz R&S UPV-B2 in connection with the Jitter and Interface Test R&S UPV-K22:
  Each analyzer channel has a DC-coupled input for this purpose. The level range is permanently defined for a nominal value of 0 V to $\pm$ 3 V.
  Depending on the selection made at Digital Audio - Meas Mode Jitter/Phase, feed-in and measurement are handled as follows:
  The jitter demodulator signal goes to analyzer channel Ch1.
  A suitably derived direct voltage from the digital phase measurement "Inp Phase to Ref" goes to analyzer channel Ch2.

  Depending on the selection made at Digital Audio - Meas Mode Common/Input, feed-in and measurement are handled as follows:
  A suitably derived common-mode amplitude signal of the digital XLR input goes to analyzer channel Ch1.
  A suitably derived direct voltage from the peak detector for acquiring the digital input amplitude ("Inp Dig Amp") goes to analyzer channel Ch2.

- Dual-channel output for providing analog input monitor signals to the monitoring output (see Monitoring Output). The level range is 0 V to 3 V RMS, referenced to the range nominal value of the analog analyzer.

- The connectors to "Phone Out" on the front of the instrument are looped through from the digital mainboard (DMB) to the analog audio board (AAB) via flat connector W41 / X41 and via plug connector X410 of the analog front panel (AFP).

Control of the analog-section fan on the analog audio board

The analog-section fan (E4 in block diagram part 2, see Fig. 3-15) is supplied via the ports on connector X44 of the AAB, which come from the digital power supply (DSP) via flat connector W41 / X41 of the digital mainboard (DMB): +5 V $\rightarrow$ X44.1, $\perp \rightarrow$ X44.2 ,3
The fan supply is on the analyzer potential and thus on the instrument housing.

Analog Front Panel (AFP)

The analog front panel (AFP) is a small separate board which houses the XLR male connectors for the generator outputs, the XLR female connectors for the analyzer inputs and the jack for the monitoring output.

It is connected directly to the analog audio board using two plug-in connections.

Connectors for the Analog Generator

The two generator outputs use the balanced XLR connectors which are common in professional studio applications. Pin 2 represents the signal and pin 3 the return. Pin 1 is not connected.

In order to improve the unbalance attenuation, pins 2 and 3 are largely embedded in the generator ground and wired with small capacitors which lead to instrument ground.

Connectors for the Analog Analyzer

The two analyzer inputs use the balanced XLR jacks which are common in professional studio applications. Pin 2 represents the signal and pin 3 the reference point. Unlike the generator outputs, pin 1 is connected so as to allow either a floating input or an input that is referred to instrument ground.

To avoid problems with high-frequency interference from the analyzer inputs, all of the pins are fitted with small capacitors.

Jack for the Monitoring Output

Besides the internal loudspeaker, the R&S UPV also allows you to monitor an internally generated audio signal or an externally supplied audio signal (which might have undergone digital processing) using a set of external headphones. Whereas the internal loudspeaker is capable of reproducing a dual-channel signal only in mono (through addition), the headphones jack has true dual-channel capabilities. A conventional 6.3 mm jack is used which is also capable of detecting a connected set of headphones using a sense line.

To keep any high-frequency interference out of the audio output, the outputs are wired with RC lowpass filters.

Analog Power Supply (APS)

The Analog Power Supply (APS) is a complete unit which is mounted on a separate sheet-metal frame. It consists of the following circuit parts:

- AC line input with line voltage switching, line filter and primary fuses
- AC line switch (the power feed branches off after this two-pole switch to the APS and the switching power supply)
- Toroidal core transformer
- Voltages for the generator
- Voltages for the analyzer

The APS is responsible exclusively for supplying power to the analog circuit parts on the analog audio board (AAB) of the R&S UPV. Power is supplied jointly via cable W13 for the generator and analyzer.

AC Line Input

The R&S UPV Audio Analyzer is equipped with an IEC power connector for operation with AC line voltages from 90 V to 132 V and 198 V to 264 V. In order to achieve optimum coverage of these two relatively large voltage ranges, the AC line input can be switched in four stages:

Primary voltage setting	Permissible voltage range
100 V	90 V to 110 V
120 V	103 V to 132 V
220 V	198 V to 242 V
230 V	207 V to 264 V

The AC line input is followed directly by an integrated AC line filter which keeps interference which is superimposed on the AC line voltage out of the R&S UPV while decoupling high-frequency pulses generated internally in the instrument from the power grid.

The unit also includes two fuses which protect the R&S UPV with respect to the power grid in a two-pole manner. Regardless of the AC line voltage setting, nominal values of the two fuses is 4.0 A.

AC Line Switch

The AC line switch has a two-pole design so that it permits true galvanic separation from the power grid when it is switched to the OFF position. It is housed directly on the APS board.

To ensure your safety when making repairs on an open instrument, the soldered connections are provided with non-conductive caps to prevent any direct contact with the AC line voltages from occurring. The actual switch is connected using a switch rod to the ON/OFF switch on the front panel.

After the AC line switch, the circuit branches off to supply the APS and the switching power supply which is responsible for supplying the digital circuit parts of the R&S UPV. The AC line voltage feed to the switching power supply does not pass via the toroidal core transformer so that its switching on the primary side does not have any influence on its input.

Toroidal Core Transformer

Due to the very demanding requirements, the transformer required for the APS uses a very costly design. Its construction as a toroidal core transformer ensures very low coupling into the sensitive analog circuit parts.

On the primary side, it has two windings with a tap which are switched in parallel or in series depending on the AC line voltage setting. This means that the voltage regulators contained in the APS always receive the same input voltage range regardless of the AC line voltage which is present. A shielding is installed between the primary and secondary windings which ensures high flashover resistance. As a result, the design of the R&S UPV on the AC line side also meets very demanding safety requirements. The integrated thermal fuse is an additional safety measure. In case of overloading where no fuse has yet triggered but where there is a risk of fire due to overheating, the thermal fuse will blow to protect the instrument against any further damage while providing additional protection to the user.

The secondary side is divided into many windings which provide the voltages for the generator and the analyzer. The reference point for the analyzer voltages is instrument ground, while the voltages for the generator are designed to be fully floating. To improve the decoupling between the floating generator ground and the analyzer ground which is referred to the housing, the toroidal core transformer contains additional shielding which is referred to generator ground.

Voltage Supply for the Analog Generator

The voltages generated on the APS for the analog generator are all configured to be floating. This costly measure ensures that the signal voltage of the generator is also floating with respect to instrument ground. The following voltages are generated:

- +5 V (for the logic modules)
- +6 V (for the signal DAC)
- ±15 V (for the operational amplifiers)
- ±20 V (for the final stage)

The alternating voltage of each secondary winding passes through four diodes configured as a bridge rectifier with a DC output voltage which is smoothed out using electrolytic capacitors and fed to a voltage regulator. This keeps the DC voltage free of interference, hum and noise. The windings and controllers are configured so that if necessary they can supply any installed options such as R&S UPV-B1 (Low Distortion Generator) and R&S UPV-B3 (Second Generator). Each secondary winding for the analog generator has individual fuse protection on the APS.

Voltage Supply for the Analog Analyzer

The voltages generated on the APS for the analog analyzer are all referred to instrument ground. The following voltages are generated:

- +5 V (for the logic modules)
- +6 V (for the signal ADCs)
- ±15 V (for the operational amplifiers)

The alternating voltage of each secondary winding passes through four diodes configured as a bridge rectifier with a DC output voltage which is smoothed out using electrolytic capacitors and fed to a voltage regulator to keep the DC voltage free of interference, hum and noise. Each secondary winding for the analog analyzer has individual fuse protection on the APS.

Switching Power Supply (SPS)

The switching power supply is responsible for supplying power to the digital circuit parts of the R&S UPV. It is a highly efficient primary switching power supply and is operated with a clock frequency of about 130 kHz. It provides the following output voltages:

- +5 V
- +12 V
- -12 V
- +24 V

In order to allow independent fuse protection for the supplied circuit parts and to be able to stabilize them if necessary with an additional voltage regulator, all of the individual voltages are fed to the power connector board (PCB).

A magnetically conductive shielding hood which encloses the entire switching power supply attenuates the interference it produces so that the interference cannot be coupled into the sensitive analog circuit parts.

IF the UPV is fitted with a FMR7/FMR9, the SPS has its own fan for a better cooling. So it is guaranteed, that despite its higher current consumption no higher temperatures can appear and the relaiability will remain.

Monitoring Output

(See Fig. 3-1 DMB signal diagram and Fig. 3-18 Analog Analyzer)

You can use the monitoring output to listen to an internally generated audio signal or an externally supplied audio signal which might have undergone digital processing. This is not a separate board. The signal processing is distributed among multiple boards (AAB, AFP, DMB).

Internal and external signals must be distinguished. All of the signal paths have in common the fact that they are limited to the extended audio range up to about 45 kHz (-3 dB). The heart of the monitoring output is formed by the monitoring DAC on the DMB via which all signals to be monitored must pass. Higher signal frequencies are suppressed by the subsequent dual-channel analog lowpass filter so that you cannot monitor them at all on the monitoring output (or they are greatly attenuated).

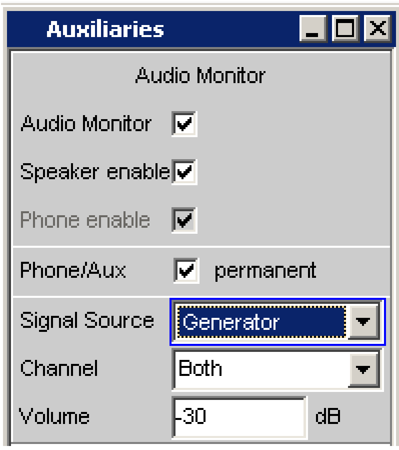
The monitoring DAC receives its digital input signal from an FPGA which practically speaking acts as an input multiplexer. A single multistage analog lowpass filter is connected to the outputs for each channel. The lowpass filter simultaneously handles the conversion of the balanced current output from the DAC into two unbalanced voltage outputs which are referred to ground.

The two output signals L and R from the DAC lowpass filters branch off to the final stage for the internal loudspeaker, to the output amplifier for the phone out jack output and (single-channel) to the output amplifier for Analog Aux Out on the rear panel of the instrument. These different outputs can be activated independently of each other.

In addition to the monitoring signal, Analog Aux Out can also supply a DC signal in the range from -2.5 V from +2.5 V.

The internal loudspeaker is operated additively with both signals for a dual-channel generator signal.

Monitoring Internal Audio Signals

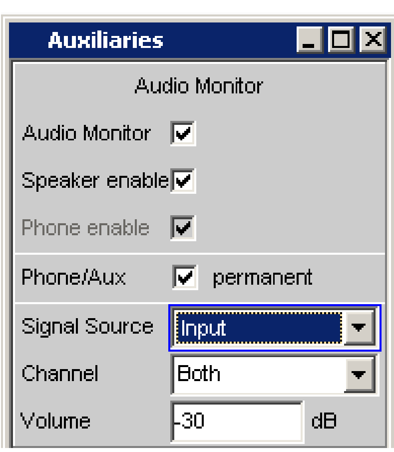


The monitoring output allows you to monitor internal generator signals regardless of whether you are dealing with the analog or the digital generator. Both generators are based on digital signal generation using DSP on the digital main board (DMB). This digital control signal is fed within the DMB to the monitoring DAC via an FPGA. This DAC is operated with the same clock frequency as the main DAC (in Generator Config Panel under "Bandwidth").
The signals at the outputs (jack on the front panel of the instrument) are directly linked to the output configuration and the signal shape for the selected generator:

- For example, if "Sinewave" or another single-channel generator channel is selected in the Generator Function Panel, the same signal will be present on both outputs.
- If any setting besides "2 = 1" is selected in the Generator Config Panel, then only the selected output will have a signal. The other output will be switched off.

In the case of the functions "Sinewave with low distortion generator" and "DIM" (in the Generator Function Panel), it is not possible to monitor the generator signal due to the different signal generation.

Monitoring External Audio Signals



External signals applied to the analog analyzer inputs can also be monitored. After the level stage, these dual-channel input signals are each fed to the DMB via a buffer for decoupling from the AAB (AAB_INPUT_MON1 and AAB_INPUT_MON2).
On the DMB, these signals pass via analog antialiasing lowpass filters to a stereo audio ADC which generates digital audio data based on the signals it receives. The clock frequency of the ADC is 96 kHz independent on the setting for the analyzer bandwidth. For monitoring purposes, these data are fed (as in the previous case) to the monitoring DAC and output as selected on the three outputs described above.

The input configuration selected in the Analyzer Config Panel determines whether single- or dual-channel monitoring is possible.

R&S UPV-B1 (Low Distortion Generator)

(See also Fig. 3-3 Block diagram, low distortion generator)

The low distortion generator (LDG) is an RC oscillator which generates a sinewave signal with very low noise and harmonic distortion in the frequency range from 10 Hz to 185 kHz with a constant level of $V_{rms} \approx 2.70$ V.
In conjunction with the "Sinewave" generator function in the Generator Function Panel, it can be switched on as a signal source instead of the universal generator by checking the tickbox for Low Dist Gen in the same panel in the line below.

The subassembly is installed on the analog audio board (AAB) over the universal generator and is connected to the analog generator using a ribbon cable.
An FPGA on the AAB handles the control of the low distortion generator. When it is powered on, the R&S UPV automatically detects the option. The software checks whether the data transmitted to the LDG can be read back for use in setting the hardware. During this procedure, the version number is simultaneously read out from the subassembly. It is entered into the file "c:\eepromdump.txt".

The oscillator operates based on the principle of a state-variable oscillator:

Two integrators are connected in series with feedback via an inverter. This results in a phase rotation of 360° so that the circuit will oscillate. Automatic level control ensures a stable sinewave oscillation with a constant amplitude.

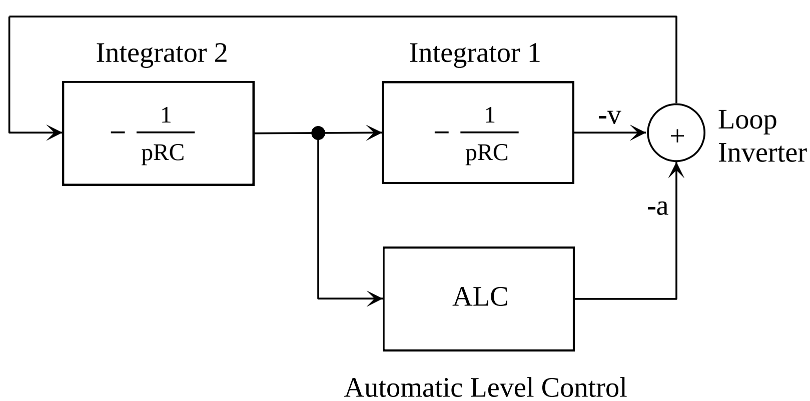


Fig. 3-3 Basic circuit principle for the LDG

The oscillator’s frequency of oscillation is set using the time constant 1/RC of the integrators and the gain v of the inverter:

$$f = \frac{\sqrt{v}}{2\pi\ RC} \quad where \quad \sqrt{v} = \sqrt{0.98} = 0.99$$

The amplitude error caused by the tolerance of the voltage reference (± 5%) in the automatic level control is determined using a compensation measurement and compensated by the software when setting the level (compensation factor cf_ldg_sin).
At the output of the oscillator, an amplifier can also be connected which can attenuate the level with a resolution of 12 bits (IMD ATTEN). This amplifier is used only when generating very low levels (< 62 µV).

The entire frequency range from 10 Hz to 185 kHz is divided into four ranges which are switched using capacitors. The frequency error caused by the tolerance of the four range capacitors (± 1%) is determined for each range using a compensation measurement and compensated by the software when setting the frequency.
Within a given range, the frequency is set by the resistor R with a resolution of 16 bits. The resistor tolerance is ± 0.1%.

Frequency range	Compensation factor	Frequency
185 kHz to 25 kHz	cf_ldg_frq[0]	50 kHz
25 kHz to 1.9 kHz	cf_ldg_frq[1]	10 kHz
1.9 kHz to 190 Hz	cf_ldg_frq[2]	1 kHz
190 Hz to 10 Hz	cf_ldg_frq[3]	100 Hz

In order to determine the compensation factors described above, there is an automatic routine available which is invoked in the diagnostic panel in the "Adjustment" box using "Exec". No test equipment is required.

Due to the extreme requirements for the distortion factor of the circuitry, only capacitors with dielectric material made of NP0 ceramics (range to about 10 nF) or polypropylene (range to about 1000 nF) are suitable for the integrators. Polypropylene has a typical temperature coefficient of -250 ppm/K = -0.025 %/K. This means the frequency will decrease by 0.25 % for a temperature increase of 10° Celsius.
There is a sensor on the AAB which measures the temperature in the temperature coefficient R&S UPV cyclically. Using this information, the software can take into account the typical temperature coefficient of the capacitors: The value of the capacitor C given in the formula above for the computation of the oscillation frequency is not constant because it is temperature-dependent. In this manner, it is possible to considerably reduce the frequency drift that occurs vs. temperature. The temperature influence is corrected only in case of a new setting or when the generator frequency is confirmed.

R&S UPV-B2 (Digital Audio I/O 192 kHz)

The option R&S UPV-B2 (Digital Audio I/O 192 kHz) allows you to use the R&S UPV to make measurements on digital audio interfaces with sampling frequencies in the range from 30 kHz to 200 kHz. With the additional option R&S UPV-K22, it becomes possible to also make impairment measurements and to measure the physical interface parameters.
The option consists of two subassemblies: the digital audio board (DAB, A20) and the digital front panel (DFP, A21) which contains the digital interfaces for the front panel of the R&S UPV. The DAB is installed over the digital main board (DMB, A2) and is connected using plug-in connection X20.
The DFP is connected to the DAB using the 26-pin ribbon cable W2.

Digital Front Panel (DFP)

The digital front panel contains the circuit parts for the digital audio inputs and outputs.
(see DFP block diagram Fig. 3-19)

Digital audio outputs:

The digital audio outputs (BAL, UNBAL and OPTICAL) are always available simultaneously. The adjustable pulse amplitude of the BAL and UNBAL outputs is set using potentiometer R13. The BAL output amplitude is always greater than the UNBAL output amplitude by a factor of 4. By switching on a corresponding filter, you can activate the long cable simulator for the BAL and UNBAL outputs.
A common signal to be superimposed on the BAL output (with option R&S UPV-K22) is fed in from the DAB via the amplifier directly on the BAL output transformer (COMMON-TX).
A switch on the subassembly makes it possible to reproduce the digital audio signal from the selected BAL or UNBAL input directly on the digital audio UNBAL output in order to monitor, for example, the BAL input signal on a oscilloscope.

Digital audio inputs:

The digital audio inputs (BAL and UNBAL) are connected via amplifiers and a comparator to the input multiplexer which is used to select the desired digital audio input (DIG-RX). Besides the optical input, a position is also possible internally which provides the signal supplied by the DAB (DIG-TX) back to its input for use in making an internal loop measurement.
The analog common signal superimposed on the BAL input is tapped off on the input transformer and fed via an amplifier to the X2 interface (COMMON-RX). The digital pulse amplitude from the BAL or UNBAL input is measured using a rectifier and the DC voltage which is measured is fed via X2 to the DAB (AES AMPL). Following an analog multiplexer on the DAB, these voltages can be processed and evaluated by the analyzer.

Digital Audio Board (DAB)

(see DAB block diagram Fig. 3-20)

The DAB contains the following functional groups:
- Digital audio interface receiver Rx1, Rx2 (analyzer)
- Digital audio interface transmitter Tx1, Tx2 (generator)
- Clock generator for digital audio generator and sync PLL
- Jitter modulator and demodulator, frame phase meter and jitter reference PLL
- Rear-panel interface for digital audio (SYNC IN/OUTPUT and digital AUX IN/OUTPUT)

Digital audio interface receiver:

The digital audio interface receivers (Rx1 and Rx2) installed on the subassembly have a VLSI design and decode the audio data and clock from the digital audio input signal or the audio aux input signal for further processing in the instrument.
The clock which is recovered from the receivers is used also for phase measurement, jitter analysis and synchronization of the audio generator to the digital audio input or the digital aux input. The modules are controlled serially via an SPI interface.

Digital audio interface transmitter Tx1, Tx2:

The digital audio interface transmitters (Tx1 and Tx2) installed on the subassembly have a VLSI design and generate standardized digital audio signals from the serial audio data and a corresponding clock for the digital output of the instrument on the front panel or the aux output on the rear panel. The Tx2 module is normally used as a digital audio reference generator. With the reclock function, the serial audio data from Rx1 are fed directly to Tx2. The clock for Tx2 comes from the jitter reference PLL which generates a low-jitter reference clock from the digital audio input clock from Rx1.
The modules are controlled via an SPI interface. Depending on the operating mode of the subassembly, the transmitter modules are switched to the corresponding clock or data source.

Clock generator for the digital audio generator and sync PLL:

The internal clock generation for the digital audio or the aux generator involves the use of a DDS module which gets its timing from the reference clock on the DMB. The DDS generates the master clock frequency needed for the sampling rate setting of the Tx1 and Tx2 modules.
The generator sync PLL is needed for synchronizing the digital audio generator to an external word clock signal. It is also used for the frame phase offset of the digital audio generator. Using a D/A converter, the corresponding phase is set between the digital audio reference generator and the digital audio generator. The PLL has three ranges for the entire sampling frequency range. The proper range is assigned based on the input of the sampling frequency of the digital audio generator.

Jitter modulator and demodulator, frame phase meter and jitter reference PLL:

Jitter generation and jitter measurement (with option R&S UPB-B22) on the digital audio generator or analyzer involves the use of phase modulation or demodulation of the master clock which provides timing for the Tx1 module or which is recovered from the integrated PLL in the Rx1 receiver.
The jitter modulator for the Tx1 module receives its modulation signal from the instrument's analog generator. An analog multiplexer selects channel 1 or channel 2 (with option R&S UPV-B3) from the analog generator for this purpose.
The jitter demodulator provides a jitter interference signal superimposed on the Rx1 clock signal which is measured with the analog analyzer. The low-jitter reference signal for the demodulator comes from either the jitter reference PLL or the internal (DDS) clock signal of the digital audio generator. The jitter reference PLL has three ranges which are assigned based on input of the analyzer sampling rate.
A phase meter determines the frame phase offset between the digital audio input (Rx1) and the digital aux input (Rx2).
Depending on the instrument's operating mode, an analog multiplexer switches the desired analog measurement signals to the proper analog analyzer channel 1 or 2. This involves the signals from the DFP for the digital input amplitude and the common mode signal on the one hand and the frame phase measurement signal and the demodulated jitter signal on the other hand.

Rear-panel interface for digital audio:

The DAB contains the connector jacks on the instrument rear panel for SYNC IN/OUT and for digital AUX IN/OUT of the option.
The sync input or the digital aux input practically always have a fixed function and are used to synchronize the instrument to suitable signals (word clock or digital audio) and to measure the frame phase.
Depending on the operating mode and selection, the sync output and the digital aux output can provide different signals.
This means it is possible via a digital multiplexer to output different generator (Tx1, Tx2) or analyzer (Rx1, Rx2) clock signals on the sync output. The clocks of the generator sync PLL and the jitter reference PLL are also available for selection.
The digital audio aux output is used primarily as a reference generator (Tx2) output. Alternatively, it is also possible here to output the looped-through digital input signal, the digital audio generator signal or the reclock signal.

R&S UPV-B3 (Second Generator)

(See Fig. 3-21 Block diagram second generator)

In terms of the circuitry involved, the second generator has a design which is identical to that of the analog generator on the AAB with few exceptions. In terms of the signals, it is connected directly into the generator unit of the AAB via X42. While the universal generator is responsible for generating all of the other signal shapes, the option R&S UPV-B3 is used to generate either the second sinewave signal for the stereo sinewave or a DIM signal. The circuit includes its own DAC, its own final stage and its own attenuator. This makes it possible to output the two sinewave signals with different levels.

Switching of the output impedance is possible only in conjunction with the universal generator. The switching facilities are housed on the AAB instead of on the second generator board. This circuit part is also used by the analog generator on the AAB if no option is installed but "2 = 1" is selected as the output configuration.

DIM generation:

The master clock frequency of 24.576 MHz (divided by two) is fed to an FPGA. This module is implemented as a programmable divider that uses the 12.288 MHz to generate a squarewave voltage of 5.88 kHz or 6.3 kHz by applying different division factors depending on the setting in the generator function panel in the line “Square/Sine”. For the best possible precision in the duty cycle of 50%, the squarewave signal passes to the input of a D-flipflop which performs another division by a factor of two. The subsequent amplifier stage limits the bandwidth to 30 kHz or 100 kHz. Its output signal is now added with the level-adapted sinewave signal from the DAC in order to generate the standards-compliant DIM signal. This signal is then fed prior to the level stage into the signal path known from the analog generator on the AAB.

The option R&S UPV-B3 is supplied with the same DC voltages as the universal generator, but they are decoupled from one another in order to improve the crosstalk.

R&S UPV-B20 (Digital Audio I/O 48 kHz)

The option R&S UPV-B20 (Digital Audio Option 48 kHz) is a low cost variant of the well known R&S UPV-B2 (see DAB block diagram Fig. 3-20). The max. sample rate is 55 kHz. With the R&S UPV-B20 it is not possible to create impairments or any external synchronisation.
The above described Digital Frontpanel (DFP) is identical to that one used with R&S UPV-B2 and is connected in the same way.
Because of this option has no connectors on the rear of R&S UPV, the openings remain closed by covering plate.
The board is connected to the DMB in the same way as the R&S UPV-B2.

R&S UPV-B41 (I^2S Interface)

The option R&S UPV-B41 (I^2S Board) allows you to use the R&S UPV to make measurements on I^2S interfaces with sampling frequencies in the range from 6.75 kHz to 410 kHz. The I^2S Board is installed in one of the two extension slots at the rear of the UPV.

On the I^2S board there is a FPGA, which is loaded from DSPs, an EEPROM, two PLLs, a DDS generator and some buffers.

The EEPROM is used to identify the board. In the FPGA a conversion of the I^2S format takes place from 32 bit wordlength to 24 bit and 16 bit wordlength. The masterclock to monitor audio signals and the masterclock for the mode „Generator extern Wordclock Sync“ is generated by PLLs. The DDS generator is used to generate the masterclock in mode “Generator intern Sync”.

R&S UPV-B42 (Universal Serial Interface)

Basic principle:

The option consists of an digital extension card, the “UPV-B42 Universal Serial Interface” which can be plugged in an extension slot of the UPV, as well as an external probe board to offer short connections between the generated or analyzed signals and the measured device under test. The Probe can be seen as a simple signal repeater since no measurement functions are performed in its internal logic. Both options are connected via a 50 pole D-sub cable included in the option.

Universal Serial Interface board:

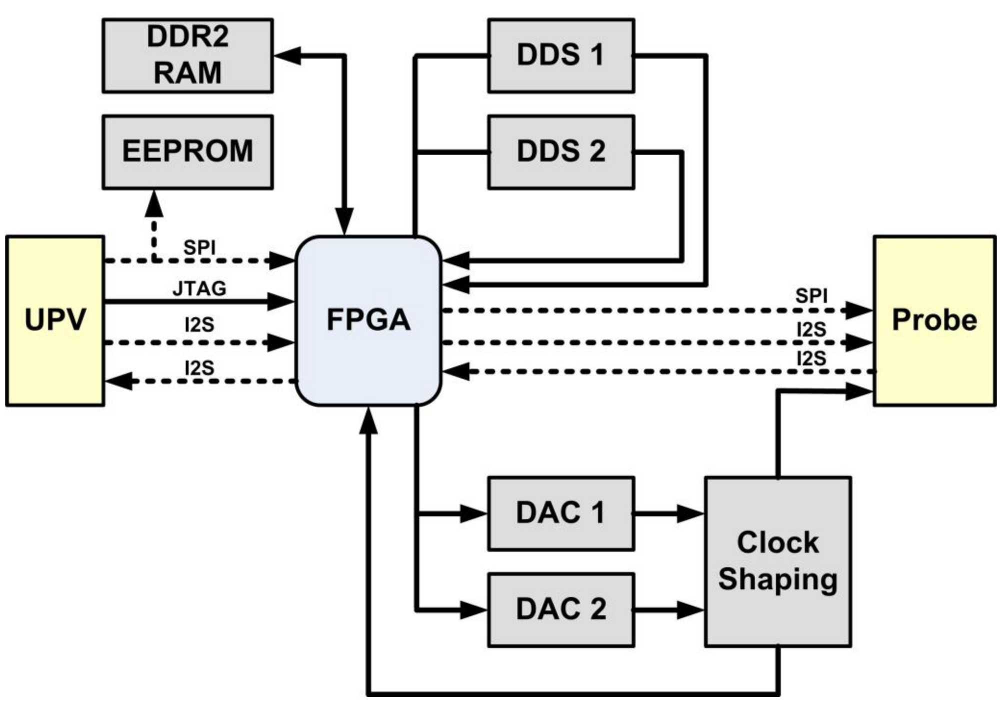
As one can see in the figure, the USI board mainly consists of a Stratix II FPGA, a DDR2 RAM, a EEPROM, two DDS frequency synthesizers as well as a pair of dual channel DACs.

The FPGA includes the control logic of the system. It interfaces the R&S UPV DSP section via I²S and receives its configuration Data via an SPI interface.

The Stratix II controls the external DDR2 RAM for buffering data in 8 channel measurement mode, since the DSP interface can only handle two audio channels simultaneously.

The two DDS components are used to generate board internal reference clocks for the internal synchronization mode which drive the FPGA internal PLLs. In external synchronization modes the reference clocks are provided by a device under test and are fed trough by the probe.

Two dual channel DACs are used to translate the digital sine waves for the masterclock and the double rate bitclock generated by the PLLs into the analog domain. These signals are then shaped into rectangular pulses by the adjacent comparator array included in the clock shaping section and fed back into the PLLs to close the control loop as well as forwarded to the probe board to clock its internal logic.

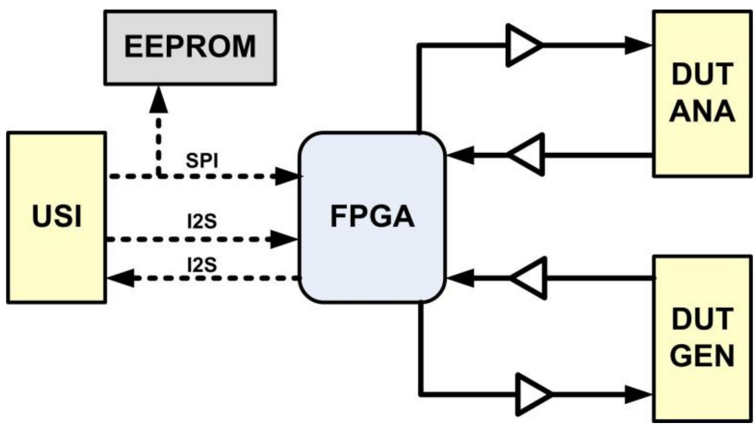


Block diagram USI board

Probe board:

The sketch provides a rough overview of the probe. As one can see it basically consist of a central Virtex 4 FPGA and a few voltage regulators to adapt the FPGA outputs to the configured voltage level.

The Virtex 4 can be configured to adapt to different logic voltage levels by changing its programming file via a booting mechanism initiated by the USI FPGA. Other than that it only includes a few FIFOs to decouple clock domains, and basically serves as a relay station between the USI board and the device under test to enable very short connections between the option and the measured circuitry.



Block diagram Probe

R&S UPV-B48 (Analog 8 Channel Inputs)

(See Fig 3-24 Block diagram)

The option consists of an analog and a digital section. The analog section is an 8 channel audio analyzer. Any of the input channels can be served commonly or independent from each other. All 8 inputs are available on a 25 pole D sub connector with TASCAM pinning. To get XLR connectors, which are common in the audio world, use a multicore cable (e.g. 1401.7709.02)

Analog Section

The 8 channels involve five ranges from 0.2 V to 50 V in 12 dB steps with a bandwidth from DC to 40 kHz. The inputs can be ac coupled alternatively to suppress superimposed dc voltages.

The input signal is led directly to the input amplifier or through an input divider, dependent on level.

The input resistor divider can decrease the input level by -24 dB. The selectable gain is 0 dB, +12 dB or +24 dB respectively. An antialiasing lowpass in front of adc limits the input spectrum to maximum 40 kHz.

The input signal is monitored by a peak detector independent for each channel. These detectors can report overrange as well as underrange condition.

The links to digital section are two quadruple AD converters, which convert the measured analog signals into the digital domain.

Digital Section

The digital section consists of a FPGA, a data RAM and an E^2PROM.

The FPGA is the main control center of the board. This component controls the gain of each channel via the relais, receives the digital signals from the ADCs and manages the audio data between RAM and DSP. The DSPs on digital main board (DMB) can only handle the data for 2 channels at a time. Therefore the signals from the other 6 channels must be stored in DDR-RAM in the meantime. So the FPGA also works as a data multiplexer. Additionally the over- or underrange information is led to the DSP via the FPGA.

The EEPROM contains the board ID and all of the calibration factors for gain and dc offset. By reading out the R&S UPV recognizes the installed option and read out the necessary calibration factors to show the exact measurement results on numeric display.

Supply Section

There are a lot of different supply voltages on the board.

±11 V are required for the opamps of the 8 analog channels. These voltages are created by linear regulators out of ±12 V, which are delivered from the power connection board (PCB). Each analog channel use its own pair of linear regulators.

A central switching regulator creates +6 V out of +5 V from PCB. From this +6 V the +5 V for relais are derived just as the very clean +5 V for the ADCs. The same is valid for the +3,3 V for the ADC clock. All supply voltages for the ADCs are additionally cleared of superimposed ac parts by linear regulators.

The ordinary digital components are provided by the +3,3 V from the PCB directly, only decoupled by a ferrit and big capacitors.

The FPGA and the RAM are supplied with +0,9 V, +1,2 V and +1,8 V created by some switching regulator modules.

R&S UPV-U1 (Source Impedance 150 Ω)

The audio analyzer R&S UPV offers in the Generator Config Panel three different source impedances, if the output type „Bal“ is selected:

- 10 Ω
- 200 Ω
- 600 Ω

Instead of 200 Ω the source impedance can be changed to 150 Ω by installing the R&S UPV-U1 option. This impedance is more common in the USA.

To change the source impedance the R&S UPV-U1 option contains eight 75 Ω SMD resistors, which must be soldered on the fee pads in the area of generator output channels. Due to this parallel connection of additional resistors the value of output impedance is decreased to wanted 150 Ω.

To inform the firmware that output impedance has changed an entry must be made in the diagnostic panel as described in chapter 4. As a result the displayed impedance in the Generator Config Panel is correct.
The option contains two adhesive labels which can be affixed on AAB and on the rear of the device as a hint for an installed option R&S UPV-U1.

R&S UPV-U2 (BNC Phone Out)

In its basic configuration, the R&S UPV is equipped with a jack on the front panel of the instrument which can be used to monitor audio signals with a set of headphones. However, in many cases you will want to monitor the signal shapes on an oscilloscope. The built-in 6.3 mm jack is not suitable for this purpose or a non-standard adapter is needed (see Chapter 1).

Using the option R&S UPV-U2, exactly the same signals which are output on the front-panel jack are fed to the rear panel of the instrument via two BNC jacks (i.e. the same output amplifiers are used). For a functional description of this feature, we recommend that you read the section on the Monitoring Output.

Both outputs have an impedance of about 600 Ω and provide protection against short-circuits.

Function Test

The settings and tests described in the following are used to quickly check the instrument's general functionality, without the use of external measuring equipment inasmuch as this is possible. They cover only part of the generator and analyzer functions and are used to test the instrument after options have been installed or modules exchanged.

Self-Test

Check the AC supply voltage on the wall socket and whether the R&S UPV is set to this voltage. Then connect the instrument with the AC supply.

The backlighting of the display must then light up, and the hard disk (HDD) and the BIOS must start up. The BIOS performs the following tests:

- Memory test
- Serial and parallel input and output check
- HDD and combo drive check

Next, the operating system is booted. Subsequently the R&S UPV application program starts up and performs the following:

- Checks the DMB, reads out the board ID
- Checks the firmware version
- Loads the FPGAs for controlling the analog modules
- Starts the DSPs
- Runs a plausibility check of the correction factors in the E^2PROMs
- Monitors the analyzer overrange and overload check and the generator overload check

Now the user interface starts up and the instrument is ready to operate. If the instrument does not reach this state, you must perform the relevant tests described in the section Troubleshooting.

Short test of analog interfaces

This short test lets you quickly check the analog interfaces of the R&S UPV. No cables or measuring equipment are required. The analyzer measures the generator signal via the internal connection.

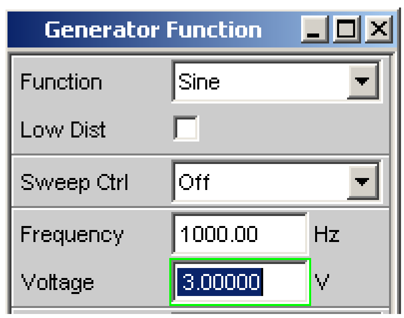
Before starting the short test, set the R&S UPV to a defined initial status by calling up the default setting:

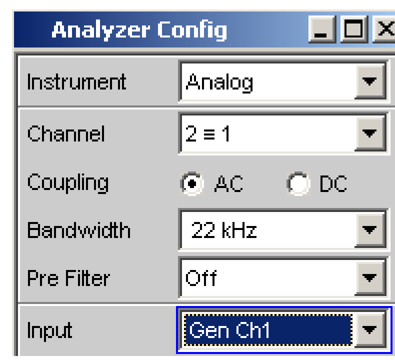
Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select *Preset (Load Default)* in the submenu.

Set the R&S UPV:





In the Analyzer Function panel, set RMS as the measurement function and then set THD+N & Sinad.

Test the specifications for THD+N, RMS level and frequency in line with the valid data sheet. If the option R&S UPV-B1 (Low Distortion Generator) is installed, then repeat the above test with the low distortion generator switched on (activate the Low Dist checkbox).

To complete the short test, it is advisable to test the monitoring output. You can use the setting from chapter 1 "Audio Monitoring Performance Test" for this test. For this purpose, the internal loudspeaker must be activated.

If this test yields a positive result, the following modules are functioning properly:

- The monitoring output and the part of the DMB that is responsible for the control of the analog section
- Analog generator and analyzer (AAB)
- Low distortion generator (if installed)

Short test of digital interfaces

This short test lets you quickly check the digital interfaces of the R&S UPV. No cables or measuring equipment are required. The analyzer measures the generator signal via the internal connection. If the option R&S UPV-B2/B20 (Digital Audio I/O) is not installed, you can omit this test, for it is not necessary.

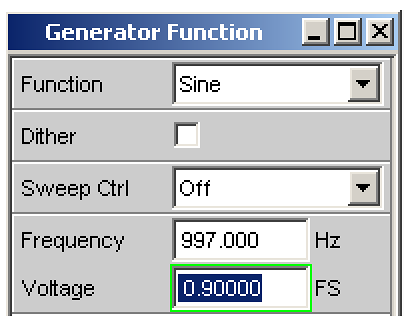
Before starting the short test, set the R&S UPV to a defined initial status by calling up the default setting:

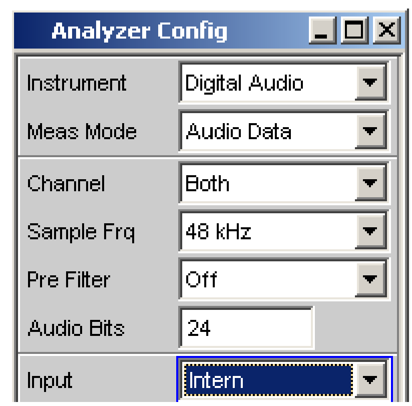
Press the PRESET key and confirm your input request with "↵"

or

Press the MENU key and select *Preset (Load Default)* in the submenu.

Set R&S UPV: Digital Audio





In the Analyzer Function panel, set RMS as the measurement function and then set THD+N & Sinad.
Test the specifications for THD+N, RMS level and frequency in line with the valid data sheet.

The monitoring output can be tested in the same way as described above, because switching to Digital Audio now automatically taps the signal of the digital generator or analyzer. For this purpose, the internal loudspeaker must be activated.

Troubleshooting

Many faults have simple causes that can be traced without the need for numerous accessories. Since the R&S UPV has a generator and an analyzer, loop tests can be carried out for fault analysis in greater depth, whilst the ability to connect the generator and analyzer internally means that not a single external cable need be used.

The troubleshooting instructions generally enable the cause of a fault to be narrowed down to the module level, so that the instrument can be returned to operational readiness by replacing a module.

We strongly recommend that a faulty instrument should be sent for module replacement to our specialists in the Service Center (see enclosed address list), in order to avoid further faults due to knock-on effects.

CAUTION

Make sure the instrument is disconnected from the AC supply before installing or replacing a module.
Take great care never to create a short-circuit when measuring voltages.

Note:
If problems occur, start by checking whether all cables are correctly plugged in and are showing no trace of damage.

Measuring equipment and accessories

Measuring equipment	Characteristics	Recommendation
Digital multimeter	ACV, DCV, Ω	HP3458A
Frequency counter	Including option PM9691/011, extremely stable oven oscillator for PM 668x	PM6680
Audio analyzer		Reference R&S UPV
Signal generator		DUT R&S UPV
Sinewave generator		Reference R&S UPV
Oscilloscope	Multichannel, memory	TDS 3000 Series
75 Ω BNC cable		
TOSLINK cable for optical interfaces		
XLR cable		

Error messages

The first hint of possible operating problems in the R&S UPV may be an error message which is displayed due to an incorrect setting or because a hardware fault has been detected.

If there is an incorrect setting, you will be told what needs to be changed in the input in order to eliminate the error.
Example: Attempting to switch on an option which has not been installed, or entering a value that is outside the permitted range.

Power-up problems

Symptom	Possible cause
The R&S UPV fails to boot after switching on, and the HDD cannot be heard running.	• Is the power cable connected? • Fuses OK? If the AC supply fuse has blown, check if the correct supply voltage has been set.

For any further troubleshooting open the instrument and proceed as follows:

- ➢ Is the cable from the APS to the switching power supply plugged in?
- ➢ Measure the output voltage from the switching power supply (see relevant chapter).
- ➢ Take measurements on the PCB.

Boot problems

Symptom	Possible cause and/or remedial action
The R&S UPV appears to boot, but the screen stays black.	• Is R&S UPV fitted with FMR7? If yes, possibly it is an older board, which needs an additional capacitor on the pins near the beeper. First it must be clarified if a DMB is built in with such a capacitor on board (see Service Info Nr. 11014)
The R&S UPV appears to boot, but the screen stays white.	• Is the white cable from the LCD adapter board to the LCD properly plugged in?
The R&S UPV boots up after switching on, but error messages appear, for instance saying among other things that the HDD cannot be detected.	• Is the operating voltage cable for the HDD connected from the controller? • Is the HDD adapter correctly plugged in? • Is the 80-pin ATA control cable plugged in? (not with FMR9)
The R&S UPV boots correctly, but hangs when the R&S UPV application program starts.	• Fault on the DMB or in a DSP module? (For troubleshooting instructions see Troubleshooting tip)

Troubleshooting tip:

If the R&S UPV hangs during the boot phase when the application program is displayed, the cause may be on the DMB or in a DSP module.
To receive detailed error messages, it is recommended that you proceed as follows:

- Switch the R&S UPV off and then on again.
- If the application program is displayed with a "Cancel" button lower left (for two seconds), click on this button. This halts loading of the R&S UPV firmware.
- Go to the directory **`c:\upv\bin`** and start the program **`ui.exe`**. The application program then starts without the software platform and generates error messages on the screen whilst running.
- **Log files** are created in the same directory **`c:\upv\bin`** during the start routine. These are simply text files which store details of the detected errors in plain text and can be read with a text editor. From these it is possible to determine how far the program reached, e.g. within the initialization. Typical error messages can look like this:
  DSP-G1 not responding. This means that an error occurred during initialization of the Generator DSP module (it is not possible to say whether the Analyzer DSP module is OK).
  DSP-B1 not responding. This means that an error occurred during initialization of the Analyzer DSP module. The Generator DSP module is definitely OK, because the initialization has run without error.
  A totally different reason for this error message can also be a missing power supply of the analog analyzer. The error message only appears in case of operating the device. Therefore it is useful to measure the voltages on the AAB first.

  The log files are always called **`Host_x.log`** where **`x`** stands for a variable text. If this text part contains a five-digit number, it means that no errors were detected in this log file. If no number is present, the log file contains details of errors which can be very useful for troubleshooting. Swapping out one or both DSP modules on a trial basis can make it clear whether a fault is present on the DSP modules or the DMB.

Problems with Control and Display Elements

The tests performed here cover the instrument's control elements (front-panel keyboard and rotary knob) and the external entry media (external keyboard and mouse) that are connected via one of the four USB interfaces.

If control elements sometimes respond in an undefined or unexpected manner, an invalid or corrupt setup may have been loaded. In such a case, proceed as follows:

- Press the PRESET button on the front panel of the R&S UPV while the application program is being started and the Cancel button is displayed (for approx. 2 seconds) in the bottom left-hand corner. This step ensures that the instrument is <u>not</u> started with the previously saved (possibly corrupt) setup but with the default state.

Front-panel keyboard

The instrument keyboard test is limited to testing the response of a few keys. Since the entire key mat is configured in rows and columns, the proper selection ensures that the connection to the controller detects all rows and columns.

To check whether all keys on the front panel are functioning properly, select one key for each row and column and check its response when you press it.

Key	Selected panel	Action
Cursor right and left	Generator Config panel	In the Ref Voltage field, the blue background disappears and a vertical bar is shifted back and forth by using the cursor keys
Numeric key 0	Generator Config panel	In the Ref Voltage field, a zero is added if you press the key
Speaker ON/OFF	–	Press key → LED must flash
Output OFF	–	Press key → LED must flash
F10 (softkey)	Generator Config panel	Select the unit **dBm** in the Ref Voltage field
Help	–	Press key → HELP must open
Page	HELP text	If you are in the left column containing the keywords, you can scroll to the right within this column by pressing key

➢ No response when key pressed?
- Is a print job currently running in the background?
  Operation is temporarily not possible while data is being sent to the printer.
- Are the green flexible conductor tracks from the front-panel keyboard to the FMC plugged in?
  Make sure that they are seated properly in the socket. Some of the keys can fail even if the tracks are slightly out of line.

Rotary knob

- No response to rotary knob?
  - Have you plugged in the cable from the rotary pulse generator to the FMC?
  - Does the current setting in the R&S UPV program prevent a rotary knob entry?
    For example, if the entry marker is on a graphical window without a pointer, the rotary knob is not functioning.

  Test: Move the entry marker to the beginning of a panel and try to move the marker up and down within the panel by means of the rotary knob (blue field in the entry field).
  If you do not succeed, either the rotary pulse generator or the corresponding circuit on the FMC is defective. To localize the error more exactly, you can connect another rotary pulse generator – if available – to the FMC and repeat the test.

- Is rotary knob difficult to move?
  - Is the control knob incorrectly installed?
  - Is something causing a jam between the control knob and the front panel?
  - Is the rotary knob axis bent?

- Pressing the rotary knob has no effect?
  - Does the current R&S UPV program setting not allow a rotary knob entry?
    For example, if the entry marker is on a graphical window without a pointer, the rotary knob is not functioning.
    Either the rotary pulse generator or the circuitry on the FMC may be defective.
    → See replacement of the rotary pulse generator.

- Rotary knob cannot be pressed?
  - Is something causing a jam between the control knob and the front panel?
    If not and no other error is apparent, the rotary knob mechanism is defective.
    → See replacement of the rotary pulse generator.

Front-panel LEDs

The LEDs on the front panel have various meanings.
Status message: START, SINGLE, Speaker ON, REM, OUTPUT OFF
Warnings: Generator OVLD, Analyzer OVLD

Press key	**Effect**
STOP / CONT	The START LED must be flashing.
SINGLE	In addition to the START LED, the SINGLE LED also illuminates. After a short time both go off.
Speaker ON	The ON LED must be flashing. You will hear a tone only if other settings are set accordingly. However, this does not affect the function of the key and the LED.
LOCAL	If the instrument is in the remote-control mode, the REM LED illuminates and the instrument cannot be operated via the keyboard. By pressing the LOCAL key, you can cancel the remote-control mode on the R&S UPV and the LED will go off.
OUTPUT OFF	The OUTPUT OFF LED must be flashing. By pressing this key, all outputs are switched off and on again.

The warning LEDs cannot be activated simply by pressing a key. Instead they indicate impermissible operating states.
For example, short circuit at the generator outputs causes the output stage to be switched off and the **Generator OVLD** LED to illuminate. At the same time, the **OUTPUT OFF** LED also illuminates to indicate that the generator has been switched off.
If the voltage to the analyzer inputs is too high and a low input impedance (300 Ω or 600 Ω) has been set, the **Analyzer OVLD** LED will illuminate. Additionally, the input impedance is switched to 100 kΩ to protect the input.

- Pressing the key has no effect?
  - Are the green flexible conductor tracks connected to the PCB.
    Make sure that the tracks are seated properly in the socket. The LEDs can fail even if the tracks are slightly out of line.
  - Is the R&S UPV in the HELP mode?
    The instrument will not respond to keystrokes that effect a measurement until the HELP window has been closed again.

At the R&S UPV66 the actual settings can be indicated by the LEDs, which are placed on the frontpanel instead of the internal monitor. They are mounted on a little board, which is connected to X24 on DMB via a 10 pole flat cable. Over this connection the board gets ground, the supply voltage of +3,3 V and the control signals.

Possible Errors:

- The LEDs remain dark
  The flat cable is plugged in on both ends. Check both sides (LED board and DMB), if it is plugged in correctly.
- The LEDs shine wrong or partly not at all
  One possibility is a incorrect FW (for example the variant for R&S UPV, but not for R&S UPV66). In this case there is no HW error, but the LEDs are used as internal monitors for the DSP activity and don’t reproduce the R&S UPV66 condition.

External keyboard

You can connect an external keyboard via one of the USB interfaces.

➢ <u>No response:</u>
- Is the keyboard cable properly plugged into the USB socket?
  If the connector is not properly inserted into the socket, the instrument cannot detect the keyboard.
- Is the cable from the USB interfaces on the front panel inserted in the FMC.
  The two USB interfaces on the front are connected directly to the FMC via a flat cable.

Test: Move the entry marker (blue field in the entry field) within a panel by using the Up/Down keys or change the existing value within an entry field.
If nothing happens when you press the key, connect the external keyboard to another USB interface and repeat the test (switch between the USB interfaces on the front panel and rear panel of the instrument).
In case of a negative result, repeat the test with another keyboard if available.
The USB interface that is used is also checked during this test. If the external keyboard functions properly on the front sockets, the DMB may be defective since the USB sockets at the rear are routed to the FMC via the DMB.

Note:
If you connect the external keyboard while the instrument is running, problems in detecting it as a USB device may occur. Therefore, connect the keyboard before you switch on the R&S UPV.

Mouse

A standard mouse can be connected to one of the USB interfaces, allowing you to operate the R&S UPV in the usual manner for Windows operating systems.

If the connected mouse does not function at the selected interface, connect it to another interface to check whether the interface selected first is defective (switch between the USB interfaces on the front panel and rear panel of the instrument).

The USB interface that is used is also checked during this test. If the mouse functions properly at the front connectors, the DMB may be defective since the USB connectors at the rear are routed to the FMC via the DMB.

The first sign of a problem may be the failure of the internal LED to illuminate when using an optical mouse, which indicates that the operating voltage is missing at the selected interface.

USB cable test

USB cables of good quality are required for EMI suppression and stable connections.

However, according to our experience USB cables are of varying and often poor quality.
This concerns the connection between the cable shield and the shield contacts of
the connectors.

Cables of poor quality may cause EMI interference and poor connection quality. EMI interference, among other things, may ultimately lead to measurement errors. Poor connection quality may create problems like increased latencies that are due to retransmissions because of data corruption or may even lead to a complete loss of data connection.

Therefore, we recommend checking every USB cable using the following easy method:

Measure the electrical resistance from the shield contact of one connector to the shield contact of the other connector. For correct measurement results, consider the contact resistance at your probe tips. Good cables have a value of less than 0.6 Ω according to USB standards.

Also check, whether the resistance is stable when you bend the cable.

Fault in the switching power supply / power connector board

As a rule the only measuring instrument needed is a digital DC voltmeter. For the location of the test points on the PCB see Fig. 3-4.

Note:
If there is a fault in the switching power supply or on the PCB, in certain circumstances the AAB controls is also affected, so that the analog section is also unable to function.

Switching power supply (SPS)

An error on SPS have an effect to the complete device, the R&S UPV shows no reaction to the ON button:
- the R&S UPV can not boot, because the supply voltages to the FMR are missing.
- the AAB can not be controlled, because the DMB has no supply voltages .

Checking the switching power supply consists of no more than measuring the output voltages. So that the connector pins specified in the following table can be reached for test measurement purposes, it is necessary beforehand to remove the HDD complete with its cable connections from the front frame and carefully lift it out of the way.

Measurement: Checking the individual DC output voltages

Voltage	Connector pin	Minimum load
+5 V	SK3 pin 2	2 A
+12 V	SK2 pin 1, 2	0 A
–12 V	SK2 pin 6	0 A
+24 V	SK2 pin 8	0.5 A

➢ Output voltages for PCB are missing?
- are all cables plugged in at the mains input?
  is one of the flat connectors at mains input interupted, is the circuit delivered by no or too low voltage?
- is the cable from toroidal core transformer to APS board (X1) plugged in?
  this connection delivers the mains voltage to the ON button.
- is cable from APS board to SPS (X14) plugged in?
  this connection delivers the input voltage to the SPS.

➢ Unreproducable problems with higher temperatures
Is the R&S UPV fitted with FMR7 or FMR9, so the SPS need better cooling. This is managed by an additional fan, which is mounted left from SPS. If the connector to PCB is imperfect or broken, the fan is not able to carry out its task
- is the rotor turning?
- check the cable from fan to PCB
- check the fan for interruption.

CAUTION

If there is no measurable voltage or the voltage has an incorrect value and the suspicion exists that the cause is an excessively high output load, it is not advisable just to unplug the connections to the PCB.
At certain output voltages the switching power supply needs a certain minimum load in order to operate correctly. Otherwise the normal characteristics are subject to interference and the voltages to be measured may be outside the specifications, or in the worst case the switching power supply may even be damaged. In this case an artificial ohmic load should be connected in accordance with the table specified above.

Power connector board (PCB)

If the above tests do not indicate a fault, the search must be continued in the PCB. All voltages from the switching power supply are individually protected on the PCB.

Note:
In order to arrive easily at the voltages on the PCB, it is sometimes advisable to remove the DAB of option R&S UPV-B2 beforehand.

CAUTION

Due to the limited accessibility of components on this board, measurements must be taken with the utmost caution when contacting the test points, in order not to cause a short-circuit inadvertently due to the test procedure.

Measurement: Checking the individual DC output voltages

Voltage	Test point
+5 V DMB	Positive pole of C1 or C10
+5 V USI	Pin 1 of X61
+12 V	Positive pole of C4
–12 V	Upper connection of L3
+24 V	Positive pole of C5

All details in the above table refer in each case to the upper contact, which in the normal installation position is relatively easy to access with the necessary caution.

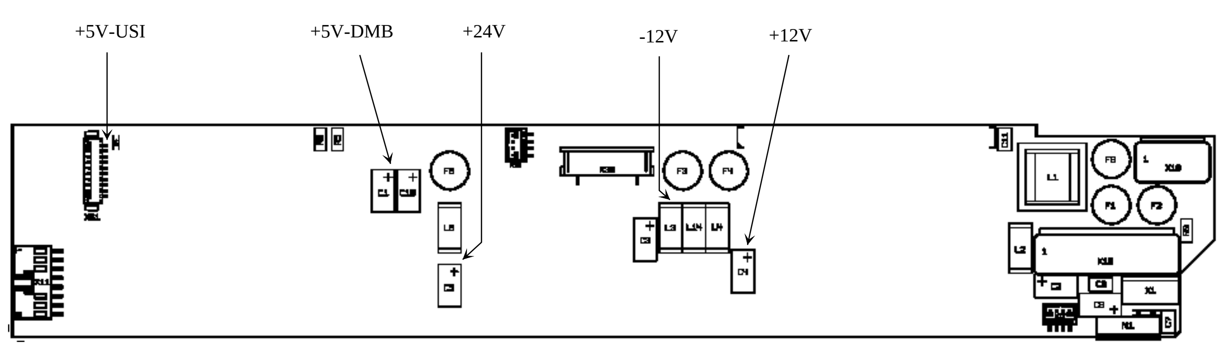


Fig. 3-4 Test points on PCB

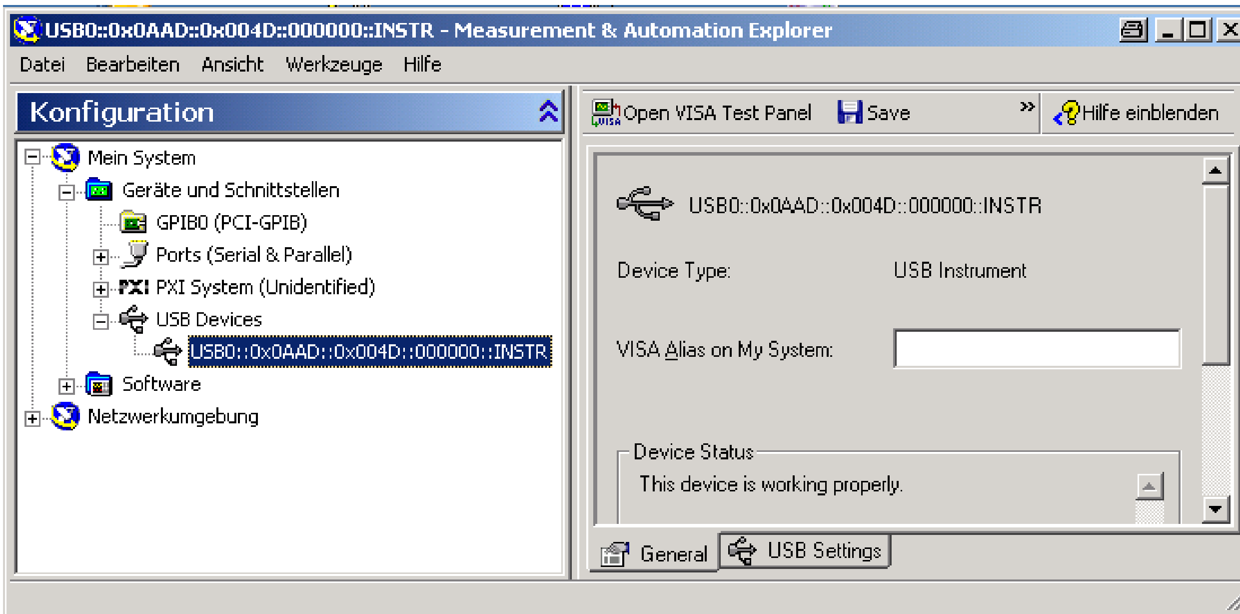
If a fault is found during this check, it is necessary to clarify whether the cause is on the PCB or whether a short-circuit on the connected board (DMB or I^2S Interface) has triggered a fuse. Since normally the PCB does not represent a load for the switching power supply, the recommendations under "Switching power supply" concerning the need for artificial loads are applicable.

It is not easy to remove the DMB from the PCB without considerable effort, and so in the normal operating status a resistance measurement will clarify whether there is a short-circuit.

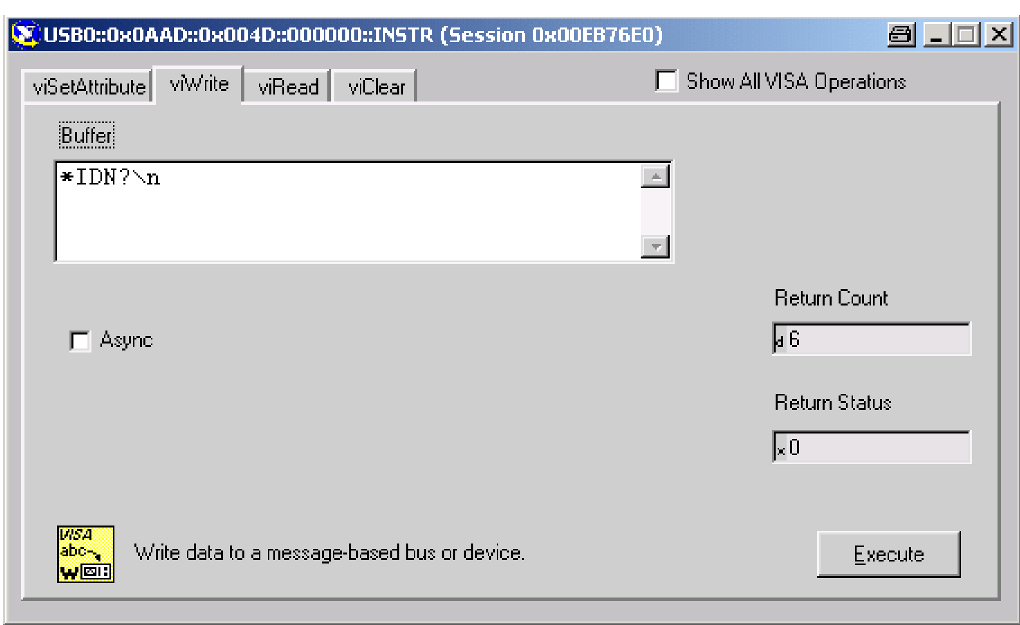
If the R&S UPV is fitted with a FMR7 or FMR9 the additional fan for the SPS is connected to X11 on the left.

Fault in USB Device Interface

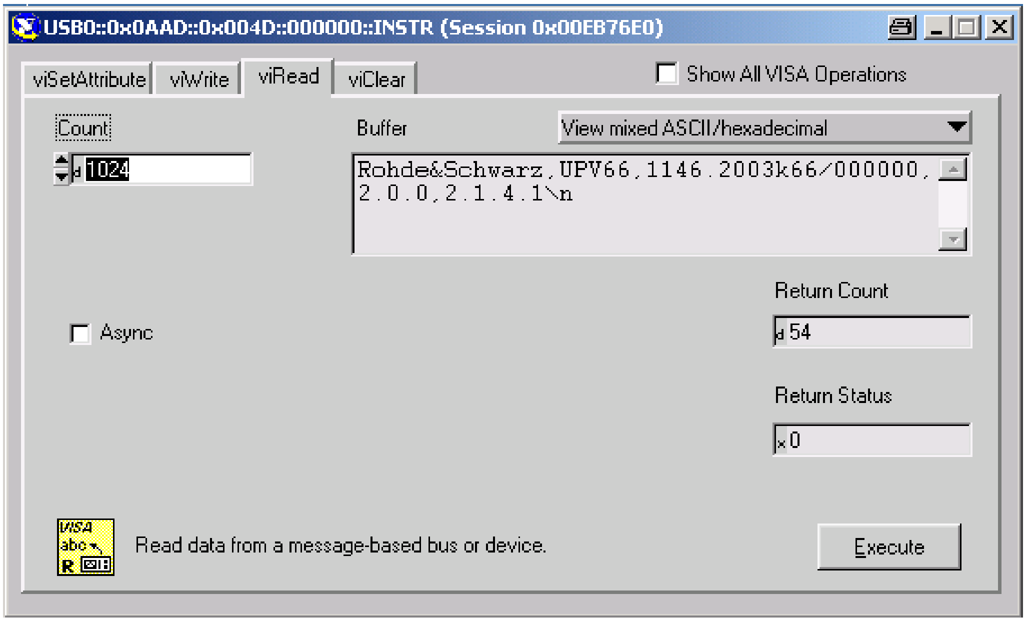
Is the R&S UPV fitted with FMR7 or FMR9, so the device can be controlled via this interface.
To check the connection use the NI-Visa-Tool with Version 3.4 or higher. Is an UPV connected, the program recognizes it as an USB-Device:



To build up a communication between the controlling PC and the R&S UPV, click „Open VISA Test Panel“:



Select tab „viWrite“. In the new window the user can write a command, which will be sent to the R&S UPV by „Execute“. After that select tab „viRead“ and press „Execute“ once again. In the window „Buffer“- the answer of R&S UPV appears:



Is connection to the R&S UPV possible by this test, so check first the cable from USB board inside and FMR7/FMR9. Is the cable o.k. a high probability for a defective FMR7/FMR9 exists.

Faulty LAN Reset Button

The R&S UPV66 is fitted with a reset button for LAN connections on the rear of the device. By pressing the button a reset of actual LAN settings is executed.

The function can be checked in two ways:

1. Press the button longer than 5 seconds
   After pressing the button the LED „Ready“ goes off and the instrument reboots.

2. Press the button three times in 5 seconds
   This combination brings the R&S UPV66 in „Shut Down“ without sending an appropriate command via the remote control line.
   After a while the LED „Shut Down“ must shine as an indication, that the device can be switched off by ON/OFF switch.

If there is no reaction on pressing the button, two reasons are possible:

1. The button is defective for itself.
   The function can be measured by an ohmmeter on the pins of button.
2. The cable to FMR7/FMR9 is defective or not plugged in.
   As before a measurement with an ohmmeter is sufficient, with which each wire can be checked.

Fault in the analog power supply (APS)

The effects of a fault:
The generator produces either no output signal or a distorted output signal and/or the analyzer either cannot measure or delivers incorrect test results. A first sign of this can occur when booting the R&S UPV, when although the application program starts correctly, the user interface is displayed and there are even no error messages on the screen during the boot procedure, nevertheless no relays can be heard clicking. This behavior indicates incorrect control signals from the DMB to the AAB or incorrect operating voltages.

All DC voltages which the APS delivers for the analog generator and the analog analyzer are individually protected on a secondary basis. Since the APS is plugged vertically in the compartment next to the AAB, the APS board is relatively difficult to access for voltage measurements. The simplest check, whether a fault is present in the APS itself, is to measure the output voltages on the AAB. Separate test points are provided there for the generator and the analyzer, at which all voltages for the analog section can be checked (see Fig. 3-12).
In contrast to the switching power supply, the APS can be operated after removal even without a load, so that in this case it can be connected to the AC supply on its own and all components such as connectors, fuses and the like are easily accessible.

Note:
Unlike the analyzer voltages, the DC voltages for the generator are <u>*not*</u> *referenced to the casing ground. Therefore choose the HVC wall of the generator as the reference point for voltage measurement.*

<u>DC voltages for the AAB:</u>

V_{DC} (Gen)	X13 pin
+20 V	1 and 2
-20 V	3 and 4
-15 V	5 and 6
+15 V	7 and 8
+5 V	9, 10 and 11
+6 V	12 and 13
GND-G	16, 17 and 18 (floating reference for generator voltages)

V_{DC} (Anlr)	X13 pin
+15 V	33 and 34
-15 V	29 and 30
+6 V	27 and 28
+5 V	25 and 26
GND-A	21, 22, 23 and 24 (voltages referenced to the casing ground)

- Faulty supply voltages for the generator?
  - Are all cables plugged in at the power input port?
    If one of the flat-cable connectors on the power input port has no contact, the linear regulators on the APS board cannot produce or stabilize the DC voltages for the generator.
  - Is the cable from the toroidal core transformer to the APS board (X1) plugged in?
    The AC supply voltage is fed to the power switch via this connection.
  - Is the cable from the toroidal core transformer to the APS board (X11) plugged in?
    The linear regulators receive the secondary voltages for the generator via this connection.
    In order to exclude the transformer as a source of the fault, it is advisable to measure the secondary AC voltages:

V_{sec} (AC)	X11 pin	from which is generated
> 17 V	1 and 2	20 V (DC)
> 17 V	3 and 4	20 V (DC)
> 13 V	5 and 6	15 V (DC)
> 13 V	6 and 7	15 V (DC)
> 6 V	8 and 9	+5 V and +6 V (DC)

(the exact size of the secondary voltages depends on the AC supply voltage and the load)

  - Is the cable from the APS board to the AAB (X13) plugged in?
    The AAB receives the DC voltages for the generator via this connection.

- Faulty supply voltages for the analyzer?
  - Are all cables plugged in at the power input port?
    If one of the flat-cable connectors on the power input port has no contact, the linear regulators on the APS board cannot produce or stabilize the DC voltages for the analyzer.
  - Is the cable from the toroidal core transformer to the APS board (X1) plugged in?
    The AC supply voltage is fed to the power switch via this connection.
  - Is the cable from the toroidal core transformer to the APS board (X10) plugged in?
    The linear regulators receive the secondary voltages for the analyzer via this connection.
    In order to exclude the transformer as a source of the fault, it is advisable to measure the secondary AC voltages:

V_{sec} (AC)	X10 pin	from which is generated
> 13 V	1 and 2	15 V (DC)
> 13 V	2 and 3	15 V (DC)
> 6 V	4 and 5	+5 V and +6 V (DC)

(the exact size of the secondary voltages depends on the AC supply voltage and the load)

  - Is the cable from the APS board to the AAB (X13) plugged in?
    The AAB receives the DC voltages for the analyzer via this connection.

If all connections are correctly plugged in and the corresponding cables are in order, the fault is on the APS board. If the secondary voltages are faulty, the AC transformer could be faulty (e.g. tripped thermal cutout).

Defective analog audio board (AAB)

The analog generator (universal DAC generator) and the analog analyzer are both on the AAB. The general functionality of the analog section can be tested in a loop measurement without any external equipment by means of the internal connection between the generator and analyzer (see "Short test of analog interfaces"). If an error occurs during this test, first determine whether it was caused by incorrect settings or whether the generator or analyzer is defective.

Reliably locating the cause of the error decides whether it is necessary to exchange a board. Further tests must be performed to clarify whether there is an error on the AAB or on the DMB.

Defective analog signal generation

An initial criterion for correct control of the AAB from the DMB is whether you can hear individual relays while the R&S UPV application program is being started. If not, the DMB may be defective, the control cable may not be connected or the supply voltages from the analog power supply (APS) may be missing.

If there is no output signal from the generator

- **Operating error?**
  - Is the generator set to OFF (in the Generator Config panel)?
  - Is the cable to the DUT connected to the inactive output (in the Generator Config panel)?
  - Is 0 V set as output voltage (in the Generator Function panel)?

If everything is correctly set and connected, go to the next test. For this test, you have to open the R&S UPV (see Removing the instrument casing).

- **Visually inspect the plug connections** (see Fig. 3-12):
  - Is power supply cable W13 connected?
  - Is control cable W40 from the digital mainboard (DMB) connected?

  If the option R&S UPV-B1 is installed:
  - Is cable W100 connected?

If you detect an error, set up the missing plug connection. When plugging in the missing connection, make sure that no connector pins are bent. If you do not find an error in this test, continue with the next step:

- **Measure the supply voltages** (see Fig. 3-12):
  - +5 V for logic and relay okay?
  - +6 V for the signal D/A converter okay?
  - ±15 V for the operational amplifier okay?
  - ±20 V for the output stage okay?

Note:
All voltages for the generator are not referenced to the housing ground! Therefore select the generator's HVC panel as the reference point for the voltage measurement.

If one or more supply voltages are missing, this may be caused by the AAB (short circuit) or the APS. To find the defective board, disconnect W13 and test the following points:

1. Measure voltages directly on the W13 jack (you can use pins 16, 17 or 18 as ground reference)

Pin 9, 10, 11:	+5 V
Pin 12, 13:	+6 V
Pin 7, 8:	+15 V
Pin 5, 6:	-15 V
Pin 3, 4:	-20 V
Pin 1, 2:	+20 V

2. Using an ohmmeter, measure the resistance of the individual voltage pads on the AAB to ground.

If the voltages on W13, i.e. those coming directly from the APS, are defective, the APS is **one** cause of the error (see). However, this may be the result of a short circuit on the AAB.
If you do not detect a short circuit when measuring the resistance, material fatigue (ageing) may have caused a blown fuse or some other error on the APS. If there is a short circuit on one of the voltages on the AAB, this is the real cause of the error and thus indicates a defective AAB. Of course, you still have to replace the faulty fuse on the APS.

➢ **Check the control** (see Fig. 3-5):
- +3.3 V for the opto-/magnetocouplers okay?
  DC measurement on U3 pin 1
- Clock signal okay?
  Check with oscilloscope on U3 pin 2 (see Fig. 3-6).
- Data signal okay?
  Check with oscilloscope on U5 pin 2 (see Fig. 3-8).

The voltages on the inputs of the couplers are referenced to the housing ground.

➢ **Check the clock and data couplers** (see Fig. 3-5):
- +3.3 V-G for the opto-/magnetocouplers okay?
  DC measurement on U3 pin 8.
- Clock signal okay?
  Check with oscilloscope on U3 pin 6 (see Fig. 3-7).
- Data signal okay?
  Check with oscilloscope on U5 pin 6 (see Fig. 3-9).

The voltages on the outputs of the couplers are referenced to the floating generator ground.

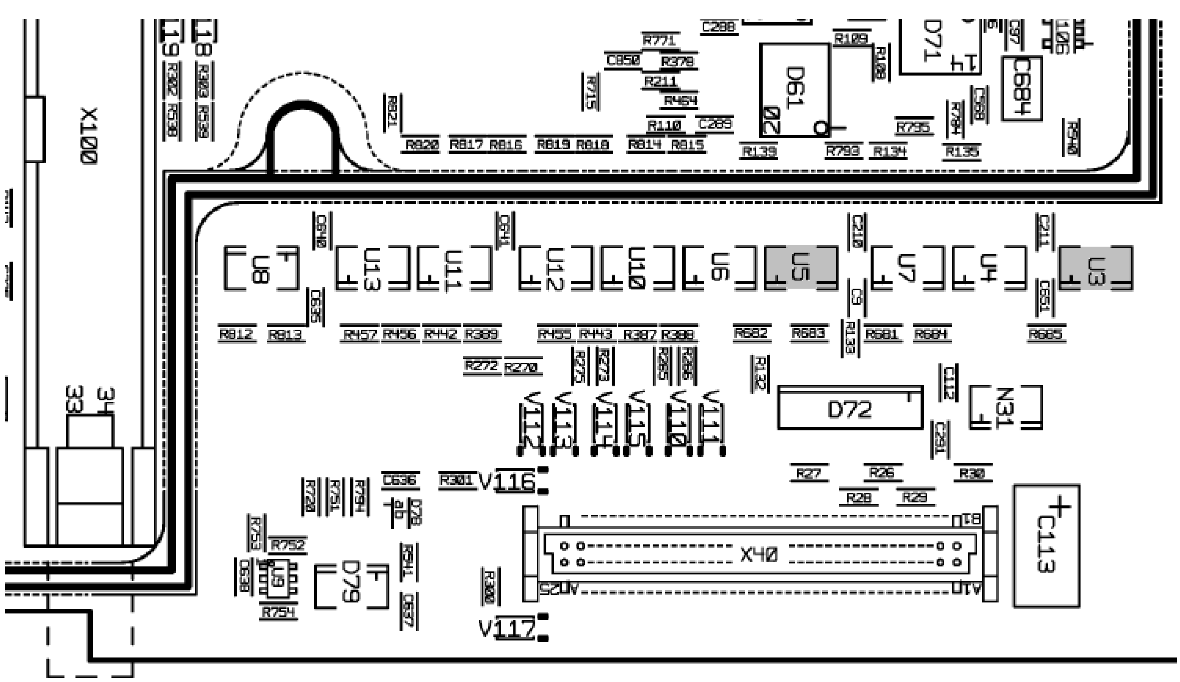


Fig. 3-5 Data Couplers

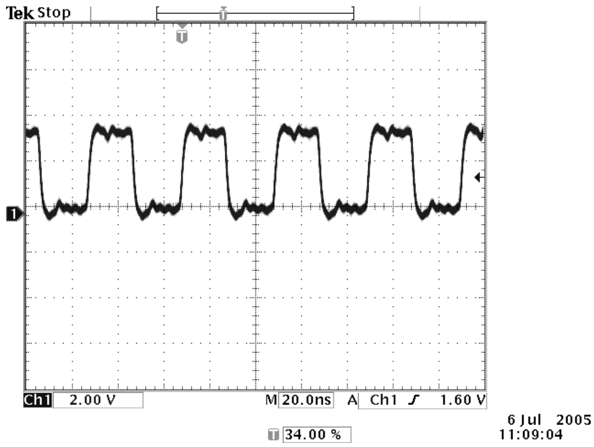


Fig. 3-6 Clocksignal at U3 Pin 2

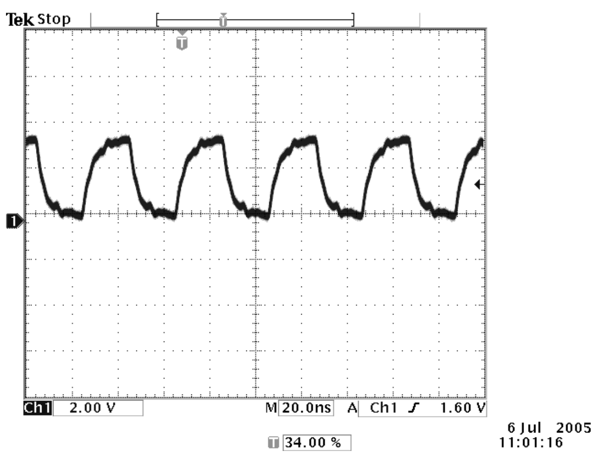


Fig. 3-7 Clocksignal at U3 Pin 6

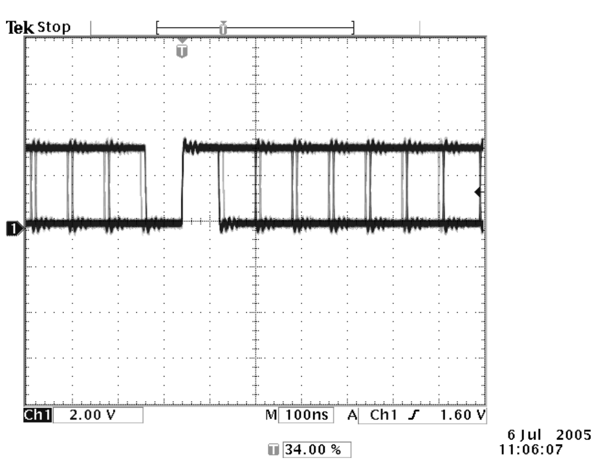


Fig. 3-8 Clocksignal at U5 Pin 2

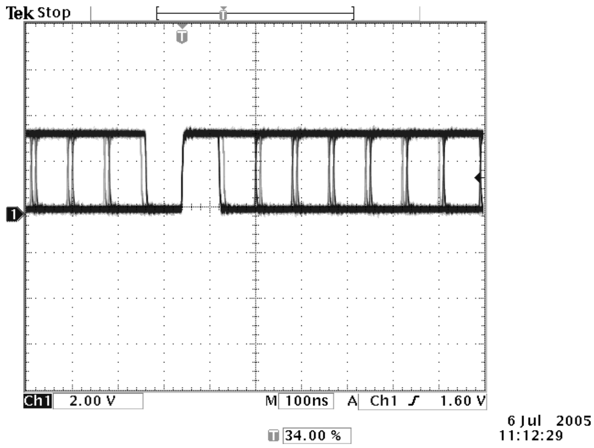


Fig. 3-9 Clocksignal at U5 Pin 6

If the control signals to the data and clock couplers are missing, the AAB cannot set its hardware correctly. In this case, however, the DMB is causing the error.
If the control signals are being properly applied to the inputs of the data and clock couplers but are either not present, distorted or have an incorrect level at their outputs, the cause is definitely on the AAB.

➢ Generator Output switches off: LED Output OFF glows
Error function: The generator switches off after the R&S UPV application appeared on screen.
- check if a cable is connected to the output, where an external voltage is fed into the generator.
Unplug all cables at generator outputs and press the Output OFF button.
If the generator has switched off again:
- Check the voltages at X7 und X8.
If a DC voltage can be measured, → replace AAB.
- Display the voltages at X7 und X8 on a screen.
If there are any radio frequency signals detectable, the power amplifier is defekt → replace AAB.

If no error can be determined, you still have one last step to assign the error with certainty to the AAB:

➢ **Switch the source** (in the Generator Function panel):
You can only do this if the option R&S UPV-B1 (Low Distortion Generator, LDG) is installed in the R&S UPV.
- Select the other generator (if the universal generator was on before, switch to the LDG and vice versa).

If the universal generator does not supply an output voltage, the AAB is defective. If solely the LDG does not supply an output voltage, the cause of the error is not on the AAB but on the option R&S UPV-B1.

If the <u>output voltage</u> is incorrect

- **Operating error?**
  - Is the desired level permissible for the selected output type (in the Generator Config panel)?
  - Is the output voltage limited by the Max Voltage setting (in the Generator Config panel)?
  - Is a high output impedance (200 Ω or 600 Ω) set, and is the load so big that a significant voltage division occurs (in the Generator Function panel)?
  - Did a short circuit or an external signal fed in to the generator cause the generator output to switch off? (Check the "Generator Ovld" and "Output Off" LEDs on the front panel of the R&S UPV.)
  - Is a DC offset switched on (in the Generator Function panel)?
    AC and DC signals are generated by the D/A converter. To prevent distortions, the D/A converter may reduce its AC level if an additional DC level is output.
  - Is a generator filter or the equalizer switched on (in the Generator Function panel)?
    This may change the set frequency in the level!

If you can exclude an operating error or a disallowed operating state, you can be quite certain that the cause of the error is on the AAB.

If the <u>frequency</u> is incorrect

- **Operating error?**
  - Was the wrong unit (e.g. Hz instead of kHz) selected (in the Generator Function panel)?
  - Is the wrong reference value (e.g. for relative units) set (in the Generator Config panel)?
  - Is an unsuitable generator bandwidth set (in the Generator Config panel)?
  - Is the low distortion generator switched on instead of the universal generator (in the Generator Function panel)? (Due to the free-running principle, the output frequency of the low distortion generator is considerably less accurate than that of the universal generator, which is derived from an internal crystal oscillator.)

If you can exclude an operating error or a disallowed operating state, check whether the analyzer can correctly measure the frequency of an externally applied signal.
If the analyzer does not measure the external signal frequency correctly, you can be quite certain that the error is not caused by the AAB but by a malfunction of the DMB or its defective control.
However, if the analyzer measures the external signal frequency correctly, you cannot clearly determine whether there is an error on the AAB (e.g. incorrect setting of the D/A converter due to an error in the control EPLD) or on the DMB without thorough testing.

If the output signal is <u>distorted</u> or <u>noisy</u>

- **Operating error?** (in the Generator Config or Function panel)
  - Is the Volt Range set to Fix 20 V, and is a very low level selected?
    Despite the very low level (e.g. 1 mV), the generator hardware is set for 20 V, which maximally amplifies the noise generated in the signal path and may result in a poorer signal-to-noise ratio.
  - Is the generator output so strained by an external signal fed in that oscillations in the end stage are induced but the monitoring circuit does not respond?

To locate the cause of the error, disconnect the external circuit or the XLR cable and, exercising the necessary caution, measure the output signal directly on output pins 2 or 3.
If you still measure a distorted signal under these operating conditions, the generator used is defective. If the option R&S UPV-B1 (Low Distortion Generator) is not installed, the error is on the AAB. If the signal is in order, the instrument is not operating properly, which is putting too much of an (e.g. high-frequency) strain on the generator but not causing it to switch off.

If the option R&S UPV-B1 is installed, you can perform another test by switching between the universal and the low distortion generator to see what happens:
If the distortions are eliminated with one of the two generators, the error is being caused by the module that emits the distorted output signal. This can therefore be either the AAB or the low distortion generator.

Malfunctioning Low Distortion Generator

Option R&S UPV-B1 (Low Distortion Generator, LDG) provides a low-distortion and low-noise sinewave signal. By enabling the Low Dist check box, you can loop the option’s signal into the signal path.

The Low Distortion Generator has two special features:

- Irrespective of the bandwidth set in the Generator Config panel, (on the universal generator, this bandwidth designates the max. frequency that can be set) the LDG always has an upper frequency level of 185 kHz. The bandwidth setting is therefore irrelevant.
- Irrespective of the setting in the Volt Range line (in the Generator Config panel), the LDG is always operated in the Auto mode. In other words, the Fix setting is ignored when you use the LDG.

- **Incorrect operation?** (in the Generator Function panel)
  - Has an R&S UPV-B1 option even been installed?
    If the R&S UPV is not equipped with the option, the ultra-pure sinewave source cannot be selected. If you try to set the ultra-pure sinewave source, the check in the check box is automatically disabled.
    Furthermore, the error message "Option Low Distortion Generator (R&S UPV-B1) not installed" is displayed.

- **Option not detected?**
  - Have you plugged in flat cable W100 correctly?
    If you have not plugged in the cable properly, a number of important contacts – for example the ones detecting the option – may be left open. Make sure that the pins are not bent!
  - Have you installed the option properly?
    Every installed option is detected when booting the instrument, and available calibration factors are provided for processing. You can look under Menu/Utilities/Install Options on the instrument to see whether an installed option was detected correctly. If the R&S UPV-B1 is not entered in the display box, it was not detected correctly. The signal generated by the option can therefore not be set.

- **No output signal?**
  If the option is detected correctly (check box enabled) but does not provide an output signal, it is probably defective.

- **Output signal distorted?**
  If the sinewave signal is distorted after you switch on the option (check box enabled), but there is no problem when using the universal generator, the LDG is defective.

Erroneous Second Generator

If option R&S UPV-B3 (Second Analog Generator) is installed, the Audio Analyzer R&S UPV provides two additional signal shapes:

- Stereo sinewave (in conjunction with the universal generator on the AAB)
- DIM signal

If neither of these two signals can be set, various reasons are possible:

- **Incorrect operation?** (in the Generator Function panel)
  - Has an R&S UPV-B3 option even been installed?
    If the R&S UPV is not equipped with the option, the two additional signals cannot be selected. After you have tried to set the signal shape, the R&S UPV automatically switches back to the previously set signal shape.
    Furthermore, the error message “Option Second Analog Generator (R&S UPV-B3) not installed” is displayed.

- **Option not detected?**
  - Have you inserted the board correctly?
    If you have not installed and screw-fastened the board properly, a number of contacts – for example the ones detecting the option – may be left open. Make sure that the pins are not bent!
  - Have you installed the option properly?
    Every installed option is detected when booting the instrument, and available calibration factors are provided for processing.
    You can look under Menu/Utilities/Install Options on the instrument to see whether an installed option was detected correctly. If the R&S UPV-B3 was not entered in the display box, it was not detected correctly. The signals generated by the option therefore cannot be set.

- **Signal generation o.k.?**
  - Are all voltages available? (+5 V, ±15 V, ±20 V)
    The option obtains its operating voltages from the universal generator via the AAB.
    For the sake of safety you should check the voltages directly on the R&S UPV-B3 board to eliminate possible interruptions on the AAB (see Fig. 3-10). The values of measured voltages can be less compared with the nominal values (up to -10%).
  - Have you connected all signal bridges?
    To make troubleshooting easier, individual function blocks can be separated from each other by jumpers. If one of these bridges is missing or does not connect the two middle pins, the signal path will be interrupted and no output signal is fed to the AAB.
  - Sine signal on Ch2 distorted?
    If the Second Generator is installed, its signal is output at Ch2. If this signal is distorted, the causes may be the same as with the universal generator (see above). If no operating errors have been made, the option is defective.

If none of these steps reveals the cause, the option is most likely defective. If the option's operating voltages are missing, the cause can be attributed to the AAB.

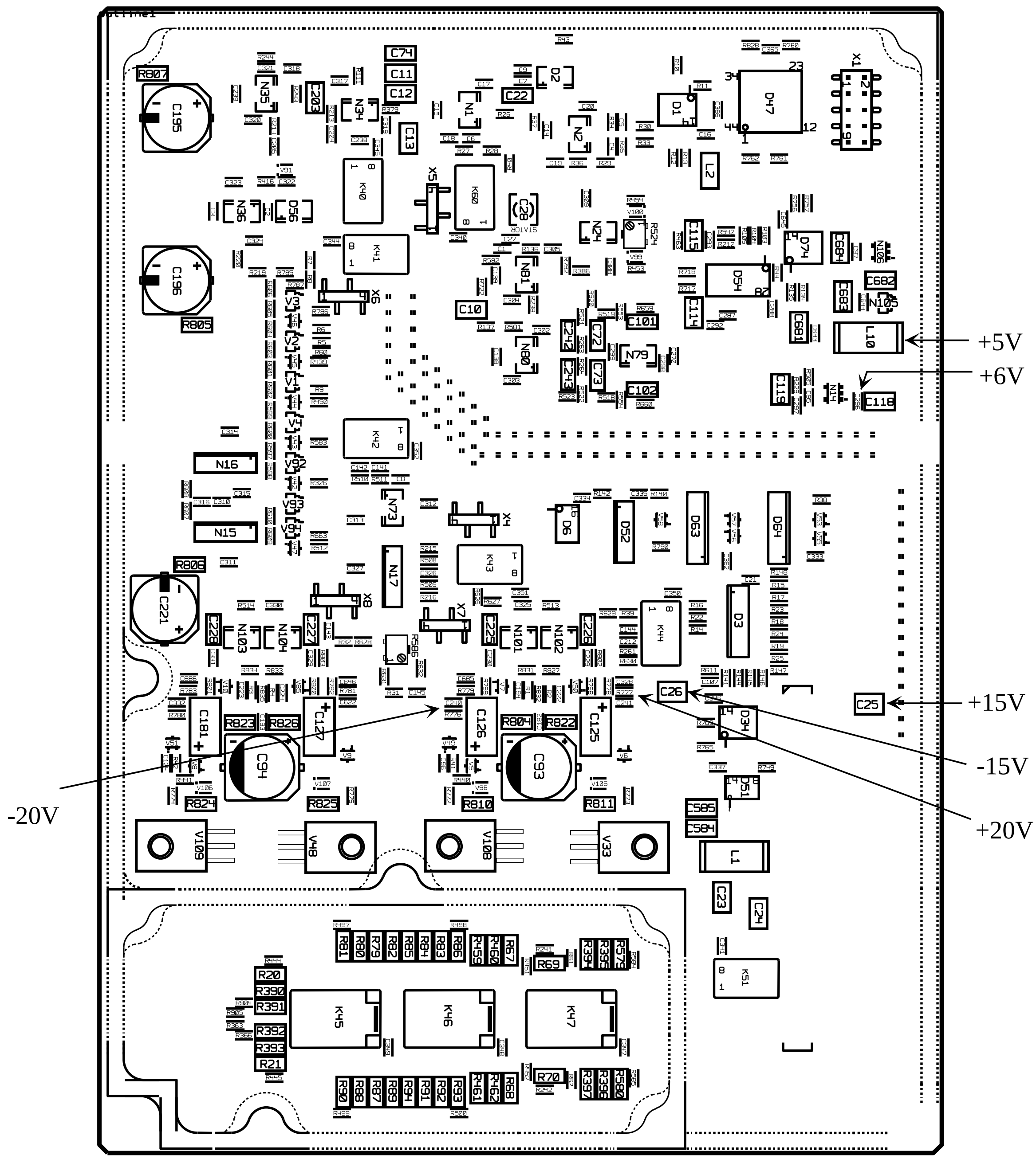


Fig. 3-10 Voltages on the R&S UPV-B3

Defective analog analyzer

Simple tests for roughly determining the cause of the error

The following tests can be carried out using correct generator signals in a loop measurement, e.g. with the analyzer setting under "Channel 2 ≡ 1" with "Input Gen Ch1". The steps must be performed in the specified sequence, for otherwise the troubleshooting result may be incorrect.

- Are both analyzer channels defective in the same way?
  If yes, then continue with the next step. Otherwise continue further below.
- Do the control relays click when the R&S UPV is switched on or after the measurement range has been manually set?
  If not, see below under Detailed tests for deciding whether to replace a board "*Measuring the supply voltages*", "*Preliminary test when switching on the R&S UPV*", "*Tests for troubleshooting on the DMB control interfaces*".
  If yes, continue with the next step.
- Are all values in the numeric display in "Off" status or "---", despite correct setting, appropriately applied signals and started measurements?
  If yes, see the tests in the next step.
- Are the RMS display values incorrect for both channels and for all bandwidth settings?
  If yes, see below under Detailed tests for deciding whether to replace a board "*Measuring the supply voltages*", "*Preliminary test when switching on the R&S UPV*", "*Troubleshooting tests on the A/D converters and their interface from/to the DMB*".
  If not, continue with the next step.
- Are the RMS display values incorrect for both channels and only for the 22 kHz/40 kHz/80 kHz bandwidth settings?
  If yes, see below under Detailed tests for deciding whether to replace a board "*Function tests of the two-channel audio ADC for analog bandwidths 22/ 40/ 80 kHz*".
  → Otherwise replace AAB immediately.
- Are the RMS display values incorrect in one or both channels and only for the 250 kHz bandwidth settings?
  If yes, see below under Detailed tests for deciding whether to replace a board "*Tests on both highspeed ADCs for the analog bandwidth 250 kHz*".
  → Otherwise replace AAB immediately.
- Is autoranging defective in both channels, or are there totally incorrect display values and strong distortions with FFT displays due to missing overrange/overload messages with Analyzer Range Fix?
  If yes, see below under Detailed tests for deciding whether to replace a board "*Faults relating to level monitoring and/or autoranging*" and *"Events for overrange / overload which trigger a status signal in both analyzer channels"*.
  → Otherwise replace AAB immediately.
- With all other exclusively channel-related errors: → Replace AAB immediately.

Detailed tests for deciding whether to replace a board

➢ Measuring the supply voltages
(see Fig. 3-12 – explanation (4))

- +5 V for logic and relays OK?
- +6 V for signal A/D converter OK?
- ±15 V for operational amplifier OK?

Note:
All voltages for the analyzer are referenced to the casing ground.

If one or more supply voltages are faulty, the cause of the problem may be the AAB (short circuit) or the APS. To locate the faulty board, unplug W13 and check the following points:

1. Measure voltages directly on the connector for W13 (pins 21 to 24 or the instrument ground can be used as the reference ground)
   Pin 25, 26: +5 V
   Pin 27, 28: +6 V
   Pin 33, 34: +15 V
   Pin 29, 30: –15 V
   Voltages may vary by around ±5 % depending on the control chip and the typical load current.
2. Use an ohmmeter to measure the resistance of the individual voltage paths on the AAB referenced to ground.

If the voltages on W13, and therefore direct from the APS are faulty, the <u>APS is a possible cause of the problem</u> (see "Analog power supply fault"). But this can be a knock-on effect from a short circuit on the AAB.
If no short circuit is found when you measure the resistance, there may be a burnt-out fuse or some other fault on the APS due to material fatigue (aging). If there is a short circuit or overload on one of the voltages on the AAB, this is the <u>actual cause of the fault</u>, and therefore indicates a faulty AAB and/or APS.

➢ <u>Additional troubleshooting</u>
  As with other modules, the approach to troubleshooting is structured around identifying and swapping out one or more defective modules.

  In the case of faulty or unused ribbon cable slots for the transmission of AAB control data and measurement data, such as X40 for the analog generator and X41 for the analog analyzer, there are various test options at interface points and test points which enable you to trace faults more precisely, and to make a decision about the module in question and whether to swap it out; → to/from digital main board (DMB).

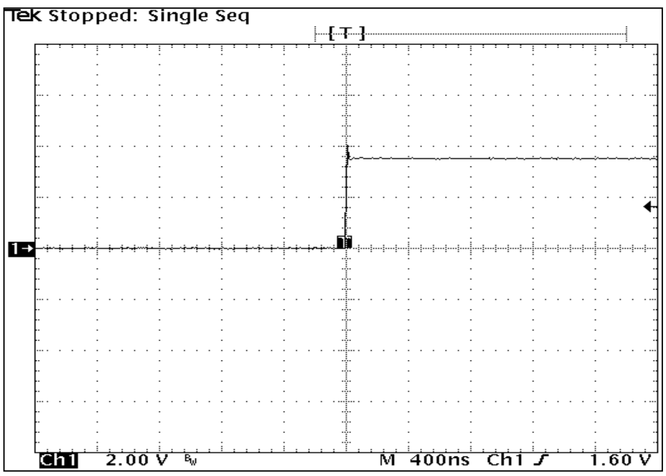
<u>Tests for signal data transmission using a multichannel scope</u>:
(For the sake of clarity the oscillograms display up to four channels. For troubleshooting you can usually do without the time-consuming test point contacting. Simply use a probe to check for the presence of signals one channel at a time).

➢ Preliminary initialization test when switching on the R&S UPV
➢ Control signal data streams for the relays and analog switches on both analyzer channels
➢ Reference master clock input and signal data & clock outputs on the A/D converter
➢ Faults in the modulation monitoring and/or autoranging on the analyzer channels

Preliminary test when switching on the R&S UPV:

To ensure correct initialization of the circuit functional groups on the analog analyzer, a reset signal is sent from the master reset of the controller module to the AAB analyzer during the power-up phase. This reset initializes the control EPLD and the audio ADC. If there are general faults on the control interface and/or audio ADC for bandwidths 22 / 40 kHz and 80 kHz, the reset function must first be tested with the aid of the following oscillogram.

Oscillogram – Analyzer master reset from the DMB:



Set 'Oscilloscope in Single Trigger Mode', switch on R&S UPV.

Trace Ch1: Test point X41 pin B15 analyzer reset signal, active low.
Lo: Status after power-up,
Hi: R&S UPV operating status,
logical level 0/+3.3 V

(optional test on D48 pin 39, D40 pin 17, D41 pins 2, 3 or D46 pins 2, 5, 10)

Scope: Input DC coupled

If the master reset is missed on the AAB, the likely cause is on the DMB, the X41 connector or the W41 ribbon cable – other possibilities are a short-circuit or overloading of the level due to faults in the AAB.

Tests for troubleshooting on the DMB control interfaces:

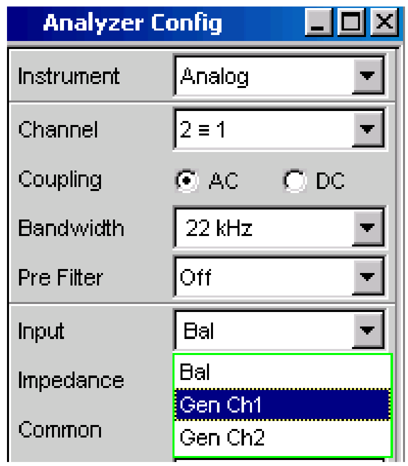
In order for the analog analyzer to carry out all its basic functions, it is first of all necessary for the analyzer control unit to work correctly with the control signal data streams for the relays and analog switches on both analyzer channels.
A first, simple function test of the analyzer control unit is to enter an appropriate setting in both channels of the analyzer and see whether the relays click. If you hear the relays click, the data transmission from the DMB to the analyzer part of the AAB is basically in order.
If nothing happens in either of the channels, the EPLD D48 may be faulty (→ "Replacing the AAB"). Or the input signals to the EPLD are partially or completely missing. You can use the following tests to decide which of the two boards is faulty, the AAB or the DMB.
Additional fault symptoms in the analyzer control unit affecting analog switch functions are probably caused by faults in the AAB and require this board to be replaced.

Another important point during fault-tracing is the correct stationary state of the input control signals for the interface. Before or after data transmission the oscillogram readings should be as follows:

X41.B17, B18: → Hi-Level 3.3 V
X41.B19, B20: → Lo-Level 0 V

➢ Testing the control signal data streams for the relays and analog switches on both analyzer channels:

Set the R&S UPV:



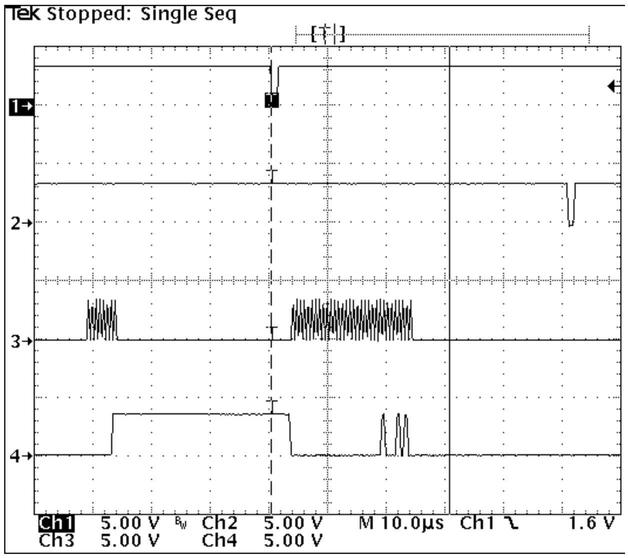
Starting from the default setup at menu item "Bal" switch to "Gen Ch1" and test the control signals with the aid of the following oscillogram.

Test points/test signals:
(logical level 0/+3.3 V for all signals)

Trace Ch1: Test point X41 pin B17, address strobe signal, negative pulse width ≈ 1.1 µs
Trace Ch2: Test point X41 pin B18, write strobe signal, negative pulse width ≈ 1.1 µs
This signal handles the settings for output in the control hardware and ends the transmission procedure.
Trace Ch3: Test point X41 pin B20, serial clock signal, frequency ≈ 1.5 MHz
Trace Ch4: Test point X41 pin B19, serial data signal
Scope: Inputs DC coupled

Note:
The signals on traces Ch1 to Ch4 are only active when manual settings are entered for the analyzer channels in the Config Panel or automatic access takes place via active measurement sequences. Signal trace Ch3 is permanent → to FW 137.

Oscillogram – analyzer control from DMB via EPLD D48:



R&S UPV analyzer config panel
Setting: Channel 2 ≡ 1,
switchover from input Bal → Gen Ch1

Trace Ch1: Test point X41 pin B17
Address strobe signal

Trace Ch2: Test point X41 pin B18
Write strobe signal

Trace Ch3: Test point X41 pin B20
Serial clock

Trace Ch4: Test point X41 pin B19
Serial data signal

Scope: Trigger Ch1 single sequence
Inputs DC coupled

➢ Troubleshooting tests on the A/D converters and their interface from/to the DMB**:**

Note:
The signals in the following tests must be permanently independent of the measurement sequences – also independent of when a measurement starts or stops.

Fault situation: For all functions the numeric display shows "OFF" or "---" or the measured values in the numeric display stop changing even under new test conditions.
Regardless of correctly activated test functions, together with correct signal settings and measurement ranges, after the Start button is pressed or the generator and analyzer are operated in the panels, after about 5 s the firmware displays popup windows with the message:

and after "OK" is pressed, another …

When the error messages have been acknowledged the numeric display shows only dashes "---" in all display fields. The DSP messages appear once only. To close the R&S UPV program restart, shut down the operating system and switch the R&S UPV off and then on again.

If error messages of this kind are displayed, it is advisable to switch the R&S UPV off and then put it into operation again as follows:
- Close the R&S UPV program.
- Shut down the operating system and switch the R&S UPV off.
- Switch the R&S UPV on again, wait for the startup screen to be displayed, and then press the Preset key within 2 s during the display of the Cancel button.
- Answer the question with "Yes".
- The R&S UPV will now start with the default setup.

If possible, you should now use the R&S UPV setting that led to the original error – either manually or by using a previously saved setup.

If the DSP error message is not displayed after you have restarted the test, the previous error message may have been the result of a hidden firmware error. If this error occurs again later, please report it to the Rohde & Schwarz Central Service indicating the firmware version, and if possible send the setup file by e-mail.

The cause may be in the analyzer section, due to faulty serial clock signals which must travel from the ADCs, operating in master mode, to the DSPs in the DMB. In the case of the audio ADC for bandwidths 22 / 40 / 80 kHz, a missing master reset from the DMB to the AAB affects the effects of the fault first, since no clock pulse or data signals are being sent at that time.
Errors of this type can also be caused by defective ADCs, their faulty peripherals or the erroneous master reference clock from the DMB. The source of the error can be in one of the two modules AAB or DMB with the associated DSP modules.

Troubleshooting and analysis for tracing the defective module is explained in Preliminary test when switching on the R&S UPV and subsequent sections.

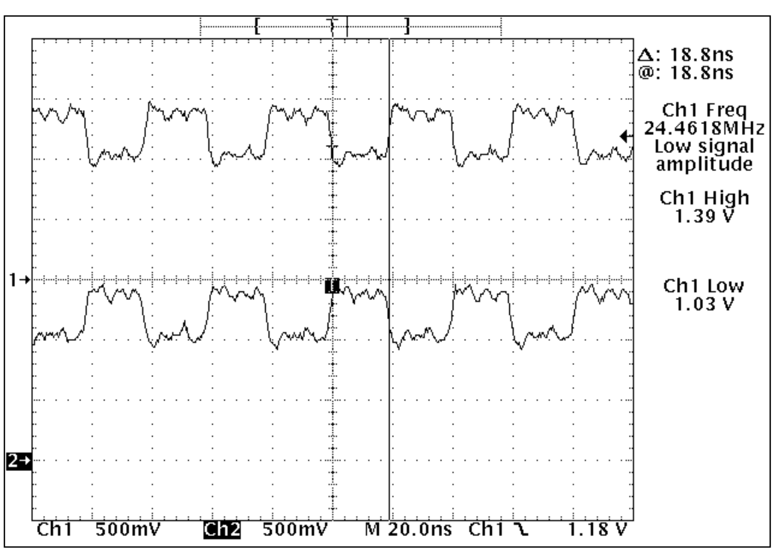
Test points for the reference clock of the ADCs:

P59 → Reference clock 24.576 MHz input, as master clock for operating the A/D converter, logical level 0/+3.3 V.

Note:
The test point P59 is not included in the first R&S UPV series. In these cases, as an alternative take the measurement at LVDS component D4 on output pin 7.

(For the location of the components see Fig. 3-11*)*

If the signal that comes from the DMB is faulty, first of all continue fault tracing with the aid of the following oscillogram:



Reference clock inputs LVDS Receiver

Trace Ch1: Test point Connector X41 pin B2 or N32 pin 1 (resistor R59)

Trace Ch2: Test point Connector X41 pin A1 or N32 pin 2 (resistor R59)

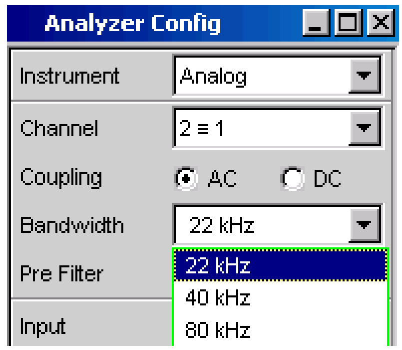
Scope: Inputs DC coupled

Attention must be paid to the symmetrical signals with the low logical input levels on the LVDS receiver components, and/or the output levels on the LVDS transmitter components listed below. If the signals on X41 are also erroneous, then the cause is either the flat cable connections or the DMB.

Function tests of the two-channel audio ADC for analog bandwidths 22 / 40 / 80 kHz:

Before the tests load the R&S UPV default setup and analyzer config panel as follows.

Set the R&S UPV:



The following signals are generated from the two-channel audio ADC: Logical output levels are 0/+3.3 V – R&S UPV setting and the associated clock frequencies are shown in the table for the functional description in chapter Analog Analyzer.

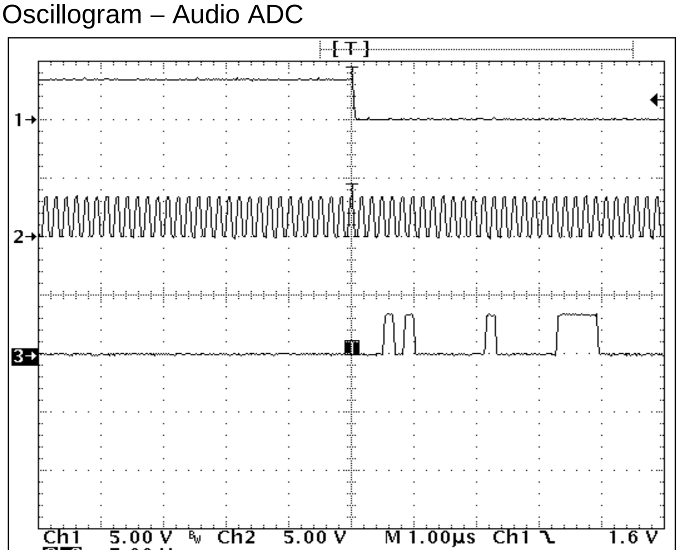
Test points/test signals
(logical level 0/+3.3 V for all signals)

P29 → Audio ADC sync out (frame LRCK),
Frame signal low level: data from analyzer Ch1
Frame signal high level: data from analyzer Ch2
P30 → Audio ADC serial clock out
P31 → Audio ADC data multiplexed out (Format I^2S)

Note:
The test points P29, 30 and 31 are not included in the first R&S UPV series. In these cases, as an alternative take the measurement at LVDS component D4 on pins 15, 1 and 7

(For the location of the components see Fig. 3-11*).*

Oscillogram – Audio ADC



Trace Ch1: Test point P29
(frequency 48 kHz @ analyzer bandwidth 22 kHz)

Trace Ch2: Test point P30

Trace Ch3: Test point P31

Scope: Inputs DC coupled

If the signals on P29, 30, 31 are correct, the symmetrical outputs from the following LVDS component, which are fed directly to the flat cable connection X41 to the DMB, should also be checked (for the location of the components see
Fig. 3-11):

LVDS component D4 pin	Signal	Corresponds to X41 pin
14	Sync Out (Frame) Hi	A4
13	Sync Out (Frame) Lo	B5
2	Serial Clock Out Hi	A3
3	Serial Clock Out Lo	B3
6	Data out Hi	B6
5	Data out Lo	A6

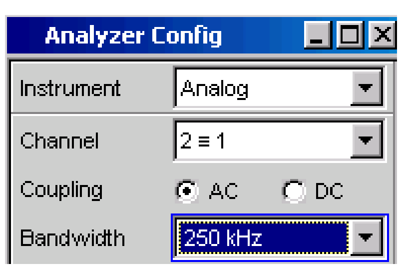
Hi/Lo: Symmetrical signals corresponding to the test diagram at P59 above.

Note:
The connectors for X41 can only be conveniently reached at row B. It is generally useful in the case of errors on the interfaces to trace the signals to the opposite DMB. Only then is it possible to decide whether a board is faulty.

<u>Tests on both highspeed ADCs for the analog bandwidth 250 kHz:</u>

Before the tests load the R&S UPV default setup and analyzer config panel as follows.

<u>Set the R&S UPV</u>:

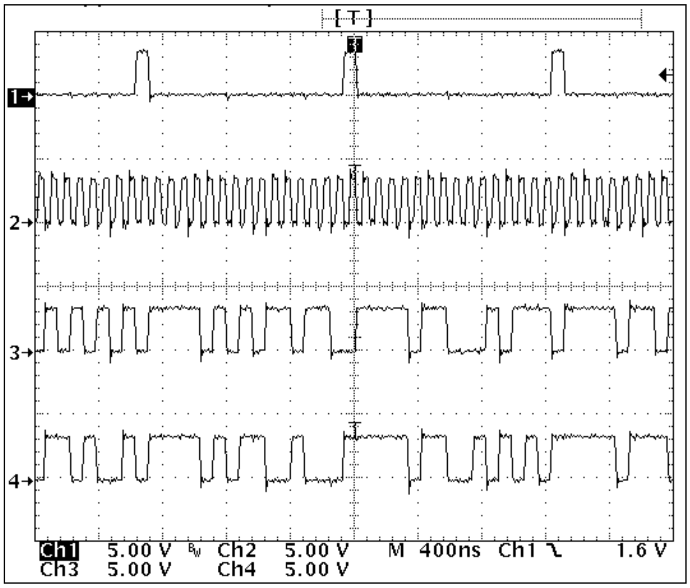


<u>Test points/test signals</u>:
(logical level 0/+3.3 V for all signals)

P32 → Serial clock out 12.288_MHz
P33 → Sync out pulse 768 kHz (frame), positive pulse width ≈ 1.2 µs,
common clock for both analyzer channels
P34 → Data signal out, analog Ch1
P58 → Data signal out, analog Ch2

Note:
The test points P32, 33, 34 and 58 are not included in the first R&S UPV series. In these cases, as an alternative take the measurement at component D69 on pins 11, 8, 6 and 3 (for the location of the components see Fig. 3-11).

Oscillogram – Highspeed ADCs



Trace Ch1: Test point P33
Frame signal

Trace Ch2: Test point P32
Serial clock

Trace Ch3: Test point P34
Data from analyzer Ch1

Trace Ch4: Test point P58
Data from analyzer Ch2

Scope: Inputs DC Coupled

These signals are generated from both the highspeed ADCs: Logical output levels are 0/+3.3 V. If the signals on P32, 33, 34 and 58 are correct, the symmetrical outputs from the following LVDS component, which are fed directly to the flat cable connection X41 to the DMB, should also be checked (for the location of the components see Fig. 3-11):

LVDS component D3 pin	Signal	Corresponds to X41 pin
14	Sync Out (Frame) Hi	B10
13	Sync Out (Frame) Lo	A10
2	Serial Clock Out Hi	B9
3	Serial Clock Out Lo	A8
6	Data out Ch1 Hi	A12
5	Data out Ch1 Lo	B12
10	Data out Ch2 Hi	A13
11	Data out Ch2 Lo	B14

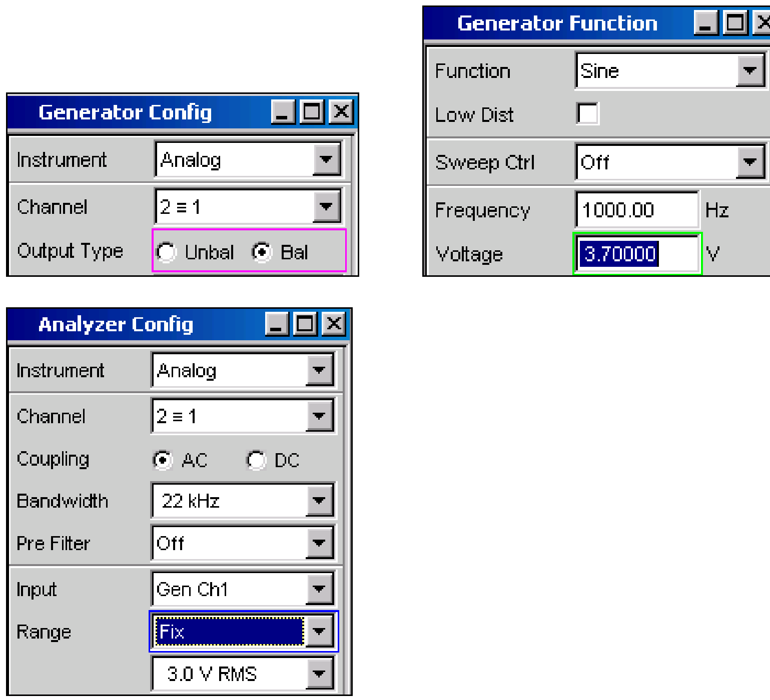
Hi/Lo: Symmetrical signals corresponding to the test diagram at P59 above.

Note:
The connectors for X41 can only be conveniently reached at row B on the AAB. It is generally useful in the case of errors on the interfaces to trace the signals to the opposite DMB. Only then is it possible to decide whether a board is faulty.

➢ Faults relating to level monitoring and/or autoranging:

Before the tests load the R&S UPV default setup and generator/analyzer panel as follows.

Set the R&S UPV:



Overrange test:

Switch "Range Fix" from 3.0 V RMS to 6.0 V RMS in accordance with the table:

Range	Numeric display		Status line	
Ch 2 ≡ 1	Ch1	Ch2	Ch1	Ch2
3.0 V RMS	---	---	Anlr1 Over	Anlr2 Over
3.0 V RMS	---	---	Anlr1 Over	Anlr2 Over
6.0 V RMS	3.7 V (nom.Value)	3.7 V (nom.Value)	Anlr1 Terminated	Anlr2 Terminated

Note:
In this example "nom.Value" will be tested only for its basic function.
Numeric display for Anlrx Over: → Display "---"..

Measurement: Set the generator signal and measurement ranges according to the test table, launch a single measurement and evaluate the result.

Example of a status display:

Anlr1 Over Anlr2 Over Gen Running Sweep Off

The above test settings with the required performance of the R&S UPV analyzer are an example of measurement ranges with signals, in which unequivocal assignment of the fault is highly possible. The tests can also be performed in other measurement ranges with appropriately allocated voltage levels – but this is unnecessary, since level monitoring always takes place at the same internal level points.

Possible errors:

- Deviation from the required behavior in one channel only: AAB fault very probable.
- Deviation in both channels: Equal probability of a fault in the AAB or the DMB.
  Equally important is maintenance of the level thresholds, which the instrument firmware always reports on in the status line in the event of an overload.
- Missing internal level monitoring signals or "Over" messages on the display result in totally incorrect display values or strong distortions in FFT displays if autoranging ("Range Auto") is selected or fixed ranges ("Range Fix") with signal overranging are selected. Autoranging no longer functions with up-ranging.
- Errors in which down-ranging no longer functions are more seldom. If autoranging is selected, it may no longer be possible to set measurement ranges that are more sensitive, and the dynamic range may be more or less heavily impaired. If this is the case, one of the two channels or both will no longer display "underrange" messages in the status line in the "Range Fix" mode.
  Example of a correct status display with underranging (in the event of an error, the display will always show "Anlrx Cont"):

  Anlr1 Undr   Anlr2 Undr   Gen Running   Sweep Off

  Program-controlled triggering of down-ranging or of the "Undr" message occurs with every measurement cycle via a channel-internally defined level threshold that is forwarded to the processors via the peak detectors and the A/D converters. If the A/D converters and their periphery were correctly tested beforehand, the error can only be caused by the additional analyzer hardware of the AAB, which means that the board must be exchanged.

If significant differences between the two channels occur, the fault lies with the AAB, which must then be replaced.

Test points/test signals:
(logical level 0/+3.3 V for all signals)

P60 →Interrupt status signal out (D41 Pin 10), active low,
Lo: Overrange / overload status,
Hi: Normal R&S UPV operating status
X41 pin B16 → Read strobe
X41 pin B20 → Serial clock
X41 pin B21 → Serial data from status register

Note:
The test point P60 is not included in the first R&S UPV series. In these cases, as an alternative take the measurement at component D41 on pin 10 (for the location of the components see Fig. 3-11).

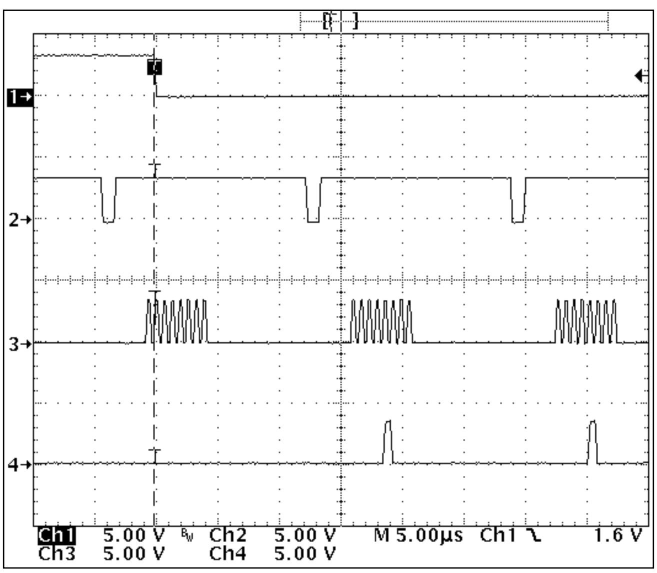
➢ Events for overrange / overload which trigger a status signal in both analyzer channels

- Level exceeded (absolute peak value) by some 15 % over each measurement range nominal value (see level table in chapter "Functional Description"); applies to in-band and out-of-band signals, which are signals that lie outside the currently chosen bandwidth of the analog analyzer.

- Level exceeded in what are called the "precision" modes of the distortion measurements with the internally switched on analog filters "notch" or "DFD-d2" (see “Functional Description”); applicable as above to in-band and out-of-band signals.
- Overloaded low-impedance input impedances (300 Ω, 600 Ω). Though this case rarely occurs there can nonetheless be a hardware fault which prevents any further status reset via the firmware thereby blocking measurement.
  → If the status cannot be reset even though the read interface is in order according to the tests in the adjoining oscillogram, the AAB must be replaced.

If an "Active low" status occurs in the analyzer logic at test point P60 due to one or more of the events mentioned above, a status register is read by the computer part with the aid of polling or an interrupt. In a trouble-free R&S UPV the event responsible is determined by the firmware and reacts automatically according to the situation, or displays messages to the user in the form of popup windows or in the status line display – or can in fact even be evaluated via the IEC bus.

Oscillogram – Read analyzer interrupt and status register: R&S UPV setting 3.7 V, 1 kHz, range fix 3.0 V RMS as above.



Trace Ch1: Test point P60
Analyzer interrupt signal, active low.

Trace Ch2: Test point X41 pin B16
Read strobe

Trace Ch3: Test point X41 pin B20
Serial clock

Trace Ch4: Test point X41 pin B21
Serial data from status register

Scope: Inputs DC coupled

In the event of an error it is often enough to check for the presence of the individual signals one after the other.
The "Read Strobe" signals and the serial clock must be constantly present, regardless of any overload on the analyzer inputs. The data signal is only evaluated by the firmware when the interrupt signal is active low.

The status signal in the above oscillogram (trace Ch1) is cyclically reset briefly in the "Fix Range" mode during continuous overloading – in the example, Hi for ≈ 200 µs (another setting of the oscilloscope).
Immediately after the event is reset the interrupt signal must become inactive again, that is, logical high. For this case therefore, in Fix Range mode the measurement range must be switched to insensitive or the signal must be reduced, so that the firmware can reset the status signal or status register.
Therefore if the signal stays constantly on active low, the fault can be in the AAB or the DMB. In this situation there is an intermediate status in the mode "Auto Range", when after resetting an overrange, a lengthy interval of several seconds elapses before the interrupt signal becomes inactive. In such cases the peak detectors can no longer be reset due to a hardware fault – the firmware then forces the analyzer channel or channels into the least sensitive measurement range and dwells there for the lengthy interval – until a peak detector resolves the overload with the aid of long time constants and depletes its own load.

→ The AAB must be replaced.

In "Range Fix" mode, the status "Anlrx Over" and the measured value display "---" are likewise blocked for some seconds in this error situation, whereas in normal status these disappear immediately, to be replaced by the status "Anlrx Cont" or "Anlrx Terminated" and regular output in the numeric display.

Special cases:

- Status signal constantly **Lo** (active):
  If the status signal to the DMB stays constantly in the active low status due to a hardware fault, the status register for each measurement cycle is of course read, but for the time being has no beneficial effect on the detection of overload cases, since the status bits are always evaluated by the firmware. If all status bits are inactive low, the analyzer is working correctly despite the active status signal.

- Status signal constantly **Hi** (inactive):
  This case leads to faulty autoranging on the analyzer channels.In Fix Range mode there are no more overrange messages. In the event of overloading in the analog analyzer, "Anlr1 Cont" and "Anlr2 Cont" are always falsely reported in the status line of the R&S UPV display.

If the status signal and its function on the AAB are in order, the fault may lie in cable connection X41/W41 – otherwise the DMB must be replaced.

If the signals are in order in analyzer mode "Range Fix", then if control data transmission (see above) is working correctly in "Auto Range" mode, it is highly likely that a fault can only be present in the peak detector logic in the AAB, and the AAB must therefore be changed.

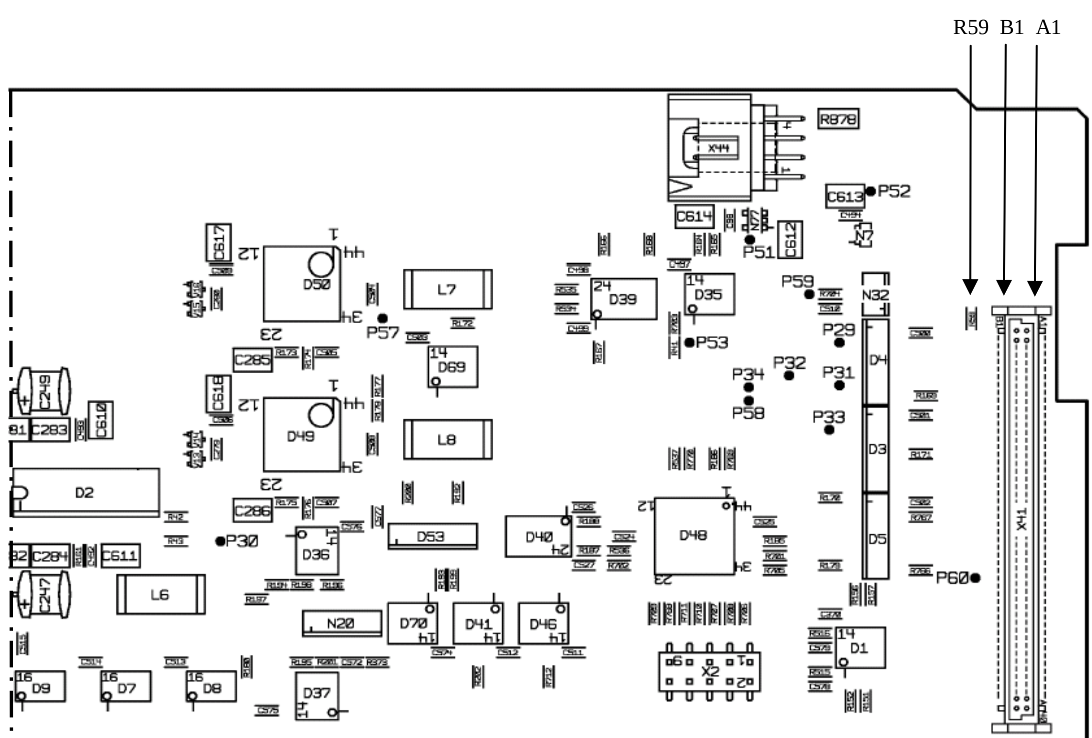


Fig. 3-11 Section of the component location plan for the AAB
(area of the 80-pin ribbon cable connector X41 - Control/Data Connector Analyzer).

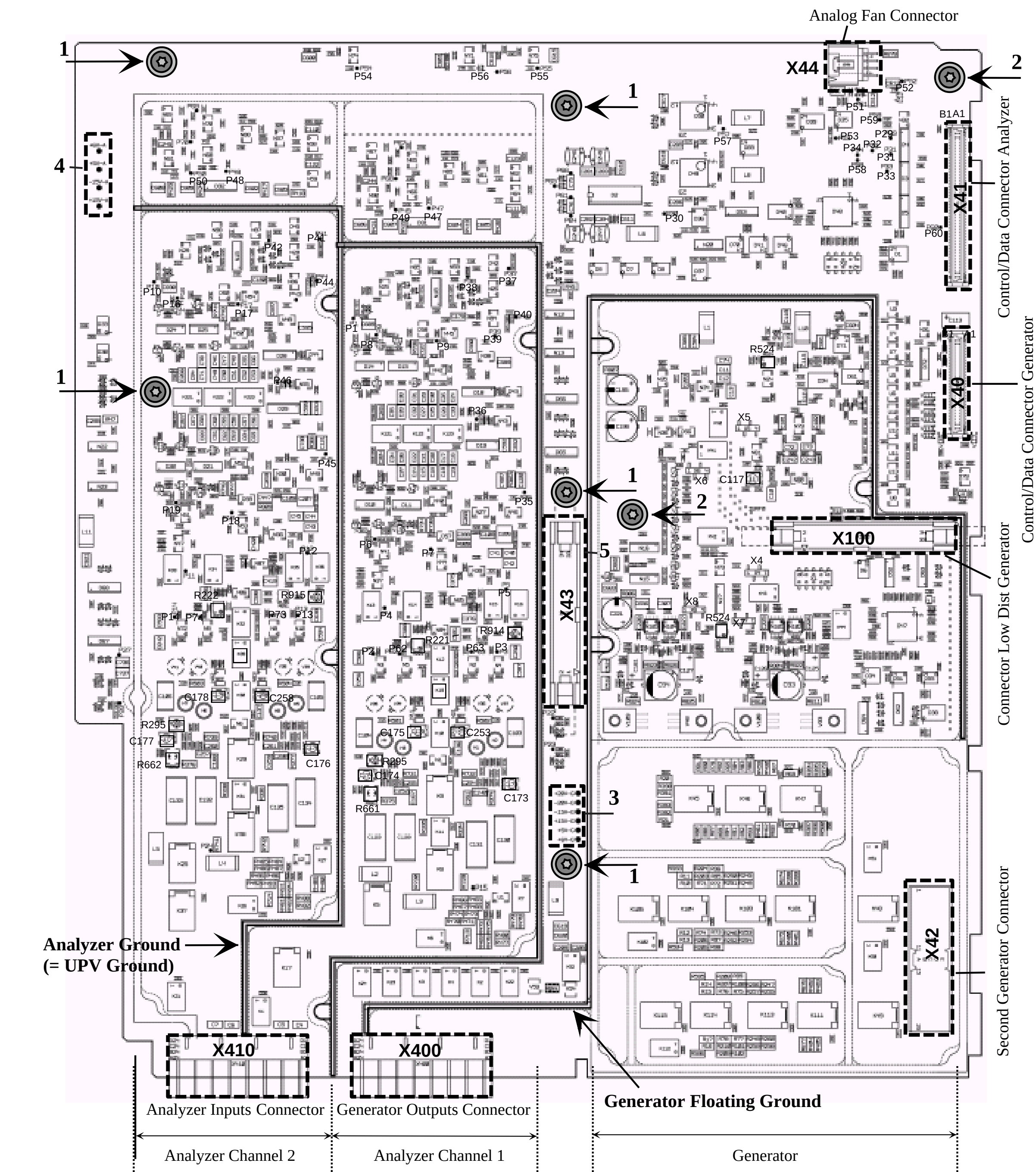


Fig. 3-12 Component-side view of the analog audio board (AAB)
(Underside of R&S UPV base unit without options R&S UPV-B1 and R&S UPV-B3)

<u>Explanations:</u>

1 Screw fixings (5) to AAB
2 Screw fixings (2) to option R&S UPV-B1
3 Test pads power supply generator (floating potential)
4 Test pads power supply analyzer (grounded potential)
5 Power connector analyzer & generator (X43)
P... Test points, X... Connectors, C... Adjustment capacitors, R... Adjustment resistors

Errors on the Digital Main Board

➢ No connection to a connected USB device via connectors X3 or X4 (instrument rear)?

- Test 1: Voltage test on the USB connector
  Test the voltage without load between pin 4 (- pole) and pin 1 (+ pole). If the voltage exceeds 5.25 volts, the switching power supply supplies an overvoltage and must be replaced. Now test the voltage with load (10 ohms) between pin 4 (- pole) and pin 1 (+ pole). If the voltage exceeds 4.6 volts, please continue with Test 3.

- Test 2: Voltage test on the DMB
  Test the voltage +5V on the DMB, see Fig. 3-13.
  If the voltage is less than 4.9 volts, the switching power supply supplies an undervoltage and must be replaced.

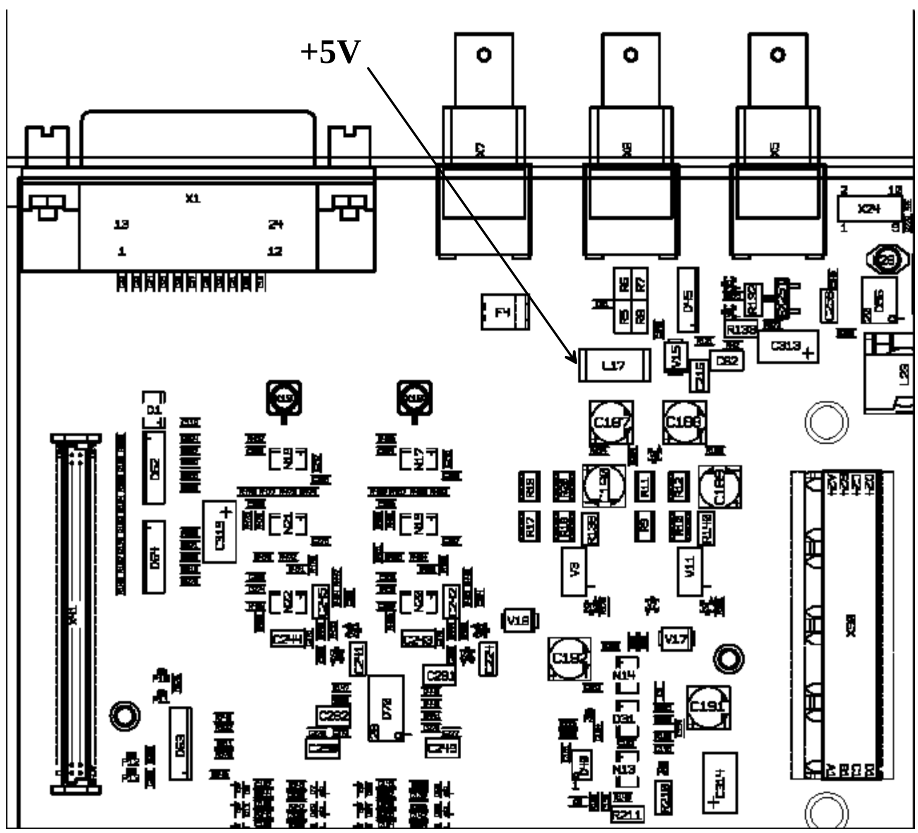


Fig. 3-13 Measurement point for +5V, L17

For further troubleshooting, please remove the front module controller.

- Test 3: resistance test on the DMB
  Check the resistance between USB connector X3 pin 2 and front module controller connector X91 pin C1, and between USB connector X3 pin 3 and front module controller connector X91 pin C2.
  If one of the measured resistances exceeds 3 Ω, the DMB is defective and must be replaced.
  Check the resistance between USB connector X4 pin 2 and front module controller connector X91 pin D2, and between USB connector X4 pin 3 and front module controller connector X91 pin E2.
  If one of the measured resistances exceeds 3 Ω, the DMB is defective and must be replaced.

- Test 4: Short-circuit test on the DMB
  Check the resistances of USB connector X3 between the following pins:
  Pin 2 and pin 4
  Pin 3 and pin 4
  Pin 2 and pin 1
  Pin 3 and pin 1
  If one of the measured resistances is less than 10 kΩ, the DMB is defective and must be replaced. Otherwise it is highly probable that the front module controller is defective. Please replace this.

➢ The LPT connector (instrument rear) does not function?
- Make sure the correct operating mode of the LPT interface is selected and that there is no software error (not with MFR9).

For further troubleshooting, please remove the front module controller.

- Test 1: resistance test on the DMB
  Check the resistance between the matching pins of LPT connector X2 and front module controller connector X92 according to the following table:

X2 pin	X92 pin
A1	B10
A2	C8
A3	D7
A4	B8
A5	C6
A6	B7
A7	D5
A8	C5
A9	B8
A10	D4
A11	C4
A12	B5
A13	D3
A14	D8
A15	B9
A16	C7
A17	D6

If one of the measured resistances exceeds 2 Ω, the DMB is defective and must be replaced.

- Test 2: Short-circuit test on the DMB
  Check the resistance between pins A2 to A17 and pin 25 of LPT connector X2.
  If one of the measured resistances is less than 10 kΩ, the DMB is defective and must be replaced. Otherwise it is highly probable that the front module controller is defective. Please replace this.

➢ The COM connector (instrument rear) does not function?
- Make sure the correct operating mode of the COM interface is selected and that there is no software error (not with FMR9).

For further troubleshooting, please remove the front module controller.

- Test 1: resistance test on the DMB
  Check the resistance between the matching pins of COM connector X2 and front module controller connector X92 according to the following table:

X2 pin	X92 pin
C1	B2
C2	D1
C3	C2
C4	B4
C6	C1
C7	B3
C8	D2
C9	C3

  If one of the measured resistances exceeds 13 Ω, the DMB is defective and must be replaced.

- Test 2: Short-circuit test on the DMB
  Check the resistance between pins C1, C2, C3, C4, C6, C7, C8, C9 and pin C5 of COM connector X2.
  If one of the measured resistances is less than 10 kΩ, the DMB is defective and must be replaced. Otherwise it is highly probable that the front module controller is defective. Please replace this.

➢ The device connected to monitor connector X2 (instrument rear) doesn't work properly?
Make sure the external monitor is activated and the correct resolution is selected.

For further troubleshooting, please remove the front module controller.

- Test 1: resistance test on the DMB
  Check the resistance between the matching pins of monitor connector X2 and front module controller connector X92 according to the following table:

X2 Pin	X92 Pin
B1	A2
B2	A1
B3	B1
B12	A13
B13	A3
B14	A4
B15	A14

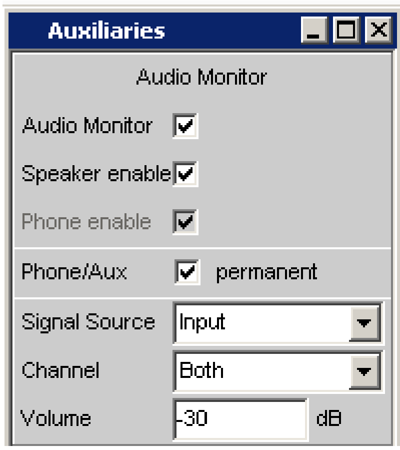
  If one of the measured resistances exceeds 2 Ω, the DMB is defective and must be replaced.

- Test 2: Short-circuit test on the DMB
  Check the resistance between pins B1, B2, B3, B12, B13, B14, B15 and Pin B5 of monitor connector X2.
  If one of the measured resistances is less than 10 kΩ, the DMB is defective and must be replaced. Otherwise it is highly probable that the front module controller is defective. Please replace this.

Error on the audio monitoring output

To allow audio monitoring of audio signals, you have to activate the audio monitoring function in the Auxiliaries panel.

Setting the R&S UPV:



If you have not enabled the Audio Monitor option, the entire audio monitoring function is deactivated. If Audio Monitor is activated, an LED at the loudspeaker icon will be illuminated. As you can see in the panel, the replay sources (loudspeaker or headphones) can be switched on and off separately from each other.

Internal Loudspeaker

➢ **Incorrect operation?** (in the Auxiliaries oder Analyzer Config panel)
- Have you selected Audio Monitor?
  If the check box is not enabled, the audio monitoring function is deactivated.
- Is the internal loudspeaker switched on?
  To activate the loudspeaker, you must also enable this option.
- Is Signal Source set to Input?
  If no signal is applied at the analyzer inputs, you cannot monitor a signal.
- Have you selected an incorrect channel under Channel?
  If Signal Source is set to Input and only one input receives a signal, but the other signal is monitored, the loudspeaker remains silent.
- Have you set the volume correctly?
  If the volume set under Volume is very low (e.g. -120 dB), the signal to be monitored cannot be heard with the internal loudspeaker.
- Have you set the correct frequency?
  If a signal whose frequency exceeds a human's audible range is fed in or internally generated, this signal cannot be heard.
- Is the signal very low?
  If Signal Source is set to "Input", the range set in the analyzer is too large or the input amplitude is too low.
- Can Signal Source not be set to "Input"?
  Check the setting in the line Anlg Aux Out. If Generator is selected there, the audio-monitoring source will also be automatically applied for Signal Source. An error message appears that prompts you to set Anlg Aux Out to DC so that you can switch on all sources under Signal Source.

- **Loudspeaker remains silent or very low?**
  - Is the loudspeaker connected?
    The loudspeaker connection has two connectors:
    1. Flat connector on the loudspeaker itself.
    2. Connector on the DMB.
    If one of the two connectors is missing, the loudspeaker remains silent.
  - Is Signal Source set to Input?
    If no signal can be heard despite correct feed, try to switch to Generator under Signal Source. This setting allows you to monitor a signal even if no signal is applied at the analyzer inputs.
    If you cannot detect a signal on Phone Out, the cause is most likely the audio-monitoring D/A converter on the DMB. If Phone Out is o.k., the loudspeaker amplifier (on the DMB) is defective.

- **Signal distorted?**
  - Is Signal Source set to Input?
    Check the range setting of the analog analyzer in the Analyzer Config panel.
    A range that is too sensitive not only leads to an overload message in the analyzer but also to a distorted output amplitude on the loudspeaker.
    If the analyzer range has been selected correctly, the cause may be in the audio-monitoring A/D converter or in the audio-monitoring D/A converter; both are on the DMB.
  - Is Signal Source set to Generator?
    The cause may either be a fault in the loudspeaker amplifier (on the DMB) or a defective loudspeaker itself.
    In this case, check the signal at Phone Out. If it is also distorted, the cause may be in the audio-monitoring D/A converter on the DMB.

Phone Out

- **Incorrect operation?** (in the Auxiliaries or Analyzer Config panel)
  - Have you selected Audio Monitor?
    If the check box is not enabled, the audio-monitoring function is deactivated.
  - Have you switched on Phone Out?
    To activate the loudspeaker output, this check box must also be enabled.
  - Is Signal Source set to Input?
    You cannot monitor a signal if no signal is applied at the analyzer inputs.
  - Have you selected an incorrect channel under Channel?
    If Signal Source is set to Input and only one input receives a signal, but the other one is monitored, the headphones remain silent.
  - Have you set the volume correctly?
    If the volume set under Volume is very low (e.g. -120 dB), the signal to be monitored cannot be heard with the headphones.
  - Have you set the correct frequency?
    If a signal whose frequency exceeds a human's audible range is fed in or internally generated, this signal cannot be heard.
  - Is the signal very low?
    If Signal Source is set to Input, the range set in the analyzer is too large or the input amplitude is too low.
  - Can Signal Source not be set to Input?
    Check the setting in the line Anlg Aux Out. If Generator is selected there, the audio-monitoring source will also be automatically applied for Signal Source. An error message appears that prompts you to set Anlg Aux Out to DC so that you can switch all sources under Signal Source.

- **None or only very low signal at the headphones output?**
  - Are the headphones correctly connected?
    If the headphones' headset plug is not correctly plugged in, it does not receive a signal.
  - Is Signal Source set to Input?
    If no signal can be monitored despite correct feed, try to switch to Generator under Signal Source. This setting allows you to monitor a signal even if no signal is applied at the analyzer inputs.
    If a signal cannot be heard when checking the internal loudspeaker, the cause is most likely the audio-monitoring D/A converter on the DMB. If the loudspeaker sends a signal, the Phone Out amplifier (on the DMB) is defective.
    To be on the safe side, connect another set of headphones at Phone Out; the headphones may be defective.

- **Signal distorted?**
  - Is Signal Source set to Input?
    Check the range setting of the analog analyzer in the Analyzer Config panel.
    A range that is too sensitive not only leads to an overload message in the analyzer but also to a distorted output amplitude at Phone Out.
    If the analyzer range has been selected correctly, the cause may be in the audio-monitoring A/D converter or in the audio-monitoring D/A converter; both are on the DMB.
  - Is Signal Source set to Generator?
    The cause can either be a fault in the Phone Out amplifier (on the DMB) or a defective set of headphones itself.
    In this case, monitor the signal with the internal loudspeaker. If this signal is also distorted, the cause may be in the audio-monitoring D/A converter on the DMB.

Option R&S UPV-U2

If option R&S UPV-U2 is installed in the audio analyzer, the signals available at the 6.3 mm jack on the front panel are also routed to two BNC sockets at the rear of the instrument. This output is also activated by enabling "Phone enable" (in the Auxiliaries panel).

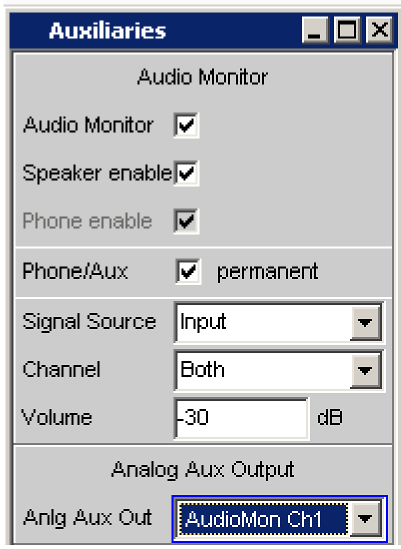
If this output is defective, you can carry out the same troubleshooting as with Phone Out to localize the cause.
If Phone Out is o.k. but not the BNC outputs of the R&S UPV-U2, the cause can be the option itself, which consists of a small board and two cables.

Note the following special feature:
The output impedance is approx. 600 Ω. Therefore, too heavy a load on the sockets causes a much more significant drop of the output level than with Phone Out.

Errors on Analog Aux Out

Either a generator signal or a DC voltage can be output at Analog Aux Out. This is set in the corresponding block under Anlg Aux Out.

Setting the R&S UPV:



Anlg Aux Out is set to *AudioMon Ch1*:

- **Incorrect operation?** (in the Auxiliaries panel)
  - Is Audio Monitor selected?
    If the check box is not enabled, the audio-monitoring function is deactivated.
  - Is "Speaker enable" or "Phone enable" selected?
    One of the two options must be selected so that a signal will be output when *AudioMon Ch1* is selected.

- **No audio signal?**
  - Is DC set?
    If DC is set as the source, no audio signal can be monitored.
  - Is Volume set to high attenuation (<-80 dB)?
    The setting of Volume in the Audio Monitor block affects the Aux Out level.

- **Very low, noisy or distorted signal?**
  - Volume set to high attenuation?
    The setting of Volume in the Audio Monitor block affects the Aux Out level.
  - Correct settings:
    To determine the cause, check the signals at Phone Out or via the internal speaker.
    If these two outputs are o.k., the cause is in the Aux Out amplifier; otherwise, the audio-monitoring D/A converter is defective (both on the DMB).

Anlg Aux Out set to DC:

- **Incorrect operation?** (in the Auxiliaries panel)
  - Is the voltage at 0.000 V?
    Please adjust the desired level in the range from -2.5 V to +2.5 V.

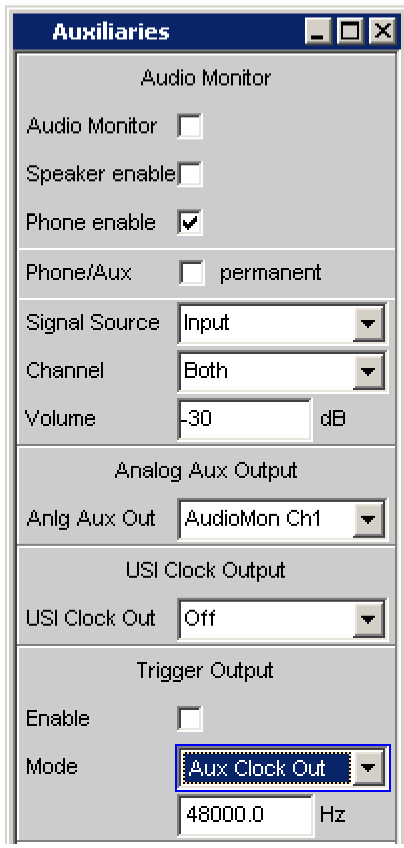
- **No DC level?**
  - Is generator audio signal o.k.?
    If the audio signal is output correctly but not the DC level, the circuit for DC generation on the DMB is defective. If this test is o.k., the cause is in the Aux Out amplifier, also on the DMB.

Error on the Trigger In/Out

Trigger output

The trigger input and output settings are entered in the Auxiliaries panel. You can activate or deactivate (Enable check box) the functions of the two BNC connectors on the rear panel of the instrument separately from each other.

<u>Setting the R&S UPV:</u>



- <u>No output signal?</u>
  - Is the Enable check box enabled?
    Before the BNC connector can supply a signal, you have to activate the output in the Auxiliaries panel.
  - Have you selected the correct mode?
    If a squarewave signal is to be output in the range from 0.1 Hz to 50 MHz, you have to select **Aux Clock Out** in the Mode selection window and enter the desired frequency below.
  - Is the BNC cable used o.k.?
    For a test, you can connect another cable.

If the output does not supply a signal despite correct setting and intact cable, the DMB is defective.

The second selection item **Measuring** has yet not been implemented in the firmware. If Rising is selected, the output constantly supplies a high level (approx. 2.5 V). If Falling is selected, the output supplies a low level.

Trigger input

No function has yet been implemented in the firmware.

Problems with two HW Optionen in the USI Slots

The R&S UPV has two extension slots for HW options on the rear. It can be a problem to fit an older device with two options simultaneously.

Reaction:
The two option can't be controlled as intended.

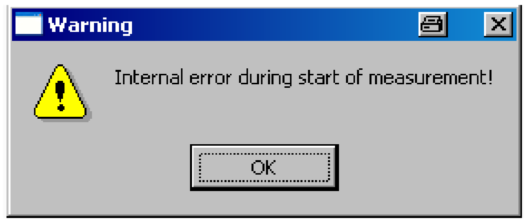
Possible cause
At older R&S UPV both extension slots are controlled with identical clock and data signals. An independent control of each option is therefore not possible!

Trouble Shooting:
Measure with an ohmmeter between connectors X101/X111 und X102/X112 Pins E17, E19, E20, E22 and E23 on Power Connector Boards (PCB). These pins must not have any connection!

Error Elimination:
The best way to eliminate the error is to replace the PCB by a board with a newer revision (TAZ 03.05 or higher), which supports two HW options (see „Replacing the power connector board (PCB)“).

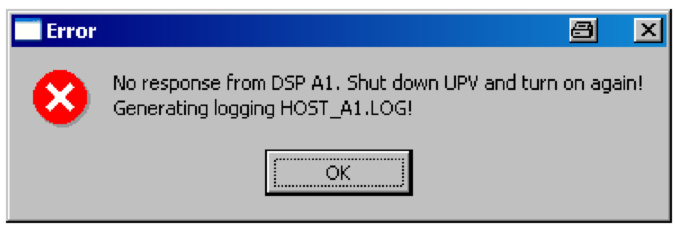
Errors in Digital Audio I/O (Options R&S UPV-B2/B20 and -K22)

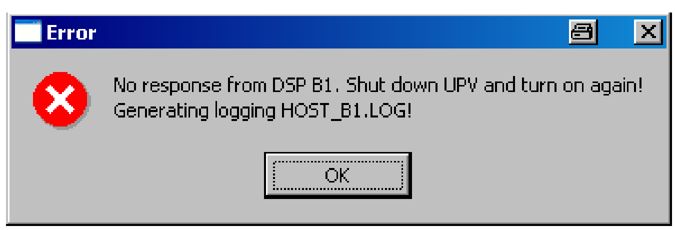
Appearance: The “Numeric Display” shows “OFF“ or “---“ instead of the measurement values
After changing the settings the following windows appears:



(sometimes)

and (always)

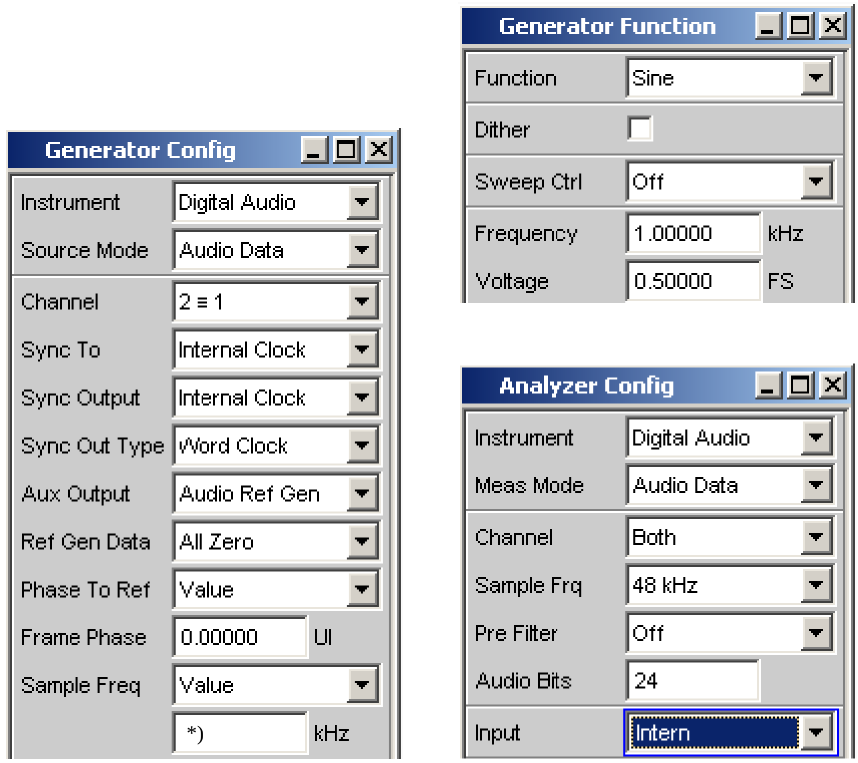




One reason for this error could be missing +5 V from DMB. The DSPs receive no clock from the UPV-B20 to read the data information.

Measurement 1: Digital loop measurement **Audio Data**

Set R&S UPV: Starting from the default state



*) Sampling frequency 30 kHz to 200 kHz

Test setup: Frequency counter to Sync Output (to check the sampling rate)

Troubleshooting tips for the audio data loop measurement:

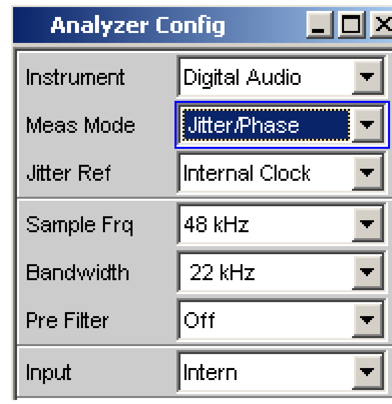
When the option R&S UPV-B2 is functioning properly, the frequency and amplitude value set in the Generator Function Panel will be measured and displayed by the digital analyzer.

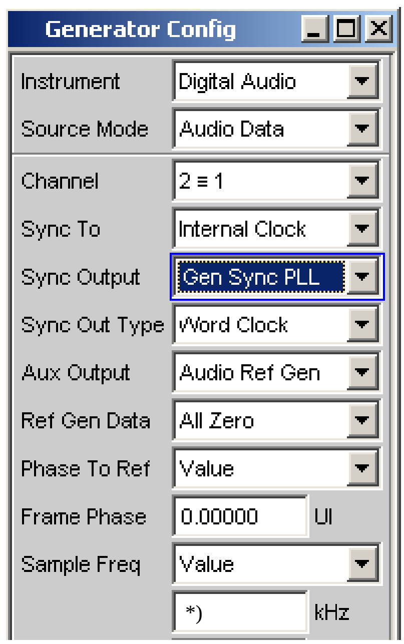
- In case of a malfunction, first check whether the digital generator and analyzer are working:
- If no external digital audio generator is available, connect the AUX output (Audio Ref Gen) to the BAL input and select it in the analyzer. If the analyzer is functioning properly, the digital audio amplitude of the Audio Ref Gen will be displayed (0 FS).

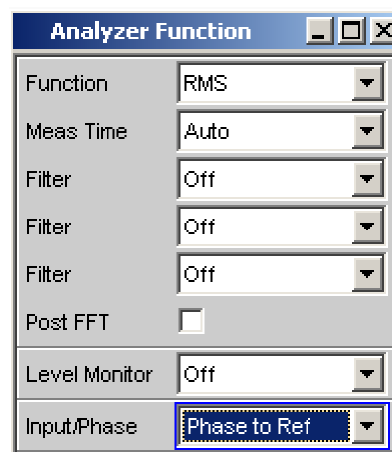
If the analyzer is not working properly, check whether the proper word clock frequency is being generated on the audio input receiver (Rx1). To do this, set the sync output to Audio In and check the frequency on the sync output corresponding to the set sampling rate on the digital generator (e.g. 48 kHz). For this frequency check, you can also use the analog analyzer with the appropriate bandwidth (80 kHz, 250 kHz). Connect it using a BNC cable and a BNC XLR adapter to the sync output.

Measurement 2: Digital loop measurement **Frame Phase** (with option R&S UPV-K22 only)

Set R&S UPV: Starting from the default state







*) Sampling frequency 30 kHz to 200 kHz

Test setup:

- ➢ Set up an XLR cable connection between AUX In and AUX Out on the rear panel of the R&S UPV.
- ➢ Connect the frequency counter to the sync output.

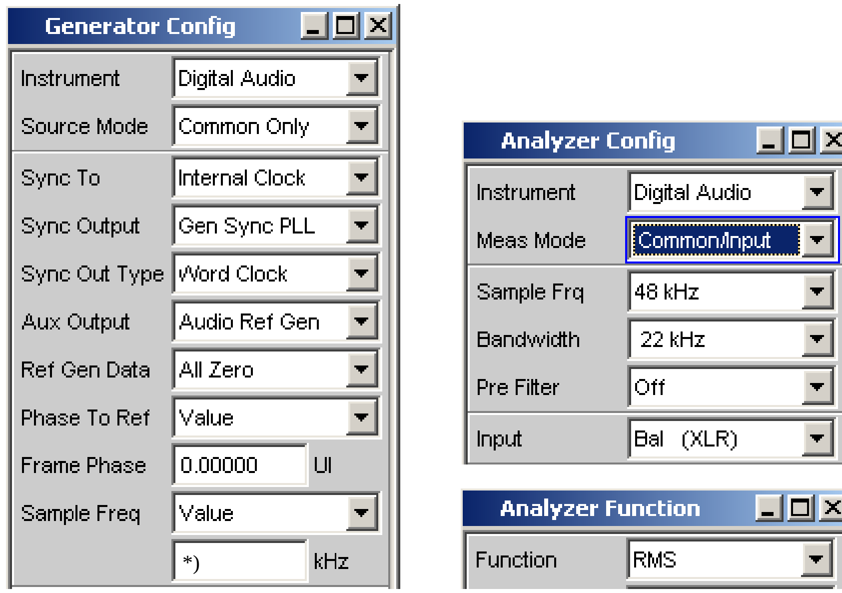
Frame phase troubleshooting tips:

When the option R&S UPV-B2/K22 is functioning properly, the frame phase value set in the Generator Config Panel will be measured and displayed by the digital analyzer. The phase to ref calibration which can be performed in the R&S UPV adjusts the phase meter and the phase generation.

- In case of a malfunction, first check whether the generator sync PLL is working properly. To do this, check the sampling frequency set on the sync output. In case of external synchronization of the generator, the sync output frequency will track the sampling rate applied externally on the AUX input. Besides proper setting of the audio frequency, the setting of the generator sampling frequency is used to select the proper generator sync PLL range and should agree with the sampling rate that is actually applied.
- A fluctuating or unstable value will be displayed if the signal at the audio input is not in sync with the signal at the AUX input which is used as the reference. When using the internal Audio Ref Gen, the AUX input must be connected to the AUX output via an XLR cable.
- The frame phase which is set always refers to Audio Ref Gen. In case of external synchronization (AUX IN) of the audio generator, a phase offset between the AUX input and Audio Ref Gen will arise for reasons related to the internal digital audio receiver and transmitter.

Measurement 3: Digital loop measurement **Common Mode** (with option R&S UPV-K22 only)

Set R&S UPV: Starting from the default state



*) Sampling frequency 30 kHz to 200 kHz

Test setup: Connect an XLR cable between the BAL output and BAL input.

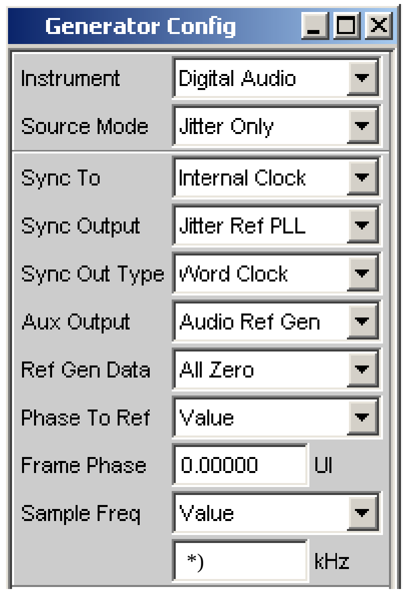
Common mode troubleshooting tips:

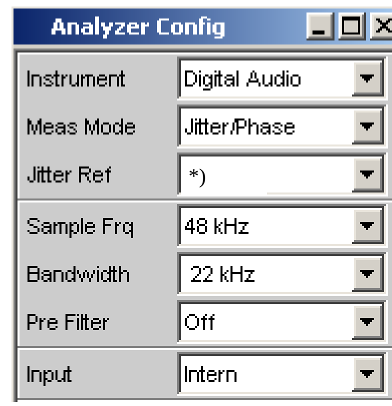
When the option R&S UPV-B2/K22 is functioning properly, the common frequency and amplitude values set in the Generator Function Panel will be measured and displayed by the analyzer.

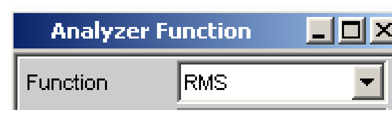
- The common mode signal is generated and measured only on the balanced (BAL) output and input.
- The circuit parts relevant to common mode signal supply and decoupling are located on the DFP.
- The common mode signal is an analog signal and is practically independent of the set digital audio signal parameters such as the sampling frequency.
- In case of a malfunction, first check whether the analog generator and analyzer are working:The superimposed common mode signal is generated by the analog generator and the signal superimposed at the BAL input is measured and evaluated by the analog analyzer. Errors in the analog generator or analyzer thus also result in a malfunction in the common mode measurement.

Measurement 4: Digital loop measurement **Jitter** (with option R&S UPV-K22 only)

Set R&S UPV: Starting from the default state







*) Sampling frequency 30 kHz to 200 kHz *) Internal clock or Ref PLL

Jitter troubleshooting tips:

When the option R&S UPV-B2/K22 is functioning properly, the jitter frequency and amplitude value set in the Generator Function Panel will be measured and displayed by the analyzer.

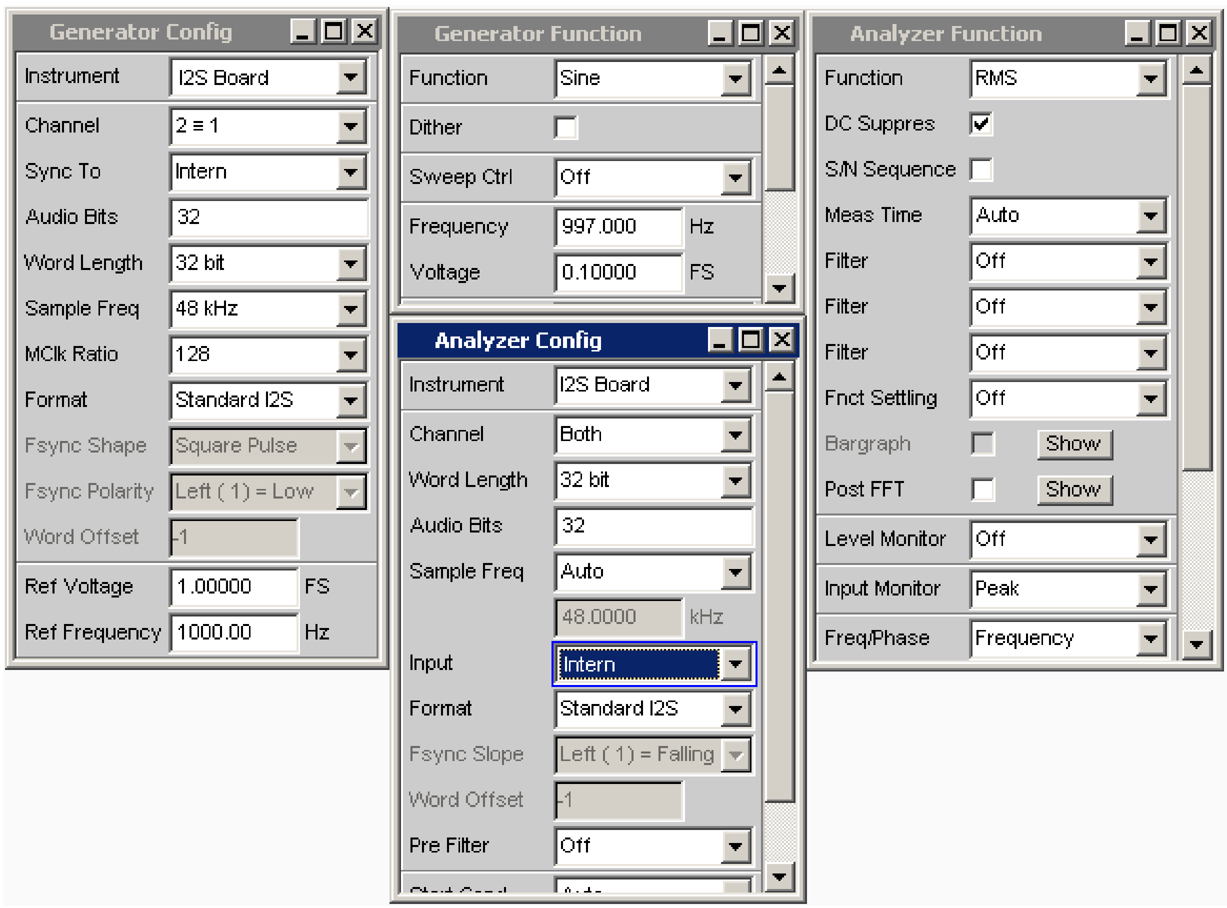
- In case of a malfunction, first check whether the jitter reference PLL is working properly. To do this, check the sampling frequency set on the sync output. Besides proper setting of the audio frequency display, the setting of the analyzer sampling frequency is used to select the proper jitter reference PLL range and should agree with the sampling rate that is actually applied.
- The jitter reference PLL has a lower cutoff frequency below which the PLL tracks the jitter interference so that a jitter amplitude which is too low is displayed.
- When using the internal clock as the jitter reference, an external test object must be synchronized to the internal generator clock.
- In case of a high jitter amplitude and high jitter frequency, under some circumstances the digital audio receiver at the input will no longer function properly so that incorrect or unstable jitter results are displayed. In such cases, it is very useful to monitor the waveform of the jitter signal in the analyzer (selection in the analyzer function panel).
- In case of external synchronization of the generator, the sampling frequency which is set determines the proper ranges for the generator sync PLL and the jitter modulator and should agree with the sampling rate which is actually applied.
- The jitter modulation signal is generated by the analog generator and the demodulated jitter signal is measured by the analog analyzer. Errors in the analog generator or analyzer thus also result in a malfunction in the jitter measurement.

Under consideration of the limitations of R&S UPV-B20, all described trouble shooting tips above are valid in full range.

Errors on I²S Board (Options R&S UPV-B41)

<u>Measurement 1</u>: Digital loop measurement

<u>Set R&S UPV</u>: Starting from the default state



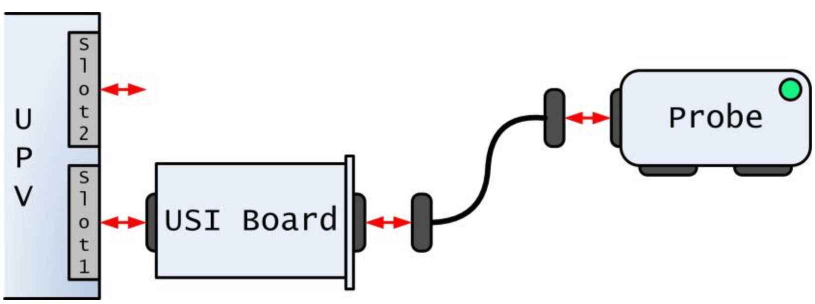
Errors on USI Board (Options R&S UPV-B42)

Recommendation in case of an error:

Since it would require a quite sophisticated measurement manual to determine whether the error is originated by the probe or the USI board, it makes no sense to perform a lengthy error detection test. Just perform the following simple steps:

Check whether to probe is properly loaded

- Upgrade the R&S UPV on newest firmware version (see release notes) if not already done
- Switch off UPV and remove the power plug
- If the option is not installed, remove cover of the left extension slot (slot 1) on the rear (TORX TX 8)
- Insert B42 board and screw down
- Connect B42 option with probe board according to draft below
- Reconnect power plug, switch on UPV and option board will be automatically recognized
- After the firmware started, a green LED on the probe indicates a successful booting



If the LED stays dark, exchange the probe and repeat the aforementioned procedure. If the booting procedure was successful, perform the operating test described in chapter 4. If the probe was properly loaded, but was not deemed functional, continue with the following steps.

Determine the source of the error

As mentioned above it is nearly impossible to determine if the source of a malfunction is located in the USI board or the probe without performing a time consuming measurement. Therefore perform the following simple tests:

Exchange the probe, run the operating test described in chapter 4.

Sucess: The probe is faulty.
Failure: Exchange the USI board and run the test again with the old probe.
Sucess: The USI board is faulty.
Failure: Exchange both, USI board and probe with new components.
Sucess: The complete option is faulty (USI board and probe).
Failure: Exchange the connection cable between USI board and probe.
Sucess: Determine whether it also works with the original components. If not determine which component might be erroneous.

Failure: If the test fails with a new UPV-B42, the error might be located inside the R&S UPV. Try another device if possible, otherwise check the R&S UPV as described in its service handbook.

Module Replacement

All R&S UPV modules and the connecting cables between them are shown in Fig. 3-14 and Fig. 3-15. Additional information can be found in the exploded view and the appropriate list of spare parts.

Overview of modules

The installation of the hardware options is described in chapter 4, Installation of Options. To remove the options, simply perform the steps in the reverse order.

Tools required

- Size 6, 8, 10 and 20 Torx screwdrivers
- Slotted screwdriver
- Phillips screwdriver
- Socket wrench
- Hexagon screwdriver (Allen key) for the toroidal core transformer
- Flat pliers for the grounding flat connectors in the APS
- Flat spanner of size 11 for the 6.3 mm jack
- Socket spanner of size 14 for the rotary knob

Replacing the fuses

- Make sure that the power cable is disconnected.
- Open the flap covering the voltage selector using a small screwdriver (or similar tool).
- Remove the cylinder labeled with the nominal voltages. Remove both fuses and install new ones. Reinsert the cylinder so that the value visible through the window in the cover flap is the same nominal voltage as before.
- Close the flap.

CAUTION

Use only fuses of type **IEC 127-T4.0H/250V**!

Note:
The Audio Analyzer R&S UPV is operated with the same fuses at all specified nominal AC supply voltages.

Removing the instrument casing

CAUTION

Only an authorized Rohde & Schwarz representative should open the casing since the calibration label can be damaged and you would lose your warranty claim!

- Switch off the R&S UPV and disconnect the power cable.
- Place the R&S UPV on its handles and remove its rear feet (four Torx screws at the instrument corners).
- Remove the casing by pulling it upward.

Replacement of the analog fan

- Place the instrument upside down so that the analog section is accessible.
- If option R&S UPV-B1 (Low Distortion Generator) is installed, remove it so that the fan will be easier to dismount.
- Unplug connector X44 on the analog audio board (AAB) at the rear of the instrument.
- Remove the two screws on the left and right of the fan cage at the rear of the instrument.
- Pull the four rubber plugs on the inside toward the front of the instrument one after the other to remove the swinging suspension devices from the installation holes.
- Remove the fan by pulling it toward the rear.
- If the four rubber plugs are still in good condition, you can use them to install the new fan; otherwise, use new ones.

CAUTION

After you install the new fan, make sure that the fan cage is neither touching the fan itself nor resting on the cover plate above the rear option shaft.

Replacing the analog audio boards (AAB)

See also Fig. 3-12 and exploded view 1146.2003.01 page 2, item nos. 700, 710.

- Place the instrument upside down so that the analog section is accessible.
- If options R&S UPV-B1 (Low Distortion Generator) and/or R&S UPV-B3 (Second Analog Generator) are installed, remove them (The installation is described in chapter 4. To remove the option, simply perform the steps in the revers order).
- Disconnect the two control cables at X40 and X41. To do this, simultaneously press together the two locking levers on the flat cable connectors and pull the cable connectors upward. When doing so, make sure that the connector parts are not skewed sideways when disconnecting them; otherwise, the connector pins could be damaged.

To remove the AAB more easily, feed both cables through the opening slots and temporarily place them in the APS chamber.

- Disconnect the supply cable at X43 after unlocking.
- Disconnect cable X44 to the analog section fan after pressing in the locking nib.
- Remove the five Torx screws.

- Push the AAB towards the rear panel of the instrument so that it unplugs from the connectors X410 and X411 to the analog front panel (AFP).
- Now remove the AAB from the analog chamber by tilting it slightly upward.

To install a new AAB, perform the steps in the reverse order. Make sure that the board recess at the rear right next to power cable X 41 engages in the guideway of the housing frame.

By replacing the AAB take care of board ID: A board with number 1146.2003.**03** contains hardware to create the "Common Mode Signal". Such a board must not be replaced by an elder board with number 1146.2003.**02**!

Replacing the analog power supply (APS)

See exploded view 1146.2510.01 D

The analog power supply (APS) is mounted on a metal bracket and includes the following components:

- Power input
- APS board
- Power switch
- Toroidal core transformer

To replace the individual components of the APS, you must first remove the entire unit from the R&S UPV.

Note**:**
If option R&S UPV-B2 is installed, you must first remove the DAB.

- Disconnect the cable to the AAB.
- Release the switch rod to the front panel from the rubber coupling over the power switch shaft and pull it backward out of the front panel and remove it.
- Remove the two Torx screws on the rear AC line input that are marked with asterisks.
- Disconnect the cable from the APS board to the switching power supply.
- Pull off the two grounding flat connectors (6.3 mm flat connectors with green-yellow wire) connected to the lateral frame.
- Undo three Torx screws on the lateral frame and push the APS toward the front panel.
- Now remove the entire unit from the R&S UPV by moving it toward the digital chamber.

To install the entire power unit, perform the steps in the reverse order. Make sure that the three nibs of the APS metal bracket correctly engage in the slots of the instrument frame. Do not forget to reconnect the two grounding flat connectors and to reinstall the DAB if you previously removed it.

Replacing the power input

Before replacing the power input, you have to dismount the APS.

The power input is a complex unit that includes one line filter, two fuses and one fourway voltage switch.

- Disconnect all cables to the power input. Due to the number of cables, make a drawing beforehand showing the cable connections.
- Remove the two Torx countersunk screws on the sides of the power input.

- The unit can now be removed from the APS bracket (be careful not to lose the additional spring plate on the side of the power input!).

To install the power input (R&S stock no 0006.0919.00), perform the steps in the reverse order. Make sure that all cables to be connected make contact with the correct flat connectors. Otherwise, an incorrect supply voltage may be accidentally set, which can damage the fuses when switching the instrument back on. To improve ground contact, insert the additional spring plate between the APS bracket and the power input and make sure that proper ground contact is made.

Replacing the APS board

Before replacing the APS board, remove the APS from the R&S UPV.

- Disconnect the cable to X11 (generator voltages).
- Disconnect the cable to X10 (analyzer voltages).
- Disconnect the cable to X1 (connection of the thermal fuses).
- Disconnect the cable to X14 (AC supply voltage to the switching power supply)
- Disconnect the cable to X3 (power supply of the AAB)
- Remove four Torx screws on the bracket (two of them directly fasten the APS board, the other two the aluminium heat sink).
- Remove the APS board together with the heat sink from the bracket.

To install a new APS board, perform the steps in the reverse order. Make sure that the board engages in the three mounts in the bracket.

Replacing the power switch

Before replacing the power switch, remove the entire APS and dismount the APS board from the bracket.

- Release the switch rod from the switch-on button to the power switch from the rubber ring.
- Remove the rubber ring from the power switch.
  The rubber ring has an asymmetrical structure and has one thick bead and one thin bead. After installing the new power switch, be sure to slide on the rubber ring in its original direction!
- Release the Plexiglas protection around the power switch on the solder side of the APS board and pull it upward so that the solder connections can be accessed.
- Remove tin-lead solder from the contacts of power switch and remove power switch from APS Board.

To install a new power switch (R&S stock no 1030.8387.00), perform the steps in the reverse order. Make sure that the protection cover engages in the slots in the APS board.

Replacing the toroidal core transformer

Before replacing the toroidal core transformer, dismount the APS.

- Disconnect the cable to X11 (generator voltages).
- Disconnect the cable to X10 (analyzer voltages).
- Disconnect the cable to X1 (connection of the thermal fuses).
- Remove the toroidal core transformer from the unit by removing the hexagon Allen screw on the bottom of the bracket.

To install a new toroidal core transformer, perform the steps in the reverse order. Make sure that the cable outlet on the primary side projects into the clear space between the bracket and power input so that the cables are not pinched.

Replacing the hard disk drive (HDD)

The following description is valid for a HDD with parallel interface:

- Disconnect the HDD adapter (2 mm on 2.54 mm) from the HDD.
- Remove two screws from the right-hand side of the instrument.
- Remove two countersunk-head screws from the front frame.
- The HDD unit can now be removed from the instrument together with the holder.
- Remove the four fastening screws from the HDD. The HDD itself can now be removed.

To install the new HDD, perform the above steps in reverse order. Before installing the HDD, make sure it is set as a slave. Do this by taking the jumper from the old HDD and plugging it onto the same pins on the new drive.

If the R&S UPV is fitted with FMR7 or FMR9, so it is also fitted with a Serial-ATA-HDD. The replacement of this HDD is different to that with parallel interface:

- disconnect SATA data cable from HDD.
- disconnect supply cable from HDD.

The mechanical removal is the same as described above. It is not necessary to select between master and slave.

After installing the new HDD, the UPV firmware must be installed.

- UPV Firmware incl. Software Platform Compass can be downloaded from GLORIS.

Replacing the front module controller (FMR)

Before removing the front module controller, the HDD must be removed (see “Replacing the hard disk drive”).

- Disconnect the LCD control cable (not R&S UPV66).
- Disconnect the front-panel USB port.
- Disconnect the flexible (green) conductors to the front-panel keyboard. (not R&S UPV66)
- Disconnect the LAN connector.
- Disconnect cable to the rotary knob (R&S UPV66: Disconnect cable to LAN Reset button on the rear).
- Disconnect the 80-pin ATA cable to the combo drive.
  In case of SATA-HDD disconnect the supply and data cables
- Remove cable to USB Device connector on the rear (not with FMR6)
- Remove the 8 (7 pieces with FMR7/FMR9) Torx screws from the front module controller
  (see exploded view 1146.2003.01 page 1).
- The front module controller can now be pulled carefully upward from the connectors and removed from the DMB. Some force may be have to be used due to the strong grip of the connector. Be careful not to bend the front module controller board too far.

Fitting the FMR in reverse order.

- After replacing the new FMR the R&S UPV BIOS must be updated. The BIOS incl. Installation Manual can be downloaded from GLORIS for
  FMR6 UPV
  FMR7 UPV
  FMR7 UPV66
  FMR9 UPV
  FMR9 UPV66

- Read out the MAC address and mark the number on a label on the backside of the instrument.
  To read out the MAC address perform following actions:
  - click the right mouse button on the lower area of display to open the task manager
  - select “new task”
  - enter “cmd” and quit with “OK”
  - close the task manager
  - enter “ipconfig /all” in the command line (with german keyboards: the minus button for slash)
  - read the MAC address under “Ethernet adapter Local Area Connection” in line “Physical Address”
  - leave the command editor with “exit”

Replacing the lithium battery in the front module controller (FMR)

CAUTION

Lithium batteries must not be exposed to high temperatures.
Since lithium batteries can harm the environment, they must not be included in household waste and must be disposed of carefully.
Replace the battery with a genuine R&S type only.

***Note*:**
3.4 V lithium battery (diameter 20 mm, height 3 mm, type CR2032) R&S stock number 0858.2049.00

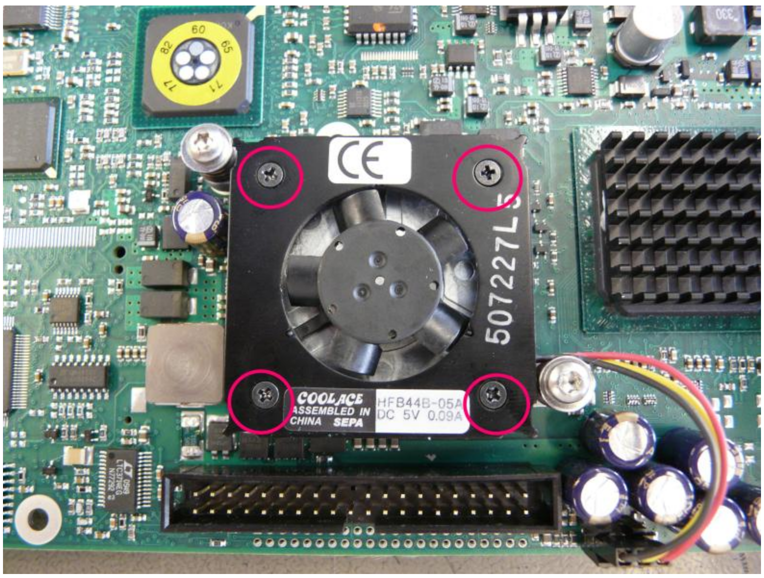
CAUTION
Do not short-circuit the battery – danger of explosion!

- Disconnect the LCD cable.
- remove battery from support.
- Insert the new battery in the holder with the positive pole (+) pointing upward.
- Reconnect the LCD cable.

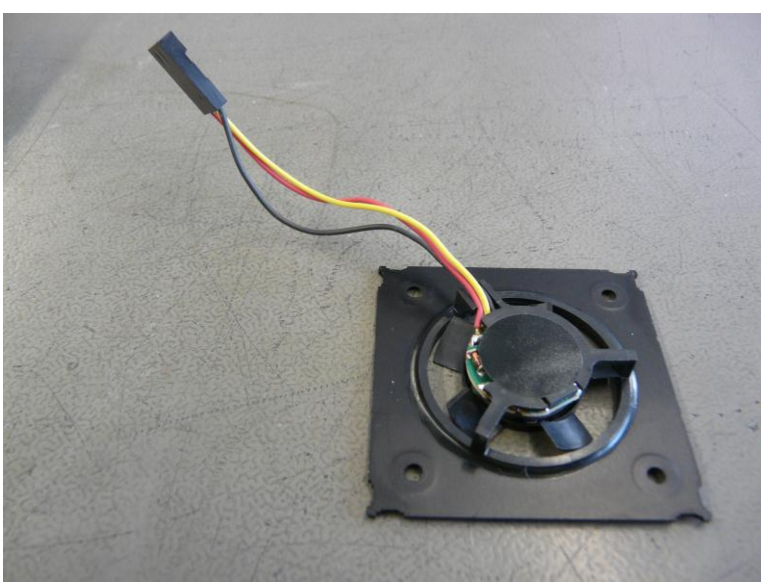
After installing the new battery it is advisable to check the date and time, and to correct them if necessary. Otherwise there could be problems with enabled software options.

Replacing the CPU fan (for FMR6 and FMR7)

- Separate the new fan from the bundle 1091.2943.00 (CPU fan plus heat sink) by removing the four screws.
- Disconnect the fan cable on FMR.
- Remove the four screws of the CPU fan on FMR (see the following picture).



- Remove the old CPU fan from the heat sink:



- Place the new CPU fan on the top of the heat sink and tighten the four screws.
- Plug the fan cable in the connector of FMR.

The bundle 1091.2943.00 is originally created for front module controller FMR6. But it can also be used for the FMR7 when applying the longer screws from built in CPU fan.

Changing the switching power supply (SPS)

- Remove the HDD (see “Replacing the hard disk drive”).
- Remove the front module controller (see “Replacing the front module controller”).
- Disconnect the flexible green conductor to the PCB (front-panel LEDs, not with R&S UPV66).
- Undo a screw from the top of the intermediate mounting plate (next to the connectors to the PCB).
- Undo a screw from the side of the intermediate mounting plate (next to the APS) and remove the fan for the SPS).
- Disconnect the AC supply from the APS.
- Disconnect the two cables that go from the switching power supply to the PCB.
- Slide the switching power supply to the left (looking outward from the front). It can then be released from the intermediate mounting plate together with a holder and removed from the instrument.
- From the switching power supply you have just taken out, remove the additional magnetic shielding (two shell halves) with which the switching power supply is fitted.

Before installing a new switching power supply carry out the following preparatory work:

- Unscrew the mounting plate from the defective switching power supply and screw it to the new one.
- Fit the new switching power supply with the magnetic shielding (two shell halves).
- The two cables to the PCB, which were removed from the R&S UPV along with the switching power supply, should now be connected to the new switching power supply.
- Assemble the fan left of SPS.

Installation takes place in reverse order, taking care to ensure that all cables are reconnected.

Replacing the SPS Fan

If R&S UPV is fitted with FMR7/FMR9, so the SPS is cooled by an additional fan. This fan is located left from the SPS and get its supply voltage from connector X11 on PCB.

- Disconnect the voltage plug to PCB (X11).
- Disconnect cable from from APS to SPS.
- Loosen the fixing screw for metal sheet of the fan left on the intermediate sheet.

Take care to pull out the fan together with its sheet metal upwards.

To build in the new fan perform the steps in the reverse order. Check the cable connection to PCB.

Replacing the power connector board (PCB)

See exploded view 1164.2003.01 page 1

Note:
If the option R&S UPV-B2 is installed, you must first remove the digital audio board (DAB).

- Remove the HDD (see “Replacing the hard disk drive”).
- Remove the front module controller (see “Replacing the front module controller”).
- Disconnect the flexible conductor tracks (green) for the front panel LED from the PCB (not necessary for R&S UPV66).
- Remove the 10 pole flat cable from LED board to DMB (R&S UPV66 only)
- Unplug the two cables coming from the switching power supply from the PCB.

- Disconnect the power supply of the combo drive from the PCB (not necessary for R&S UPV66).
- Unplug the cable to the digital fan from the PCB.
- Remove the cable to SPS fan (not for FMR6)
- Unplug the black cable coming from the DC/AC converter from the PCB (not necessary for R&S UPV66).
- Unplug the internal speaker from the digital main board (DMB).
- Disconnect the two control cables to the analog audio board (AAB) from the DMB.
- Unscrew the complete unit from the intermediate plate (two Torx screws) and from the R&S UPV rear panel (four Torx screws); look at exploded drawing.
- Push the complete unit comprising the sheet-metal frame, the DMB and the PCB in the top chamber of the R&S UPV diagonally to the front, bend the power supply cables of the switching power supply out of the way and remove the unit from the instrument.
- Unscrew the linear regulator LT1084 from the sheet-metal frame.

CAUTION

Do not forget the insulating washer between the linear regulator and the sheet-metal frame!).

- Unscrew the PCB with five Torx screws from the sheet-metal frame.
- Pull the PCB sideways off the DMB.

Replacing the digital main board (DMB)

See exploded view 1164.2003.01 page 1

The DMB is relatively difficult to replace, because other units have to be removed first. For this reason, please strictly follow the sequence described below, so that you do not forget any screws or plug connections or accidentally make a mistake that could make the instrument malfunction or even destroy it.

To get to the DMB, first remove the following units:

- Digital audio board (DAB), described in chapter 4.
- Hard disk, see Replacing the hard disk drive (HDD)
- Front module controller, see Replacing the front module controller.
- Power connector board (PCB)

The first steps for removing the DMB are the same as those for removing the PCB (refer to section "Exchanging the power connector board (PCB)". To exchange the DMB, carry out the following additional steps:

- Unscrew the two DSP boards from the DMB and remove them.

CAUTION

Do not interchange the two DSP boards when you reinstall them!

- Undo the two Torx screws and remove the DMB from the sheet-metal frame.

Installation takes place in reverse order. Make sure that no cables are trapped or forgotten.

Restore UPV Device Key and Software Option Keys

General

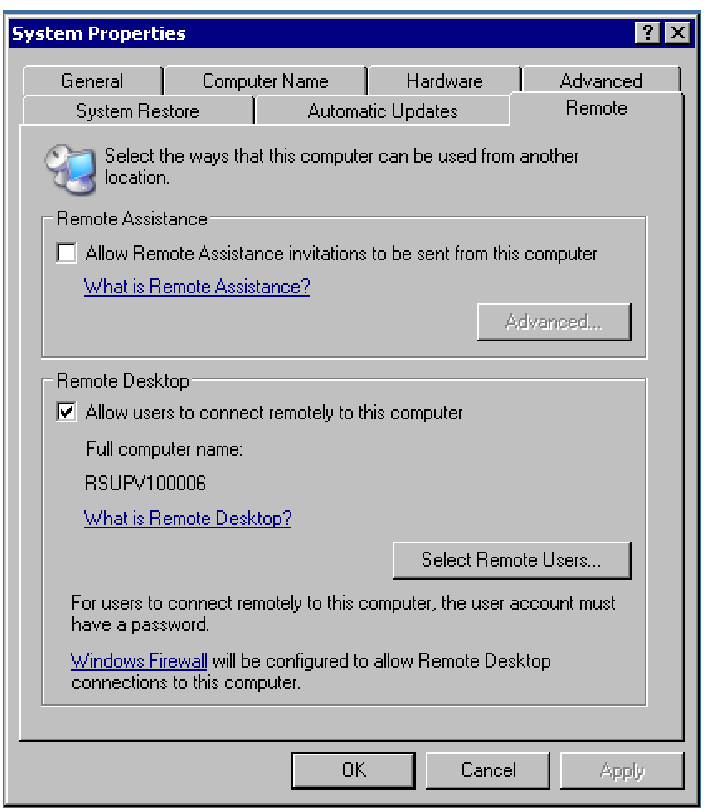
After the UPV DMB has been replaced, Device Key and Software Option Keys have to be restored. This can only be performed by the central service department via remote control of UPV. Please get in contact with the person who is in charge for service of Audio Analyzer UPV.

Prerequisites

Connect an external keyboard and a mouse to the UPV.
Connect the UPV to the LAN.

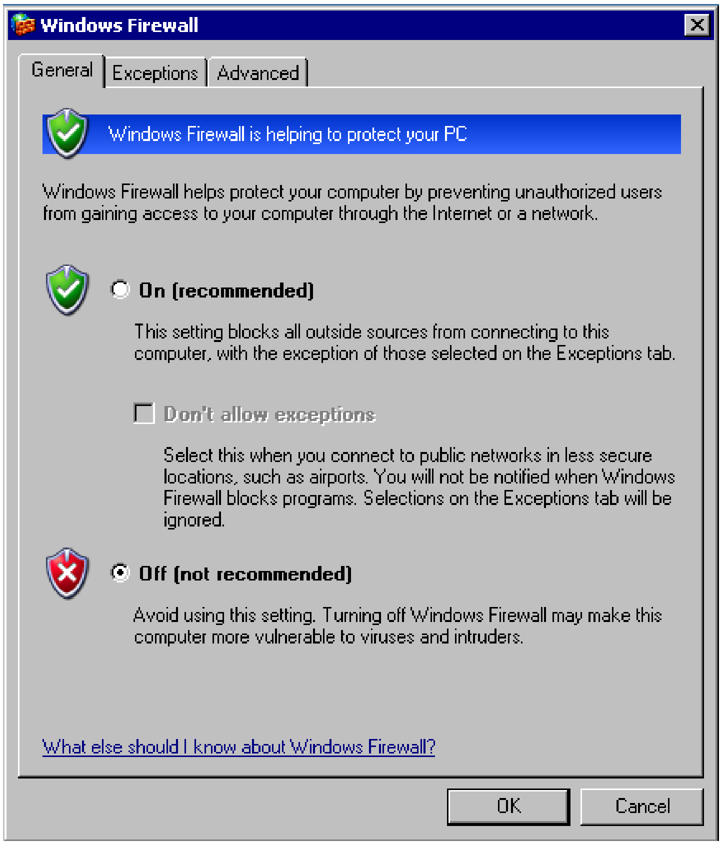
Prepare UPV for remote operation

Click "*Start - Settings - Control Panel – System*" and select the "*Remote*" tab in the menu.
Activate the "*Allow users to connect remotely to this computer*" tick box.



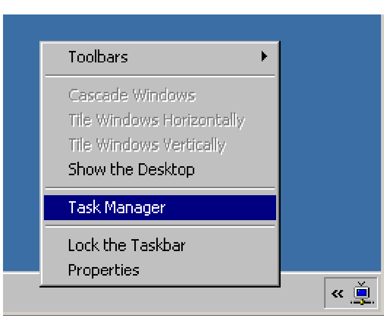
Disable Windows Firewall

Click "*Start - Settings - Control Panel - Windows Firewall*"
On the "*General*" tab select "*Off (not recommended)*"



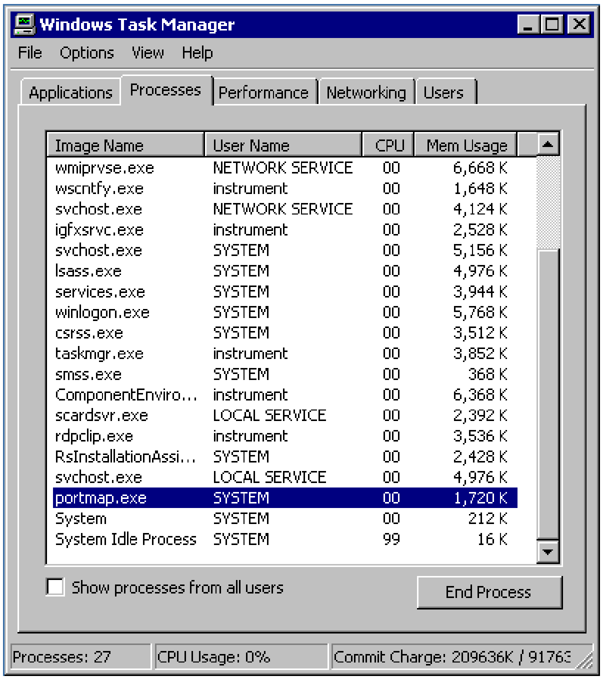
Check if process "portmap.exe" is running

Open Task Manager: right-click on the Taskbar - select Task Manager from the menu.



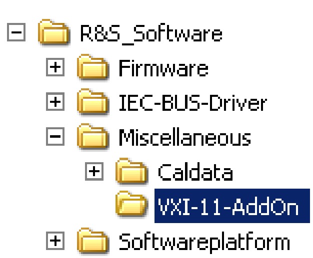
Or press ctrl+alt+del on an external keyboard

Select the "*Processes*" tab in the menu and search for the image name "*portmap.exe*".

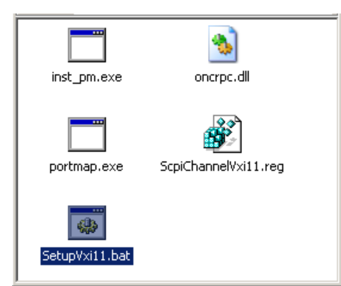


If this process is not running you have to install it. This might be the case only on older UPVs with firmware version 1.4.0 or lower.

On drive D: of UPV there is a folder "*VXI-11-AddOn*"



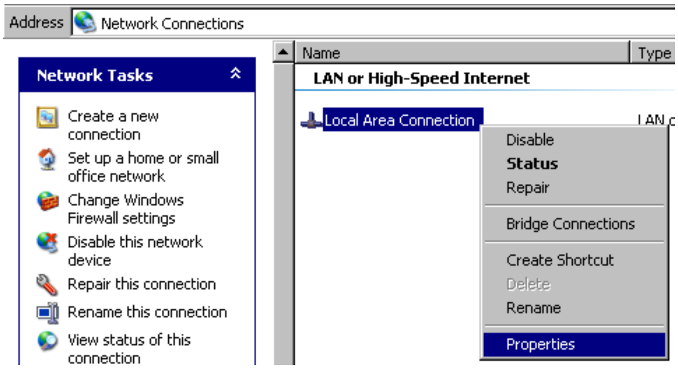
containing the following files



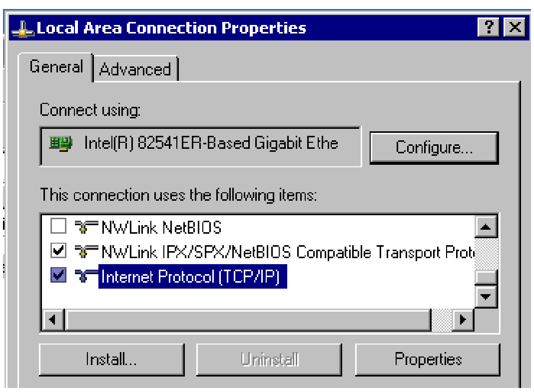
Run SetupVxi11.bat to install the VXI-11-AddOn which starts the portmap.exe process.
Follow the instructions on screen.

Check the setting of the IP Address

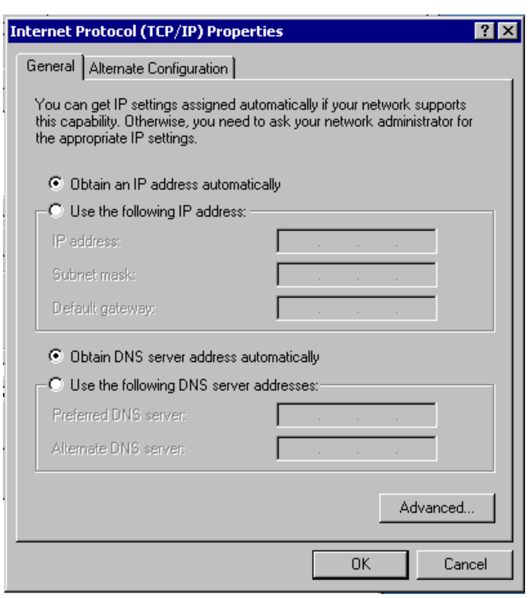
The default setting should be "*Obtain an IP address automatically*" (DHCP).
Please check this setting:
Open the Network Connections menu: "*Start - Settings - Control Panel - Network Connections*"
Right-click "*Local Area Connection*" and then click the "*Properties*" button



On the "*General*" tab, select "*Internet Protocol (TCP/IP)*", then click the Properties button.

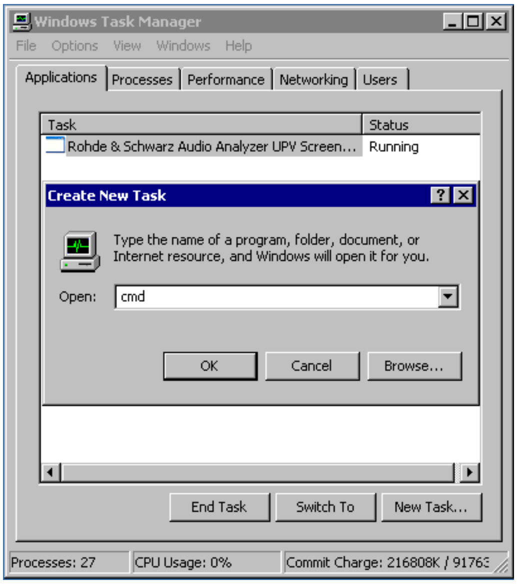


If not already set correctly, select "*Obtain an IP address automatically*".



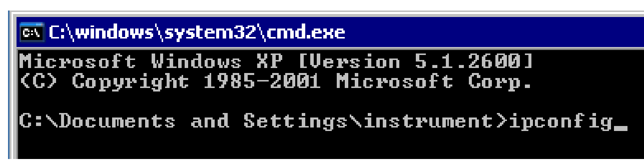
Read the IP Address

Open Task Manager. Select the "*Applications*" tab in the menu, then click the "*New Task…*" button. Enter "*cmd*" in the entry field of the Create New Task window

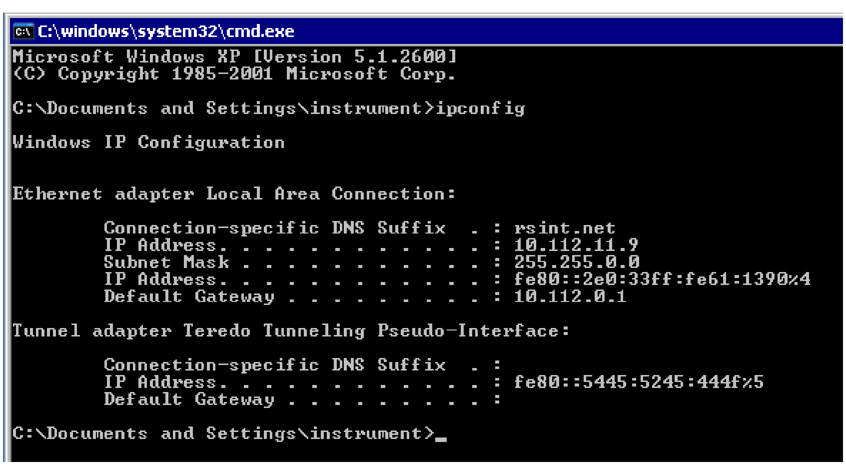


Close Task Manager

Enter “*ipconfig*” at the input prompt …



… and you get the following informations about the Ethernet adapter Local Area Connection:



Inform the central service about the displayed “*IP Address*”.
Close the command window.

Restore Device Key and Software Option Keys

The central service will now remote operate the UPV and restore the Device Key and the previously installed Software Option Keys.

After this is done, deactivate the Remote Desktop and enable the Windows Firewall.

Replacing the DSP modules

See exploded view 1164.2003.01 page 1

The two DSP modules are plugged directly to the DMB but are covered by the FMR during operation. The boards themselves are fastened upside down on the DMB.

- Remove the HDD (see Replacing the hard disk drive (HDD))
- Remove the front module controller (see Replacing the front module controller)
- Undo the five Torx screws on each DSP module
- Carefully remove the DSP module to be exchanged, paying attention to the ESD environment so that sensitive components are not accidentally destroyed by electrostatic discharges.

Replacing the digital section fan

The digital section fan is removed in two steps:
- Unscrew the fan from the side wall (four Torx screws).
- Unplug the three-core supply cable.

To unplug the supply cable, carry out the following steps:
- Remove the HDD (see Replacing the hard disk drive (HDD)).
- Remove the front module controller (see Replacing the front module controller).
- Unplug all the cables on top of the PCB, otherwise it will be impossible to access the digital fan supply cable, which is right underneath.
- Unplug the fan cable.

***Note*:**

Instead of unplugging the fan cable it is often easier to cut through the cable conductors at a suitable point and reconnect them to the new fan by a commonly-used method and shrink-on sleeves.

CAUTION

To make sure that the fan blows in the right direction after installation (i.e. out of the instrument), it must be fitted so that the labeled hub points outward. The cable must be in the slot in the plastic frame so that it is not inadvertently trapped.

Installation takes place in reverse order. Make sure that all the cables previously disconnected from the PCB or front module controller are reconnected correctly.

Replacement of USB Device Connector (not for FMR6)

- Remove cable fixing at digital section fan.
- Disconnect cable from FMR7/FMR9.
- Loosen screws on the rear of the device.
- Remove the Board upwards together with the metal sheet.

Now the board can be unscrewed from its own metal sheet.

Replacement of LAN Reset Button (R&S UPV66 only)

- Disconnect the flat cable at FMR.
- Loosen screws on the rear of the device.
- Remove the button.

Now the button can be removed from its own metal sheet.

Replacing the internal loudspeaker

- Disconnect the two flat-cable connectors from the loudspeaker.
- Undo the four screws from the side wall (the R&S UPV metal frame has four captive nuts on the inside).
- Remove the loudspeaker.
- If the cable is also faulty, it should be unplugged from the DMB instead of from the two flat-cable connectors on the loudspeaker. The connector on the DMB can now easily be reached through the opening.

Hold the new loudspeaker against the side wall from the outside and fix it in place with four Torx screws. Then either plug the two flat-cable connectors that are still in the instrument to the new loudspeaker or plug the cable with the white jack into the connector on the DMB.

Replacing the front unit

Before actually working on the front unit, remove the side handles (two Torx screws each, left and right, on the outside of the instrument) and pull the printed front panel forward.

- Remove the HDD (see “Replacing the hard disk drive").
- Remove three Torx countersunk-head screws from the top and three from the bottom of the front frame of the instrument.
- Take the two countersunk-head screws above and below the USB cover plate out of the front panel. (not necessary for R&S UPV66)
- Disconnect the flexible green conductor to the PCB (front-panel LEDs, not necessary for R&S UPV66).
- Disconnect the flexible green conductor to the front module controller (front-panel keyboard, not necessary for R&S UPV66).
- Disconnect the rotary knob cable from the front module controller. (not necessary for R&S UPV66).
- Disconnect the USB cable from the front module controller.
- Disconnect the black cable from the PCB (DC/AC converter supply, not necessary for R&S UPV66).
- Disconnect the LCD control cable from the front module controller (to the display adapter board, not necessary for R&S UPV66).
- Disconnect the 10pole flat cable to LED Board from DMB (R&S UPV66 only)
- The whole front unit can now be lifted forward out of the front frame.

Installation takes place in reverse order. When reassembling everything, make sure that no cables are trapped or forgotten.

Replacing the USB ports on the front panel

- Remove the HDD (see “Replacing the hard disk drive”).
- Remove the handles and the printed front panel (see "Replacing the front unit")
- From the front unit, undo the two screws holding the mounting plate.
- Disconnect the USB cable from the front module controller.
- Disconnect the power supply cable from the combo drive (not necessary for R&S UPV66).
  The cable is locked into the connector. When pulling it out, make sure the body of the plug does not become damaged.
- Pull the 80-pin ATA cable (or the SATA cable with FMR9) out of the combo drive (not necessary for R&S UPV66).
- Pull the unit formed by the combo drive and the USB ports sidewise out of the instrument. With R&S UPV66 the USB port is build on ist own board, which can be unscrewed from 2mm front metal sheet.
- Remove the three screws that attach the small board with the two front-panel USB ports to the mounting plate.
- Unplug the orange colored USB cable from the USB board.

Installation takes place in reverse order. Before reassembling everything, be sure to plug the USB cable back into the small board and the 80-pin ATA control cable into the connector for the combo drive adapter. Once everything is reassembled these connectors are not very easy to access.
Also, for the sake of the EMC shielding on the R&S UPV, the mounting plate must once more make close contact with the front unit via the snap-in spring plate.

Replacing the combo drive

- Remove the HDD (see “Replacing the hard disk drive”).
- Remove the handles and the printed front panel (see "Replacing the front unit")
- From the front unit, undo the two screws holding the mounting plate.
- Disconnect the USB cable from the front module controller.
- Disconnect the power supply cable from the combo drive.
  The cable is locked into the connector. When pulling it out, make sure the body of the plug does not become damaged.
- Pull the 80-pin ATA cable (or the SATA cable with FMR9) out of the combo drive.
- Pull the unit formed by the combo drive and the USB ports sidewise out of the instrument.
- Remove the four Phillips screws holding the combo drive into the mounting frame (one of these can only be accessed through a small hole in the mounting frame).
- Remove the combo drive from the mounting frame.

Installation takes place in reverse order. Before reassembling everything, be sure to plug the 80-pin ATA control cable into the connector for the combo drive adapter. Once everything is reassembled this connector is not very easy to access.
Also, for the sake of the EMC shielding on the R&S UPV, the mounting plate must once more make close contact with the front unit via the snap-in spring plate.

Replacing the analog front panel (AFP)

The AFP is part of the front unit. For this reason the front unit must first be removed from the instrument frame (see Replacing the front unit).

- Remove the additional bent metal sheet from 2mm front metal sheet (R&S UPV66 only)
- Remove the two Torx screws just above the XLR connector from the front panel (use a size 8 Torx screwdriver)
- Remove all eight Torx screws from the XLR connector (use a size 10 Torx screwdriver)
- Undo the fixing nut from the 6.3 mm snap-in connector (use an 11 mm open-end wrench)
- Pull the AFP out of the front panel.

Installation takes place in reverse order. When reassembling everything, make sure that the twist protection for the snap-in connector fits snugly into the cutout in the front panel.

Replacing the digital front panel (DFP)

- In order for the screws in the DFP to be accessible, the side handles and printed front panel must first be removed from the instrument (two Torx screws each, left and right).
- Disconnect the Wx connecting cable from the DAB.
- Remove the five countersunk-head screws from the front frame.
- Push the DFP back into the inside of the instrument, lift it up and remove it.
  Since the AC supply connection from the APS to the switching power supply runs immediately behind the DFP, please take care when working in this area, and for safety's sake even feed the cable and rubber bushing out through the opening in the APS panel.

Installation takes place in reverse order. When reassembling everything, make sure that if you have fed the AC supply connection from the APS to the switching power supply out through the opening, it is put back correctly.

Replacing the rotary pulse generator (not with R&S UPV66)

See exploded view 1146.2203.01, item nos. 120, 131, 132.

Note:
The rotary pulse generator comes in different versions with somewhat different installation techniques and mounting parts. Prior to exchanging it, you should unscrew the hard disk and hang it on the side.

- Remove the HDD (see “Replacing the hard disk drive”).
  The ribbon data cable including the connector adapter can remain plugged in and the HDD can remain screwed in on the plate. Once you have removed the HDD (still with its cables), carefully hang it outside on the side.

<u>Version with cubic housing in the initial R&S UPV off-the-shelf devices</u>

- Remove the rotary knob.
- Carefully remove the round plastic collar piece on the front side on the recessed circle segments from the catches using a pair of tweezers or a small, flat screwdriver.
- Remove the locking screw (Torx size 6) on the front side of the rotary generator.
- Turn the rotary generator from the inside by 45° clockwise so that the black plastic segments come to rest precisely in the recesses in the front panel and pull it out to the inside.

- Detach the ribbon cable on the front module controller.
- Replace the rotary generator used previously with the new (cylindrical) model with R&S material no. 0852.2701.00 (this is a special number valid only for the “Old” vs. “New” exchange of the rotary generator).
- Insert the new rotary generator and fasten it with a 14 mm hexagon nut (see next item) using a socket wrench.
- Also replace the round plastic collar piece with the special new model (R&S stockno. 0852.1105.00). The size 14 mm nut for fastening the rotary generator is supplied loose with the spare part. Relock the plastic collar piece in the recesses on the front panel.
- Attach the ribbon cable on the front module controller and finally place the rotary knob on the axis.
- Reattach the HDD.

Version with cylindrical housing in further R&S UPV series devices

- Remove the rotary knob.
- Unscrew the round plastic collar piece on the front side on the 14 mm hexagon nut on the axial side.
- Pullout the rotary generator to the inside.
- Detach the ribbon cable on the front module controller.

Replacing the DC/AC converter (not with FMR9 or R&S UPV66)

See exploded view 1146.2203.01, item nos. 200, 206, 210, 225, 230.

- Loosen the two fastening screws (Torx size 8, item no. 230) which fasten the shielding box of the DC/AC converter from the rear of the front unit using approx. four turns.
- Slide the converter including the shielding box to the right out of the holder (item no. 200).
- Detach the three-wire cable (pink-white) for LCD illumination on the right side.
- Detach supply cable W61 on the left side.
- Remove the two screws which fasten the DC/AC converter module in the shielding box.
- You can now remove the actual converter module (item no. 210).

Install in reverse order. What is important here is to ensure an insulated installation of the module in the shielding box. During reinstallation, make sure that the insulating foil (item no. 206) is installed in the same manner at the fastening points. When installing the completed unit, make sure that the washers for the combination screws (item no. 230) do not cause any disruption when inserted laterally. During reassembly, make sure that the cables are correctly plugged into the connectors on the board and that none of the pins are twisted.

Replacing the display adapter board

- Remove the two Torx screws from the board.
- Pull out the multi-pole white plug-in connection (single wires) to the LCD.
- Detach the single-pole black supply cable.
- Detach the multi-pole control cable on the front module controller. This cable has a fixed connection to the adapter board.
- You can now remove the adapter board from the instrument.

Install the new board in reverse order. We recommend that you connect the cables which need to be plugged in directly on the adapter board prior to installing the printed circuit board. Otherwise, you will have accessibility problems due to the very small dimensions when installed.

Replacing the TFT display (not with R&S UPV66)

See exploded view 1146.2203.01 (page 2 with AUO display), item nos. 150, 152 to 155, 170, 180, 190.

The TFT display is part of the front unit. It must be removed beforehand from the instrument frame (see “Exchanging the front unit”).

- Place the front unit which you removed with the display side on a soft lint-free surface.
- On the left and right, remove the two screws (Torx size 8) from the display panel.(item nos. 180, 190)
- Unplug the multi-pole white plug-in connection (single wires) to the display adapter board.
- Disconnect the three-wire cable (pink-white) for display illumination on the DC/AC converter. (AUO: Disconnect powercable (item no. 213) and datacable from display.)
- Remove the display unit and place it with the display side to the front.
- Pull up the shorter lateral foam adhesive strips (item nos. 153, 154) on the ends somewhat, and then remove the four screws on the TFT display.
- Hang out the three-wire cable for display illumination with the rubber guard on the frame (not with AUO display).
- Carefully pull the display out of the frame. On the rear, hang out the multipole white cable from the rubber guard (item no. 170) and guide the cable with the connector through the cut-out in the frame (not with AUO display). You can now completely remove the display from the frame.

- When reinstalling a replacement display, after installation in the frame you should reapply four <u>new</u> foam adhesive strips (item nos. 152 to 155) laterally on the display. Carefully avoid leaving any lint or fingerprints during installation. We recommend that you wear fine work gloves.
- Connect the two cables on the DC/AC converter and on the display adapter board. AUO: Connect the power- and datacable to the display)
- Fasten the complete display unit with two Torx screws on the left and right on the front unit. Be aware of the different screw lengths (item nos. 180, 190).
- If you need to clean the TFT display and the filter plate, <u>do not use</u> any cleaning agents or solvents. Only use a dust-free and lint-free cloth or towel.

Replacing the shielded filter plate in front of the TFT display (not with R&S UPV66)

See exploded view 1146.2203.01, item nos. 30, 40, 50.

Prior to exchanging the filter plate, you must remove the front unit, the rotary pulse generator, the TFT display, the holding plate for the key switching film, the key switching film and the switching mat for the softkeys (see “Exchanging the front unit”, “Exchanging the rotary pulse generator”, “Exchanging the TFT display” and “Exchanging the softkeys”).

- Place the front unit which you removed with the display side on a soft lint-free surface.
- On the left and right, remove the two countersunk screws with the two washers on the filter plate.
- Press the filter plate inwards from the front side and remove it.
- Place the new filter plate (item no. 50) including new spring strips (item nos. 30, 40) from the inside on the display cutout in the front frame and carefully press in the plate. We recommend that you use fine work gloves to avoid getting any fingerprints on the plate.
- If you need to clean the filter plate and the FFT display, <u>do not use</u> any cleaning agents or solvents. Only use a dust-free and lint-free cloth or towel.

Replacing the keypad and the softkeys (not with R&S UPV66)

See exploded view 1146.2203.01, item nos. 80, 90, 100.

Prior to exchanging the keypad, remove the front unit, the rotary pulse generator and the complete TFT display group (see “Exchanging the front unit”, “Exchanging the rotary pulse generator" and “Exchanging the TFT display”).

- Place the front unit which you removed with the display side on a soft lint-free surface.
- Remove the display unit (see “Exchanging the TFT display”).
- Lift up the holding plate (item no. 100) for the switching films and mats somewhat after removing the three Torx countersunk screws and take it out.
- Remove the keypad/softkey switching film (item no. 90).
- Take out and exchange the keypad switching mat and softkey switching mat (item no. 80).
- During reinstallation, make sure that the holding plate catches on the bottom side of the front frame into the cutouts which are provided.

Replacement of LED Boards (R&S UPV66 only)

To know the settings of R&S UPV66, it has an extra LED board on the front panel.

- Remove the complete front unit (see “Replacing the front unit”)
- Remove the two Torx screws to fix the LED board at the front modul.
- Remove the 10 pole flat cable at LED board. It must be used again together with the new board.

Now the LED board can be extracted from its metal sheet. The installation of the new board must be done in revers order.

Alignment and testing after exchanging subassemblies

- **Analog audio board (AAB)**:
  No realignment or software adjustment as described in Chapter 2 “Alignment” is required since the board is shipped from the factory fully adjusted with the proper data. The software adjustment data for the analyzer and the generator are found on the E^2PROM on the AAB. After a board is exchanged, the data are automatically detected by the instrument firmware and used after performing a plausibility test. At the same time, a backup copy of the new adjustment data is saved on the hard disk.
  A software adjustment is required using manually executed routines only for the optional subassemblies R&S UPV-B1 (low distortion generator) and R&S UPV-B3 (second analog generator). These routines execute fully automatically in the R&S UPV as described in Chapter 2 “Software adjustment”.

  Functional test after exchanging subassemblies:
  If you want to check whether the subassembly is working or not, all you have to do is execute the “Brief test of the analog interfaces” .

  Brief performance test for the analog generator (without option R&S UPV-B1 Low Dist):
  (The measurements are described in Chapter 1, "Performance Test Analog Generator").
  - Level accuracy for sinewave, 1 V, 1 kHz, output unbal and for 2 V, 1 kHz output bal, channel 1
  - THD+N for 2.5 V, 1 kHz, output unbal, channel 1
  - Frequency response for 2 V, output unbal, channel 1

  If the "Low Distortion Generator" option is installed, test additionally for "Low Dist On":
  (The measurements are described in Chapter 1, "Performance Test R&S UPV-B1").
  - Level accuracy for 1 V, 1 kHz, output unbal, channel 1
  - Frequency response for 2 V, output unbal, channel 1
  - THD and THD+N for 2.5 V, 1 kHz, output unbal, channel 1
  - Frequency accuracy

  If the "Second Analog Generator" option is installed, also perform the following in channel 2:
  (The measurements are described in Chapter 1, "Performance Test R&S UPV-B3").
  - Level accuracy for stereo sinewave 1 V, 1 kHz, output unbal and for 2 V, 1 kHz output bal.
  - THD and THD+N for stereo sinewave for 2.5 V, 1 kHz, output unbal.
  - Frequency response for stereo sinewave for 2 V, output unbal.
  - DIM level for total 2 V, square/sinewave 2.96/14 kHz, bandwidth 30 kHz

  Brief performance test for the analog analyzer (with the bandwidths 22/40/80 kHz and 250 kHz and both channels):
  (The measurements are described in Chapter 1, "Performance Test Analog Analyzer").
  - Level accuracy for 3 V RMS
  - Frequency response in the level range 3 V
  - THD+N for 3 V, 1 kHz
  - Inherent noise for bandwidth 22 kHz with no signal for input bal, input imped. 300 Ω, filter CCIR unwtd:
    min. 0.9 µV, typ. 1 µV, max. see test report and data sheet

Block Diagrams

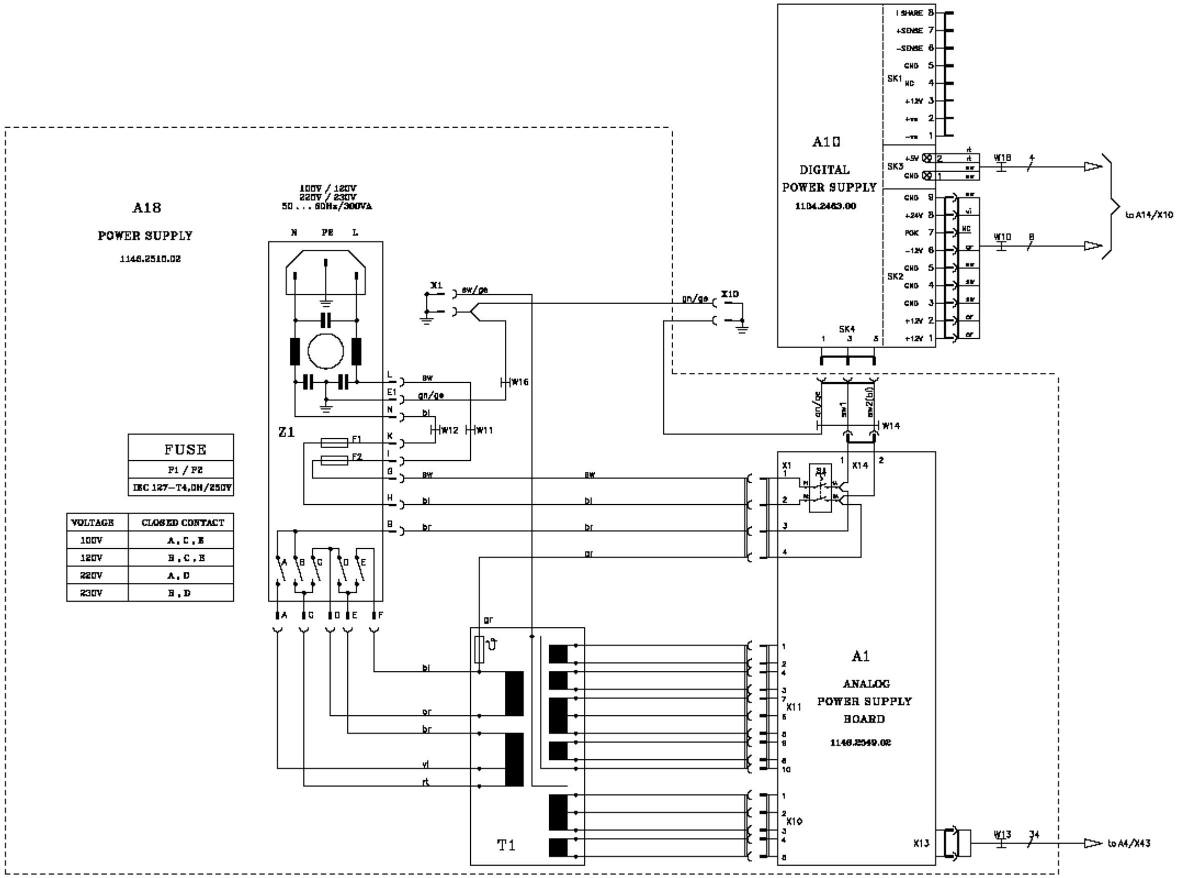


Fig. 3-14 Block Diagram R&S UPV (Part 1)

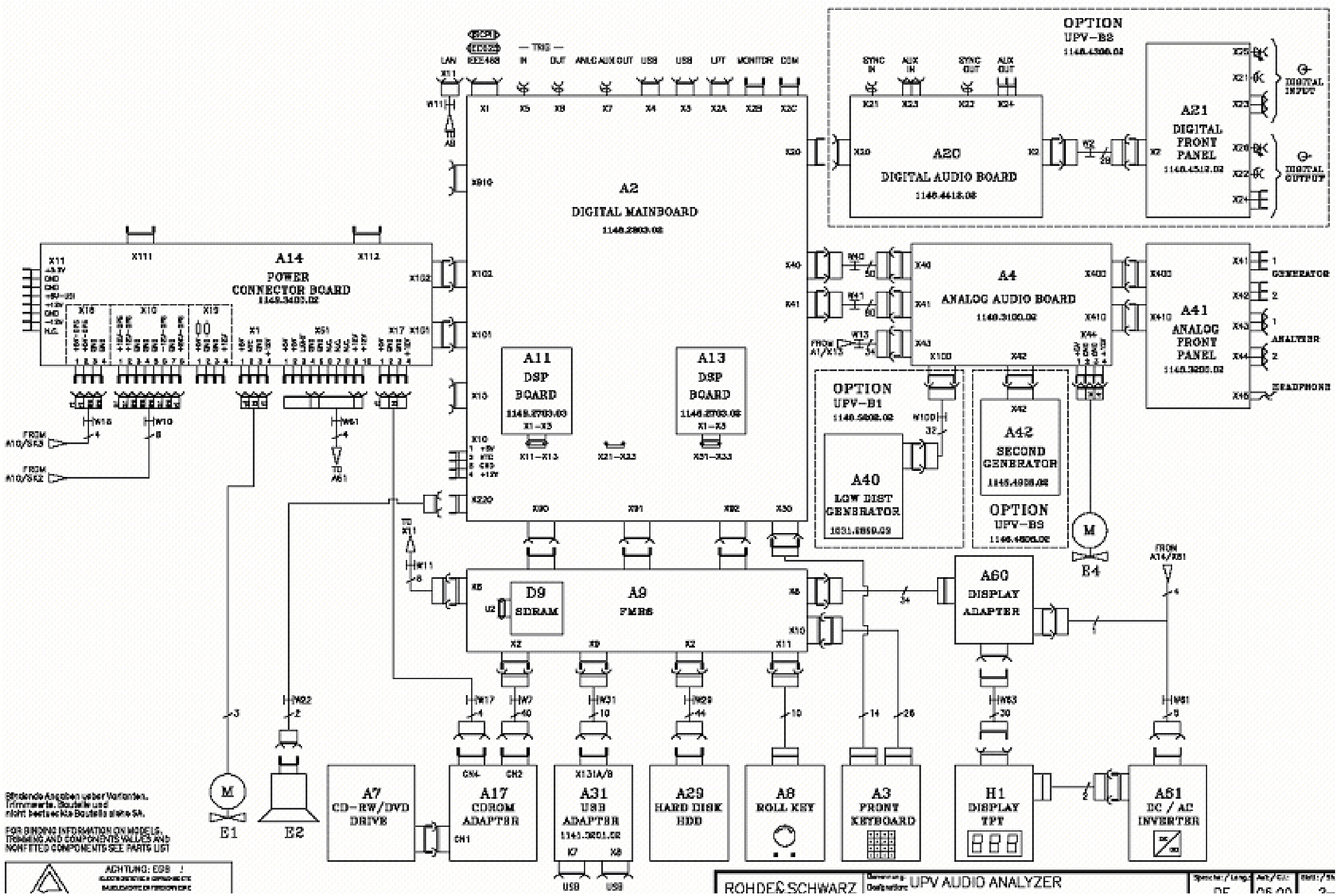


Fig. 3-15 Block Diagram R&S UPV (Part 2)

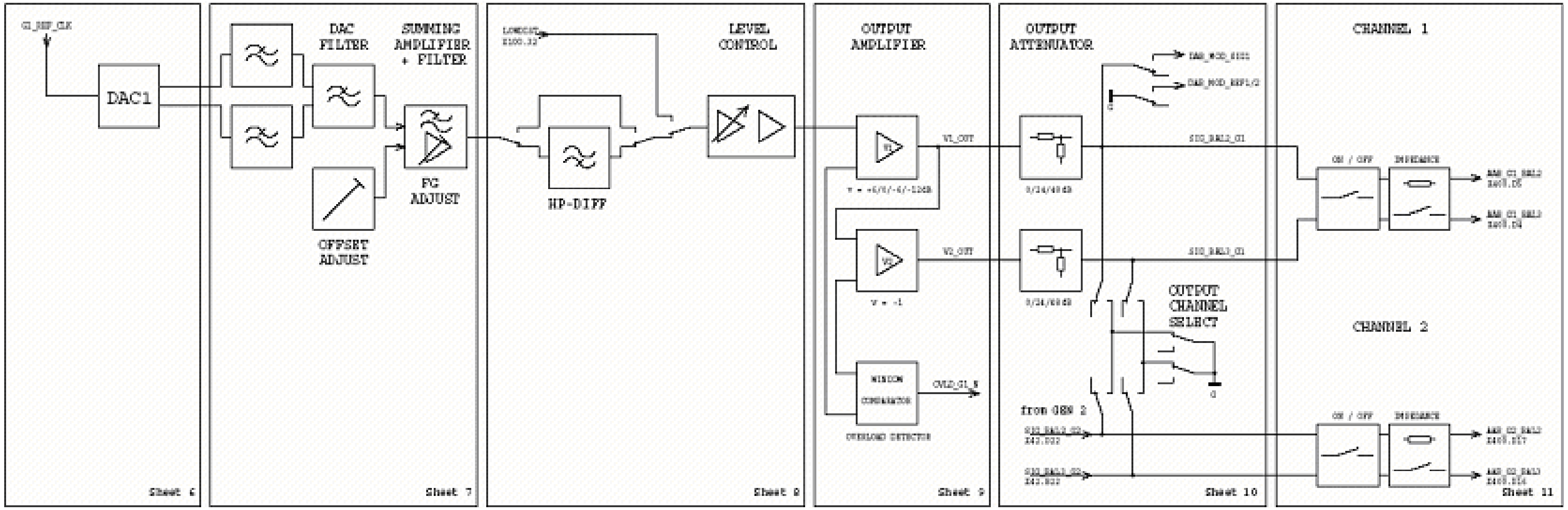


Fig. 3-16 Block Diagram R&S UPV Analog Audio Board (AAB) – Generator (part 1)

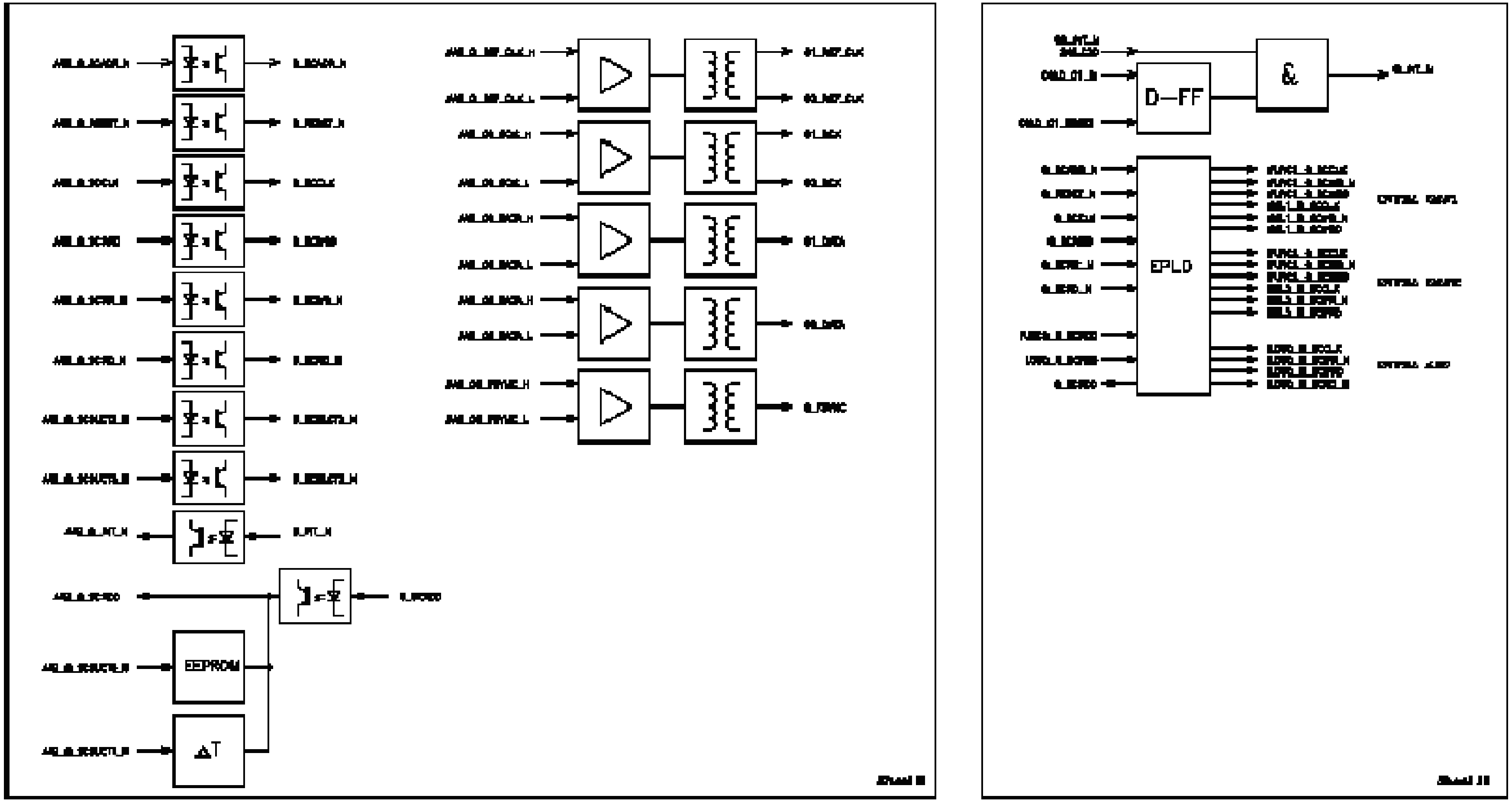


Fig. 3-17 Block Diagram R&S UPV Analog Audio Board (AAB) – Generator (part 2)

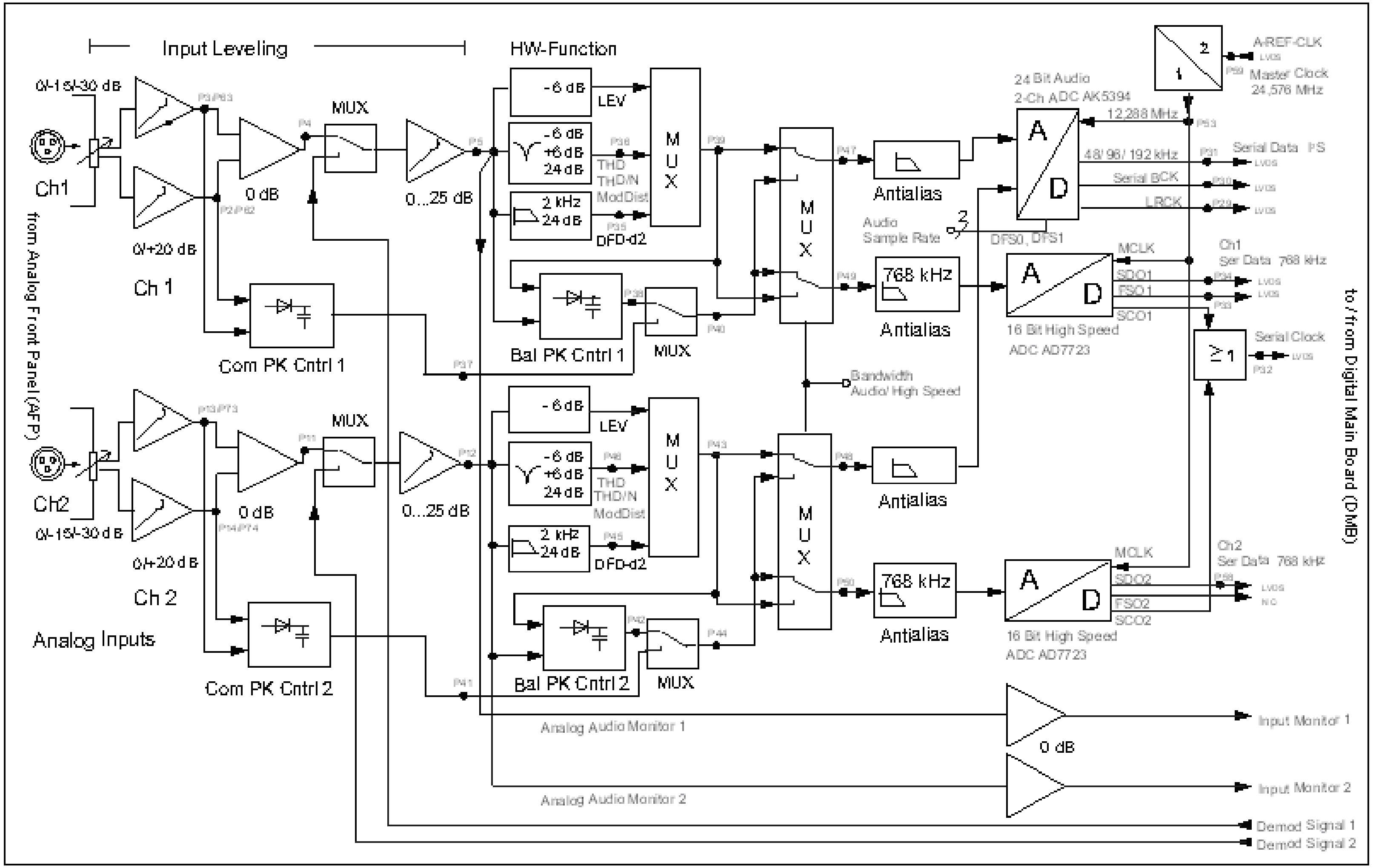


Fig. 3-18 Block Diagram R&S UPV Analog Audio Board (AAB) – Analyzer

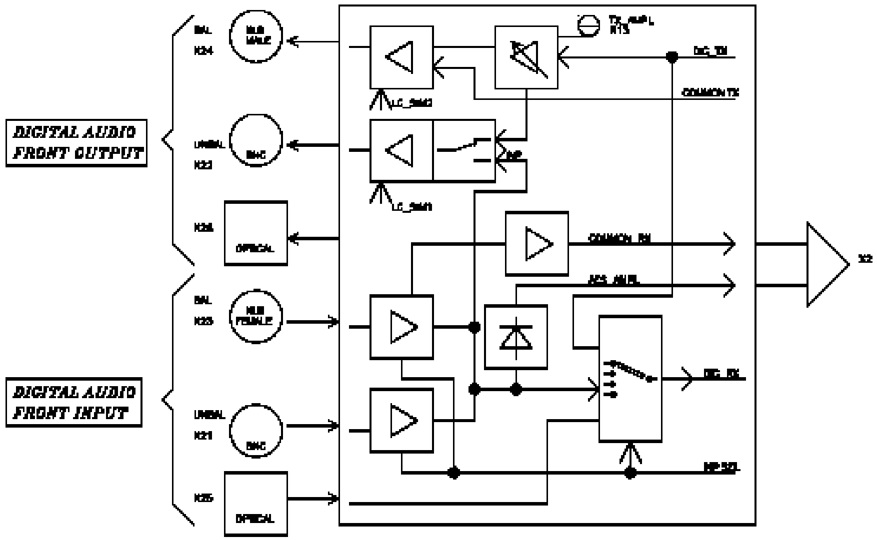


Fig. 3-19 Block diagram DFP (to option R&S UPV-B2/B20)

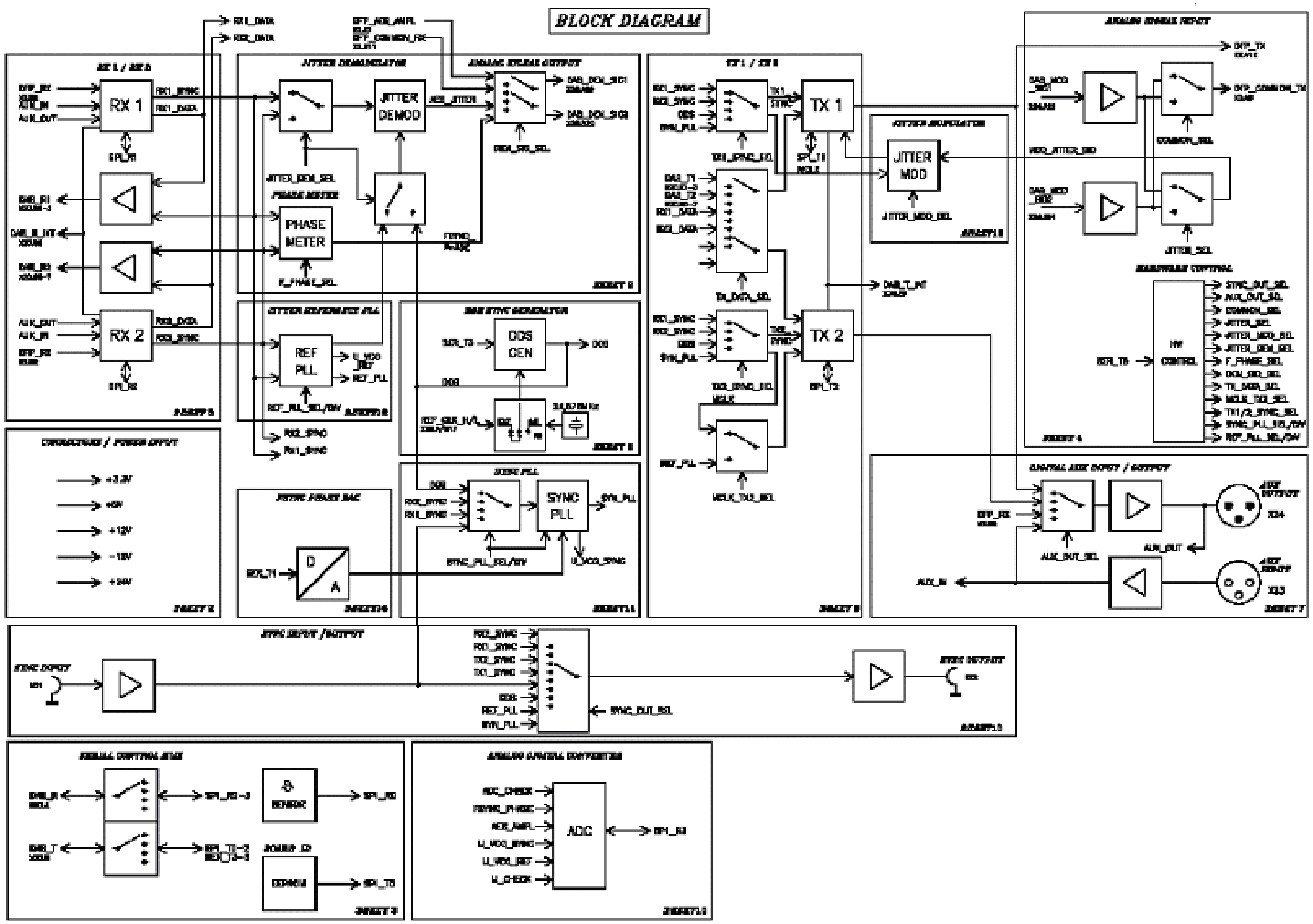


Fig. 3-20 Block Diagram DAB (to option R&S UPV-B2)

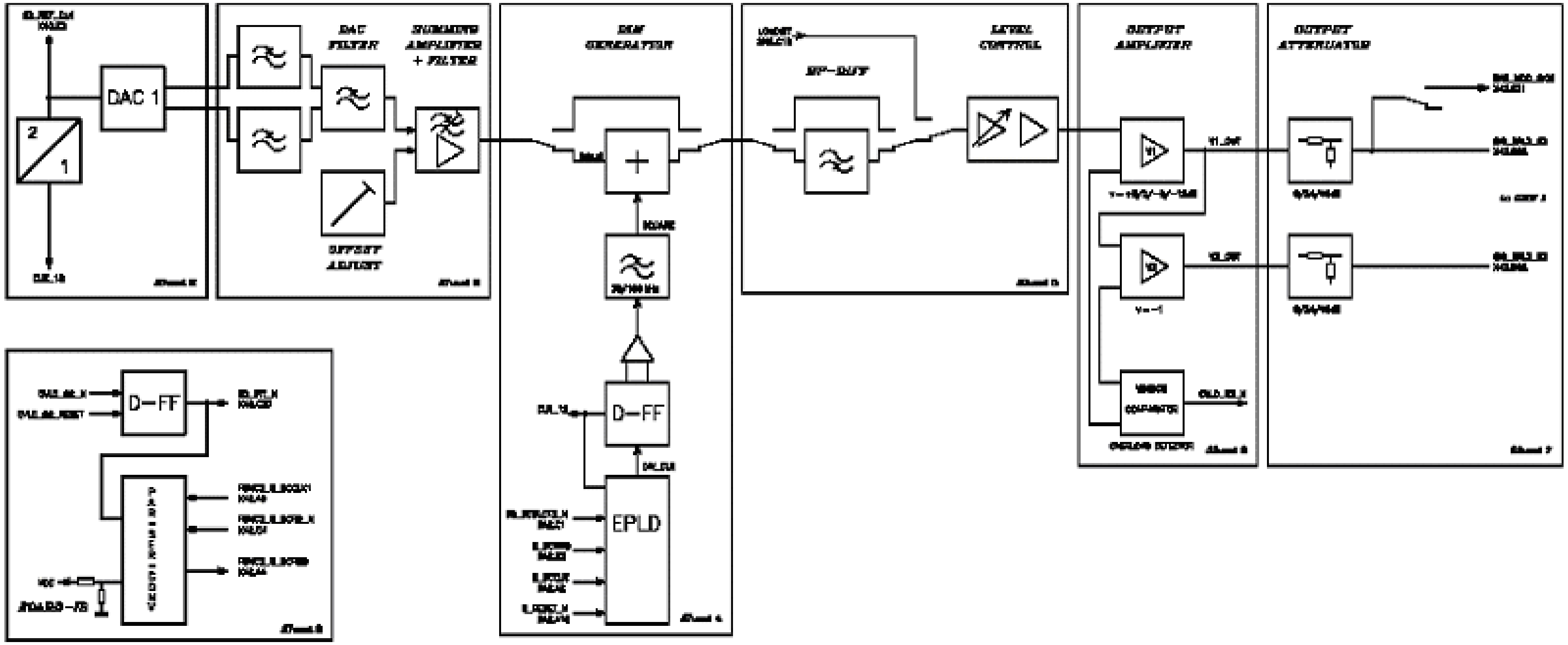


Fig. 3-21 Block diagram second generator (option R&S UPV-B3)

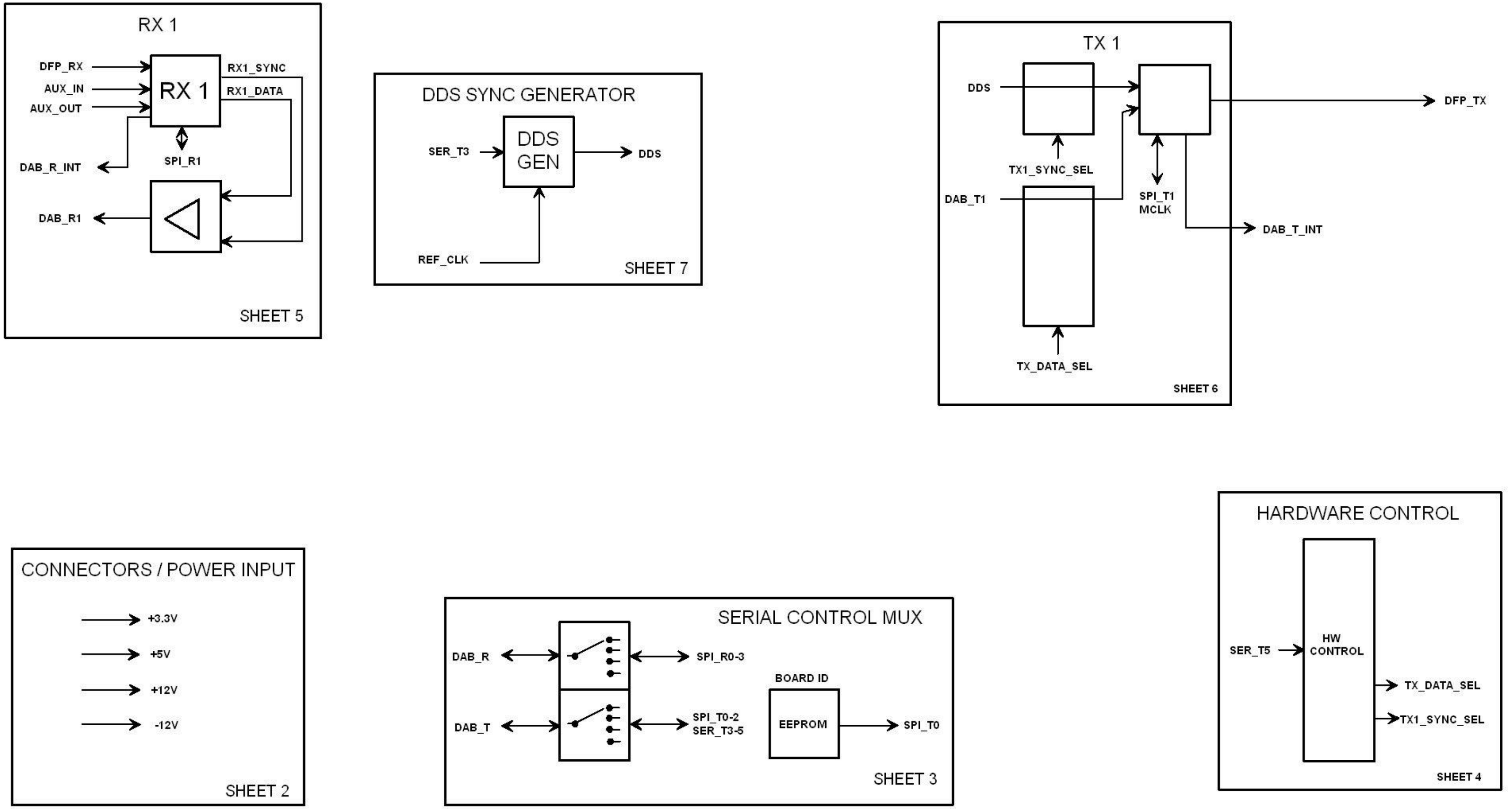


Fig. 3-22 Block diagram DAB (option R&S UPV-B20)

I²S Board

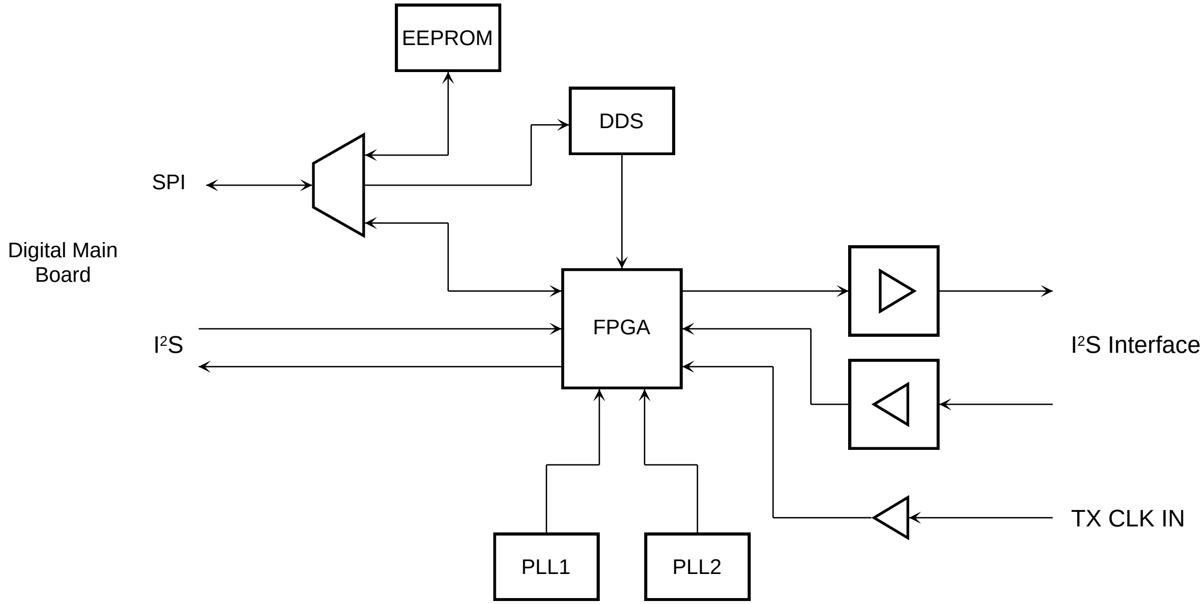


Fig. 3-23 Block diagram I²S Board (option R&S UPV-B41)

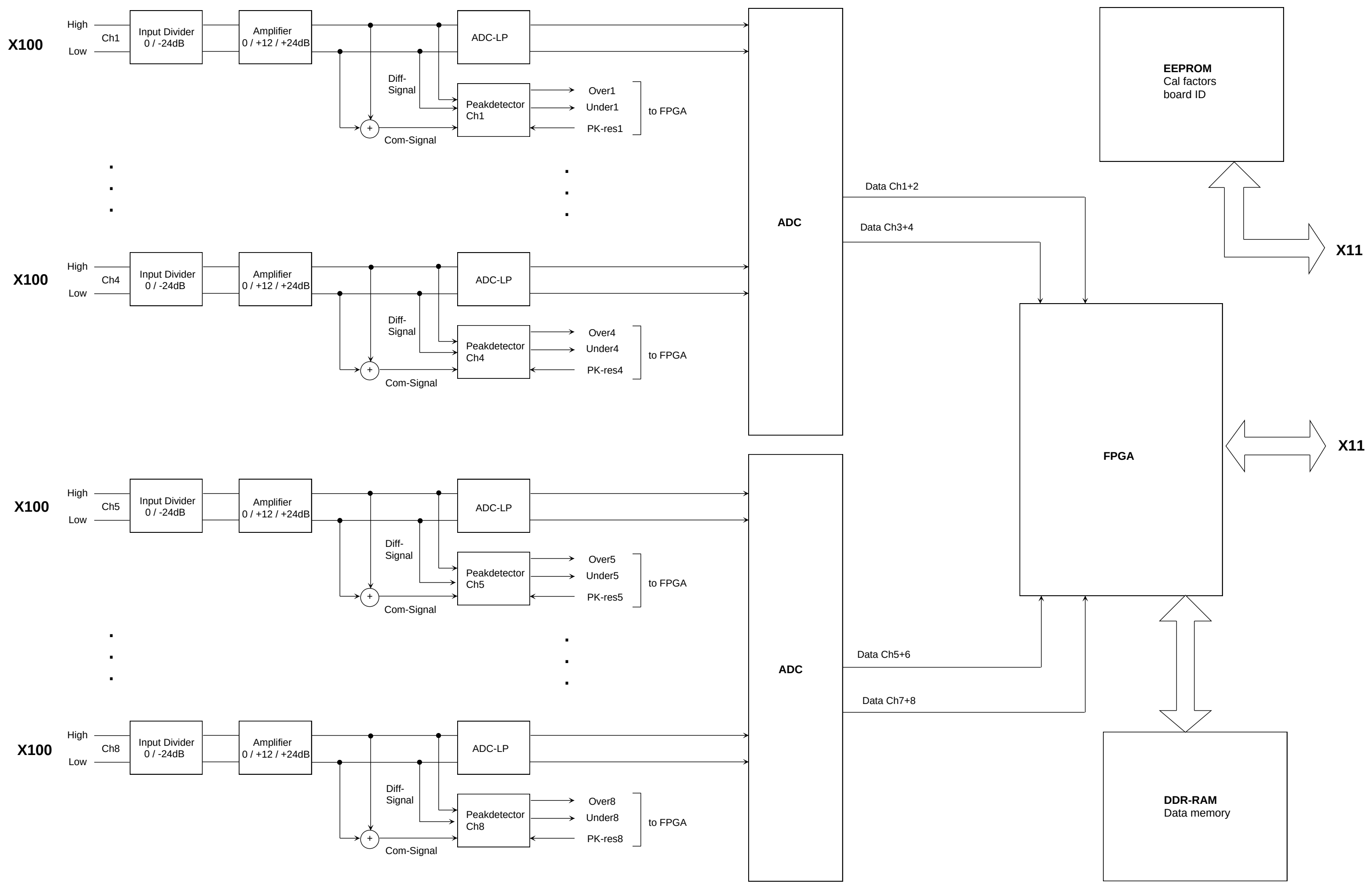


Fig. 3-24 Block diagram 8 channel inpuits (option R&S UPV-B48)

Contents

Figures

4 Firmware Update / Installing Options

The R&S UPV firmware is supplied in a file named "setupxxxRelease.exe". The sequence of digits for "xxx" consists of the main version number immediately followed by the subversion number, revision number and build number.

The initial installation and firmware updates are carried out by starting this EXE file. By doing this you start an Installer program which automatically checks which type of installation is necessary:

Main installation	The Installer displays what it has found out about the environment into which the firmware will be installed and how much disk space is needed. It then takes you through the "Setup Wizard". You normally just click the "Next" button to go from step to step.
Major update	The Installer detects that the installed firmware is too old for a minor update to be carried out. It therefore displays a message asking you to uninstall the old software completely.
Minor update	The Installer simply displays a short prompt asking whether you wish to update the firmware. The rest is performed automatically.

Troubleshooting During a Firmware Update

The two most common problems that can occur when installing the software (or during a major update) are these:

a) At the very start, before the progress bar appears, the progress window displays the message "Installshield is preparing installscript“. Occasionally you then see an error message and installation is canceled.

   This problem can usually be solved by restarting Windows and carrying out the firmware installation again.

b) When the Installer has installed the firmware and the progress bar is full, the progress window displays the message "Removing Backup Files", "Registering Components" or "Publishing Product Information". Here too it occasionally happens that an error message appears followed by a second message, and the firmware is then not installed.

   This problem can sometimes be solved by restarting Windows and carrying out the setup again. If the error occurs again, this can be for two reasons:

   1) Installation of the front panel driver went wrong. In this case you must install it using the Windows Wizard; the necessary INF file is called c:\UPV\fpnl_wdm.inf. You should now reinstall the firmware.

   2) The installation of additional Windows settings went wrong. In this case execute the files "C:\UPV\ScanFirmwareVersions.exe" and "C:\UPV\SetReg.exe" one after the other. You should now reinstall the firmware.

   If neither of these steps is successful, the instrument needs to go in for service (or the Windows image program must be reloaded).

E^2PROM Data Management

In the R&S UPV, important data which must not be lost is managed in the E^2PROMs of the various modules. Among the most important elements of this data are the following:

- Device key (serial number) and enabled software options
- Calibration data for analog modules and the low distortion generator
- Versions (hardware options)

This data management takes place in the firmware, in a central unit which ensures that the contents are consistent and protected.

Handling the E^2PROMs

There is an E^2PROM on each of the larger modules: digital main board, analog audio board, digital audio board, I^2S board. However, the E^2PROM management does not detect expansion cards in detail, but only whether or not a particular slot is occupied by a module.

In this way the management detects the following E^2PROMs:

main board	Digital main board on the R&S UPV, responsible for controlling the DSPs. It stores the serial number of the R&S UPV and the enabled software options. If the U2 is installed, that too is stored here.
digital audio board	Digital generator and analyzer. The calibration values for digital audio are stored here.
analog audio board	Analog generator and analyzer. The calibration values for the analog analyzer and the low distortion generator are stored here. If the U1 is installed, that too is noted here.
EIS slot 1 board EIS slot 2 board	If an E^2PROM is detected, the stock number of the board decides which option the firmware detects.

In order to ensure as far as possible that this data does not become lost, E^2PROM data management has a built-in backup mechanism which combines a number of protection mechanisms:

- The data in the E^2PROM is stored in blocks, each of which forms a logical unit. Each block is protected by a checksum (CRC).
- The blocks in an E^2PROM are sequentially chained, but can be appended to one another at any point in the sequence.
- The end of a block list is separately identified.

Whenever there is a readout from the E^2PROMs, the data management scans this block structure and verifies the checksum each time. This immediately detects bit errors that can result from defective E^2PROMs or faulty access points (such as dry joints).

After every firmware start or write operation in an E^2PROM a further scan takes place. If this scan is successful, the firmware stores a bit-compatible copy of the contents on the hard drive. Each E^2PROM has its own dedicated file.

main board	C:\eeprom_mainboard.bin
digital audio board	C:\eeprom_digaudio.bin
analog audio board	C:\eeprom_anaaudio.bin
EIS slot 1 board	C:\eeprom_eisslot1.bin
EIS slot 2 board	C:\eeprom_eisslot2.bin

If the E^2PROM management detects a problem in a subsequent firmware start, it can react positively:

- If the E^2PROM is blank but there is a backup on disk, then very probably the E^2PROM for the module has been swapped and the old content can be restored.

  In a few cases the whole module has been swapped and the new module does not have a programmed E^2PROM. The firmware cannot detect this, but in practice it should not occur. Even so, in this case you can prevent the contents of the E^2PROM from being restored.

- If the E^2PROM is faulty (checksum error), there is probably a hardware fault (E^2PROM defective or wiring problems such as a dry joint). The firmware can attempt to restore the correct content to the E^2PROM.

Even a change of hard drive is no problem: At the first subsequent power-up the E^2PROMs are scanned and the E^2PROM contents are copied to the hard disk again.

Data Structure in the E^2PROM

The data structure of the E^2PROMs is divided into blocks. Each block is defined by a unique number (ID) which also applies to its content. Some blocks are mandatory (M), other optional (O). The following table lists the blocks that are relevant to the R&S UPV:

Block name	Status	Remarks
IDENT_2	M	Contains the serial number, amendment index and hardware code of a module. The hardware code contains a certain amount of additional information such as U1 installed (analog audio) or U2 installed (digital main). The stock number entered in the block decides which hardware option the firmware will detect.
MODIFICATION_100	O	Contains up to 10 entries as documentation of modifications to the board.
200	O	See TVR300
300	O	See TVR300
ANLR0_CAL	M	Contains the correction data for the analog analyzer
LDG_CAL	M	Contains the correction data for the low distortion generator
AGEN_CAL	M	Contains the correction data for the analog generator
DIG_CAL	M	Contains the correction data for the digital board
SWPLATFORM	M	Contains the device key, serial number, enabled options in encrypted form. Further details can be found in the TVR300

Further details concerning blocks can be found in the TVR265.

Recording the Contents

Every time the firmware starts, a full scan of all detected E^2PROMs takes place. The purpose of this scan is to detect modules and their associated hardware options, to read in valid calibration values and to detect special options such as U1 and U2.

This scan creates a copy of the E^2PROM data in RAM, in order to enable rapid access to the firmware during operation. This copy is then written to the boot drive as a plain text extract.

File "C:\eepromdump.txt" contains full details of the contents that the firmware has found in the E^2PROMs. For example:

```
main board eeprom contains following blocks:
  contents of block swplatform:
    devicekey size       : 256
    devicedataset size   : 39
    devicemac size       : 16
    installed sw options : 1
      option id          : 0
      option len         : 30
      option cipher      : 2657495639573648509567453759762

digital audio board eeprom contains following blocks:
  contents of block ident_2:
    eeprom size      : 2048
    material number  : 11464412
    variant          : 2
    hardware code    : 0
    product index    : 200
    serial number    : 100034002
    production date  : 12615
    read code        : 0
    test instruction : 100
    name             : Dig Audio
  contents of block modification_100:
    ServiceCode 0: 0
    ServiceCode 1: 0
    ServiceCode 2: 0
    ServiceCode 3: 0
    ServiceCode 4: 0
    ServiceCode 5: 0
    ServiceCode 6: 0
    ServiceCode 7: 0
    ServiceCode 8: 0
    ServiceCode 9: 0
  contents of undefined block:
    id               : 200
    offset in eeprom : 72
    size             : 24
  contents of undefined block:
    id               : 300
    offset in eeprom : 96
    size             : 12
  contents of block DIG_CAL:
    description of block   : // --- Correction data of digital audio I/O --- //
    number of values       : 5
      calibration value   0: 1.00000000   // 0  dig_phase_ana_slope
      calibration value   1: 0.00001000   // 1  dig_phase_ana_offset
      calibration value   2: 28.12500000   // 2  dig_phase_gen_slope
      calibration value   3: -2048.00000000   // 3  dig_phase_gen_offset
      calibration value   4: 1.00999999   // 4  dig_phase_ana_slope_neg

analog audio board eeprom contains following blocks:
  contents of block ident_2:
    eeprom size      : 16384
    material number  : 11463100
    variant          : 2
    hardware code    : 0
    product index    : 300
    serial number    : 100021004
    production date  : 12615
    read code        : 0
    test instruction : 100
    name             : Analog Audio
```

```
  contents of block modification_100:
    ServiceCode 0: 0
    ServiceCode 1: 0
    ServiceCode 2: 0
    ServiceCode 3: 0
    ServiceCode 4: 0
    ServiceCode 5: 0
    ServiceCode 6: 0
    ServiceCode 7: 0
    ServiceCode 8: 0
    ServiceCode 9: 0
  contents of block ANLR0_CAL:
    description of block   : // --- Correction data of analog analyzer --- //
    number of values       : 15
      calibration value   0: 1.01999998   // 0  notch Ch 1 range 0
      calibration value   1: 1.01999998   // 1  notch Ch 1 range 1
      calibration value   2: 1.01999998   // 2  notch Ch 1 range 2
      calibration value   3: 1.01999998   // 3  notch Ch 1 range 3
      calibration value   4: 1.01999998   // 4  notch Ch 2 range 0
      calibration value   5: 1.01999998   // 5  notch Ch 2 range 1
      calibration value   6: 1.01999998   // 6  notch Ch 2 range 2
      calibration value   7: 1.01999998   // 7  notch Ch 2 range 3
      calibration value   8: 1.04999995   // 8  level BW 22/40/80kHz Channel 1
      calibration value   9: 1.04999995   // 9  level BW 22/40/80kHz Channel 2
      calibration value  10: 1.01999998   // 10 level BW 250kHz Channel 1
      calibration value  11: 1.01999998   // 11 level BW 250kHz Channel 2
      calibration value  12: 1.00010002   // 12 frequency
      calibration value  13: 2.00000000   // 13 phase factor
      calibration value  14: 1.01999998   // 14 phase offset
  contents of block AGEN_CAL:
    description of block   : // --- Correction data of analog generator --- //
    number of values       : 2
      calibration value   0: 0.97000003   // 0  cf_agen_0    Analog Generator Level Channel
1
      calibration value   1: 1.02999997   // 1  cf_agen_1    Analog Generator Level Channel
2
  contents of block LDG_CAL:
    description of block   : // --- Correction data of low distortion generator --- //
    number of values       : 6
      calibration value   0: 1.00000000   // 0  cf_ldg_sin    Sin Level
      calibration value   1: 1.00100005   // 1  cf_ldg_imd    IMD Level
      calibration value   2: 1.00199997   // 2  cf_ldg_frq[0] Freq Range 0 (at 50 kHz)
      calibration value   3: 1.00300002   // 3  cf_ldg_frq[1] Freq Range 1 (at 10 kHz)
      calibration value   4: 1.00399995   // 4  cf_ldg_frq[2] Freq Range 2 (at  1 kHz)
      calibration value   5: 1.00500000   // 5  cf_ldg_frq[3] Freq Range 3 (at 100 Hz)

EIS slot 1 board eeprom is empty.

EIS slot 2 board eeprom is empty.
```

It can be seen that the instrument contains a valid device key (and therefore serial number) and a software option (in this case a K0). The digital audio board has the serial number 100034, revision 002, and in the analog audio board the values are 100021 / 004. There is no U1 installed (<hardware code> in AnaAudio=0), and no U2 either (digital main board E^2PROM contains no IDENT block).

This memory extract is recreated whenever the content of an E^2PROM changes, such as when a calibration value is rewritten or a change in a serial number takes place via the diagnostics panel.

Troubleshooting During E^2PROM Access

When enabling options, changing calibration values or amending hardware codes, problems can arise in principle when one of the many checks within the firmware discovers an error. In all these cases messages are generated which can give precise information about the cause of the problem. The table shows precise causes and possible remedies.

R&S UPV firmware found a factory default for the … eeprom device. Do you want to install this factory default?	This is a special firmware mode that allows the content of an E^2PROM to be completely changed, even when the instrument is already in the field. This prompt must **not** be answered by Yes without the agreement of a Rohde & Schwarz representative.
The ... seems to have changed. Do you want to restore its eeprom data from backup?	This message appears when the firmware detects that the E^2PROM of a module is blank even though a backup file exists for this E^2PROM. This case should only occur when a module has been used as a design model.
The ... eeprom content is damaged. Do you want to restore its data from backup?	This message appears when a checksum violation is found in the E^2PROM. It indicates a defective E^2PROM or a dry joint. If a similar fault occurs after the backup has been restored or if the Verify goes wrong during restoration, it seems highly likely there is a hardware fault.
restore operation of the ... eeprom failed!	The firmware has tried to restore a backup, and it succeeded at the bit level (Verify OK). Even so the content of the E^2PROM is corrupt, since the scan has detected a checksum error. This error occurs if the content of the backup is corrupt or an attempt is made to load an E^2PROM content that is not consistent.
write operation in ... eeprom failed!	When attempting to write a block or part of a block to the E^2PROM, the hardware reported an error. This can happen if the SPI bus has a problem.
unknown size of ... eeprom!	The firmware has tried to delete the content of an E^2PROM but does not know the exact size. This error indicates a problem within the firmware and should be reported to a Rohde & Schwarz representative.
verify operation for ... eeprom failed!	The firmware has written to the E^2PROM, but the subsequent read operation failed. This error indicates a defective E^2PROM or a dry joint.
write operation for ... file failed!	The firmware has tried to create a backup file for an E^2PROM, but was unable to create the file on the hard drive. This error can occur if the file already exists and is protected.
rescan operation for ... eeprom failed!	The firmware has written to an E^2PROM and the Verify was in order. Despite this the scan after writing finds a defective structure in the E^2PROM (checksum error). This error indicates a problem within the firmware when the data is being prepared for writing, and should be reported to a Rohde & Schwarz representative.
... eeprom data size exceeded!	A dynamic block with calibration data has been extended within the firmware (e.g. new values appended). On attempting to write this to the E^2PROM, the firmware discovered that the E^2PROM is too small for the new data size. This error indicates that the data structure is too large, and should be reported to a Rohde & Schwarz representative.

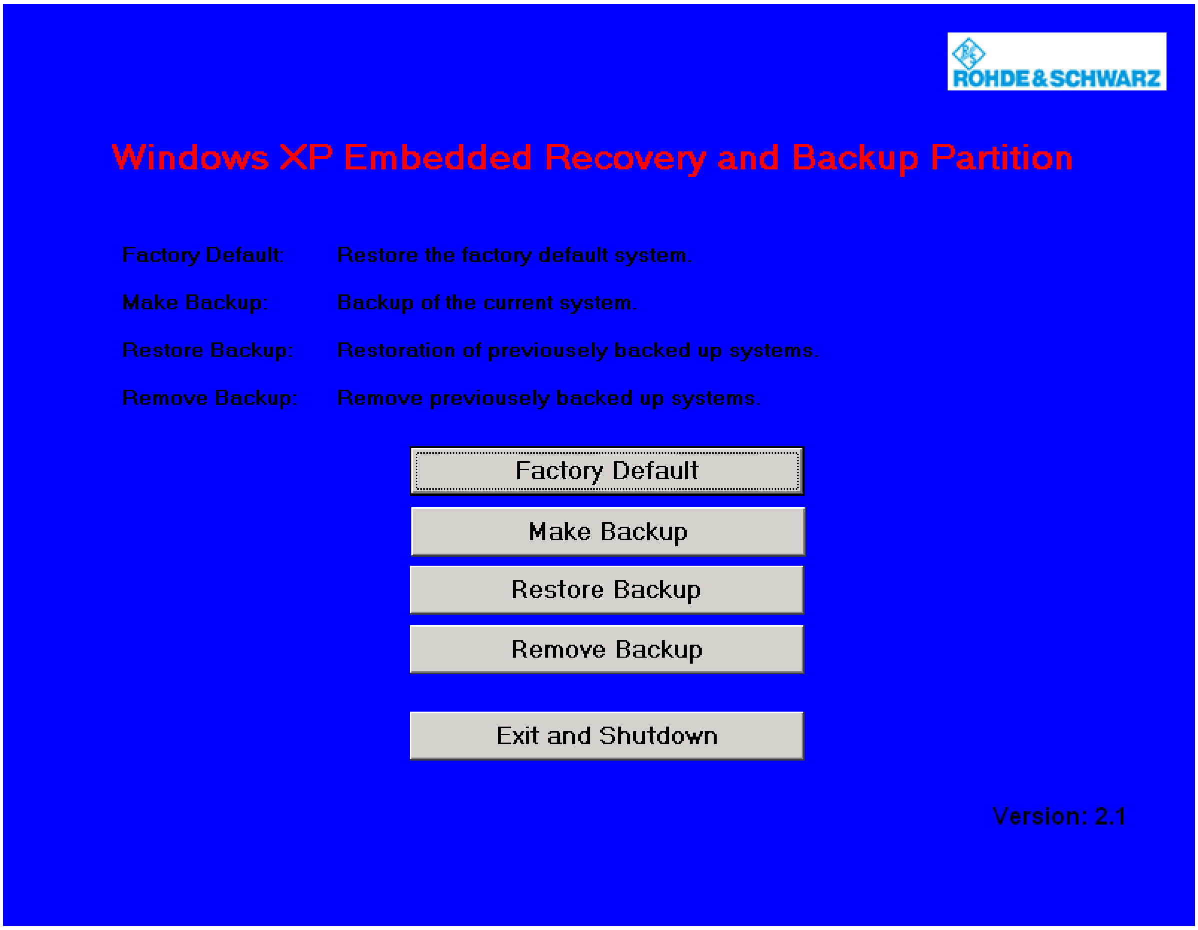
Windows XP Recovery and Backup Partition

R&S UPV provides a backup and recovery partition. A backup of the factory system partition (C:\) is stored per default and can be recovered in case of a system crash.
In addition, backups of up to 5 firmware versions can be stored on this partition. It is e.g. possible to backup the current system partition prior to a firmware update or to provide different system configurations for different environments. When recovered, the system partition (C:/) is deleted, formatted and the newly written. The data partition (D:\) is not affected.

Call the Windows XP Recovery and Backup Partition Menu

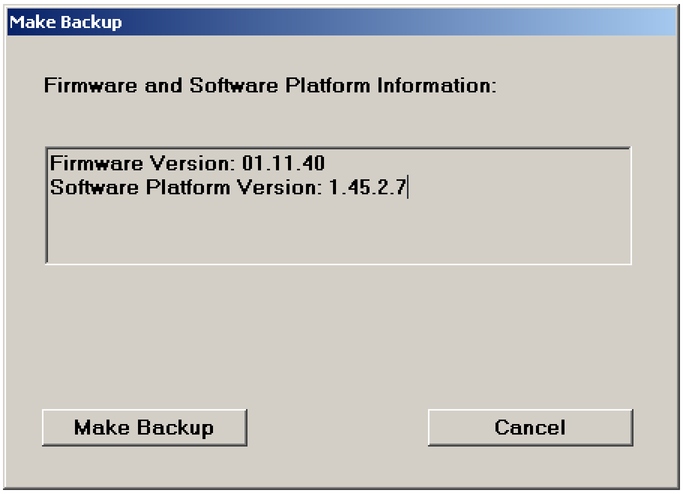
1. Switch the instrument off and on again
2. In the boot menu select line **Backup/Recovery** with the up/down cursors.
3. Open **Windows XP Recovery and Backup Partition** menu by pressing the rotary knob.
   The menu shows the available selections for the recovery and backup partition:

Note:
*If already several backups are stored on the disk the remaining space might not be sufficient for an additional backup. In this case a warning is indicated in the **Windows XP Recovery and Backup Partition** menu and the user is requested to remove an old backup before making a new one.*



Backup Current System Partition

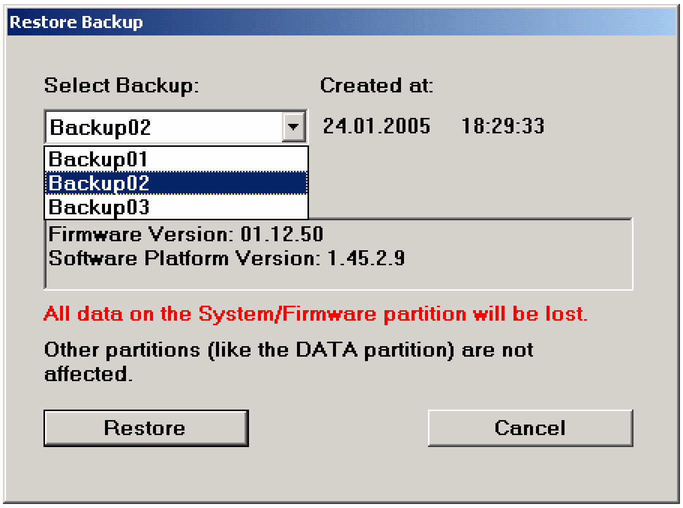
1. Select the **Make Backup** button in the **Windows XP Recovery and Backup Partition** menu with the rotary knob.
2. Open the **Make Backup** menu with the [ENTER] key.
   The menu shows the current versions of the firmware and the software platform.



3. Select the **Make Backup** button with the rotary knob
4. Start the backup with the [ENTER] key
   After the backup the **Windows XP Recovery and Backup Partition** menu appears again.
5. Select the **Exit and Shutdown** button with the rotary knob
6. Exit and shut down with the [ENTER] key.

Recover Selected Version of System Partition

1. Select the **Restore Backup** button in the **Windows XP Recovery and Backup Partition** menu with the rotary knob to recover a selected version of the system partition.
2. Open the **Restore Backup** menu with the [ENTER] key.
   The menu shows the versions of the firmware and the software platform of the backup displayed in the **Select Backup** window.



3. Select the **Select Backup** window with the rotary knob.
4. Select the backup to be restored with the up/down cursor keys and the [ENTER] key.
5. Select the **Restore** button with the rotary knob
6. Start the recovery with the [ENTER] key
   The script which is performed during recovery is displayed.
   After the recovery the instrument is shut down and switched off.

Recover Factory Default

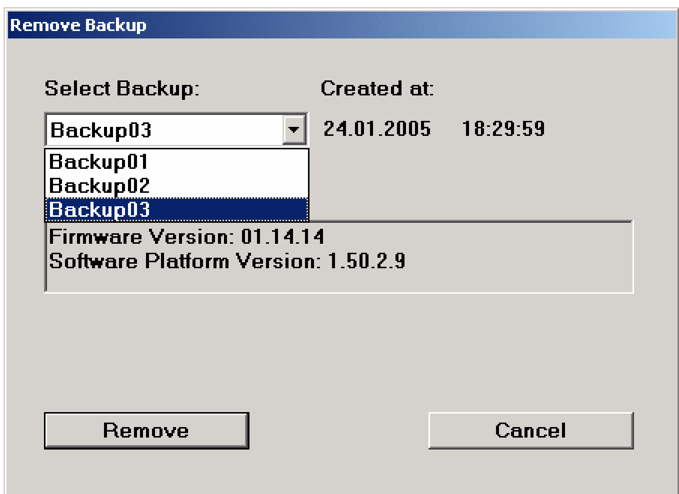
1. Select the **Factory Default** button in the **Windows XP Recovery and Backup Partition** menu with the rotary knob to recover the factory version of the system partition.
2. Open the **Factory Default** menu with the [ENTER] key.
   The menu shows the versions of the firmware and the software platform on delivery.

3. Select the **Restore now** button with the rotary knob.
4. Start the recovery with the [ENTER] key
   The script which is performed during recovery is displayed.
   After the recovery the instrument is shut down and switched off.

Delete Backups

Up to five backups in addition to the factory default can be stored on the recovery partition. To provide space for new backups it might be necessary to remove older backups. The factory default cannot be deleted.

1. Select **Remove Backup** button in the **Windows XP Recovery and Backup Partition** menu with the rotary knob to delete a selected backup.
2. Open the **Remove Backup** menu with the ENTER key
   The menu shows the versions of the firmware and the software platform of the backup displayed in the **Select Backup** window.



3. Select the **Select Backup** window with the rotary knob.
4. Select the backup to be deleted with the up/down cursor keys and the ENTER key.
5. Select the **Remove** button with the rotary knob
6. Start the deletion with the ENTER key
   After the deletion, the instrument returns to the **Remove Backup** menu as long as backups are still available. If the last backup is deleted the **Windows XP Recovery and Backup Partition** menu opens again.
7. Select the **Cancel** button with the rotary knob
8. Close the **Remove Backup** menu with the ENTER key.
   The **Windows XP Recovery and Backup Partition** menu opens.
9. Select the **Exit and Shutdown** button with the rotary knob.
10. Exit the menu and shutdown the instrument with the ENTER key.

Installing Options

Hardware Options

Option R&S UPV-B1 (Low Distortion Generator)

1. Switch off the R&S UPV and disconnect the power cable.
2. Place the R&S UPV on its handles and remove its rear feet (four Torx screws at the corners of the instrument).
3. Remove the casing by pulling it upward.
4. Place the R&S UPV upside down so that the Audio Analog Board (AAB) points upward.
5. Insert the R&S UPV-B1 into the slots of the AAB and slide it as far as it will go towards the front panel.
6. Screw the R&S UPV-B1 onto the AAB (two Torx screws).
7. Use the cable W100 to connect the R&S UPV-B1 option with the AAB.
8. Slide the casing back on. Ensure that the casing is correctly seated in the slots in the front unit and the sealing cord is correctly laid.
9. Tightly screw the four instrument feet back on (four Torx screws).
10. Place the R&S UPV in its operating position. Connect the power plug, mouse and external keyboard.

Required tools

Size 8, 10 and 20 Torx screwdrivers
Size 0 Phillips screwdriver

After the R&S UPV-B1 option has been installed, you have to adjust the level and frequency accuracy. To do this, you need no external measuring instruments, since the generator signal is measured via an internal connection from the analyzer. Make sure that the universal generator and the analog analyzer have been adjusted and calibrated.

Voltage is adjusted relative to the universal generator. The signal of the universal generator is taken as a reference, not the measurement accuracy of the analyzer.
Thus, the low distortion generator offers the same level accuracy as the factory-set universal generator.

The frequency is measured with the frequency counter of the R&S UPV.

You need not adjust the frequency response. To check, see service manual.

CAUTION

- No cables should be connected to the outputs and inputs of the analyzer during adjustment.
- The adjustment is to be performed at an ambient temperature of 23 ±5 °C.
- Before adjustment, the R&S UPV should warm up for two hours.

Adjustment

- Switch on the R&S UPV and await warm-up time.
- Call the adjustment routine (firmware version 1.2.0 or later):
  - Press the MENU key and use Utilities to call the Diagnostic Panel.
  - Go to the "Adjustment" field and press the "EXEC" button in the "Low Dist (B1)" line.

  Adjustment is performed automatically.

Option R&S UPV-B2 (Digital Audio I/O 192 kHz)

The R&S UPV-B2 option consists of two boards which are interconnected by a 26-pin ribbon cable.

1. Switch off the R&S UPV and disconnect the power cable.
2. Place the R&S UPV on its handles and remove its rear feet (four Torx screws at the corners of the instrument).
3. Remove the casing by pulling it upward.
4. Place the R&S UPV in the normal operating position, so that the digital main board (DMB) and the FMR6 computer can be seen from above.
5. To install the digital audio board (DAB) (1146.4412.02):
   - Remove the dummy panel screwed to the rear panel at the back of "Digital Audio".
   - Insert the board from above and slide it obliquely toward the back, so that the connectors on the angled sheet-steel of the DAB project through the preformed holes in the rear panel of the R&S UPV.
   - Flexing the board slightly, plug the DAB into X20 on the DMB.
   - Screw the DAB to the DMB (two 2.5 x 8 mm Torx screws + two 2.5 x 30 mm Phillips screws) and then to the rear panel of the R&S UPV (two Torx screws).
6. To install the digital front panel (DFP) (1146.4512.02):
   - Unscrew the two side-mounted handles (four Torx screws).
   - Pull the lettered front panel forward and remove it.
   - Remove the foil which is stuck to the 2mm mounting plate and covers the holes.
   - Insert the DFP from behind into the 2mm mounting plate, so that the connectors and plugs project through the preformed holes in the 2mm mounting plate.
   - Screw the DFP to the 2mm mounting plate (five countersunk head, Torx or Phillips screws).
   - Plug the 26-pin W2 ribbon cable into the X2 connector on the DFP. Plug in the jack from W2 so that the ribbon cable points in the direction of the DAB. Plug the other end from the W2 into the X2 connector on the DAB.
7. Reassemble the R&S UPV front unit:
   - Slide the lettered front panel onto the 2mm mounting plate on the R&S UPV.
   - Screw the two handles back onto the left-hand and right-hand sides of the R&S UPV. Whilst tightening the screws, make sure that the lettered front panel is pressed tight against the 2mm mounting plate (four Torx screws)
8. Slide the casing back on. Ensure that the casing is correctly seated in the slots in the front unit and the sealing cord is correctly laid.
9. Tightly screw the four instrument feet back on (four Torx screws).
10. Place the R&S UPV in its operating position. Connect the power plug, mouse and external keyboard.

Required tools

Size 8, 10 and 20 Torx screwdrivers
Size 0 Phillips screwdriver

Function check

No adjustments are required when you have installed the R&S UPV-B2 option. Simply check whether the firmware recognizes the option and allows it to work.

- Switch on the R&S UPV.

- Load default setup. To do this press the "Preset" button on the R&S UPV front panel and press "Enter" to confirm the prompt.
  or
  open the "File" menu and choose "Preset (Load Default)".
  The following panels are then displayed:
  Generator Config, Generator Function, Analyzer Config, Analyzer Function and the Numeric Display
- Enter the following settings (starting from the default state):

- Generator Config:	Instrument	Digital Audio
- Analyzer Config:	Instrument	Digital Audio
	Input	Intern

The numeric display must now show the following values:

RMS:	-20 dBFS (corresponds to 0.1 FS in the Generator Function Panel)
Inp Peak:	-20 dBFS or 100.00 mFS
Frequency:	0.9970 kHz or 997.00 Hz

This concludes the function check for the R&S UPV-B2 option.

Option R&S UPV-B3 (Second Generator)

1. Switch off the R&S UPV and disconnect the power cable.
2. Place the R&S UPV on its handles and remove its rear feet
   (four screws at the corners of the instrument; use a size 20 Torx screwdriver).
3. Remove the casing by pulling it upward.
4. Place the R&S UPV upside down so that the Audio Analog Board (AAB) points upward.
5. Only when replacing the option.
   Remove the fastening screws from the R&S UPV-B3 option.
   (four screws; use a size 10 Torx screwdriver; see Fig. 4-1).
6. Only when replacing the option.
   Pull the R&S UPV-B3 option upward from the connector, then remove it by tilting it slightly sideways under the AAB power supply cable.
7. Install a new R&S UPV-B3 by proceeding as described above but in the opposite order.
8. Slide the casing back on. Ensure that the casing is correctly seated in the slots in the front unit and the sealing cord is correctly laid.
9. Tightly screw the four instrument feet back on.
10. Place the R&S UPV in its operating position. Connect the power plug, mouse and external keyboard.

Adjusting the Output Voltage

In the case of R&S UPVs with firmware created before August 2005, the output voltage must be adjusted manually. (The firmware creation date can be checked in menu sequence Help / About). Proceed as follows:

- Switch on the R&S UPV.
- Open the following panels on the screen:
  Generator Config, Generator Function, Analyzer Config, Diagnostic Panel, Numeric Display
- Make the following settings (starting from the default state):

- Generator Config:	Output	Bal
	Impedance	10 Ω
- Generator Function:	Function	Stereo Sine
	Freq Mode	Ch1&2
	Volt Mode	Ch1&2
	Volt Ch2	1.000 V

- Analyzer Config:	Channel	1&2
	Ch2 Input	Gen Ch2
	Ch2 Range	Fix 1.0 V
- Diagnostic Panel:	Calibration	Cal Agen
	Cal Address	1

- Enter the supplied calibration value in the "Cal Value" field.
- Carry out the adjustment by selecting "Cal Agen" from the Calibration window.
  The output voltage on Ch2 should now be exactly 1.000 V.

If the R&S UPV is fitted with firmware created from August 2005 onward, the option can be fully adjusted simply by pressing a button. (The firmware creation date can be checked in menu sequence Help / About).

- Switch on the R&S UPV.
- Load default settings.
- Use the "Utilities" menu to open the Diagnostic Panel.
- Within the "Adjustment" block actuate the "EXEC" button of Sec. Gen (B3).
  The output voltage on Ch2 should now be exactly 1.000 V.
  The phase is also adjusted in the case of stereo sine.

The board includes additional adjustments for the DC offset and the frequency response of the DAC low pass filter, but these are not changed and remain valid.

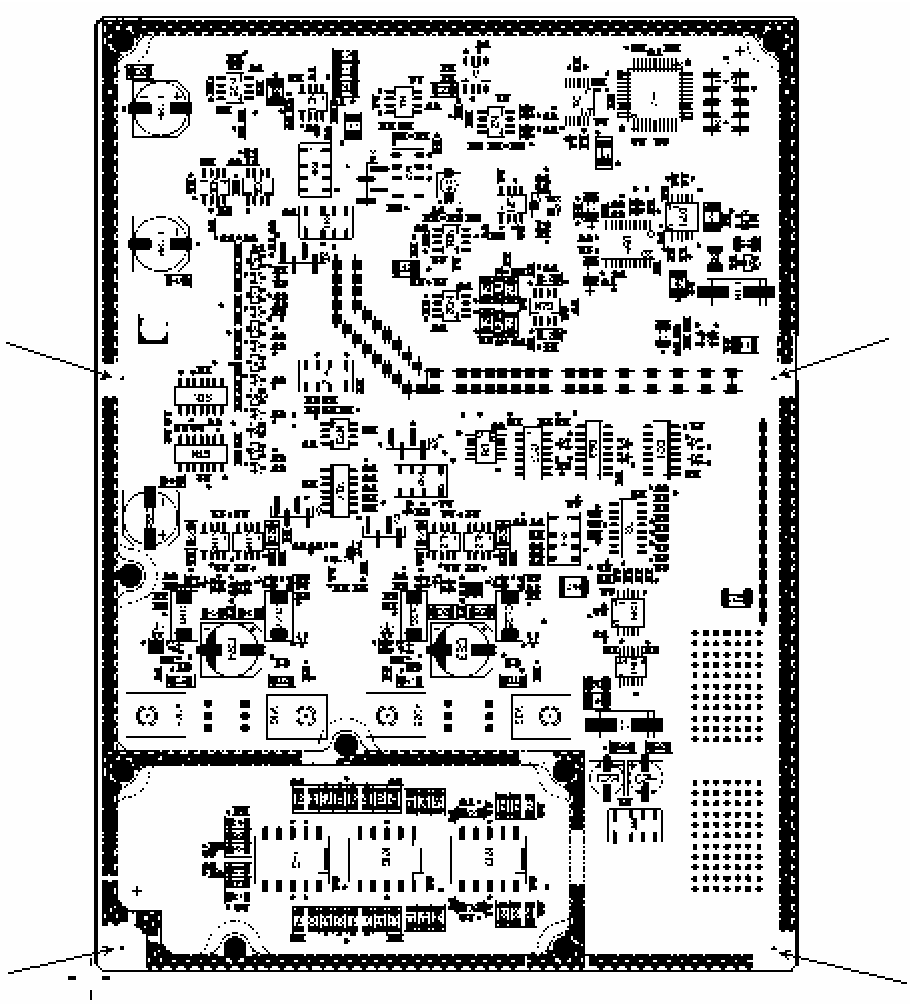


Fig. 4-1 Positions of the fastening screws

Option R&S UPV-B20 (Digital Audio I/O 48 kHz)

The R&S UPV-B20 option consists of two boards interconnected by a 26-pin ribbon cable.

1. Switch off the UPV and disconnect the power cable.
2. Place the UPV on its handles and remove its rear feet (four Torx screws at the instrument corners).
3. Remove the casing by pulling it upward.
4. Place the UPV in its normal operating position such that the Digital Main Board (DMB) and processor FMR6 or FMR7 are visible from above.
5. Instructions for mounting the Digital Audio Board (DAB, 1402.2100.02):
   - Insert the board from above.
   - Insert it into X20 on the DMB.
   - Screw the DAB onto the DMB (two 2.5 x 8 mm Torx screws and two 2.5 x 30 mm Phillips screws).
6. Instructions for mounting the Digital Front Panel (DFP, 1146.4512.02):
   - Unscrew the two side handles (four Torx screws).
   - Pull off the labeled front plate toward the front.
   - Pull off the foil covering the holes that is adhered to the 2 mm mounting plate.
   - Insert the DFP into the mounting plate from the rear such that the male and female connectors protrude through the prepunched holes in the 2 mm mounting plate.
   - Screw the DFP onto the 2 mm mounting plate (five countersunk, Torx or Phillips screws).
   - Plug the 26-pin ribbon cable W2 into male connector X2 on the DFP.
     When doing so, insert the female cable connector of W2 such that the ribbon cable points toward the DAB. Plug the other end of W2 into male connector X2 on the DAB.
7. Reassemble the UPV front unit:
   - Push the labeled front plate against the 2 mm mounting plate of the UPV.
   - Screw on the two handles on the left and right sides of the UPV. When tightening the screws, make sure that the labeled front plate is pressed firmly against the 2 mm mounting plate (four Torx screws).
8. Slide the casing back on. Make sure that the casing is properly seated in the grooves of the front unit and that the sealing cord has been properly laid.
9. Firmly screw the four instrument feet back on (four Torx screws).
10. Place the UPV in its operating position. Connect the power plug, mouse and external keyboard.

Tools required:
Size 8, 10 and 20 Torx screwdrivers
Size 0 Phillips screwdriver

Functional test

After the UPV-B20 option has been mounted, no adjustments are required. You merely need to verify that the firmware recognizes the option and permits operation.

- Switch on the UPV.
- Load the default setup as follows:
  Press the Preset key on the UPV front panel and confirm with Enter when prompted.
  or
  Open the File menu and select Preset (Load Default).
  The following panels will appear:
  Generator Config, Generator Function, Analyzer Config, Analyzer Function and Numeric Display
- Make the following settings (starting from the default state):

- Generator Config:	Instrument	Digital Audio
- Analyzer Config:	Instrument	Digital Audio
	Input	Intern (= internal)

The Numeric Display must now show the following values:
RMS: –20 dBFS (corresponds to 0.1 FS on the Generator Function panel)
Inp Peak: –20 dBFS or 100.00 mFS
Frequency: 0.9970 kHz or 997.00 Hz

This completes the functional test for the R&S UPV-B20 option.

Option R&S UPV-B41 (I^2S Interface)

- Switch off UPV, remove power plug
- Remove cover of one of the rear extension slots (screwdriver TORX TX 8). From UPV firmware version 2.0.0 both extension slots can be used, with lower versions the right slot, seen from the rear side, must be used.
- Insert I^2S interface board and screw on
- Insert power plug, switch on UPV, the I^2S interface board will be automatically recognized
- Operating test: starting from default state (press PRESET key) make the following settings:
  - Generator Config → Instrument: I^2S Board
  - Analyzer Config → Instrument: I^2S Board
  - Analyzer Config → Input: Intern

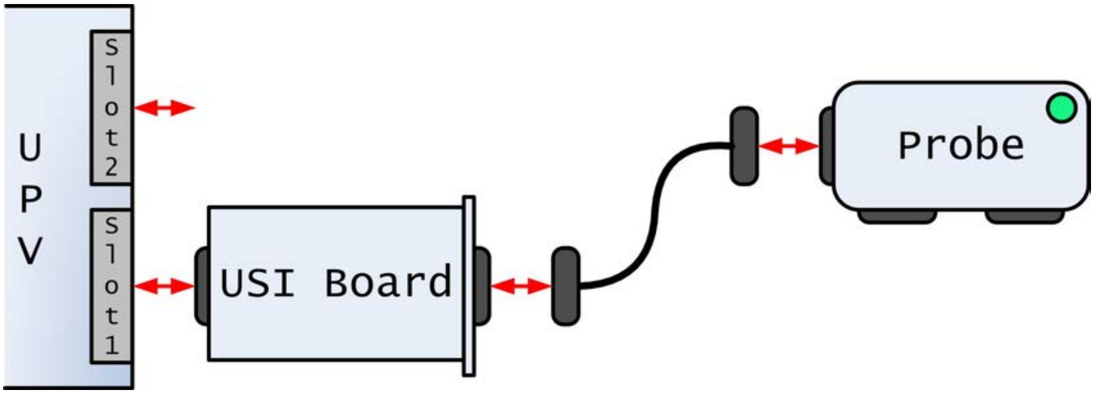
  the Numeric Display shows: -20.000 dBFS 997.00 Hz

Note: If **two** options UPV-B4x shall be used in an UPV model 02 (1146.2003.02) with serial number lower than 100587, a modification of UPV is necessary, which can only be installed by R&S service.

Option R&S UPV-B42 (Universal Serial Interface)

Installation

- Upgrade the R&S UPV on firmware version 2.4.0 (see release notes)
- Switch off UPV and remove the power plug
- Remove cover of the left extension slot (slot 1) on the rear (TORX TX 8)
- Insert USI Board and screw down
- Connect USI Board and probe with cable according to figure below
- Reconnect power plug, switch on UPV, the option will be automatically recognized
- The green LED on the probe indicates the successful booting procedure



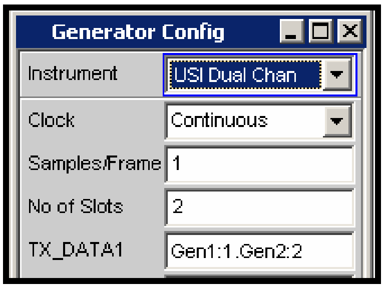
Note

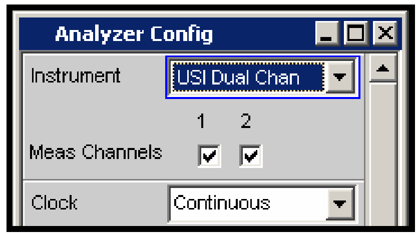
If two UPV-B4x options shall be used in an UPV model 02 (1146.2003.02) with a serial number lower than 100587, a modification of the UPV is necessary, which can only be performed by R&S service.

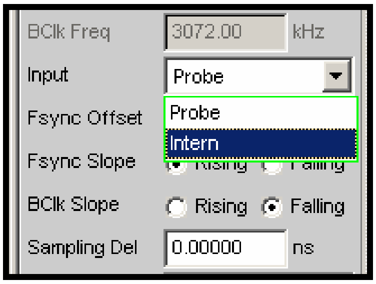
Operating test

Starting from default state (press Preset key) perform the following settings:

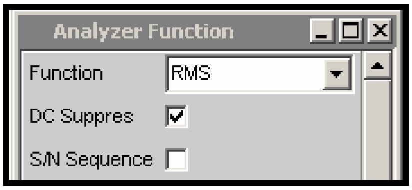
Choose the „*USI Dual Channel*“ instrument in the „*Generator Config*“, as well as in the „*Analyzer Config*“ panel and activate the internal loop measurement between analyzer and generator by setting the signal source to intern in the „*Analyzer Config*“ panel.

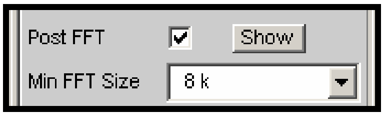


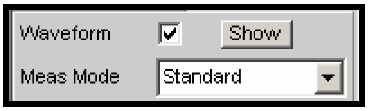




In the „*Analyzer Function*“ panel choose the „*RMS*“ measurement function, activate the checkboxes for the FFT and waveform displays and hit the corresponding “*Show*” Button.

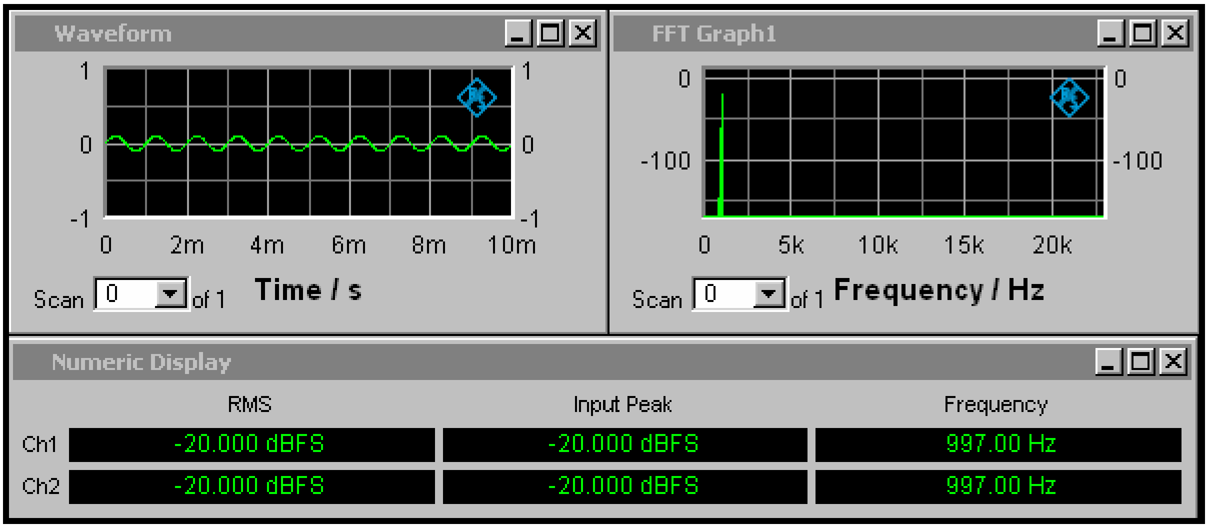






Start a continuous measurement.

The „*Numeric Display*“, the windows for „*FFT Graph1*“and „*Waveform* “ should display the following results.



Option R&S UPV-B48 (8 Channel Analog Inputs)

Fitting

- upgrade the R&S UPV on firmware version 2.3.0 (see release notes)
- switch off UPV, remove power plug
- remove cover of one of the extension slots on the rear (screwdriver TORX TX 8)
- insert 8 channel analog board and screw on
- insert power plug, switch on R&S UPV, the 8 channel analog board will be automatically recognized

Operating test

Starting from default state (press PRESET key) make the following settings:

Analyzer Config → Instrument: Analog 8 Chan

To contact the inputs of UPV-B48 use a multicore cable (for example 1401.7709.02). So one or more of input channels can be supplied with signals from an audio generator.
The Numeric Display shows voltages and frequencies in channels which are selected in the analyzer config panel under "Meas Channels".

Note:

If **two** options R&S UPV-B4x shall be used in an R&S UPV model 02 (1146.2003.02) with serial number lower than 100563, a modification of R&S UPV is necessary, which can only be installed by R&S service.

Option R&S UPV-U1 (150 Ω Generator Output Impedance)

1. Switch off the R&S UPV and disconnect the power cable.
2. Place the R&S UPV on its handles and remove its rear feet (four Torx screws at the instrument corners).
3. Remove the casing by pulling it upward.
4. Affix one of the two supplied adhesive label to the rear panel of the R&S UPV.
5. Turn instrument upside down so that Analog Audio Board (AAB) can be seen.
6. If the R&S UPV is fitted out with the R&S UPV-B3 (Second Generator) option, so it must be removed first. Therefore disconnect the ribbon cable W13 from male connector X43, remove four Torx screws and disconnect the module from AAB.
7. Affix the second supplied adhesive label on the AAB below the barcode label.
8. Remove the groove cover above the generator output (four Torx screws).
9. Solder SMD resistors R71 to R78 as shown in Fig. 4-2.
10. Refit groove cover.
11. An earlier removed R&S UPV-B3 option must be refitted.
12. Plug the cable W13 into male connector X43.
13. Slide the casing back on. Make sure that the casing is properly seated in the grooves of the front unit and that the sealing cord has been properly laid.
14. Tightly screw the four instrument feet back on (four Torx screws).
15. Place the R&S UPV in its operating position.

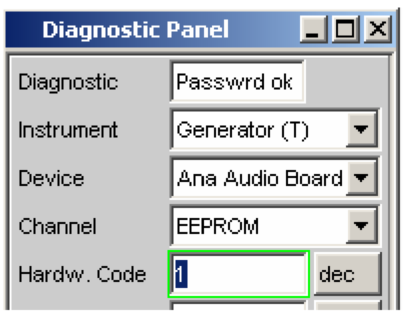
Tools required:

Size 8, 10 and 20 Torx screwdrivers
Size 0 Phillips screwdriver

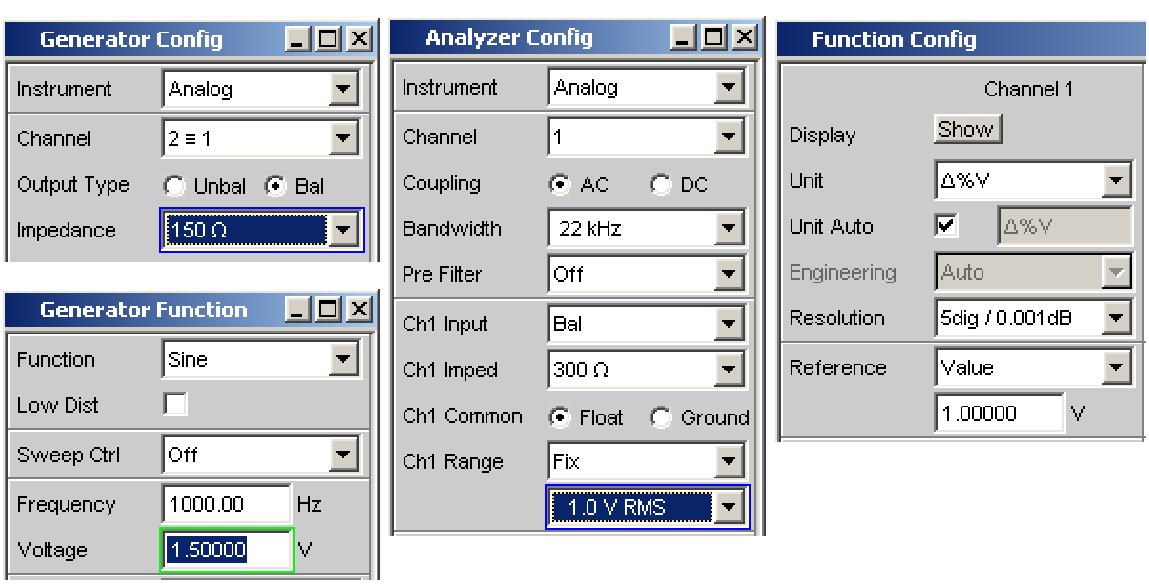
Checking the modification

After you install the R&S UPV-U1 option, no adjustments are required. It is only checked whether the option is known by the firmware.

- Switch on the R&S UPV.
- Install new software version if necessary.
- Open the Generator Config Panel on screen.
- To be known by the firmware, an entry in the diagnostic panel must be made:
  - enter 1.4142 as Diagnostic password
  - select Instrument "Generator (T)"
  - select Device "Ana Audio Board"
  - select Channel "EEPROM"
  - enter "1" as Hardw. Code



- End the UPV application program and start it again. The change will only be effective after restart the R&S UPV.
- Check if 150 Ω is displayed at "Impedance" in the Generator Config Panel.
  If 200 Ω is displayed, repeat the entry in line "Hardw. Code" in the diagnostic panel. End the R&S UPV application and start it again.
- Set R&S UPV:



- Measure output voltage of generator by means of analyzer. To this end, connect analyzer channel 1 with generator via an XLR cable (do not use the internal connection).
  - Generator channel 1: check RMS value: min. -2.5 Δ%V, max. +2.5 Δ%V
  - Generator channel 2: check RMS value: min. -2.5 Δ%V, max. +2.5 Δ%V
  (typical error should be <1 Δ%V).
  If measured values deviate from the above values, check that resistors are soldered correctly and measure resistors with ohmmeter: a nominal total resistance of 94.726 Ω between the soldering points should be obtained (with R&S UPV switched off)

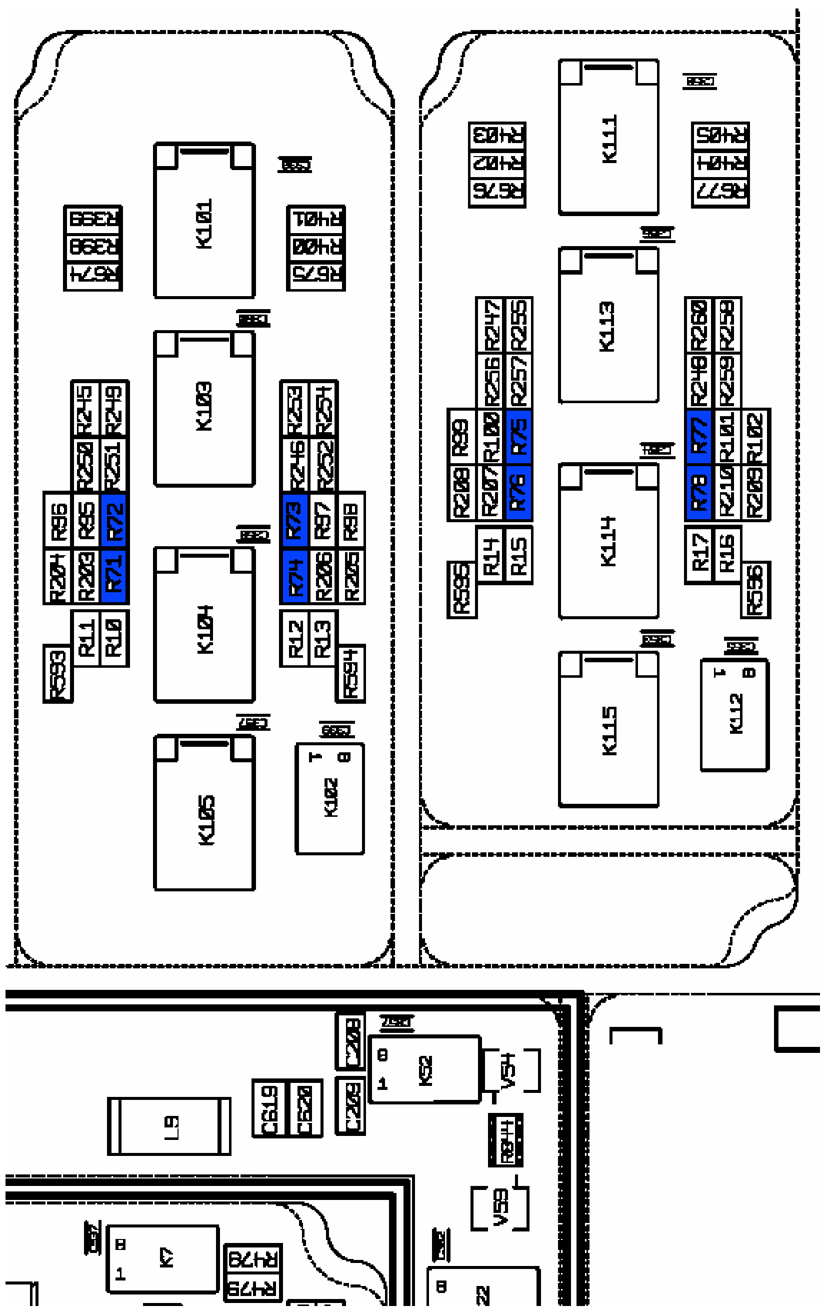


Fig. 4-2 Position of additional resistors

Option R&S UPV-U2 (BNC Phone Out)

The signals available at the 6.3 mm jack on the R&S UPV front panel are also routed to two female BNC connectors on the R&S UPV rear panel when the R&S UPV-U2 option is installed. The R&S UPV-U2 option consists of a board that is screwed and soldered to the digital main board (DMB), plus two shielded cables. The cables' female BNC connectors are mounted on the rear panel of the R&S UPV. The other ends are plugged into the R&S UPV-U2 board.
If R&S UPV is fitted with a DMB version 05 or higher the R&S UPV-U2 board is not necessary. The cables can be plugged into DMB directly.

1. Switch off the R&S UPV and disconnect the power cable.
2. Place the R&S UPV on its handles and remove its rear feet (four Torx screws at the instrument corners).
3. Remove the casing by pulling it upward.
4. Remove the two dummy plugs from the BNC openings and affix the supplied adhesive label to the rear panel of the R&S UPV. Make sure that the upper edge of the sticker is flush with the black overprint at the top of the rear panel (see Fig. 1).
5. Place the R&S UPV in its normal operating position such that the DMB and the front module controller (R&S FMR) are visible from above.
6. If the R&S UPV-B2 option (Digital Audio I/O 192 kHz) or the R&S UPV-B20 option (Digital Audio I/O 48 kHz) is installed, you must first remove it as follows:
   - Remove two Torx screws at the rear of the instrument (not with R&S UPV-B20).
   - Remove two Torx screws and two Phillips screws that connect the R&S UPV-B2(0) with the DMB.
   - Disconnect the 26-pin flat cable W2 from male connector X2.
   - Disconnect the module from X20 on the DMB.

   You can now access the part of the DMB that is necessary for installing the R&S UPV-U2.
7. If the R&S UPV is still equipped with an older-model DMB, you must solder two press-in pins into the P6 and P7 holes on the DMB before installing the R&S UPV-U2 board.
8. Place the R&S UPV-U2 board on the P6 and P7 press-in pins and fasten it to the DMB with a Torx screw (see Fig. 4-2). Solder P6 and P7 to the R&S UPV-U2 board.
   If the R&S UPV is fitted with a DMB version 05 or higher this item can be omitted.
9. Feed cable W70 into the hole labeled CH1 from the outside. Slide the tooth lock washer and nut over the free cable end and screw the female BNC connector onto the rear panel of the R&S UPV. Plug the other end onto the R&S UPV-U2 board at connector X70.
   If the R&S UPV is fitted with a DMB version 05 or higher connector X70 is a component part of DMB.
10. Feed cable W60 into the hole labeled CH2 from the outside. Slide the tooth lock washer and nut over the free cable end and screw the female BNC connector onto the rear panel of the R&S UPV. Plug the other end into the R&S UPV-U2 board at connector X60.
    If the R&S UPV is fitted with a DMB version 05 or higher connector X60 is a component part of DMB.
11. Wrap a cable tie around the two shielded cables and secure the tie to the DMB (see Fig. 4-2).
12. Slide the casing back on. Make sure that the casing is properly seated in the grooves of the front unit and that the sealing cord has been properly laid.
13. Tightly screw the four instrument feet back on (four Torx screws).
14. Place the R&S UPV in its operating position.

Tools required:

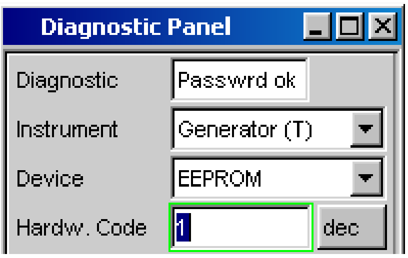
Size 8, 10 and 20 Torx screwdrivers
Size 0 Phillips screwdriver
Size 12 open-end wrench or strong flat-nosed pliers

Function check

After you install the R&S UPV-U2 option, no adjustments are required. You merely have to perform a function check as follows:

Switch on the R&S UPV.

- Set to default state:
  Press the PRESET button on the front panel of the R&S UPV and respond to the prompt with ↲ or by pressing the Enter key on the external keyboard. To be known by the firmware, an entry in the diagnostic panel must be made:
  - enter 1.4142 as Diagnostic password
  - select Instrument "Generator (T)"
  - select Device "EEPROM"
  - enter "1" as Hardw. Code



- Make the following settings (starting from the default state):
  (All menu panels are located under Instruments)

- Generator Function:	Voltage	1.000 V
- Analyzer Config:	Channel	1 & 2
	Ch1 Input	Gen Ch1
	Ch1 Range	Fix
		1.0 V RMS
	Ch2 Input	Gen Ch2
	Ch2 Range	Fix
		1.0 V RMS
- Auxiliaries:	Phone active	Enable by selecting box
	Volume	0 dB

- Connect the two female BNC connectors to the inputs of an oscilloscope by using cables.
  For both channels, the screen should now show the **1 kHz signal** at a level between approx. **3.9 V (rms)** and **4.1 V (rms)** (4 V (rms) ±2.5%, approx. 11.3 V (pp)).
- Make sure that the channels are not reversed:
  - In the Analyzer Config panel, switch Ch1 Range from 1.0 V RMS to 3.0 V RMS.
    → The level from Ch1 female BNC connector must drop to approx. **1.27 V (rms)**.
  - In the Analyzer Config panel, switch Ch2 Range from 1.0 V RMS to 3.0 V RMS.
    → The level from the Ch2 female BNC connector must drop to approx. **1.27 V (rms)**.

  If the Ch1 Range affects the Ch2 level or vice versa, cables W60 and W70 from the R&S UPV-U2 board to the R&S UPV rear panel are reversed!

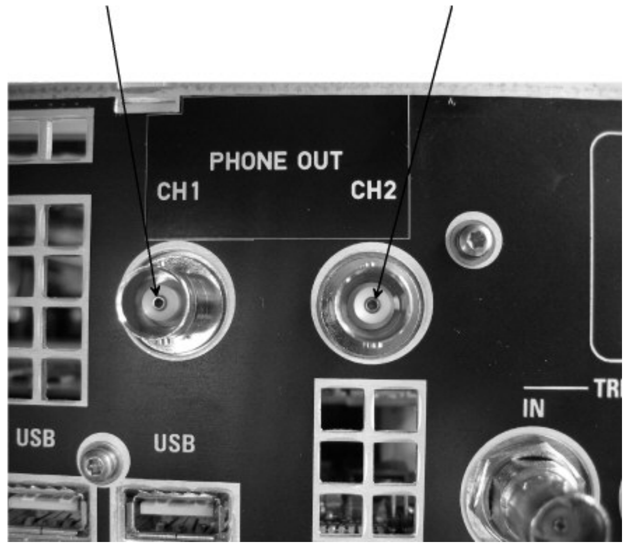
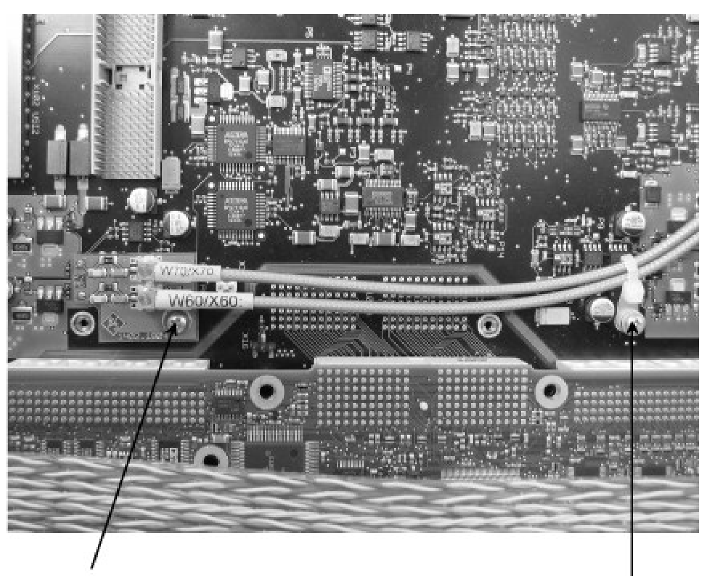


Fig. 4-3 Position of female BNC connectors and adhesive label on the rear panel



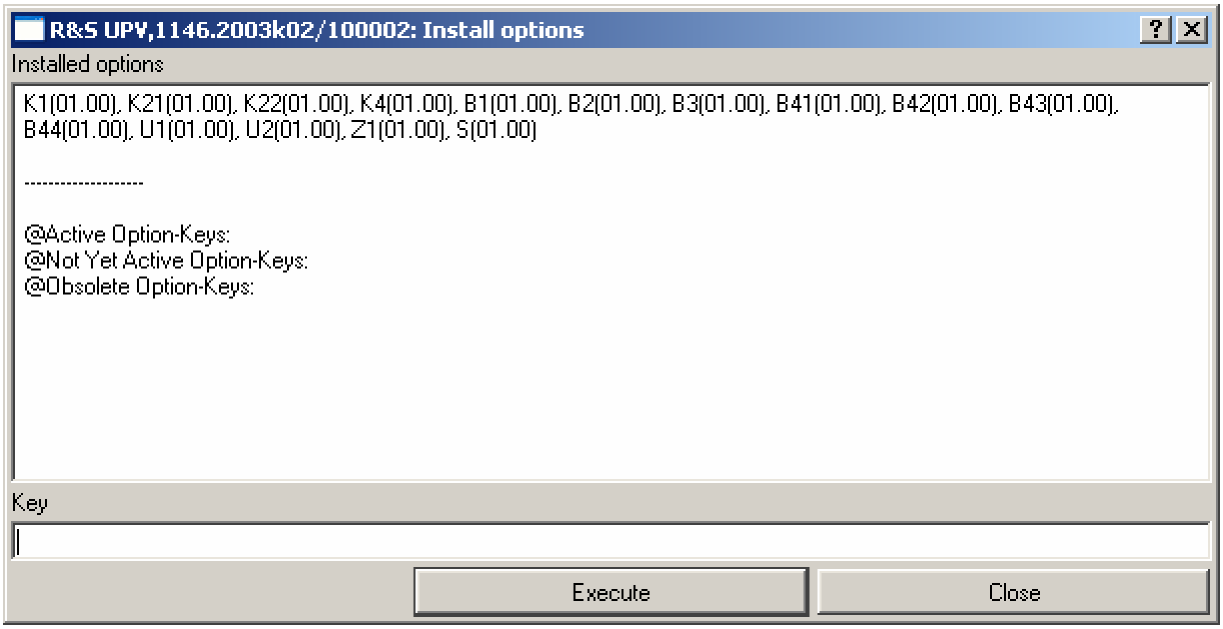
Fastening screw for R&S UPV-U2 board

Fastening screw for cable tie

Fig. 4-4 Fastening of the R&S UPV-U2 board and the W60/W70 cables

Software Options

Software options are installed via the "Install Options…" entry in the Utilities menu.



The first line displays the hardware and software options that have been installed. In this example a K0 is installed, with all known software options enabled.

Below that is additional information about option key management. This shows you which of the option keys are active, not yet active and obsolete.

An option key is installed by entering a corresponding 30-digit numeric string in the "Key" field and then clicking on "Execute". It is thus possible to enter several keys in succession.

Each successfully installed key is acknowledged in the input field with the message "Installation Successful".

Receiving the Option Key by E-Mail

Copy the 30-digit number from the e-mail into a text file which you then transmit to the R&S UPV. On the R&S UPV open this file in NOTEPAD.EXE. You can now use the mouse to select the number and copy it to the input field with the aid of the clipboard.

Receiving the Option Key in a File

The files for enabling option keys are in XML format and typically have names such as "OptionKey5_1146.2003k02_9999999999_0.xml". Open this file with the Internet Explorer. The contents of such a file typically look like this:

```
  <?xml version="1.0" standalone="yes" ?>
  <!DOCTYPE KeyInstallation (View Source for full doctype...)>
- <KeyInstallation format_id="0" content_type="OptionKey" device_id="1146.2003k02/100010"
   material_description="Audio Analyzer" model_name="UPV">
  <OptionKeyData material_no="1401.9001.02" format_id="0" option_index="4" start_date=""
   full_name="Remote Control" creation_date="2004-12-01" customer_order_no="9999999999"
   duration="" key_type="Customer Order" license_count="1" option_type="UPV-K4"
   activation_type="Permanent" />
  <OptionKey format_id="0" key="303671555220886565692418413311" license_count="1" />
  </KeyInstallation>
```

You can find the 30-digit number at "key=..." in the last couple of lines. Use the mouse and clipboard to copy this number into a text file which you then transmit to the R&S UPV. On the R&S UPV open this file in NOTEPAD.EXE. You can now use the mouse to select the number and copy it to the input field with the aid of the clipboard.

Troubleshooting During Key Enablement

Occasionally a key is rejected by the firmware. In almost all such cases, when you click on "Execute" the word "Invalid" is added after the key you have just entered. The possible causes are as follows:

1) The key does not fit the instrument concerned. In this case you need to check whether the serial number agrees. (The serial number is encoded in the installation key).

2) The key was created at Rohde & Schwarz before the instrument received a valid serial number. The option management also checks whether the creation dates are plausible. This situation can occur if for example an instrument was serviced due to defective E^2PROMs and the device key had to be recreated.

3) In a few cases the key is rejected even though everything is correct. This can occur if the time and/or date on the instrument are not correctly set. Verification of the internal time stamp has an allowance of only 48 hours. In this case it may be necessary to generate a new device key and/or installation key.

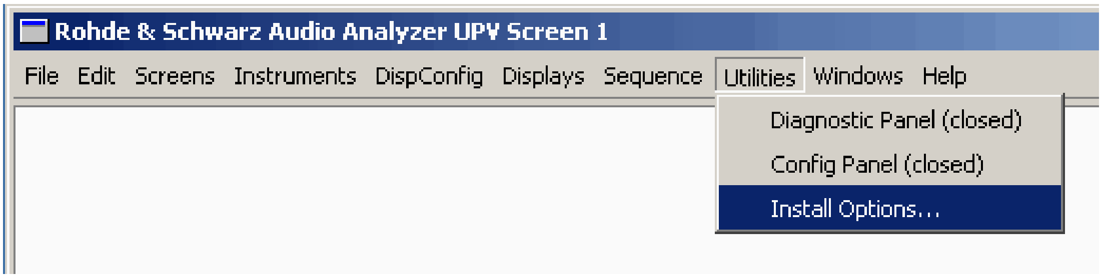
Option R&S UPV-K21 (Digital Audio Protocol)

CAUTION

Valid for R&S UPV firmware version 1.2.0 or later.
The hardware option R&S UPV-B2 (Digital Audio I/O 192 kHz) must be present.

Installation

When you open the "Install Options…" window the following menu is displayed:



Now enter the key code and press "Enter" to confirm.
The message "OK Successfully installed" indicates that the keyword was correctly entered.

Note:
Part of this software option is a list from which the keyword for this option is taken. Be sure to retain these installation instructions and the software option list. Both are important service documents.
In the event of problems please contact your Rohde & Schwarz Service Center.

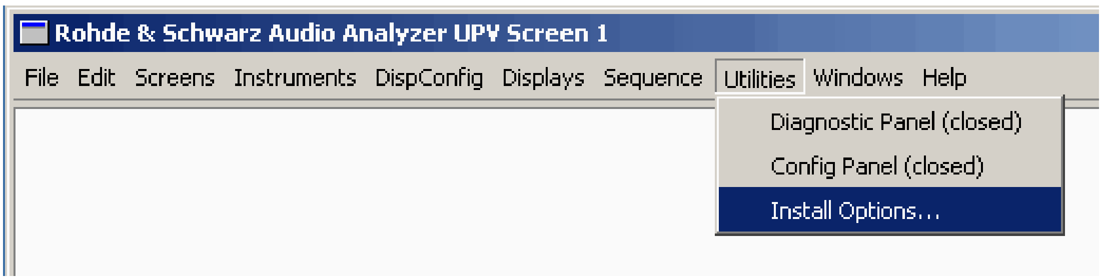
Option R&S UPV-K22 (Jitter and Interface Test)

CAUTION

Valid for R&S UPV firmware version 1.1.0 or later.
The hardware option R&S UPV-B2 (Digital Audio I/O 192 kHz) must be present.

Installation

When you open the "Install Options…" window the following menu is displayed:



Now enter the key code and press "Enter" to confirm.
The message "OK Successfully installed" indicates that the keyword was correctly entered.

Note:
Part of this software option is a list from which the keyword for this option is taken. Be sure to retain these installation instructions and the software option list. Both are important service documents.
In the event of problems please contact your Rohde & Schwarz Service Center.

Contents

5 Documents

Spare Parts

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

CAUTION

Risk of shock hazard and instrument damage

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

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

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 250 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	

ROHDE&SCHWARZ

Spare Part List

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL VAR03=VAR02 MIT FRM9/6 UND AUO DISPLAY MOD03=MOD02 WITH FRM9/6 AND AUO DISPLAY VAR66=FUER UPV66, = OHNE DISPLAY UND FRONTPANEL MOD66=FOR UPV66, = WITHOUT DISPLAY AND FRONTPANEL VAR67=VAR66 MIT FRM9/6 MOD67=MOD66 WITH FRM9/6					
5	0	S		PH BEMERKUNG NOTE Ersatzteilliste für / Spare Parts list for UPV = 1146.2003.01 ST UPV-B1 = 1146.5202.01 ST UPV-B2 = 1146.4341.01 ST UPV-B3 = 1146.4806.01 ST UPV-B20 = 1402.2000.01 ST UPV-B41 = 1146.5402.01 ST UPV-B42 = 1146.5802.01 ST UPV-B48 = 1402.2200.01 ST		0999.9610.00		B	O
10	0	S	A1	ED NETZTEILPLATTE POWER SUPPLY BOARD	Z	1146.2549.02	X	M	P
30	0	S	A2	ED DIGITAL MAINBOARD DIGITAL MAINBOARD ab TAZ 05.01 (= mit USB2.0) nur passend zu FMR7 (in dieser Liste mit Mat.Nr. 1406.0554.02, ! = Fertigungsteil) Nur Zentralservice Muenchen !!! ########################### ersetzt durch 1146.2803.03	Z	1146.2803.02	X	M	P
31	1	S	A2	ED DIGITAL MAINBOARD DIGITAL MAINBOARD Ersatz für 1146.2803.02 in Verbindung mit FRM/9 1406.1038.02	Z	1146.2803.03		M	P
50	0	S	A4	ED ANALOG AUDIO BOARD ANALOG AUDIO BOARD ersetzt durch 1146.3100.03	Z	1146.3100.02	X	M	W
55	1	S	A4	ED ANALOG AUDIO BOARD ANALOG AUDIO BOARD	Z	1146.3100.03	X	M	O
60	1	S	A11	EE DSP MODUL DSP MODUL	Z	1146.2703.03	X	M	P
70	1	S	A13	EE DSP MODUL DSP MODUL	Z	1146.2703.02	X	M	O
110	1	S	A14	EE POWER CONNECTOR BOARD POWER CONNECTOR BOARD	Z	1146.3400.02	X	M	O
130	1	S	A18	ZE POWER SUPPLY POWER SUPPLY	Z	1146.2510.02	X	M	P
135	0	S	A31	ED USB 1.1 ADAPTER USB 1.1 ADAPTER USB 1.1 bis DigMainboard 1146.2803.02 TAZ 04	Z	1141.3201.02	X	M	W
140	1	S	A31	ED 2X SINGLE USB2.0 BOARD USB 2.0 BOARD VAR 02 ab DigMainboard 1146.2803.02 TAZ 05.01	Z	1141.3160.02	X	M	W

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
150	1	S	A41	EE ANALOG FRONT PANEL ANALOG FRONT PANEL	Z	1146.3200.02	X	M	O
190	1	S		LT RINGKERNTRAFO UPV TRANSFORMER	Z	1146.2749.00	X	M	O
210	1	S		DX LUEFTEREINHEIT (DIG) FAN UNIT	Z	1146.3297.00	X	M	P
230	0	S		DX LUEFTEREINHEIT 60x60 FAN UNIT mit 4x Gummistiftbefestigung (1146.2161.00). Sind in Lüftereinheit enthalten.	Z	1146.3300.00	X	M	W
235	1	S		DX LUEFTEREINH. 60MM F. FLANSCHBEFEST. FAN UNIT 60MM für Manschettenhalterung (1400.3345.00). nicht in Lüftereinheit enthalten!	Z	1406.0419.00	X	M	P
236	1	S		EV LUEFTERMANS. 60X60X3 T=1.5-2.5 FRILL FOR FAN 60X60X25 für Lüftereinheit 1406.0419.00		1400.3345.00	X	B	O
240	1	S		DX LUEFTEREINH. 60MM F. NT- BELUEFTUNG FAN UNIT FOR POWER SUPPLY ab FMR7, ca. Ende 2006	Z	1406.0383.00	X	M	P
250	1	S		KB FRONTBLENDE BESCHR. 4E FRONT MASK W.INSCRIPTION 4U VAR 02	Z	1146.2355.00	X	M	B
255	1	S		KB FRONTBLENDE BESCHR. 4E UPV66 FRONT MASK W.INSCRIPTION 4U UPV66 VAR 66	Z	1406.0648.00	X	M	W
290	0	S		NR 256MB SODIMM F. FMR6 256MB SDRAM SODIMM144 ersetzt durch 1091.2850.00		1138.6578.00	X	B	N
295	0	S		NR 256MB SODIMM F. FMR6 256MB SDRAM SODIMM144 Ersatz für 1138.6578.00		1091.2850.00	X	B	A
300	0	S	A7	NM CD-RW/DVD LAUFW.SLIM CD-RW DRIVE VAR 02 ersetzt durch 1161.7960.00		1161.7860.00	X	B	A
301	1	S	A7	NM TEAC DV-W28S-W93 DVD-RW BRENNER TEAC DV-W28S-W93 DVD-RW BRENNER VAR 02 Ersatz für 1161.7860.00		1161.7960.00		B	O
310	0	S	A8	EM DREHIMPULSGEBER ROTARY PULSE ENCODER VAR 02 ersetzt durch 852.2799.00 1:1 Ersatz !!		0852.1170.00	X	B	A
315	1	S	A8	EM DREHIMP.4 (MIT TASTE) ROTARY PULS-GENERATOR VAR 02 Ersatz für 0852.1170.00		0852.2799.00	X	B	I
319	1	S		NR LUEFTER F. FMR5+ / 6+ BLOWER F. FMR5+ / 6+ Für FMR6 Rechner		1091.2943.00		B	V
320	0	S	A9	NR FMR6/5 FRONT MOD. CONTROLLER		1091.2520.00	X	B	A

Pos.-Nr. ItemNo	Menge Quantity	ME Unit	El.Kennz Ref.Des.	Benennung / Bezeichnung Designation	Z	Sachnummer Stock No.	Ersatzteil Subst.part	BA	VH
				ersetzt durch 1091.2908.00					
321	0	S	A9	NR FMR6/5+ FRONTMOD. CONTR. 6/5+ Bis Ende 2006 Ersatz für 1091.2520.00 *** Ersetzt durch 1406.0554.02 + DMB 1146.2803.02 TAZ 05.01		1091.2908.00	X	B	A
322	0	S	A9	ZE FMR7 MIT ADAPTERBOARD + KABEL FMR7 WITH ADAPTER + CABLE ab Ende 2006 (UPV TAZ 24.00) Ersatz für 1091.2908.00 + DMB 1146.2803.02 TAZ 05.01 + USB2.0 BD 1141.3160.02 *********** ersetzt durch 1406.1038.02	Z	1406.0554.02	X	M	W
323	1	S	A9	ZE FMR9/6 MIT ADAPTERBOARD + KABEL FMR9/6 WITH ADAPTER + CABLE Ersatz für 1406.0554.02	Z	1406.1038.02		M	
326	1	S	A99	ED USB-DEVICE-BOARD UPV USB-DEVICE-BOARD UPV im UPV vorh. ab Dig.Mainboard 1146.2803.02 TAZ 05.01	Z	1406.0502.02	X	M	W
327	1	S	A98	ED DVI INTERFACE DVI INTERFACE neu hinzu ab FRM9/6 1406.1038.02 und Dig.Mainb. 1146.2803.03	Z	1091.1860.02		M	P
330	1	S	A10	NJ SCHALTNETZT.AC115/230V SWITCHING POWER SUPPLY		1104.2463.00	X	B	V
340	0	S	A17	NP CDROM-IDE40- ADAPTER ADAPTER BOARD VAR 02 entfällt beim Ersatz von 1161.7860.00 durch 1161.7960.00		1091.1960.00	X	B	V
345	0	S	A29	ZM HARD DISK INCL. XP-CDROM HARD DISK INCL. XP-CDROM nur für FMR6	Z	1406.0160.00	X	M	W
346	0	S	A29	NM HDD 2.5 INCH 30GB 2.5 HARDD. 30GB Empty Hard Disk , included in 1406.0160.00 (Hard Disk incl. XP-CDROM)		0041.5807.00	X	B	N
347	1	S	A29	ZM HARD DISK INCL. XP-CDROM (FMR7) HARD DISK INCL. XP-CDROM (FMR7) nur für FMR7 und FRM9	Z	1406.0190.00	X	M	W
348	0	S	A29	NM HDD 2.5 INCH SATA 40GB MHV2040BH Empty Hard Disk , included in 1406.0190.00 (Hard Disk incl. XP-CDROM) replacement 3583.1503.00		1161.7925.00	X	B	A
349	0	S	A29	NM HDD 2.5 SATA 40GB MHW2040BH HDD 2.5 SATA 40GB MHW2040BH Ersatz durch 3583.1855.00 - ab Geraet TAZ 42.00 (2009-03) Empty Hard Disk , included in 1406.0190.00 (Hard Disk incl. XP-CDROM)		3583.1503.00	X	B	N
350	0	S	A29	NM HDD 2.5 SATA 80GB MHZ2080BH HDD 2.5 SATA 80GB MHZ2080BH		3583.1855.00	X	B	A

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				Ersatz durch 3586.5680.00 - ab Geraet TAZ 46.00 (2010-08) *** Empty Hard Disk , included in 1406.0190.00 (Hard Disk incl. XP-CDROM)					
351	0	S	A29	NM HDD 2.5 SATA 160GB MK1665GSX HDD 2.5 SATA 160GB MK1665GSX Ersatz fuer 3583.1855.00 - ab Geraet TAZ 46.00 (2010-08) Empty Hard Disk , included in 1406.0190.00 (Hard Disk incl. XP-CDROM) ersetzt durch3587.7306.00		3586.5680.00	X	B	A
352	1	S	A29	NM HDD 2.5 SATA 160GB MK1676GSX HDD 2.5 SATA 160GB MK1676GSX Ersatz für 3586.5680.00		3587.7306.00		B	T
359	0	S		PB UPV FW-UPGRADE BESCHREIBUNG UPV FW UPGRADE INST. MANUAL 1.x auf 2.x Upgrade für FMR6	Z	1406.0154.42	X	M	W
360	0	S	A60	NP DISPL.VERB.FMR6-TOSHIB DISPL.CONNECT FMR6-TOSHIBA VAR 02 Bis ca. 10.2007 hierzu TFT 0048.8599.00 (Verbindungskabel zu FMR enthalten)		1091.2937.00	X	B	A
365	0	S	A60	NP LST ADAPTER TOSHIBA-FMR (LVDS) LST ADAPTER TOSHIBA-FMR (LVDS) VAR 02 Display Kabel zu TFT enthalten ! hierzu TFT 1201.8403.00 und LVDS Dis. Kabel 1406.1015.00 A C H T U N G : Einbau erst ab FMR7 moeglich ! ersetzt durch 1311.1577.00		1406.0960.00	X	B	V
366	1	S	A60	NP LSA BOARD FSU LSA BOARD FSU VAR 02 Ersatz für 1406.0960.00 nur in Verbindung mit 3587.6274.00 und FMR9/6		1311.1577.00		B	T
370	0	S		NJ VNR-08C351-INV DC/AC-INVERTER CCFL BACKLIGHT INVERTER VAR 02 in Verbindung mit Wandlerkabel 1091.2650.00		0048.8760.00	X	B	N
372	0	S		DF WANDLERKAB.L=310 10POL CABLE 310MM 10PIN VAR 02 für 0048.8760.00		1091.2650.00	X	B	V
375	0	S	A61	NJ DQS-0166 DC/AC CONV DC/AC CONVERTER VAR 02 in Verbindung mit Wandlerkabel 1146.3851.00 entfällt beim Umstieg auf Display 3587.6274.00		1146.3122.00	X	B	A
377	0	S	W61	DX INVERTER POWER CABLE DC/AC INV. POWER CABLE VAR 02 für 1146.3122.00 entfällt beim Umstieg auf Display 3587.6274.00	Z	1146.3851.00	X	M	P

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
380	1	S		EL LAUTSPRECHER 10W 8 OHM LOUDSPEAKER		1031.5398.00	X	B	V
390	0	S	H1	ND TFT 8.4 SVGA DRGB CCFL 8.4 COLOR TFT VAR 02 bis ca. 10.2007 Ersatz durch 1201.8403. hierzu Displ.Verb.FMR6-Toshiba 1091.2937.00		0048.8599.00	X	B	A
395	0	S	H1	ND TFT 8.4 SVGA LVDS CCFL SVGA LVDSA DISPLAY 8.4 INCH VAR 02 Mechanik 1:1 verwendbar ! hierzu LST.Adapt.Toshiba-FMR (LVDS) 1406.0960.00 und LVDS Dis. Kabel 1406.1015.00 A C H T U N G : Einbau erst ab FMR7 moeglich ! ersetzt durch 3587.6274.00		1201.8403.00	X	B	A
396	1	S	H1	ND TFT 8.4 SVGA LVDS LED AUO TFT 8.4 SVGA LVDS LED AUO VAR 02 nur inVerbindung mit 1311.1577.00 Ersatz für 1201.8403.00		3587.6274.00		B	N
400	0	S	W62	DF DISPL.KAB.TOSHIBA DISPL.CABLE TOSHIBA VAR 02 Bis ca. 10.2007 nur in Verbindung mit Displ.Verb.FMR6-Toshiba 1091.2927.00 und TFT 0048.8599.00		1091.2666.00	X	B	V
405	1	S	W62	DY LVDS DISPLAY CABLE LVDS DISPLAY CABLE VAR 02 hierzu TFT 1201.8403.00 und LST.Adapt.Toshiba-FMR (LVDS) 1406.0960.00 A C H T U N G : Einbau erst ab FMR7 moeglich ! ab FMR9 Display 3587.6274.00 und LSA Board 1311.1577.00	Z	1406.1015.00	X	M	P
410	1	S	A3	SF SCHALTFOLIE 53T UPV FLEX.SWITCH BOARD VAR 02		1146.2284.00	X	B	V
420	1	S		SF SCHALTMATTE 53T UPV RUBBER KEYPAD UPV VAR 02	Z	1146.2290.00	X	B	V
700	0	S		PH BEMERKUNG NOTE ------- Optionen UPV -------		0999.9610.00		B	O
710	1	S	A40	ED LOW DIST.GENERATOR LOW DIST.GENERATOR included in UPV-B1	Z	1031.2699.03	X	M	O
720	1	S	A20	ED DIGITAL AUDIO BOARD DIGITAL AUDIO BOARD included in UPV-B2	Z	1146.4412.02	X	M	O
730	1	S	A20	ED DIGITAL_AUDIO_I/O_48KHZ DIGITAL_AUDIO_I/O_48KHZ included in UPV-B20	Z	1402.2100.02	X	M	
740	1	S	A21	ED DIGITAL FRONT PANEL DIGITAL FRONT PANEL included in UPV-B2	Z	1146.4512.02	X	M	W
750	1	S	A42	EE SECOND GEN. BOARD	Z	1146.4906.02	X	M	P

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				SECOND GEN. BOARD included in UPV-B3					
760	1	S		EE I2S / DAI BOARD I2S / DAI BOARD included in UPV-B41	Z	1146.5602.02	X	M	P
770	1	S	A100	EE USI BOARD USI BOARD included in UPV-B42	Z	1146.5825.02	X	M	W
780	1	S	A200	ED USI PROBE BOARD USI PROBE BOARD included in UPV-B42 => A200 - 1146.5819.02	Z	1146.5925.02	X	M	P
790	1	S		EE 8-CHANNEL ANALOG BOARD 8-CHANNEL ANALOG BOARD included in UPV-B48	Z	1402.2400.02	X	M	P
860	1	S	W100	DY Low dist conn cable Low dist conn cable included in UPV-B1	Z	1146.5254.00	X	M	P
870	1	S	W2	DY DIG. AUDIO FRONT CABLE DIG. AUDIO FRONT CABLE included in UPV-B2	Z	1146.4570.00		M	W
880	1	S	W2	DY DIG. AUDIO FRONT CABLE DIG. AUDIO FRONT CABLE included in UPV-B20	Z	1146.4570.00		M	W
890	1	S	W100	DG MIN-D 50POL. RIBBON CABLE ASSEMBLY CABLE ASSEMBLY included in UPV-B42		1146.5977.00	X	B	B

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL VAR03=VAR02 MIT FRM9/6 UND AUO DISPLAY MOD03=MOD 02 WITH FRM9/6 AND AUO DISPLAY VAR66=OHNE DISPLAY UND FRONTPANEL MOD66=WITHOUT DISPLAY AND FRONTPANEL VAR67=VAR66 MIT FRM9/6 MOD67=MOD 66 MIT FRM9/6					
3	0	S		ZS ERSATZTEILLISTE VORHANDEN SPARE PARTS LIST AVAIL Ident-Nr. 1146.2032.01 / Part No. 1146.2032.01		0999.9684.00		M	O
10	1	S		ZM Rahmen vormont. Equipment frame	Z	1146.2403.02		M	O
40	1	S	A14	EE POWER CONNECTOR BOARD POWER CONNECTOR BOARD	Z	1146.3400.02	X	M	P
42	1	S		AZ THERMAFILMSCH TO3P INSULATING DISC		0086.9247.00		B	V
50	6	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
52	1	S		VS HVC/ISR-M2.5X12-A2 COMBI SCREW HVC/ISR-M2.5X12-A2		1096.5205.00		B	B
56	1	S	A2	ED DIGITAL MAINBOARD DIGITAL MAINBOARD ersetzt 1146.2803.02	Z	1146.2803.03		M	P
57	1	S		ZN RUECKPL.DIG.MAINB. MIT FMR9/6 REARP.DIG.MAINB. WITH FMR9/6 ersetzt 1146.2484.00	Z	1146.2478.00		M	P
58	2	S		FM VERRIEGEL.BOLZEN 4-40 SPACER SET		0243.7850.00		B	B
63	2	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2 zur Montage von Rueckplatte an A2		0041.1653.00		B	T
66	3	S		FJ FAECHERSCHEIBE SERRATED LOCKWASHER zur Montage von X5, X6, X7 an Rueckplatte		3583.1578.00		B	O
67	3	S		FJ MUTTER HEX 14 1/2 -28UNEF HEX 14 NUT 1/2 -28UNEF zur Montage von X5, X6, X7 an Rückplatte		3583.1561.00		B	O
70	3	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
80	2	S		VS 6900/ISR-M2.5X10-A2 COMBI SCREW 6900/ISR-M2.5X10-A2		0041.1660.00		B	T
90	1	S	X11	FT EINBAUADAPTER 8P.GER 2XRJ45 COUPLER JACK STRAIGHT		1093.9122.00		B	V
110	1	S	A11	EE DSP MODUL DSP MODUL	Z	1146.2703.03	X	M	W
120	1	S	A13	EE DSP MODUL DSP MODUL	Z	1146.2703.02	X	M	W

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
130	10	S		VS 6900/ISR-M2X12-A2 COMBI SCREW 6900/ISR-M2X12-A2	Z	1091.2872.00		B	B
167	1	S	A9	ZE FMR9/6 MIT ADAPTERBOARD + KABEL FMR9/6 WITH ADAPTER + CABLE ersetzt 1406.0554.02	Z	1406.1038.02		M	P
170	1	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
177	6	S		VS DIN137-A2.6-A2 WAVE SPRING WASHER		0005.0280.00		B	V
178	6	S		VS DIN125-A2.7-A4 WASHER DIN125		0082.4663.00		B	V
181	6	S		VS DIN7985-M2.5X30-A4 SCREW DIN7985-M2.5X30-A4		0455.5966.00		B	V
183	1	S	A99	ED USB-DEVICE-BOARD UPV USB-DEVICE-BOARD UPV ab DMB 1146.2803.02 TAZ: 05.01	Z	1406.0502.02	X	M	M
187	2	S		VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
190	1	S	W11	DG PATCHKABEL CAT6. 0.5M PATCHCABLE CAT.6. 0.5M		0041.9283.00		B	T
193	1	S	A90	DX LAN RESET UNIT / CABLE LAN RESET UNIT / CABLE VAR 66	Z	1406.0860.00	X	M	
195	2	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2 VAR 66		0041.1653.00		B	T
196	1	S	A98	ED DVI INTERFACE DVI INTERFACE	Z	1091.1860.02		M	O
197	2	S		FM VERRIEGEL.BOLZEN H=4.5 LOCKINSCREW		1093.9180.00		B	O
198	2	S		VS DIN128-A3-A2 SPRING LOCK WASHER DIN128-A3-A2		0005.2499.00		B	O
199	1	S	W98	DG YFB KABEL L=190 CABLE		1206.0269.00		B	V
200	1	S	A29	NM MK1676GSX 160GB HDD 2.5 SATA MK1676GSX 160GB HDD 2.5 SATA		3587.7306.00	X	B	B
210	1	S	W19	DG SATA DATENKABEL 265 SATA DATACABLE 265		1091.3440.00		B	O
212	1	S	W191	DF SATA VERSORGUNGSKABEL 285 SATA POWERCABLE 285		1091.3427.00		B	O
220	4	S		VS 6900/ISR-M3.0X6-A2 COMBI SCREW 6900/ISR-M3.0X6-A2		0041.1682.00		B	O
230	1	S		MZ HDD-Halterung VORNE HDD Panel	Z	1146.2332.00		M	W
232	2	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
233	2	S		VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA		1148.3288.00		B	T
250	1	S		MZ Haltebl. f. CDR+USB Panel for CDR+USB VAR 02	Z	1146.2778.00		M	P

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
252	1	S		MZ ABDECKUNG F. CDLW-SCHACHT Panel VAR 66	Z	1406.0725.00		M	
255	.12	M		WW KLEB-BD3 X 9PUR-SCH SW ADHESIVE FOAM		0852.1805.00		B	O
260	1	S	A31	ED 2X SINGLE USB2.0 BOARD USB 2.0 BOARD VAR 02	Z	1141.3160.02	X	M	O
270	3	S		VS 6900/ISR-M2.5X6-A2 COMBI SCREW 6900/ISR-M2.5X6-A2 VAR 02		1148.3059.00		B	T
280	1	S	W31	DF KABEL 4X2 U.SCHIRM 380 CABLE VAR 02		2085.4350.00		B	O
350	1	S	A7	NM DV-W28S-W(93) DVD+RW/CD-RW SLIM DV-W28S-W(93) DVD+RW/CD-RW SLIM VAR 02 ersetzt 1161.7860.00		1161.7960.00	X	B	O
355	1	S	W7	DX KABEL SATA SLIMLINE DATEN UND STROM CABLE SATA SLIMLINE DATA AND POWER VAR 02 ersetzt 1146.3480.00 und 1138.9583.00	Z	1406.1044.00		M	O
360	4	S		VS DIN7985-M2X3-A4 SCREW DIN7985-M2X3-A4 VAR 02		0088.8354.00		B	V
370	2	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
380	4	S		VS 965/ISR-M2.5X6-A4-PA 965/ISR-M2.5X6-A4-PA VAR 02		1148.3288.00		B	T
500	1	S	A18	ZE POWER SUPPLY POWER SUPPLY	Z	1146.2510.02		M	O
510	1	S	W13	DY ANALOG POWER CABLE ANALOG POWER CABLE	Z	1146.3445.00		M	W
540	2	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
560	1	S	E3	DX LUEFTEREINH. 60MM F. NT-BELUEFTUNG FAN UNIT FOR POWER SUPPLY	Z	1406.0383.00	X	M	O
570	1	S		ZN LUEFTERHALTERUNG F. NT-BELUEFT. PANEL FOR FAN	Z	1406.0390.00		M	M
575	1	S		EV LUEFTERMANS. 60X60X3 T=1.5-2.5 FRILL FOR FAN 60X60X25		1400.3345.00		B	O
585	1	S		VS 6900/ISR-M2.5X10-A2 COMBI SCREW 6900/ISR-M2.5X10-A2		0041.1660.00		B	T
600	1	S		MZ NT-Halterung (digNT) Panel for Power Supply	Z	1146.2655.00		M	W
610	1	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
620	1	S	A10	NJ SCHALTNETZT.AC115/230V SWITCHING POWER SUPPLY		1104.2463.00	X	B	V
623	1	S		MZ SCHIRMWANNE F. DIGNT SHIELDING TUB	Z	1146.2184.00		M	W

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
625	1	S		MZ SCHIRMHAUBE F. DIGNT SHIELDING TUB	Z	1146.2190.00		M	W
627	2	S		MP ELASTIKPUFFER SELBSTKL SILIKON 12 BUFFER		1097.6105.00		B	O
630	8	S		VS 7985/ISR 6-32UNC1/4 A2 SCREW - 6-32UNC1/4 A2		2084.7985.00		B	O
660	1	S	W10	DX DIGITAL POWER CABLE DIGITAL POWER CABLE	Z	1146.3439.00		M	O
662	1	S		DZ KABELBI.RD 1 BIS 25 B2 CABLETIE		0015.9038.00		B	O
670	1	S	W18	DX DIG. POWER CABLE +5V DIG. POWER CABLE +5V	Z	1146.3822.00		M	W
675	1	S		DZ DURCHF.TUELLE 4X11X8 GROMMET		0395.3305.00		B	B
700	1	S	A4	ED ANALOG AUDIO BOARD ANALOG AUDIO BOARD	Z	1146.3100.03	X	M	V
710	5	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
740	1	S	W41	DY ANALYZER DATA CABLE ANALYZER DATA CABLE	Z	1146.3468.00		M	W
750	1	S	W40	DY GENERATOR DATA CABLE GENERATOR DATA CABLE	Z	1146.3474.00		M	W
850	1	S		MZ Blindplatte f Rückwand Blind panel	Z	1146.3697.00		M	W
855	2	S		MZ BLINDPLATTE (F.RW/USI) PANEL	Z	1146.3716.00		M	O
860	6	S		VS 6900/ISR-M2.5X8-A2 COMBI SCREW 6900/ISR-M2.5X8-A2		0041.1653.00		B	T
900	1	S		MZ Schaltstange kompl. Switchbar	Z	1146.2661.00		M	W
931	1	S		ZE Fronteinheit UPV66 Front panel unit UPV66 VAR 66	Z	1406.0602.02		M	
932	1	S		MP KLEBEFOLIE 108X45 GRAU ADHESIVE FOIL 108X45 GREY		1146.2249.00		B	O
933	1	S		ZE Fronteinheit UPV03 Front panel unit VAR 02 ersetzt 1146.2203.02	Z	1146.2203.03		M	
940	6	S		VS 965/ISR-M2.5X4-A4-PA 965/ISR-M2.5X4-A4-PA		1148.3271.00		B	T
950	1	S		KB FRONTBLENDE BESCHR. 4E FRONT MASK W.INSCRIPTION 4U VAR 02	Z	1146.2410.00		M	O
952	1	S		KB FRONTBLENDE BESCHR. 4E UPV66 FRONT MASK W.INSCRIPTION 4U UPV66 VAR 66	Z	1406.0648.00		M	W
970	1	S		MM FUEHRUNGSKRAGEN SPOUT		0396.0897.00		M	O
1000	2	S		KR BW2-FRONTGRIFF 4E FRONT HANDLE		1096.1480.00		B	V

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
1010	4	S		VS SCHR. M4X14-ISR-PA SCREW M4X14-ISR-PA		1096.4896.00		B	O
1040	4	S		KR BW2-RUECKWANDFUSS REAR WALL FOOT		1096.2487.00		B	V
1050	1	S		OS BW2-SCHILD F RUECKWAND BW2 LABEL F. REAR PANEL FOOT		1096.2435.00		M	V
1060	6	S		MP ABDECKK. RD11.1/9.9 COVER		0009.9217.00		B	O
1100	2	S		OS EGB-SCHILD 14X30 (12X28) WARNING LABEL FOR ESDS		0061.1520.00		M	O
1110	1	S		OS KLEBESCHILD LXI LABEL LXI		1400.7492.00	X	M	O
1130	1	S		MZ BW2 TUBUS 4E1/1T450 SONDERPERF BW2 TUBE 4HU1/1D450 SPECIAL	Z	1146.2503.00		M	L
1140	4	S		KR BW2-GERAETEFUSS FOOT		1096.2506.00		B	V
1150	2	S		KR BW2-AUFSTELLFUSS FOOT		1096.2529.00		B	V
1160	1	S		KR BW2-TRAGEGR.SEITL.T450 BW SIDE HANDLE	Z	1096.2670.00		M	V
1170	2	S		KR BW2-ABDECKUNG SEITLICH COVER LATERALLY		1096.2558.00		B	V
1200	1	S		HS WINDOWS XP EMBEDDED OPERATING SYSTEM		1099.8570.00		B	V
1220	1	S		HS FIRMWARE UPV FIRMWARE UPV	Z	1146.2103.00		M	
1270	1	S		HS ISO IMAGE BIOS FOR UPV ISO IMAGE BIOS FOR UPV ersetzt 1406.0060	Z	1406.1173.00		M	O
1290	1	S		PI INST.MANUAL WIN-XP OPERATING SYSTEM INST.MANUAL WIN XP OPERATING SYSTEM ersetzt 1406.0083.00	Z	1411.2074.00		M	P
1310	1	S		GH UPV-K4 REMOTE CONTROL UPV-K4 REMOTE CONTROL VAR 66	Z	1401.9001.02		M	W
1320	1	S		OS KC SCHILD UPV KC LABEL UPV geklebt nach HVL700 auf Rueckwand ueber CE-Zeichen		1146.2790.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL VAR03=MIT AUO DISPLAY MOD03=WITH AUO DISPLAY					
20	1	S		MZ MONTAGEWANNE UPV MOUNTING TROUGH UPV	Z	1146.2303.00		M	W
25	1	S		MZ DICHTUNGSFEDER L=12.05 MZ SEAL SPRING L=12.05	Z	1143.8881.00		M	W
30	2	S		MZ HF-FEDER (177) RF SPRING	Z	1069.3011.00		M	W
40	2	S		MZ HF-FEDER (137) RF SPRING	Z	1069.3105.00		M	W
50	1	S		OP MESH-SCHEIBE 8.4 GLAS MLAR MESHPLATE UPV		3584.0800.00		B	B
60	2	S		MB SCHEIBENHALTER RF CABLE W9		0852.0850.00		M	I
70	2	S		VS 965/ISR-M2.5X5-A4 965/ISR-M2.5X5-A4		0041.1618.00		B	B
80	1	S		SF SCHALTMATTE 53T UPV RUBBER KEYPAD UPV	Z	1146.2290.00	X	B	V
90	1	S	A3	SF SCHALTFOLIE 53T UPV FLEX.SWITCH BOARD		1146.2284.00	X	B	V
100	1	S		MZ HALTEBLECH HOLDING PLATE		1146.2278.00		M	W
110	3	S		VS 965/ISR-M2.5X5-A4-PA SCREW		1148.2752.00		B	T
120	1	S	A8	EM DREHIMP.4 (MIT TASTE) ROTARY PULS-GENERATOR		0852.2799.00	X	B	I
131	1	S		MP KRAGEN M. MUTTER COLLER WITH NUT	Z	0852.2699.00		B	O
132	1	S		OK DREH.RD28 ACHS-RD6 KNOB		0852.1086.00		B	V
140	1	S		MZ LCD-HALTEBLECH LCD-HOLDING PLATE VAR 02	Z	1146.2255.00		M	P
141	1	S		MZ SCHIRMHAUBE LCD 8.4 ZOLL AUO COVER LCD 8.4 AUO VAR 03	Z	1406.1073.00		M	L
150	1	S	H1	ND TFT 8.4 SVGA LVDS CCFL SVGA LVDSA DISPLAY 8.4 INCH VAR 02		1201.8403.00	X	B	A
151	1	S	H1	ND TFT 8.4 SVGA LVDS LED AUO TFT 8.4 SVGA LVDS LED AUO VAR 03		3587.6274.00	X	B	T
152	.191	M		WW KLEB-BD3 X 9PUR-SCH SW ADHESIVE FOAM		0852.1805.00		B	O
153	.191	M		WW KLEB-BD3 X 9PUR-SCH SW ADHESIVE FOAM		0852.1805.00		B	O
154	.1305	M		WW KLEB-BD3 X 9PUR-SCH SW		0852.1805.00		B	O

ROHDE&SCHWARZ	Benennung/*Designation* **Fronteinheit** ***Front panel unit***	Sprach./Lang de en	Ä.I. / *C.I.* 13.00
			Blatt/Sheet 1 of 3
UPV	Datum/ *Date* 2011-09-28 · Abt. / *Dept.* MTEK · Name / *Name* WU	Dokument Nr. / Document No.	**1146.2203.01 *ST***

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ADHESIVE FOAM					
155	.1305	M		WW KLEB-BD3 X 9PUR-SCH SW ADHESIVE FOAM		0852.1805.00		B	O
160	4	S		VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS VAR 02		1148.3059.00		B	T
161	4	S		VS 7985/ISR-M2.5X5-A4-PA 7985/ISR-M2.5X5-A4-PA VAR 03		1148.2617.00		B	T
170	2	S		DZ DURCHF.TUELLE 4X11X8 GROMMET VAR 02		0395.3305.00		B	B
180	2	S		VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS		1148.3059.00		B	T
190	2	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
200	1	S		MZ HAUBE DC/AC-WANDLER COVER DC/AC-CONVERTER VAR 02	Z	1146.2261.00		M	W
205	1	S		OS SCHILD 12.5MM BLITZPFEIL SIGN 12.5 LIGHTNING ARROW VAR 02		4024.5843.00		B	O
206	1	S		MZ ISOLIERUNG INSULATION VAR 02		1146.2378.00		M	W
210	1	S	A61	NJ DQS-0166 DC/AC CONV DC/AC CONVERTER VAR 02		1146.3122.00	X	B	B
212	1	S	W61	DX INVERTER POWER CABLE DC/AC INV. POWER CABLE VAR 02	Z	1146.3851.00	X	M	O
213	1	S	W61	DX AUO LCD POWER CABLE AUO LCD POWER CABLE VAR 03	Z	1406.1080.00		M	O
225	1	S		VS 7985/ISR-M2X8-A4-PA 7985/ISR-M2X8-A4-PA VAR 02		1148.2600.00		B	O
226	1	S		VS 7985/ISR-M2X6-A4-PA 7985/ISR-M2X6-A4-PA VAR 02		1148.2700.00		B	O
227	2	S		VS DIN125-A2.2-A4 WASHER DIN125 VAR 02		0082.4640.00		B	V
230	2	S		VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS VAR 02		1148.3059.00		B	T
240	1	S	A60	NP LST ADAPTER TOSHIBA-FMR (LVDS) LST ADAPTER TOSHIBA-FMR (LVDS) VAR 02		1406.0960.00	X	B	V
241	1	S	A60	NP LSA BOARD FSU LSA BOARD FSU VAR 03		1311.1577.00	X	B	T
250	2	S		VS 6900/ISR-M2.5X6-A2 COMBINATION SCREWS		1148.3059.00		B	T
255	1	S	W62	DY LVDS DISPLAY CABLE	Z	1406.1015.00	X	M	W

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				LVDS DISPLAY CABLE					
260	1	S	A41	EE ANALOG FRONT PANEL ANALOG FRONT PANEL	Z	1146.3200.02	X	M	W
270	2	S		VS 965/ISR-M2.5X8-A4-PA 965/ISR-M2.5X8-A4-PA		1148.3294.00		B	T
280	8	S		VS 965/ISR-M3X5-A4-PA SCREW		1148.2775.00		B	O
290	1	S		MB Dist.huelse f. Kli.bu. Distancer		1146.2310.00		M	W
295	1	S	X100	FT TELEFONBU. BLANK SOCKET		0018.3030.00		B	V
297	1	S		VS DIN6797-A6.4-A2 TOOTHED LOCK WASHERS		0016.2866.00		B	O
300	1	S		DZ KABELBI.L100 B2.4 CABLETIE		0209.4852.00		B	O
310	1	S		VS 6900/ISR-M2.5X10-A2 COMBINATION SCREWS		0041.1660.00		B	T
320	1	S		DZ HALTER KAB.BIND 4.2 HOLDER		0794.5214.00		B	O
330	1	S		DZ KABELBI.RD 1 BIS 25 B2 CABLETIE		0015.9038.00		B	O

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD					
				*VARIANTENERKLAERUNG *EXPLANATION OF MODELS					
				VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
10	1	S		KB U-Rahmen Beschr. 4E U-Frame	Z	1146.2426.00		M	
20	1	S		MZ Zwischenblech m. Einpr Interpanel	Z	1146.2455.00		M	
40	1	S		MZ Frontrahmen 4E 1/1 Frame	Z	1146.2349.00		M	
45	2.4	M		WG HF-DICHT O-PROF 2.0 SI SEALING		0396.1035.00		B	T
50	16	S		VN BLINDNIET 3.2X5.8 ST		1096.4821.00		B	O
60	1	S		MZ Schirmpl. auf Zwi.bl. Shielding panel	Z	1146.3380.00		M	
70	1	S		MP ELASTIKPUFFER SILIKON BUFFER		1097.6105.00		B	O
80	1	S	E1	DX LUEFTEREINHEIT (DIG) FAN UNIT	Z	1146.3297.00		M	
82	1	S		EV SCHUTZGITTER F.92X92 GUARD GRILL 92 X 92		2013.6311.00		B	O
90	2	S		VS SCHRAUBE F.KUST 5.0X10 SCREW		1096.4838.00		B	T
95	1	S		EV LUEFTERMANSCH. 92X92X4 T=1.5-2.5 FRILL FOR FAN		2112.3032.00		B	M
100	1	S	E4	DX LUEFTEREINH. 60MM F. FLANSCHBEFEST. FAN UNIT 60MM	Z	1406.0419.00		M	
107	1	S		MZ LüFTERHAUBE F. 60ER M. MANSCH.BEFE. COVER FOR FAN 60MM	Z	1406.0354.00		M	
108	1	S		EV LUEFTERMANSCH. 60X60X3 T=1.5-2.5 FRILL FOR FAN 60X60X25		1400.3345.00		B	I
120	1	S	E2	EL LAUTSPRECHER 10W 8 OHM LOUDSPEAKER		1031.5398.00		B	V
130	6	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
150	1	S	W22	DX SPEAKER CABLE SPEAKER CABLE	Z	1146.3516.00		M	
200	1	S	X10	FV FLACHSTECKER GR 6.3 CONNECTOR		0543.6705.00		B	O
210	1	S		VS 6900/ISR-M3.0X8-A2 COMBINATION SCREWS	Z	2084.7991.00		B	O
220	1	S		VS DIN6797-A3.2-A2 TOOTHED LOCK WASHERS		0016.2820.00		B	O
240	1	S		MZ Traeger f. dig. LPs Panel for circ boards	Z	1146.2610.00		M	
250	1	S		MZ U-Schiene auf Traeger	Z	1146.2632.00		M	

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				U rail					
260	3	S		VN BLINDNIET 3.2X5.8 ST		1096.4821.00		B	O
270	2	S		VS 6900/ISR-M2.5X8-A2 COMBINATION SCREWS		0041.1653.00		B	T
280	.23	M		WW KLEB-BD3 X 9PUR-SCH SW ADHESIVE FOAM		0852.1805.00		B	O

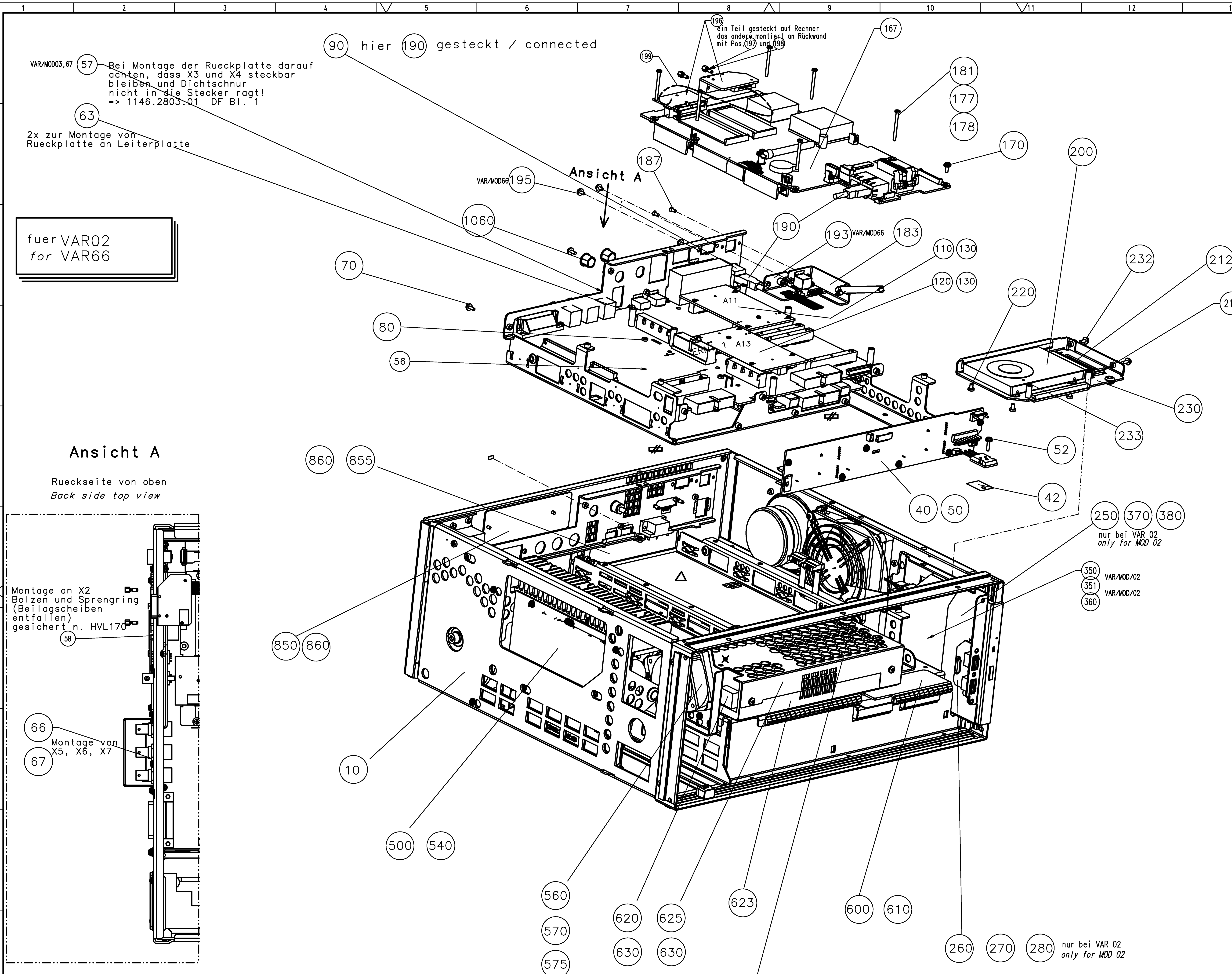
ROHDE&SCHWARZ	Benennung/*Designation* **Rahmen vormont.** ***Equipment frame***	Sprach./Lang de en	Ä.I. / *C.I.* 09.00	Blatt/Sheet 2 of 2
UPV	Datum/ *Date* 2006-05-09 · Abt. / *Dept.* 1GPK · Name / *Name* Hi	Dokument Nr. / Document No. **1146.2403.01 *ST***		

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLAERUNG *EXPLANATION OF MODELS VAR02=GRUNDVARIANTE MOD02=BASIC MODEL					
5	0	S		PH BEMERKUNG NOTE *** ZUGEHÖRIGE UNTERLAGEN / ADDITIONAL DOCUMENT 1146.2510.01 D *** MIT STÜCKLISTEN-POSITIONEN !/ WITH PARTS LIST POSITIONS !		0999.9610.00		B	O
20	1	S	JMZ1	MZ NT-Haltebl. m. einpr. Panel for Power Supply	Z	1146.2584.00		M	P
30	.035	M	JWT1	WT KTSCH.PROF PVC-W 1-2 SW EDGE PROTECTIVE STRIP		0298.1477.00		B	O
50	1	S	Z1	FN EURO-ST.M.NETZFILTER4A FILTER W.VOLTAGESLECTION		0006.0919.00		B	V
55	1	S	JMZ2	MZ KONTAKTF. F. NETZEING. SHIELDING CONTACT	Z	1146.2178.00		M	P
60	2	S	F1 F2	SS SCHMELZS. 4A T IEC60127-2/V FUSE 4A T IEC60127-2/V Sicherung für / Fuse for: (100 / 120 / 200 / 235) V		0020.7600.00		B	B
70	2	S	Z1.1 Z1.2	VS 965/ISR-M3X8-A4-PA SCREW		1148.2798.00		B	O
100	1	S	X1	FV FLACHSTECKER GR 6.3 CONNECTOR		0543.6705.00		B	O
110	1	S	X1.1 X1.2	VS 6900/ISR-M3.0X8-A2 COMBINATION SCREWS	Z	2084.7991.00		B	O
120	1	S	X1.3 X1.4	VS DIN6797-A3.2-A2 TOOTHED LOCK WASHERS		0016.2820.00		B	O
140	1	S	T1	LT RINGKERNTRAFO UPV TRANSFORMER	Z	1146.2749.00		M	W
150	1	S	T1.1	VS DIN912-M6X12-A4 SCREW		0061.4770.00		B	B
160	1	S	T1.2	VS DIN128-A6-A2 SPRING LOCK WASHER DIN 128-A6-A2		0005.2524.00		B	O
180	1	S	A1	ED NETZTEILPLATTE POWER SUPPLY BOARD	Z	1146.2549.02	X	M	W
190	2	S	A1.1 A1.2	VS 7985/ISR-M2.5X20-A4 SCREW		1148.2946.00		B	B
195	2	S	A1.3 A1.4	VS DIN137-A2.6-A2 WAVE SPRING WASHER		0005.0280.00		B	V
200	3	S	A1.5 A1.6 A1.7	VS 6900/ISR-M2.5X10-A2 COMBINATION SCREWS		0041.1660.00		B	T

ROHDE&SCHWARZ	Benennung/*Designation* **POWER SUPPLY** ***Power supply***	Sprach./Lang de en	Ä.I. / *C.I.* 06.00	Blatt/Sheet 1 of 2
UPV	Datum/*Date* 2012-01-23 · Abt. / *Dept.* MTEK · Name / *Name* WU	Dokument Nr. / Document No. **1146.2510.01 *ST***		

Pos.-Nr. *ItemNo*	Menge *Quantity*	ME *Unit*	El.Kennz *Ref.Des.*	Benennung / Bezeichnung *Designation*	Z	Sachnummer *Stock No.*	Ersatzteil *Subst.part*	BA	VH
220	1	S	W14	DX DIG.PRIMARY POW.CABLE DIG. PRIMARY POWER C.	Z	1146.3422.00		M	P
250	1	S	W12	DX DRAHTBRÜCKE BLAU	Z	1134.9789.00		M	W
260	1	S	W11	DX DRAHTBRUECKE SCHWARZ WIRE BLACK	Z	1134.9795.00		M	
270	1	S	W16	DX SCHUTZLEITER SHIELDING CABLE	Z	1146.3500.00		M	W
280	1	S		LF RINGKERN MIT GEHÄUSE - KLAPPBAR SPLIT FERRITE RING WITH HOUSING		3588.3262.00		B	B

Mechanical Drawings



auf 625 gekl. mit 0002.0489.00
zur Daempfung von 167

Affixed to 625 with 0002.0489.00
for damping of 167

Die Nummern der Teile entsprechen der Pos. in der Stueckliste 1146.2003.01

The parts are numbered the same as in parts list 1146.2003.01

Hinweis zur Montage- / Demontagevereinfachung der oberen Leiterplatten

Notes on how to simplify the mounting/ dismounting of the upper printed boards

Montage: Zuerst die mit △ gekennz. vormontierten Bleche demontieren.

Mounting: First dismount the premounted metal panels labeled with △

Demontage: Die 3 Schrauben 70 entfernen und die 2 Schrauben bei ⇏ ca. 3 Umdrehg. loesen, ganze Einheit nach vorne schieben und anheben

Dismounting: Remove the 3 screws 70 and loosen the 2 screws at ⇏ by approx. 3 turns. Slide the entire unit forward and lift

660 bei ✖ mit 662 am Deckel wegen Kurzschlussgefahr im Fehlerfall kurz festbinden

Fasten 660 with shot lenght at ✖ by means of 662 on cover to prevent short circuit in event of error

nicht dargestellte Kabel gesteckt nach Stromlauf

Cables not shown, connected in accordance with circuit diagram

355 510 660 670 740 750
675

nur VAR02
only MOD02

Variantenerklaerung /

VAR02 = Grundausfuehrung

VAR66 = ohne Display, Tastatur, CDRom-Laufwerk

Explanation of Models

MOD02 = Basic model

MOD66 = without Display, keyboard, CDRom-drive

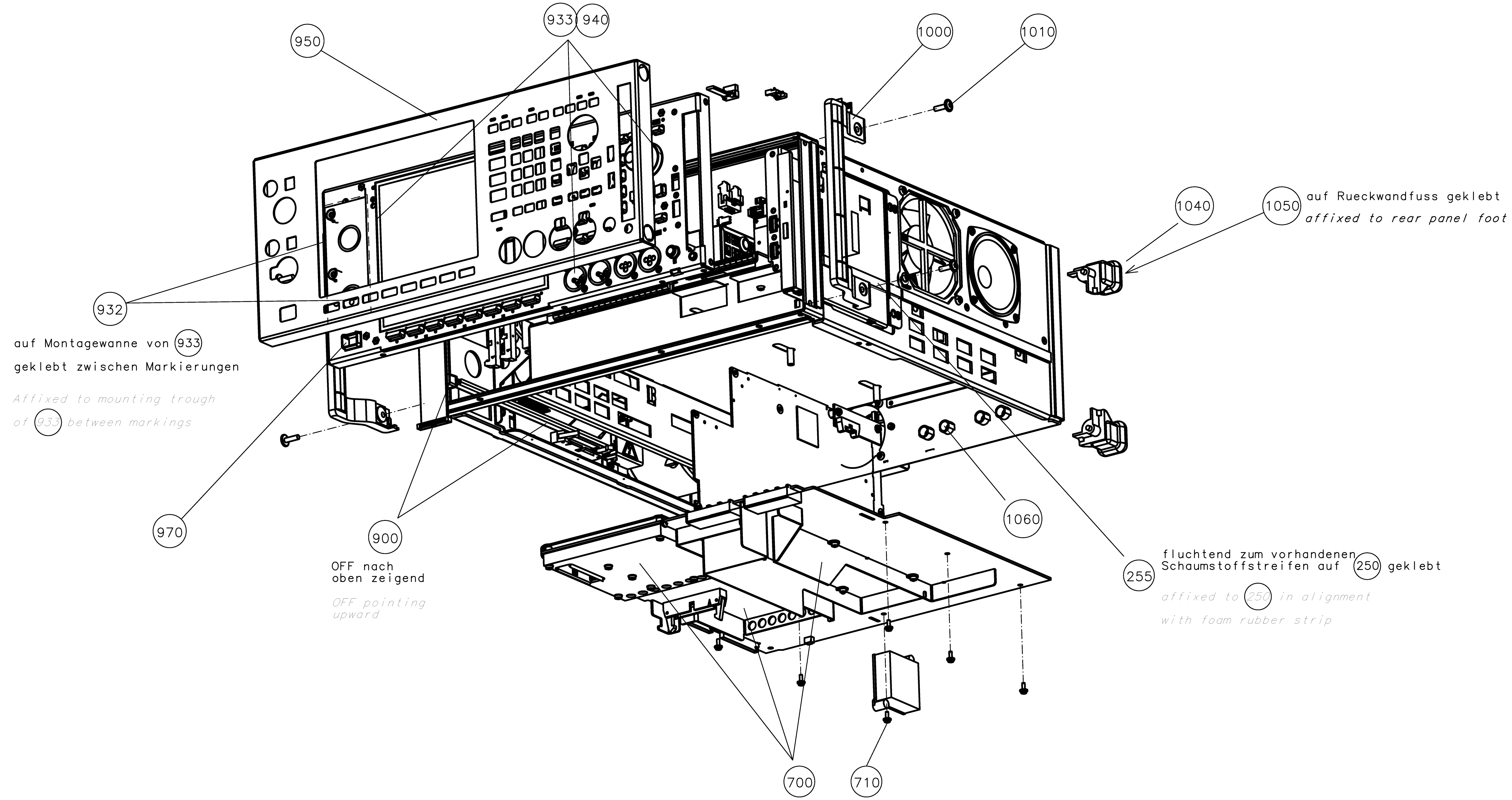
Projektionsmethode
Projection Method

Maßstab / *Scale*	1:2	Toleranz / *Tol.*	ISO2768-m	Werkstoff / *Material*	
ROHDE&SCHWARZ	Benennung / *Designation*: UPV AUDIO ANALYZER / UPV AUDIO ANALYZER			Sprache / *Lang.*: de en	Aei. / *C.I.*: 13.00
				Blatt / *Sh.*	1
UPV	Datum / *Date*: 2012-01-12	Abteilung / *Dept.*: MTEK	Name / *Name*: WU	Zeichn.Nr. / *Drawing No.*	1146.2003.01 D

fuer VAR 02
for MOD 02

Achtung: EGB

Caution: ESD



Geraetetubus und Anbauteile
nicht dargestellt:

Instrument casing and auxiliary hardware not shown

1130 1140 1150 1160 1170

links mont.

rechts mont.

Variantenerklaerung /

VAR02 = Grundausfuehrung

VAR66 = ohne Display, Tastatur,
CDROM-Laufwerk

Die Nummern der Teile entsprechen der
Pos. in der Stueckliste 1146.2003.01

The parts are numbered the same as in parts list 1146.2003.01.

Maßstab / Scale 1:2	Toleranz / Tol.	Werkstoff / Material	
ROHDE&SCHWARZ	UPV AUDIO ANALYZER UPV AUDIO ANALYZER	de en	04.00	2
UPV	2012-01-12 MTEK WU	1146.2003.01	D

Kabel von 212 und Kabel von 240 mit 300 am Gehaeuse befestigen
Secure cable from 212 and cable from 240 on housing by means of 300
Part of 240
152 153 154 und 155 buendig auf Metallrand des Displays geklebt
152 153 154 and 155 flush with and bonded to metal edge of display
buendig an Durchbruch-Oberkante und Kontakte anliegend, von Rueckseite geklebt
Reverse side affixed flush with upper edge of cutout, with contacts facing outward
Tuelle 170 vor Montage aufschneiden und um die entsprechenden Kabel legen.
Cut open grommet 170 before mounting and place around the corresponding cables
Kabel 156 auf Display 150 und auf Displ.verbinder 240 gesteckt.
Cable 156 connected to display 150 and to display connector 240.
Kabel 212 auf Displ.verbinder 240 und auf Wandler 210 gesteckt.
Cable 212 connected to display connector 240 and to converter 210.
Beleuchtungskabel von Display auf Wandler 210 gesteckt.
Lighting cable from display connected to converter 210.
Die Nummern der Teile entsprechen den Pos. in der Stueckliste 1146.2203.01
The parts are numberedthe same as in parts list 1146.2203.01
CAUTION! ESD
Für dieses Dokument behalten wir uns alle Rechte vor
For this document all rights are reserved
Projektionsmethode
Projection Method
Maßstab Scale 1:1
ROHDE&SCHWARZ
Typ Type UPV
used in 1146.2003.00
Datum Date 2008-01-24
Abteilung Dept. MENZ
Name hm
Benennung / Designation
Fronteinheit
Front panel unit
Sprache / Lang. de en
Rel. / C.I. 10.00
Blatt / Sh. 1
Zeichn.Nr. / Drawing No. 1146.2203.01 D

200 210 220

220 zwischen 200 und 10

220 between 200 and 10

80 82 90 95

Pfeil am Luefter nach aussen (= rechts) zeigend
Lueftergitter innen mont. mit 90

Arrow on fan pointing outward(=toward right)

120 130 150

Kontakte oben

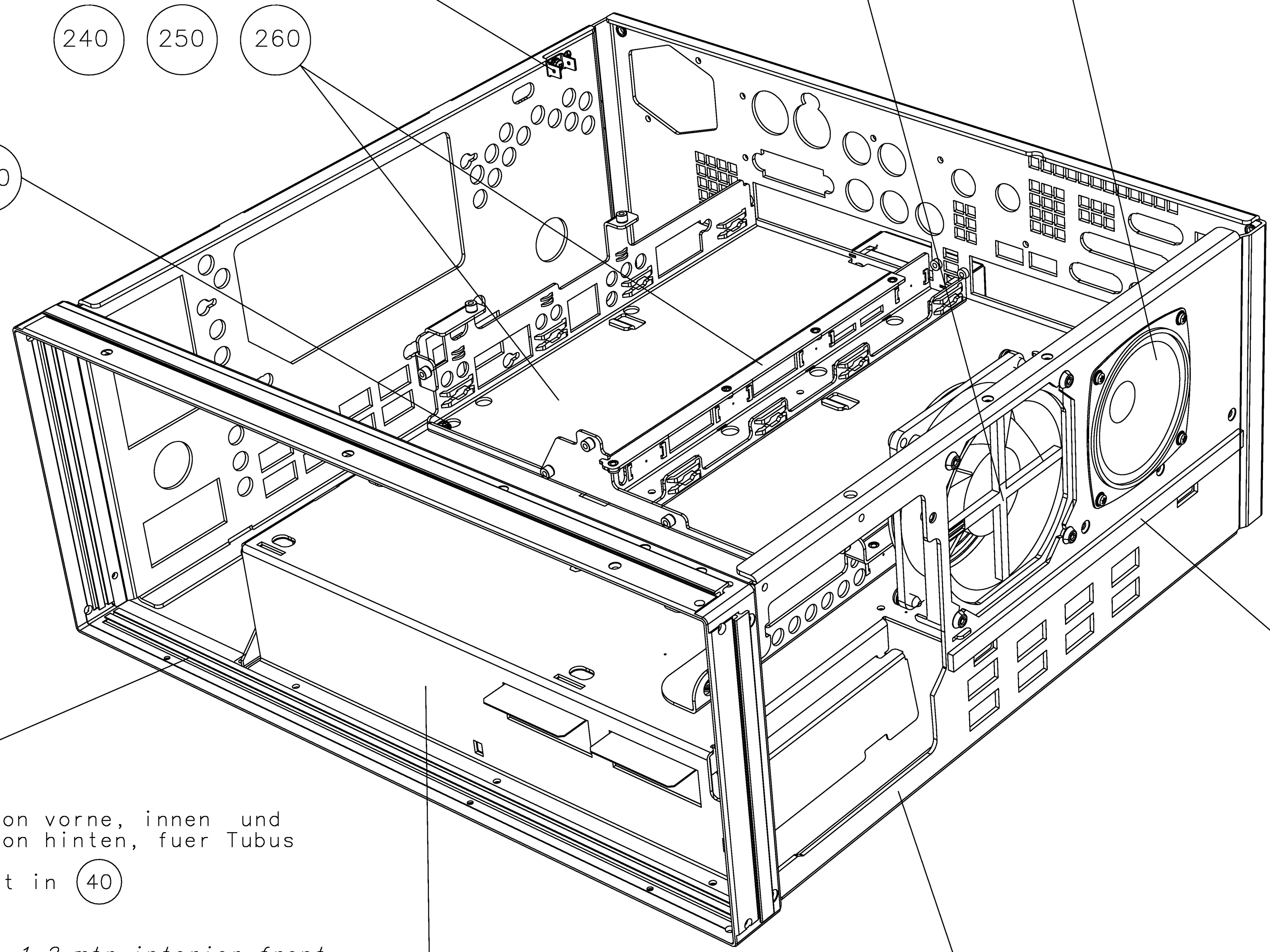
contacts at top

rt an + , sw an - /

red to +, blk to -

240 250 260

270



280

40 45

1,2 mtr von vorne, innen und
1,2 mtr von hinten, fuer Tubus
eingesetzt in 40

Mounted in 40, 1,2 mtr interior front

and 1.2 mtr interior rear

20

10 50

100 107 108 130

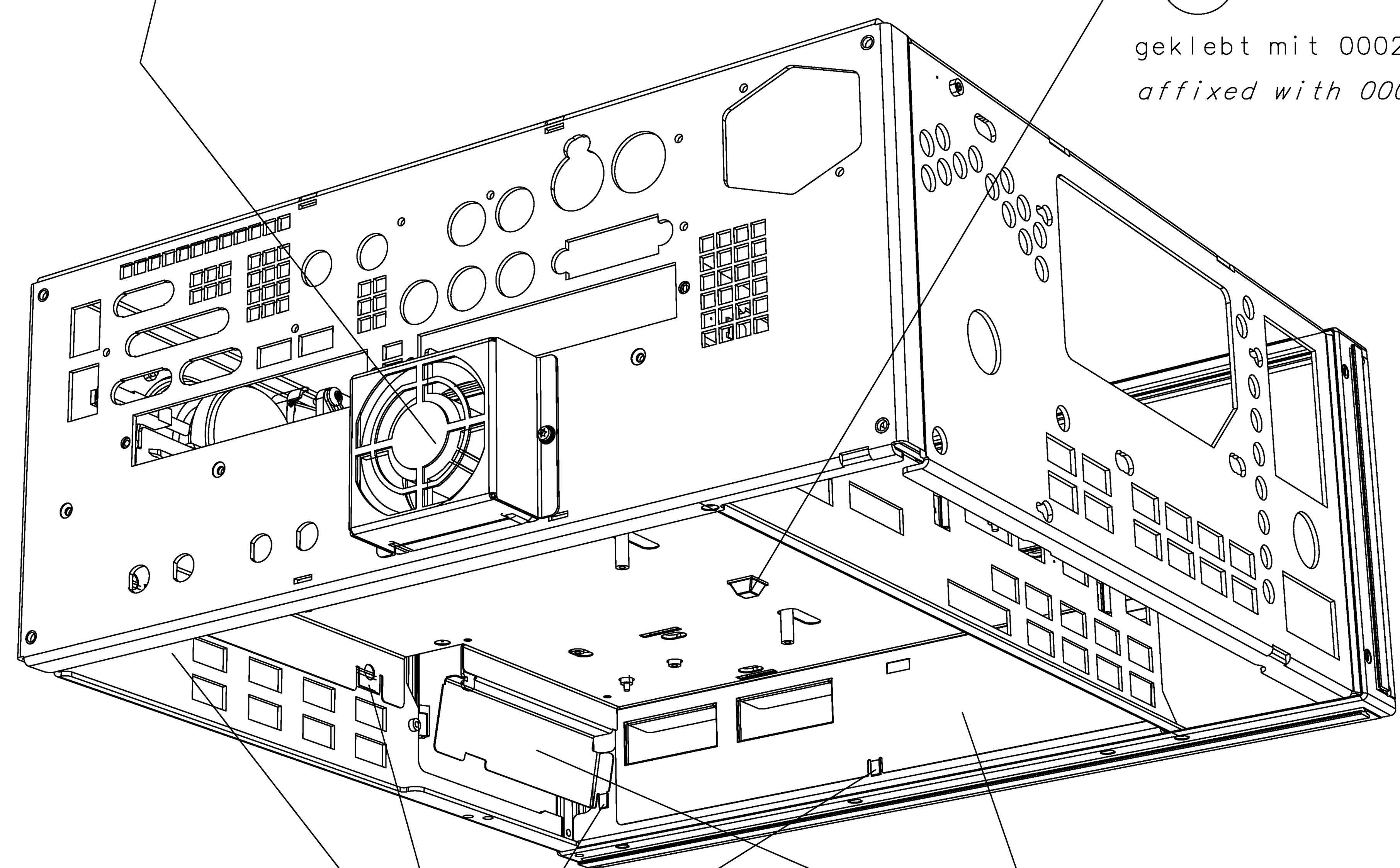
Pfeilrichtung von 100 nach aussen

Arrow direction from 100 toward exterior

70

geklebt mit 0002.0489.00

affixed with 0002.0489.00



60

Vor dem nieten auf 20 montiert.

Mounted on 20 prior to riveting.

Mit 5 - 8 kleinen Punkten 0290.5115.00 oder 0002.0498.00 auf Zwischenblech geklebt.
Die 4 Biegelappen ca. 2mm tief in die Durchbrueche der Alu-Bleche gedrueckt.

Affixed to partition panel with 5 to 8 dabs of 0290.5115.00 or 0002.0489.00
4 taps pressed approx. 2 mm into the cutouts on the aluminum panel.

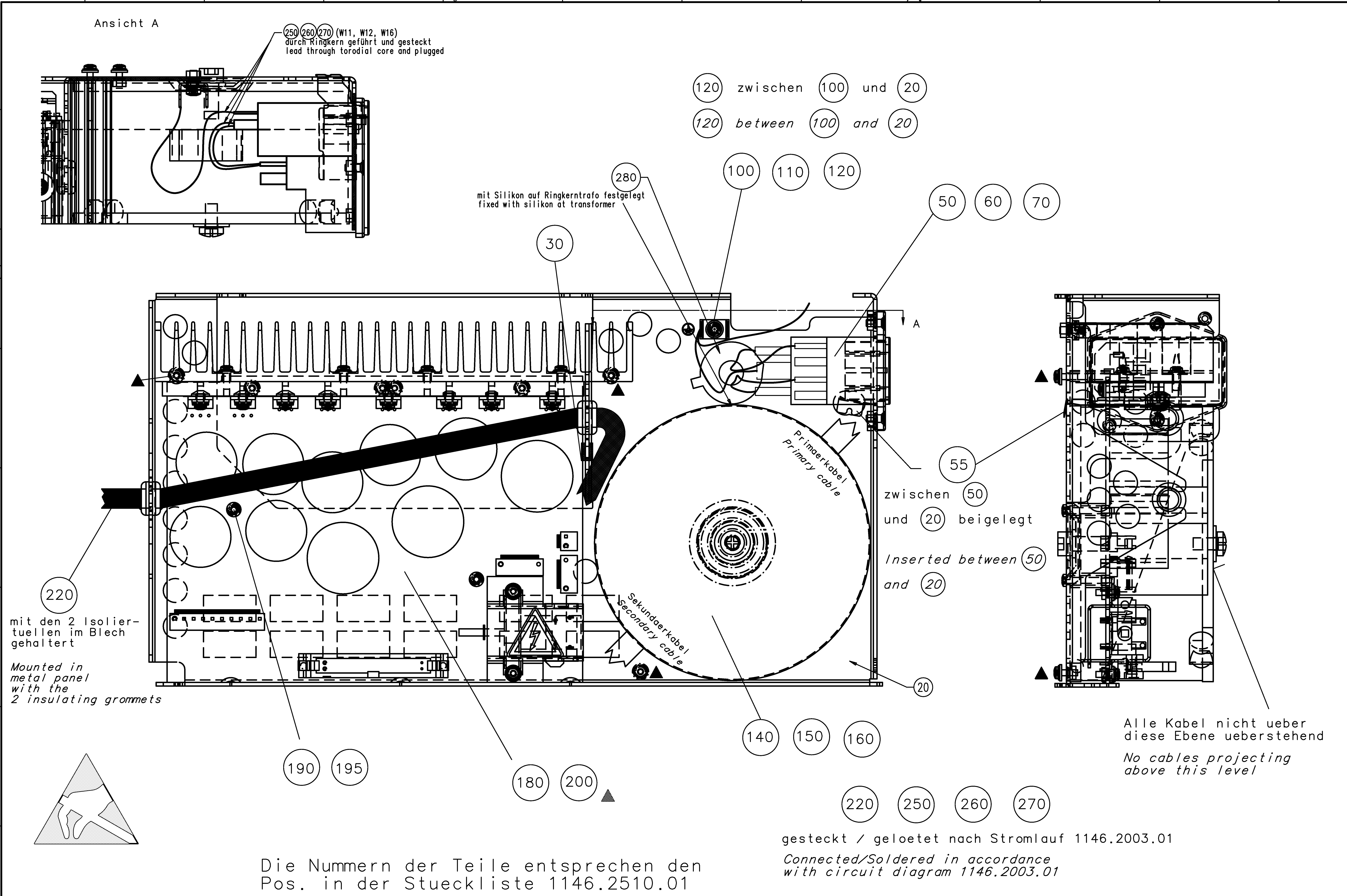
Variantenerklaerung:
VAR 02 = Grundausfuehrung
MOD 02 = Basic model

Die Nummern der Teile entsprechen den
Pos. in der Stueckliste 1146.2403.01

The parts are numbered the same as
in parts list 1146.2403.01

Projektions-methode / *Projection Method*

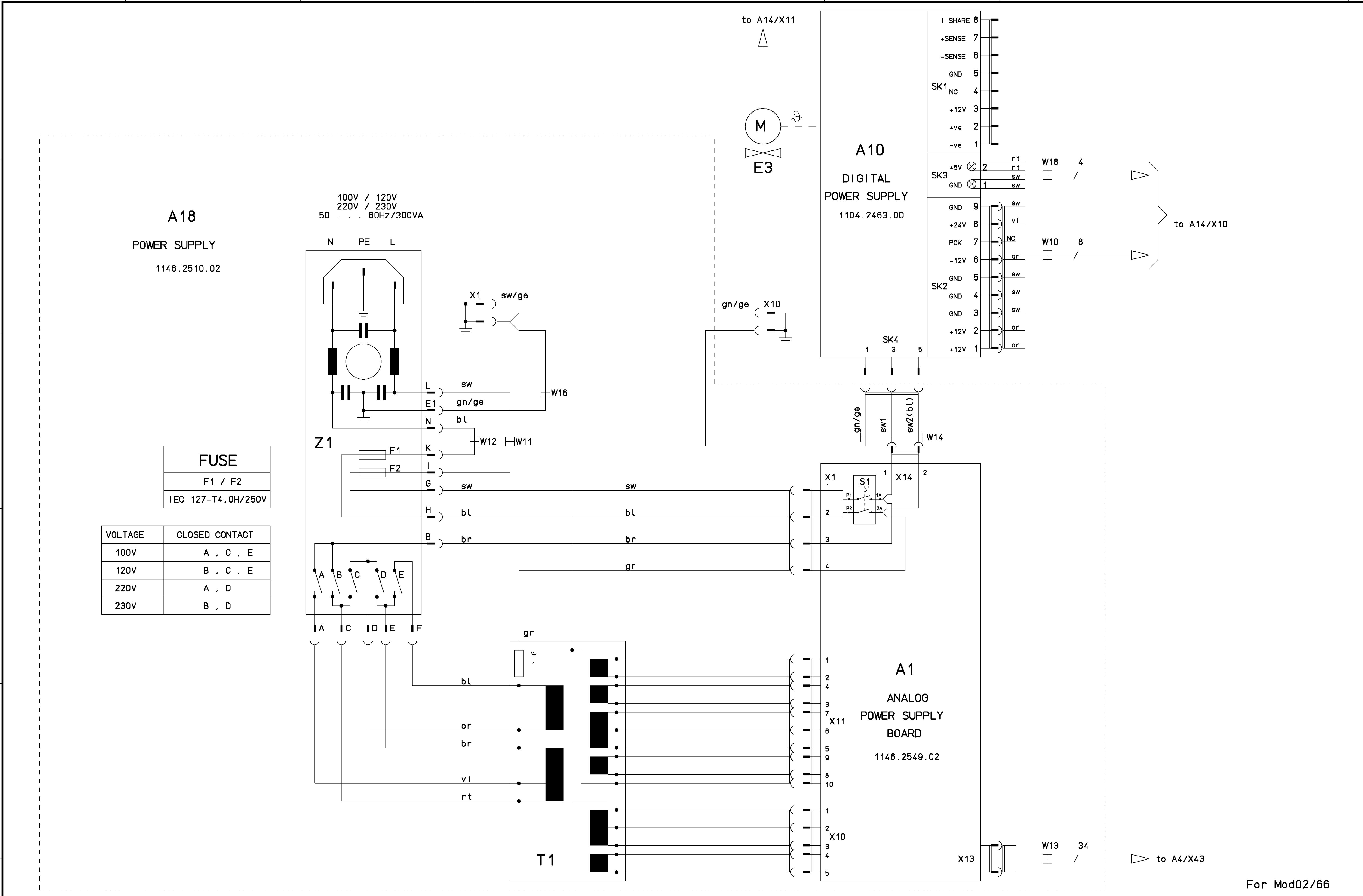
Maßstab / Scale 1:2	Toleranz / Tol.	Werkstoff / Material	Sprache / Lang. de en · Ausg. / C.I. 06.00 · Blatt / Sh. 1
ROHDE&SCHWARZ	Benennung / Designation: Rahmen vormont. Equipment frame		
Typ / Type UPV			Zeichn.Nr. / Drawing No. 1146.2403.01 D
i.V. / used in 1146.2003.01	Datum / Date 2006-05-08	Abteilung / Dept. 1GPK · Name Hi	



Maßstab / Scale: 1:1	Toleranz / Tol.: ISO2768-m	Werkstoff / Material			
ROHDE&SCHWARZ	Benennung / Designation: POWER SUPPLY Power supply		Sprache / Lang.: de en	Ånd. / C.I.: 04.00	Blatt / Sh.: 1
UPV	Datum / Date: 2012-01-12	Abteilung / Dept.: MTEK	Name: WU	Zeichn.Nr. / Drawing No.: 1146.2510.01	D

ROHDE&SCHWARZ

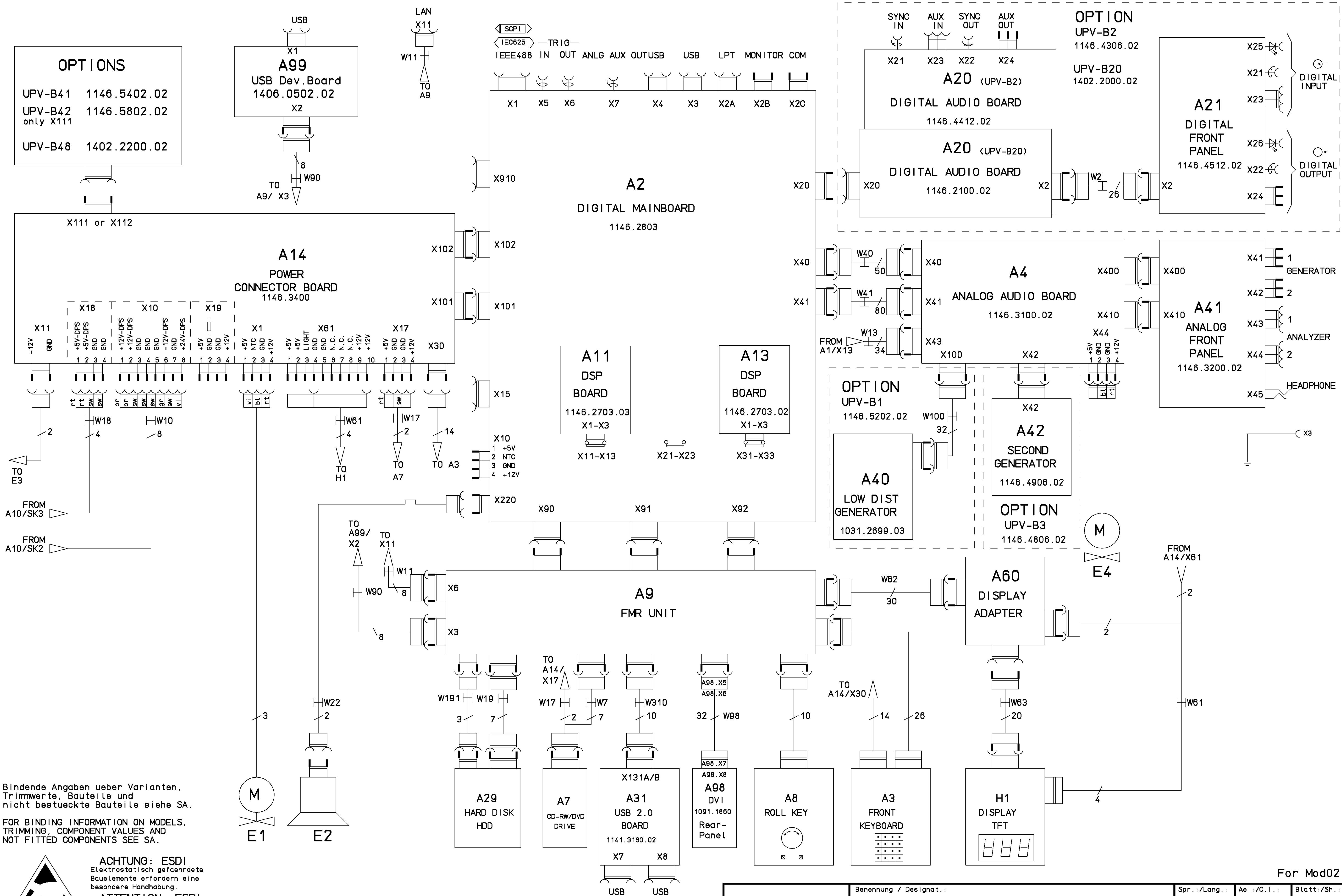
Block Diagrams



FUSE
F1 / F2
IEC 127-T4,0H/250V

VOLTAGE	CLOSED CONTACT
100V	A , C , E
120V	B , C , E
220V	A , D
230V	B , D

ROHDE&SCHWARZ	Benennung / Designat.: UPV AUDIO ANALYZER UPV AUDIO ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 12.00	Blatt:/Sh.: 1 +
UPV	Datum:/Date: 12-02-14 · Abteilung:/Dept.: MTEK · Name:/Name: eichfeld	Zeichn.Nr.:/Drawing No.: 1146.2003.01 S		



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

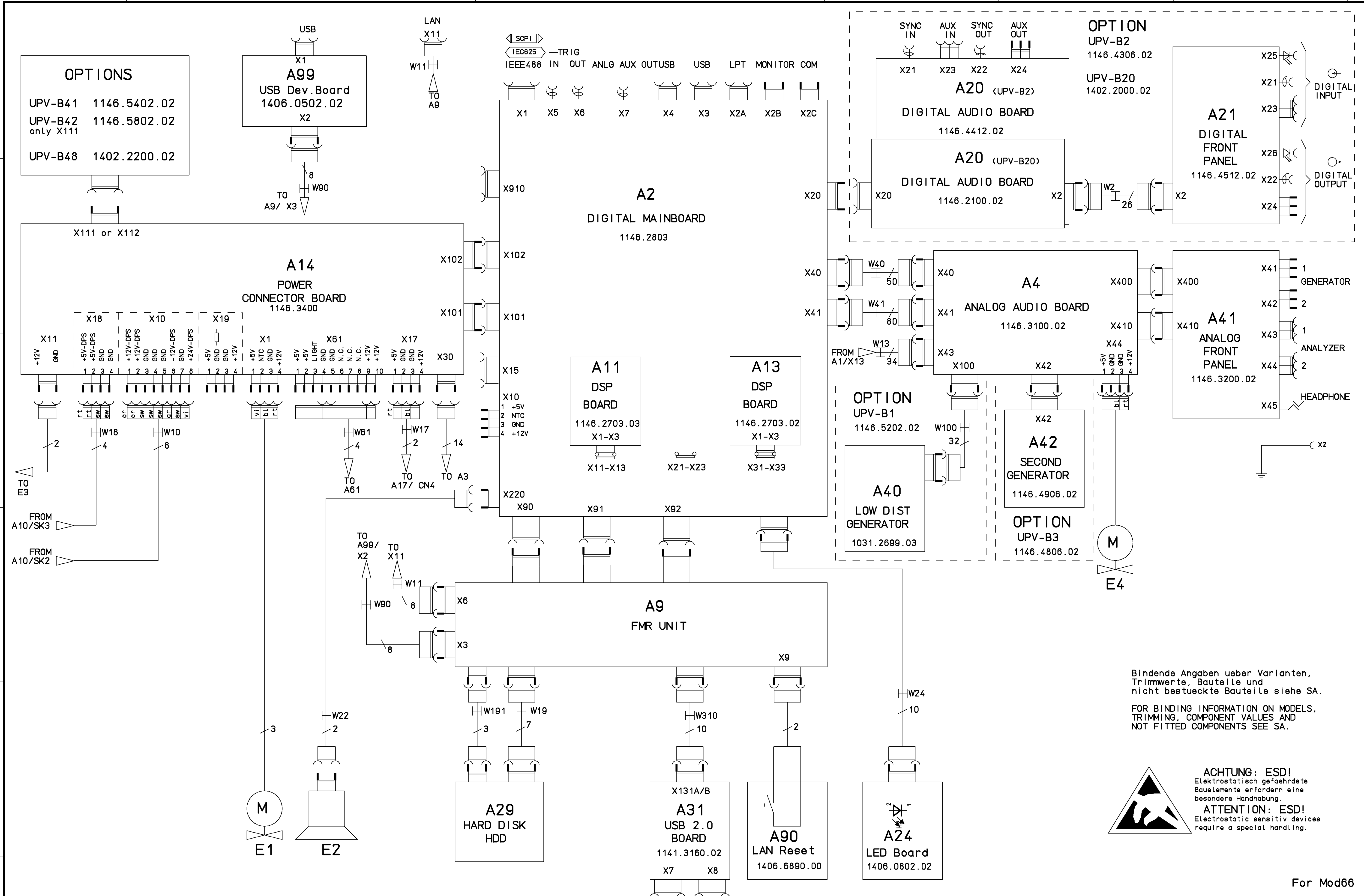
FOR BINDING INFORMATION ON MODELS, TRIMMING, COMPONENT VALUES AND NOT FITTED COMPONENTS SEE SA.

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

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

For Mod02

ROHDE&SCHWARZ	Benennung / Designat.: UPV AUDIO ANALYZER UPV AUDIO ANALYZER	Spr.:/Lang.: de	Aei:/C.I.: 12.00	Blatt:/Sh.: 2 +
UPV	Datum:/Date: 12-02-14 · Abteilung:/Dept.: MTEK · Name:/Name: eichfeld	Zeichn.Nr.:/Drawing No.: 1146.2003.01 S		



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

FOR BINDING INFORMATION ON MODELS, TRIMMING, COMPONENT VALUES AND NOT FITTED COMPONENTS SEE SA.

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

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

For Mod66

ROHDE&SCHWARZ	Benennung / Designat.: UPV AUDIO ANALYZER / UPV AUDIO ANALYZER	Spr.:/Lang.: de	Ael:/C.I.: 12.00 / Blatt:/Sh.: 3 -
UPV	Datum:/Date: 12-02-14 · Abteilung:/Dept.: MTEK · Name:/Name: eichfeld	Zeichn.Nr.:/Drawing No.: 1146.2003.01 S	