

R&S®UPP

Audio Analyzer

Service Manual



1411105582

This service manual is valid for R&S UPP Audio Analyzer and its options.

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

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

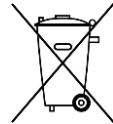
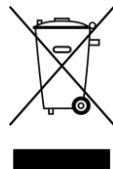
Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety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

Safety labels on products

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

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

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

Signal words and their meaning

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



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



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



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



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

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

Basic Safety Instructions

Operating states and operating positions

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

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

Electrical safety

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

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

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

Operation

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

Basic Safety Instructions

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

Repair and service

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

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

Batteries and rechargeable batteries/cells

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

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

Transport

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

Basic Safety Instructions

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

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

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

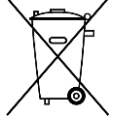
Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto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

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

Instrucciones de seguridad elementales

Señalización de seguridad de los productos

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

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

Instrucciones de seguridad elementales

Palabras de señal y su significado

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



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



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



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



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

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

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

Estados operativos y posiciones de funcionamiento

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

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

Instrucciones de seguridad elementales

Seguridad eléctrica

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

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

Instrucciones de seguridad elementales

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

Funcionamiento

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

Instrucciones de seguridad elementales

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

Reparación y mantenimiento

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

Instrucciones de seguridad elementales

Baterías y acumuladores o celdas

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

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

Transporte

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

Eliminación/protección del medio ambiente

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

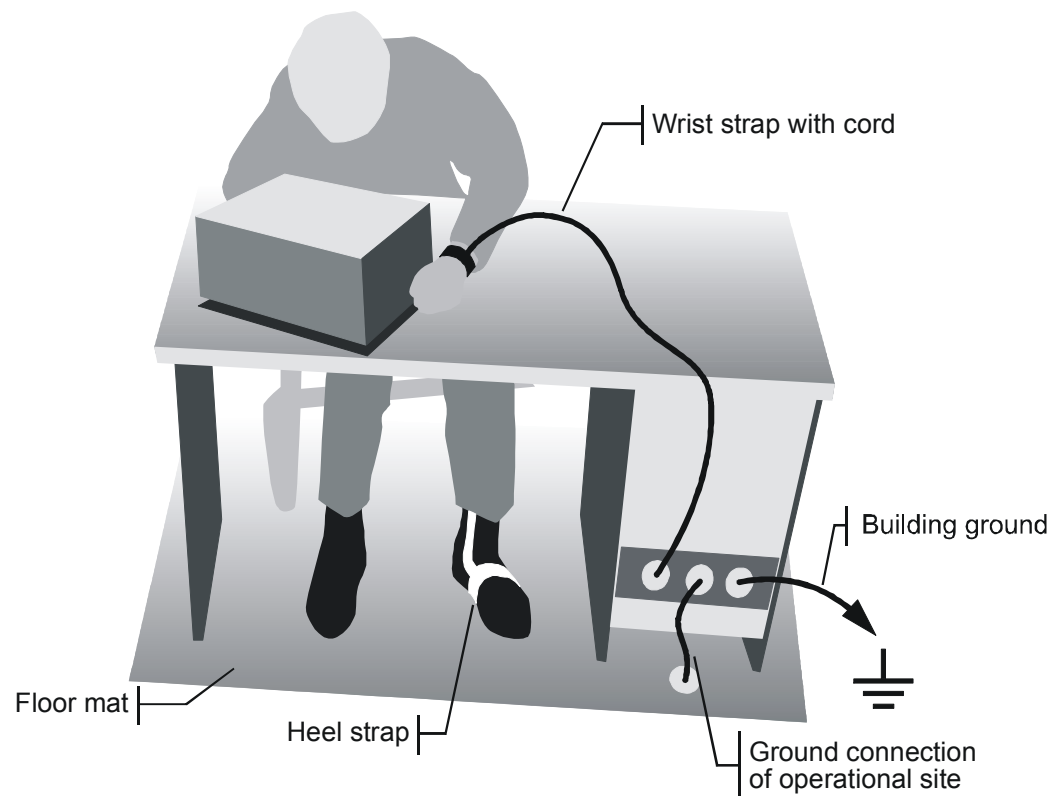
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

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



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

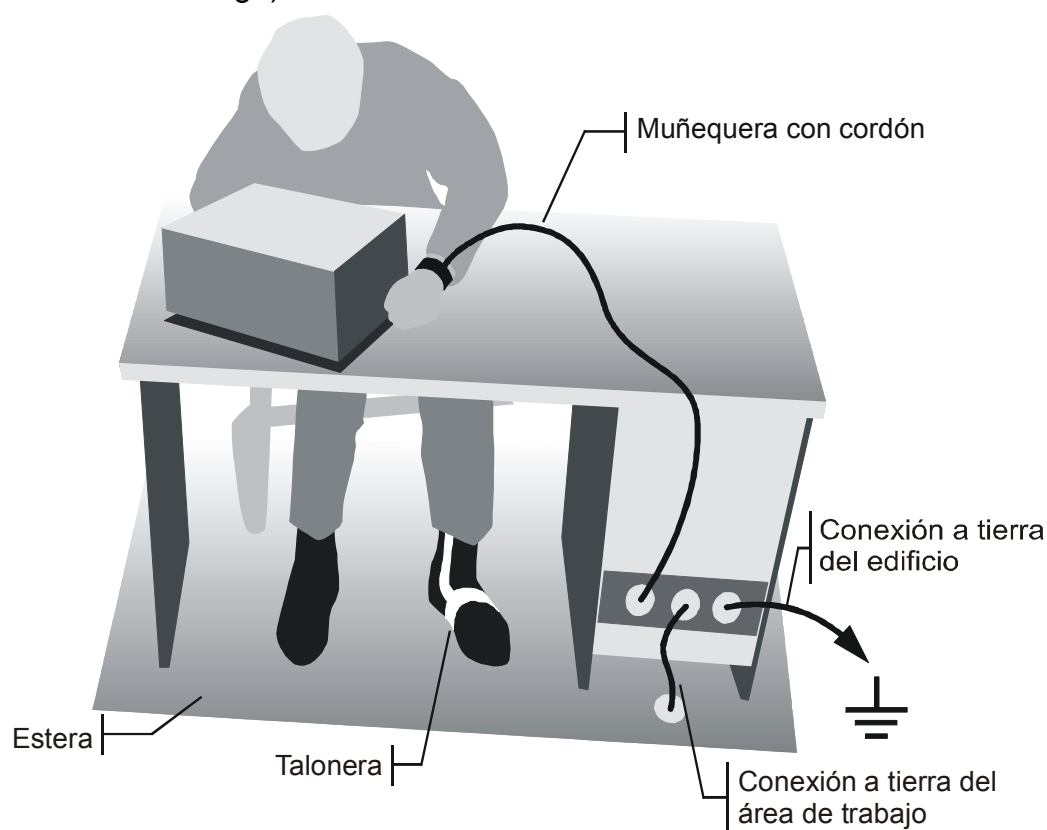
- Wrist strap with cord to ground connection
 - Conductive floor mat and heel strap combination
-

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

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



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

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

Procedure for servicing and repairs

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

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

Shipping the instrument or module

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

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

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

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

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

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

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1 Introduction

High measurement speed, parallel signal processing in multichannel applications, and high reliability in continuous operation are vital requirements to be met by audio analyzers for use in production. If a cost-efficient instrument for system use is what you need, the solution is the R&S UPP audio analyzer.

1.1 Key Features

- Suitable for all interfaces: analog, digital and combined
- Parallel measurements on up to eight channels
- Up to 80 kHz bandwidth and 200 kHz sampling rate
- Powerful and fast
- All test signals and measurement functions in a single box

1.2 For Your Safety

The R&S UPP is designated for use in industrial, administrative and laboratory environments. Use the R&S UPP only for its designated purpose. Observe the operating conditions and performance limits stated in the data sheet.

The product documentation helps you to use the R&S UPP safely and efficiently. Keep the product documentation in a safe place and pass it on to the subsequent users.

Safety information is part of the product documentation. It warns you about the potential dangers and gives instructions how to prevent personal injury or damage caused by dangerous situations. Safety information is provided as follows:

- In the "Basic Safety Instructions", safety issues are grouped according to subjects. For example, one subject is electrical safety. The "Basic Safety Instructions" are delivered with the R&S UPP in different languages in print.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation. Always read the safety instructions carefully. Make sure to comply fully with them. Do not take risks and do not underestimate the potential danger of small details such as a damaged power cable.

1.3 Documentation Overview

This section provides an overview of the R&S UPP user documentation and on how to access it.

Included in delivery

- **Getting started and basic safety instructions**

The printed getting started manual and the basic safety instruction are delivered together with the instrument.

The getting started describes how to set up and start working with the instrument, it includes basic operations and general information, e.g. safety instructions,

- **User manual** for the instrument and its options

The user manual is provided as context-sensitive online-help on the instrument.

In addition to the chapters of the quick start guide, the user manual contains the description of all instrument functions and the remote control of the instrument.

Furthermore, it features notes for the preventive maintenance of the R&S UPP and for locating errors based on the warnings and error messages issued by the instrument.

As download on the Internet via the download section of the instrument page

- **Getting started**

In addition to the printed manual, the getting started is provided as download on the Internet (PDF format).

- **User manual** for the instrument and its options

In addition to the online help, the user manual is provided as download (PDF format) and as online manual (HTML format) on the Internet.

- **Instrument security procedures**

The instrument security procedures manual deals with security issues when working with the R&S UPP in secure areas.

- **Data sheet and brochure**

The data sheet contains the technical specifications of the R&S UPP. It lists the options, their order numbers and optional accessories. The brochure provides an overview of the instrument and deals with the specific characteristics.

- **Release notes and open source acknowledgment**

Release notes and open source acknowledgment are provided together with the corresponding firmware.

The release notes describe the installation of the firmware, new and improved functions, problems solved and last-minute changes to the documentation. The corresponding firmware version can be seen on the cover sheet of the release notes.

The open source acknowledgment document provides verbatim license texts of the used open source software. The acknowledgment is also provided on the instrument.

- **Application notes**

Application notes deal with special applications or background information on particular topics.

Link to the product page on the Internet; www.rohde-schwarz.com/product/upp.html.

As download for registered customers on GLORIS, the Global Rohde & Schwarz Information System.

- **Service manual**

The service manual contains all the necessary information to maintain the R&S UPP by replacing modules and to expand its functionality by installing options.

Link to GLORIS: gloris.rohde-schwarz.com.

2 Performance Test

NOTICE

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

2.1 Measuring Equipment and Accessories

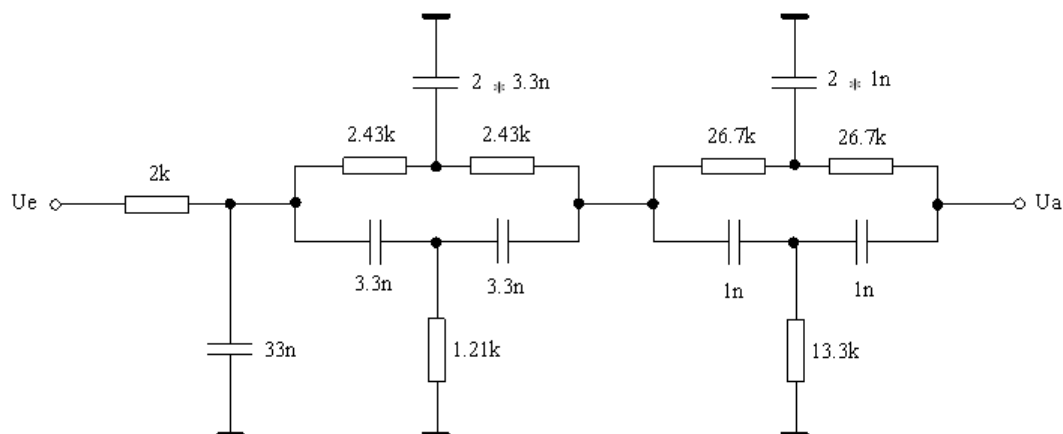
Table 2-1: Measuring Equipment

Measuring Equipment	Characteristics	Recommendation
Digital Multimeter	AC measurement: 15 mV to 20 V, 2 Hz to 80 kHz ±0.1 %, 10 Hz to 20 kHz ±0.2 %, 20 kHz to 80 kHz Input impedance: > 1 MΩ DC measurement: ±0.05 %, 100 mV to 100 V	HP3458A
Frequency Counter	±0.8 ppm 10 Hz to 20 Hz ±0.4 ppm 20 Hz to 80 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
Signal Generator		Reference R&S UPV
Output Switcher	8 Channels	R&S UPZ 1120.8004.03
Oscilloscope	Multichannel, memory	TDS 3000 Series
DFD Lowpass		
Test Cables	TOSLINK cable for optical interfaces XLR cable HDMI 1.4 cable with Ethernet support 50 Ω & 75 Ω BNC cables Multi core cable UP-Z8A or UPV-Z48 alternatively Multicore cable UP-Z8D AES/EBU cable UP-Z2	

2.1.1 Difference-frequency distortion lowpass LP DFD

For measurement of Analog Generator DFD d2 (chapter 2.2.1.7)

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 $\pm 1\%$		Capacitors Polypropylene, tolerance $\pm 1\%$	
Value	R&S order no.	Value	R&S order no.
1.21 k Ω	0083.0655.00	1.0 nF	0007.7598.00
2.00 k Ω	0083.0826.00	3.3 nF	0007.7623.00
2.43 k Ω	0083.0884.00	33 nF	0007.7681.00
13.3 k Ω	0082.2577.00		
26.7 k Ω	0083.1597.00		

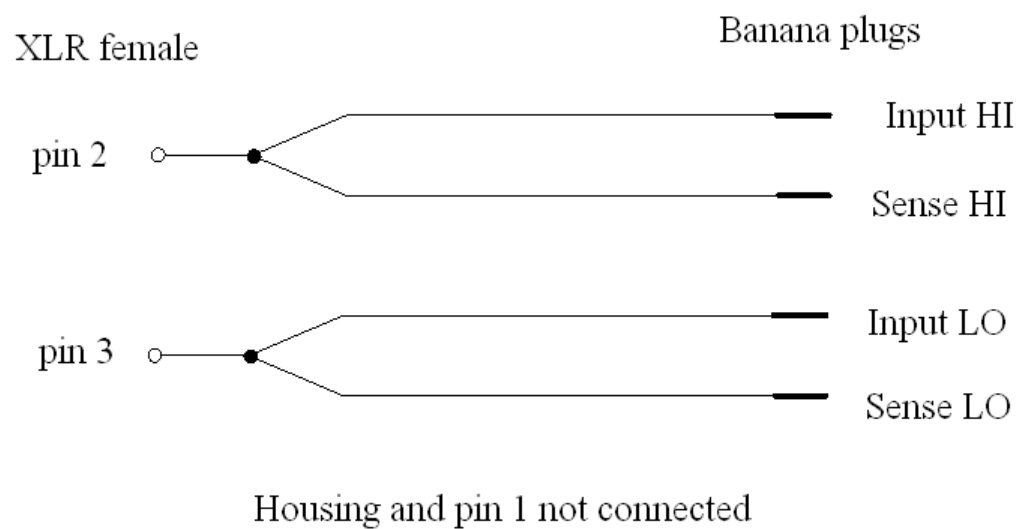
2.1.2 Test cable 1

For measurement of Analog Generator source resistance (chapter 2.2.1.10)

Material:

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

Setup:



2.1.3 Test cable 2

For measurement of Analog Analyzer common mode rejection (chapter 2.2.2.11)

Material:

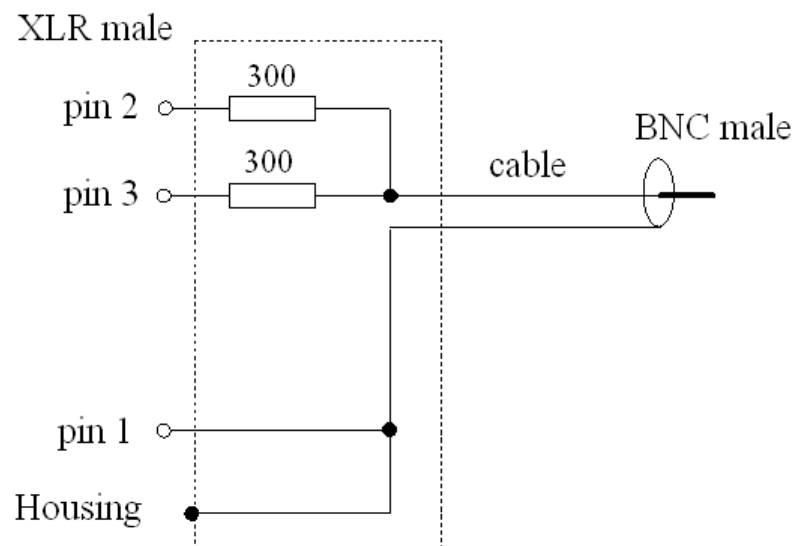
- XLR cable connector, consisting of:
 - Housing (order name: NM3MXI, Neutrik)
 - Cable outlet (order name: CML, Neutrik) BNC cable
- 2 matched 300 Ω resistors

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. 0633.8299.00 as a spare part from R&S, Central Service in Munich ($\Delta R < 0.005$ %, $\Delta TK < 1$ ppm/K).

Setup:

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



2.1.4 Test cable 3

For measurement of Analog Generator level error sine (chapter 2.2.1.2), frequency response (chapter 2.2.1.3) and DC offset (2.2.1.8) as well as Analog Analyzer level error sine (chapter 2.2.2.2)

Material:

- Balanced cable with XLR male and XLR female connectors
- 2 banana plugs

Setup:

Remove XLR male connector from one end of the balanced cable.

Connect the banana plug instead of the XLR male connector for Input HI to pin 2 of the XLR female connector.

Connect the banana plug instead of the XLR male connector 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 UPZ1MF, order no. 1411.3306.02
- BNC cable, commercially available
- Adapter BNC female / 2*banana plugs, R&S order no. FJ 0099.6687.00

2.1.5 Test cable 4

For measurement of Analog Generator frequency uncertainty (chapter 2.2.1.4)

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 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 UPZ1MF (1411.3306.02) can be used.

2.2 Test Sequence

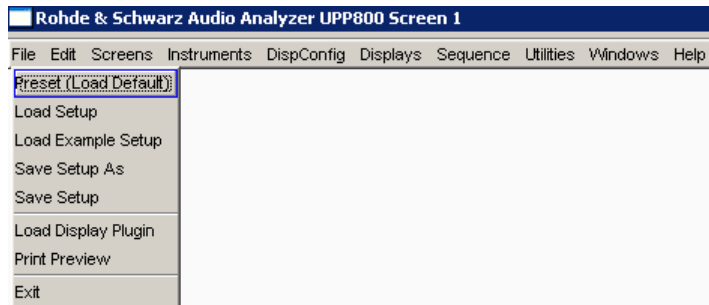
2.2.1 Performance Test Analog Generator

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

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



2.2.1.1 Adapting 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 UP-Z1MF (XLR/BNC adapter set, 1411.3306.02).
- 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 [Chapter 2.1, "Measuring Equipment and Accessories"](#), on page 13.

2.2.1.2 Level Error Sine

Set R&S UPP:

Generator Config		Generator Function	
Instrument	Analog	Function	Sine
Channel	2 $\equiv$ 1	Sweep Ctrl	Off
Output Type	*)	Frequency	1000.00 Hz
		Voltage	*) V

*) according to test report

Meas. instrument:

AC voltmeter

Measurement:

Connect the AC voltmeter to the output of the R&S UPP generator. You will need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17. For the remaining R&S UPP settings and measurement procedure, see the test report.



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

2.2.1.3 Frequency Response

Set R&S UPP:

Generator Config		Generator Function	
Instrument	Analog	Function	Sine
Channel	2 $\equiv$ 1	Sweep Ctrl	Off
Output Type	*)	Frequency	*) Hz
		Voltage	*) V

*) according to test report

Meas. instrument:

AC voltmeter

Measurement:

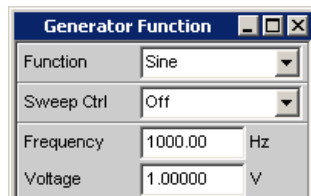
Connect the AC voltmeter to the output of the R&S UPP generator. You will need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17. Relative display in dB, reference is the voltage measured at 1 kHz. For the remaining R&S UPP settings and measurement procedure, see the test report.



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

2.2.1.4 Frequency Uncertainty

Set R&S UPP:



Meas. instrument:

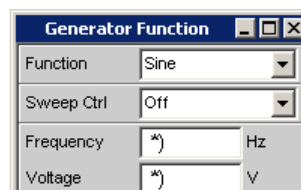
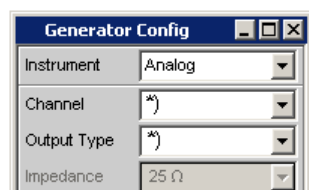
Frequency counter

Measurement:

Connect the frequency counter to the output of the R&S UPP generator. You will need the test cable 4 for this purpose, see [Chapter 2.1.5, "Test cable 4"](#), on page 17.

2.2.1.5 THD Inherent Distortion

Set R&S UPP:

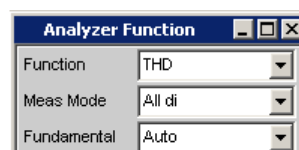
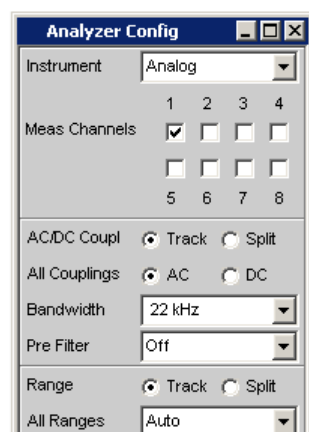


*) according to test report

Meas. instrument:

Analyzer for THD: R&S UPP

Set R&S UPP:



Test setup:

Connect the R&S UPP analyzer to the output of the R&S UPP generator.

Output Bal or Unbal: Use a balanced cable (XLR).

Measurement:

For the remaining R&S UPP settings and measurement procedure, see the test report.

2.2.1.6 MOD DIST Inherent Distortion

Set R&S UPP:

Generator Config		Generator Function	
Instrument	Analog	Function	Mod Dist
Channel	2 = 1	Sweep Ctrl	Off
Output Type	Bal	Upper Freq	*) Hz
Impedance	25 Ω	Lower Freq	60.0000 Hz
		Volt LF:UF	4.00000
		Total Voltage	*) Vpp

*) according to test report

Meas. instrument:

Analyzer for Mod Dist: R&S UPP

Set R&S UPP:

Select the analyzer function "Mod Dist"

Test setup:

Connect a balanced XLR cable between the output of the R&S UPP generator and the input of the R&S UPP analyzer.

Measurement:

For the remaining UPP settings and measurement procedure, see the test report.

2.2.1.7 DFD Inherent Distortion

Set R&S UPP:

Generator Config		Generator Function	
Instrument	Analog	Function	DFD
Channel	*)	Mode	☒ IEC268 ☐ IEC118
Output Type	*)	Sweep Ctrl	Off
Impedance	25 Ω	Mean Freq	*) Hz
		Diff Freq	425.000 Hz
		Total Voltage	*) Vpp

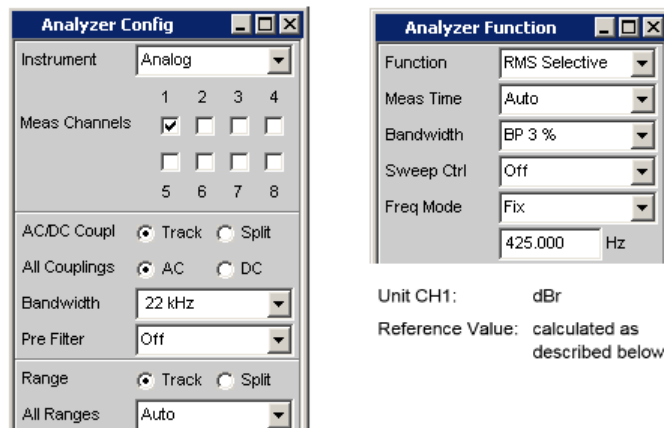
*) according to test report

For DFD d2:

Meas. instrument:

Selective voltmeter: R&S UPP

Set R&S UPP:



Accessories:

External RC lowpass: LP DFD, see [Chapter 2.1.1, "Difference-frequency distortion low-pass LP DFD"](#), on page 14.

Test method:

Connect the LP DFD between the output of the R&S UPP generator and input to the R&S UPP 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 (max 5 dB) does affect the measurement and is taken into account in the reference value of the analyzer:

Analyzer reference value (V_{rms}) = Generator total voltage (V_{pp}) divided by 5.

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:

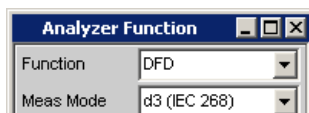
For the remaining R&S UPP settings and measurement procedure, see the test report.

For DFD d3:

Meas. instrument:

Analyzer for DFD d3: R&S UPP

Set R&S UPP:



Measurement:

Connect the R&S UPP analyzer to the output of the R&S UPP generator. For the remaining R&S UPP settings and measurement procedure, see the test report.

2.2.1.8 DC Offset

Residual Offset

Set R&S UPP:

*) 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.



This test item is affected by the DC offset adjustment.

Setting Error DC Offset

Set R&S UPP:

*) according to test report

Meas. instrument:

DC voltmeter

Measurement:

Connect the DC voltmeter to the output of R&S UPP generator and measure the DC voltage at the output of the R&S UPP generator. You will need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17. For the remaining R&S UPP settings and measurement procedure, see the test report.



This test item is affected by the following adjustments:

- Level adjustment analog generator
- DC offset adjustment

2.2.1.9 Cross Talk Attenuation

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 R&S UPP analyzer, for example, is required.

Set R&S UPP:

Generator Config	
Instrument	Analog
Channel	*)
Output Type	*)
Impedance	25 Ω

Generator Function	
Function	Sine
Sweep Ctrl	Off
Frequency	20.0000 kHz
Voltage	7.00000 V

*) according to test report

Meas. instrument:

Audio analyzer: R&S UPP

Set R&S UPP:

Analyzer Config	
Instrument	Analog
Meas Channels	1 2 3 4 ☒ ☐ ☐ ☐ 5 6 7 8 ☐ ☐ ☐ ☐
AC/DC Coupl	☒ Track ☐ Split
All Couplings	☒ AC ☐ DC
Bandwidth	22 kHz
Pre Filter	Off
Range	☒ Track ☐ Split
All Ranges	Auto

Analyzer Function	
Function	FFT

Test setup:

Connect the R&S UPP analyzer to the output of the DUT R&S UPP generator via a shielded cable.

Output Bal or Unbal: Use a balanced cable (XLR).

Measurement:

Set the R&S UPP generator according to the test report.

For improved legibility, scale the graphics panel from 19 kHz to 21 kHz.

FFT measurement on the activated channel. The cursor must indicate a value of about 0 dBr (= 7 V) at 20 kHz.

FFT measurement on the deactivated channel. The crosstalk will be displayed directly as the cursor value at 20 kHz.

Repeat the same measurement on the other channel.

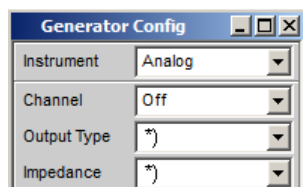


To avoid having the measurement result corrupted due to the internal coupling of the channels in the R&S UPP, we recommend measuring the crosstalk in a single-channel fashion one after another. Do not use the analyzer channel 1 for this measurement due to the possibility of coupling from generator channel 2 into analyzer channel 1!

Make the entry in the test report with a positive sign as the actual crosstalk attenuation.

2.2.1.10 Output Impedance

The output impedance R_{off} of the deactivated channel is measured using an ohmmeter.

Set R&S UPP:

*) according to test report

Meas. instrument:

- Digital multimeter for impedance measurement (ohmmeter)

Test setup for measurement of R_{off} :

Connect the ohmmeter to the output of the R&S UPP 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 fourwire system like the test cable 1, see [Chapter 2.1.2, "Test cable 1"](#), on page 15.

Measurement:

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

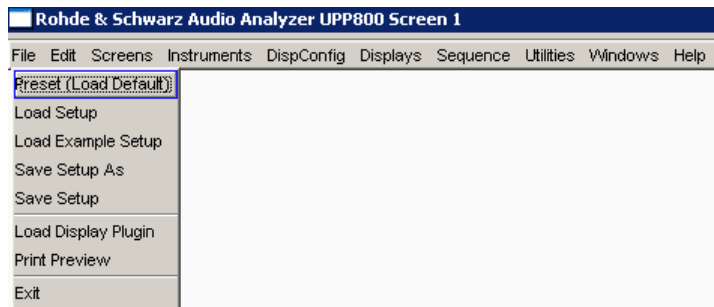
2.2.2 Performance Test Analog Analyzer

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

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



2.2.2.1 Adapting instruments to the analyzer input

The analyzer inputs are eight 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:

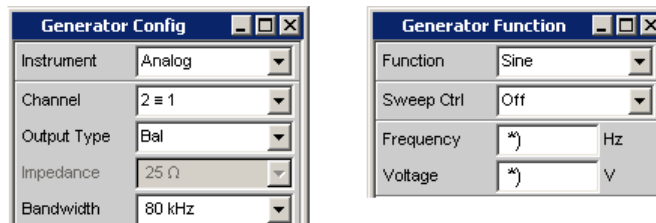
- Retrofit the inputs of the analyzer to BNC female using R&S UP-Z1MF (XLR/BNC adapter set, 1411.3306.02).
- Retrofit the input to the digital multimeter to BNC female using an adapter BNC female / 2*banana plug.

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

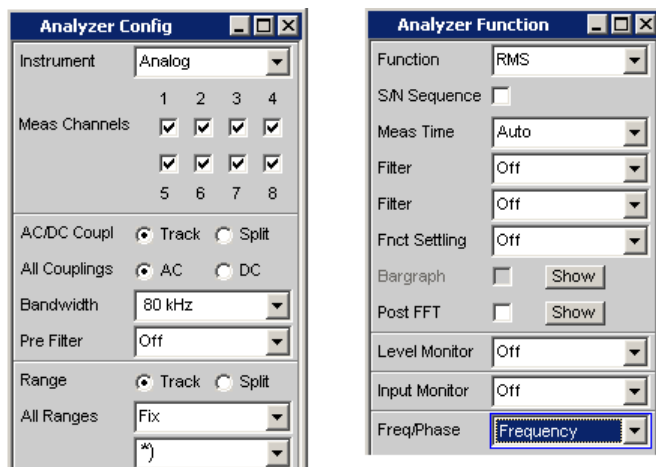
As an alternative, special cables can be made for XLR female to 2*banana plug or XLR female to BNC male. The configuration of such cables is described in [Chapter 2.1, "Measuring Equipment and Accessories"](#), on page 13.

2.2.2.2 Level Error Sine

Set R&S UPP:



*) according to test report (for level calibration set frequency to 1 kHz)



*) according to test report

Meas. instrument:

AC voltmeter

Test setup:

Connect the AC voltmeter to a balanced output of the UPP generator. You will need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17. Connect the same balanced output of the UPP generator to the output switcher R&S UPZ via an XLR cable.

The inputs under test are connected to the RS& UPZ by using XLR cables. By using the output switcher the measurements can be made simultaneously for all 8 channels.

Measurement:

For the remaining R&S UPP settings and measurement procedure, see the test report.

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)



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

2.2.2.3 Frequency response**Set R&S UPP:**

Same as before

Meas. instrument:

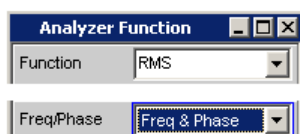
AC voltmeter

Test setup:

Same as before. The R&S UPP Generator generates the signal which is measured using the AC voltmeter.

Measurement:

Remaining R&S UPP settings and measurement procedure according to test report.

2.2.2.4 Phase synchronism**Set R&S UPP:****Test setup:**

The R&S UPP Generator provides the signal to all 8 channels simultaneously via the R&S UPZ.

Measurement:

Remaining R&S UPP 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 numeric display in ° (degrees) and use channel 1 as reference channel.

2.2.2.5 THD&N Inherent Distortion



This test is made as a loop measurement along with the R&S UPP analog generator.

Set R&S UPP:

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

Generator Function	
Function	Sine
Sweep Ctrl	Off
Frequency	*) Hz
Voltage	*) V

*) according to test report

Analyzer Config																	
Instrument	Analog																
Meas Channels	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr> <td>☒</td><td>☒</td><td>☒</td><td>☒</td></tr> <tr> <td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr> <td>☒</td><td>☒</td><td>☒</td><td>☒</td></tr> </table>	1	2	3	4	☒	☒	☒	☒	5	6	7	8	☒	☒	☒	☒
1	2	3	4														
☒	☒	☒	☒														
5	6	7	8														
☒	☒	☒	☒														
AC/DC Coupl	☒ Track ☐ Split																
All Couplings	☒ AC ☐ DC																
Bandwidth	80 kHz																
Pre Filter	Off																
Range	☒ Track ☐ Split																
All Ranges	Fix																
	*)																

Analyzer Function	
Function	THD+N & SINAD
Meas Mode	THD+N
Rejection	☐ Narrow ☒ vWide
Reject Bandw	60 Hz max
Fundamental	Auto
Filter	Off
Filter	Off
Equalizer	☐
Frq Lim Low	20.0000 Hz
Frq Lim Upp	*) kHz

*) according to test report

Measurement:

Set the R&S UPP analyzer and generator according to test report.

The signal should be supplied via R&S UPZ.

Read off the THD&N value in dB in the numeric display.

2.2.2.6 MOD DIST Inherent Distortion

Set R&S UPP:

Generator Config	
Instrument	Analog
Channel	2 $\equiv$ 1
Output Type	Bal

Generator Function	
Function	Mod Dist
Sweep Ctrl	Off
Upper Freq	7000.00 Hz
Lower Freq	60.0000 Hz
Volt LF:UF	4.00000
Total Voltage	2.50000 V

Analyzer Config	
Instrument	Analog
Meas Channels	1 2 3 4 ☒ ☒ ☒ ☒ 5 6 7 8 ☒ ☒ ☒ ☒
AC/DC Coupl	☒ Track ☐ Split
All Couplings	☒ AC ☐ DC
Bandwidth	22 kHz
Pre Filter	Off
Impedance	☒ Track ☐ Split
All Impeds	200 K Ω
Range	☒ Track ☐ Split
All Ranges	Fix
	3.0 V RMS

Analyzer Function	
Function	Mod Dist
Equalizer	☐
Funct Settling	Off
Bargraph	☒ Show
Post FFT	☐ Show
Level Monitor	RMS
Input Monitor	Off
Freq/Phase	Frequency

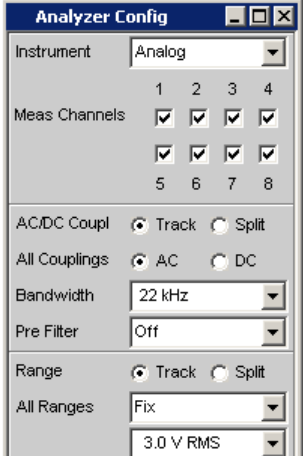
Measurement:

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

2.2.2.7 DFD Inherent Distortion**Set R&S UPP:**

Generator Config	
Instrument	Analog
Channel	2 $\equiv$ 1
Output Type	Bal
Impedance	25 Ω
Bandwidth	22 kHz

Generator Function	
Function	DFD
Mode	☒ IEC268 ☐ IEC118
Sweep Ctrl	Off
Mean Freq	7.00000 kHz
Diff Freq	500.000 Hz
Total Voltage	2.00000 V



Analyzer Config

Instrument: Analog

Meas Channels: 1 2 3 4 (all checked), 5 6 7 8 (all checked)

AC/DC Coupl: ☒ Track ☐ Split

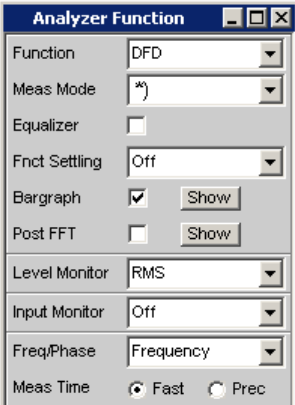
All Couplings: ☒ AC ☐ DC

Bandwidth: 22 kHz

Pre Filter: Off

Range: ☒ Track ☐ Split

All Ranges: Fix, 3.0 V RMS



Analyzer Function

Function: DFD

Meas Mode: *)

Equalizer: ☐

Fnct Settling: Off

Bargraph: ☒ Show

Post FFT: ☐ Show

Level Monitor: RMS

Input Monitor: Off

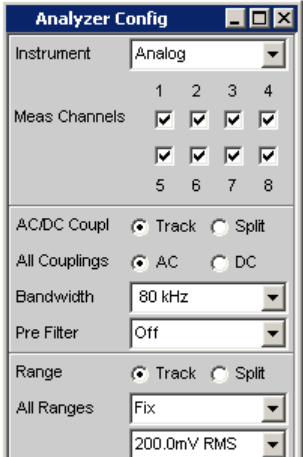
Freq/Phase: Frequency

Meas Time: ☒ Fast ☐ Prec

Measurement:

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

2.2.2.8 Inherent Noise**Set R&S UPP:**



Analyzer Config

Instrument: Analog

Meas Channels: 1 2 3 4 (all checked), 5 6 7 8 (all checked)

AC/DC Coupl: ☒ Track ☐ Split

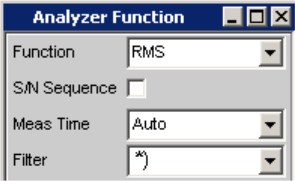
All Couplings: ☒ AC ☐ DC

Bandwidth: 80 kHz

Pre Filter: Off

Range: ☒ Track ☐ Split

All Ranges: Fix, 200.0mV RMS



Analyzer Function

Function: RMS

S/N Sequence: ☐

Meas Time: Auto

Filter: *)

*) according to test report

Test setup:

Terminate inputs externally with $\leq 50 \Omega$. Use XLR cables, an R&S UPZ, an XLR/BNC adapter and 50Ω coaxial termination for this purpose.

Measurement:

Set the R&S UPP analyzer according to test report.

Read off the inherent noise in the numeric display.

2.2.2.9 DC Measurement

Set R&S UPP:

Generator Function	
Function	Sine
Sweep Ctrl	Off
Frequency	1000.00 Hz
Voltage	0.00000 V
Filter	Off
Equalizer	☐
DC Offset	☒ V

Analyzer Function	
Function	RMS
S/N Sequence	☐
Meas Time	Auto
Filter	Off
Filter	Off
Fnc Settling	Off
Bargraph	☐ Show
Post FFT	☐ Show
Level Monitor	DC

*) according to test report

Measurement:

Read off the input DC voltage value using the DC voltmeter.

Read off the measured DC voltage value in the numeric display (at Level Monitor DC).

2.2.2.10 Cross Talk Attenuation



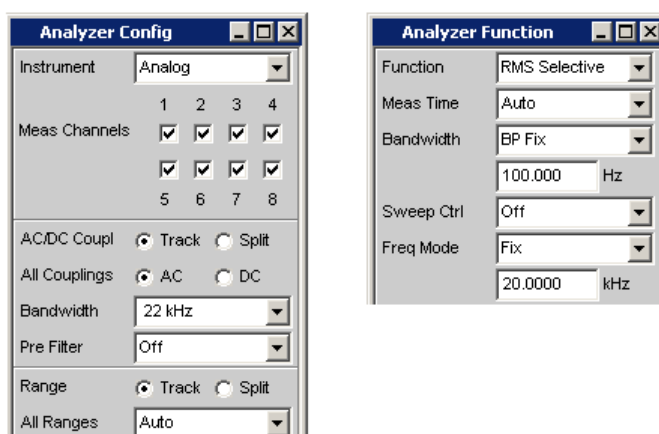
The measurement is made in mode "all but one". This means that all channels are supplied with a sine signal except the measurement channel. So the maximum cross talk is measured. Make the entry in the test report with a positive sign as the actual cross-talk attenuation.

Set R&S UPP:

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

Generator Function	
Function	Sine
Sweep Ctrl	Off
Frequency	20.0000 kHz
Voltage	10.0000 V

*) according to test report

**Test setup:**

Connect the generator signal to the analyzer inputs via the R&S UPZ output switcher.

The output of signal generator must be connected to busbar “B” of R&S UPZ.

The busbar “A” is terminated by a resistor with a value of 600 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.

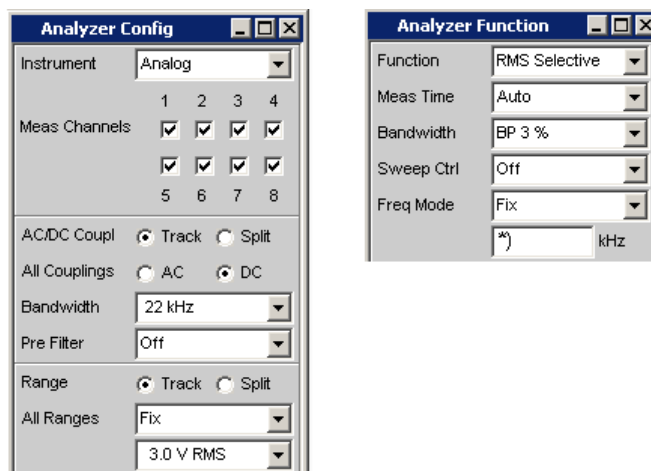
Busbar “B” is set to “-1”, so all other channels are connected to the generator output.

Relative display in dBr: The reference for each channel is 10 V.

2.2.2.11 Common Mode Rejection CMRR

Make the entry in the test report with a positive sign as the actual crosstalk attenuation.

Set R&S UPP:



*) according to test report

Test setup:

Connect the generator signal with a level of 3.000 V and a frequency of 1 kHz and 20 kHz to the analyzer inputs via the R&S UPZ output switcher.

The output of signal generator must be connected to busbar “A” of R&S UPZ.

The busbar “B” is terminated by a resistor with a value of 600 Ω or less.

Measurement:

Connect the signal generator R&S UPP to the R&S UPP input under test using test cable 2, see [Chapter 2.1.3, "Test cable 2"](#), on page 16.

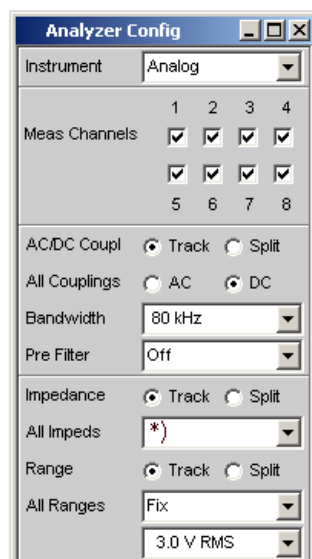
The measurement channel is selected in busbar “A” and is connected to the generator output.

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.

2.2.2.12 Input Impedance

Set R&S UPP:



*) according to test report

Meas. instrument:

Ohmmeter

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.

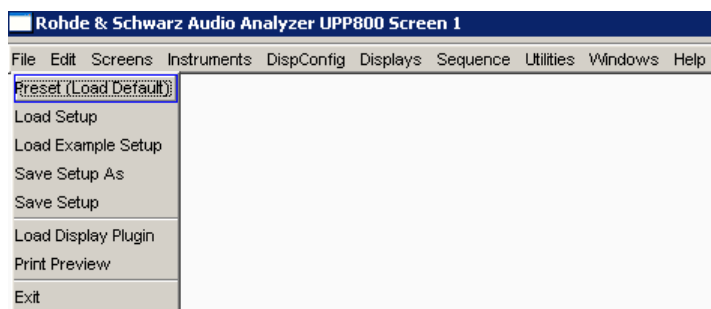
2.2.3 Performance Test Audio Monitor

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

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.

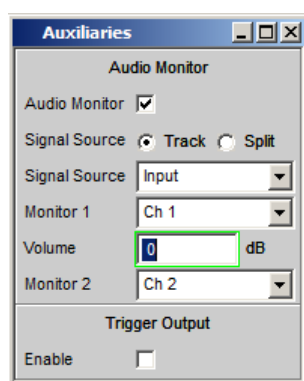


Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



2.2.3.1 Level Error Sine

Set R&S UPP:



Meas. instrument:

R&S UPV

Test setup:

Set the R&S UPP analog generator to 1 kHz.

Connect the R&S UPP generator signal to the analyzer inputs of the R&S UPP under test.

Connect the Audio Monitor jacks of the R&S UPP under test with the R&S UPV analyzer inputs.

Measurement:

Set the R&S UPP generator output level **2.2 V** (until Ser. 1x0099) or **2.4 V** (from Ser. 1x0100).

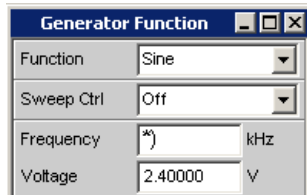
Set the R&S UPP analyzer into the 3 V range.

To connect the monitor outputs 1 and 2 to the R&S UPV analyzer use BNC cables and XLR/BNC adaptors.

Read off the value of the RMS voltage in the numeric display of the R&S UPV.

2.2.3.2 Frequency Response

Set R&S UPP:



*) according to test report

Meas. instrument:

AC voltmeter or R&S UPV analyzer

Test setup:

Same as before.

Measurement:

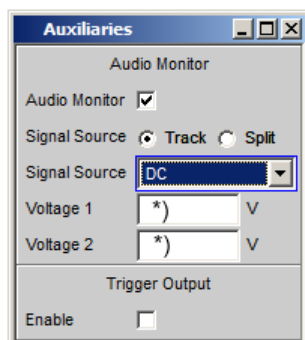
Set the R&S UPP generator frequency according to the test report. Measure the frequency response for the monitor outputs 1 and 2. The reference frequency for the frequency response is 1 kHz.

Read off the value of the RMS voltage in the numeric display of the R&S UPV.

2.2.3.3 Level Error DC

Test this item only with R&S UPP from serial number 1x0100; x = 2, 4 or 8.

Set R&S UPP:



*) according to test report (-5 V and +5 V)

Meas. instrument:

DC voltmeter or R&S UPV

Test setup:

Connect the Audio Monitor jacks of the R&S UPP under test with the R&S UPV analyzer inputs.

Measurement:

Read off the value of the DC voltage in the numeric display of the R&S UPV.

2.2.4 Performance Test R&S UPP-B2

Connect a monitor, mouse and keyboard to the R&S UPP or access it remote desktop connection.

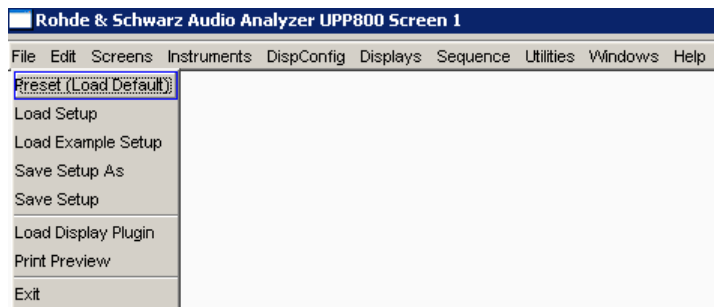
Before starting the test, set the R&S UPP to a defined initial status.

To do this, call up the default setting:

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



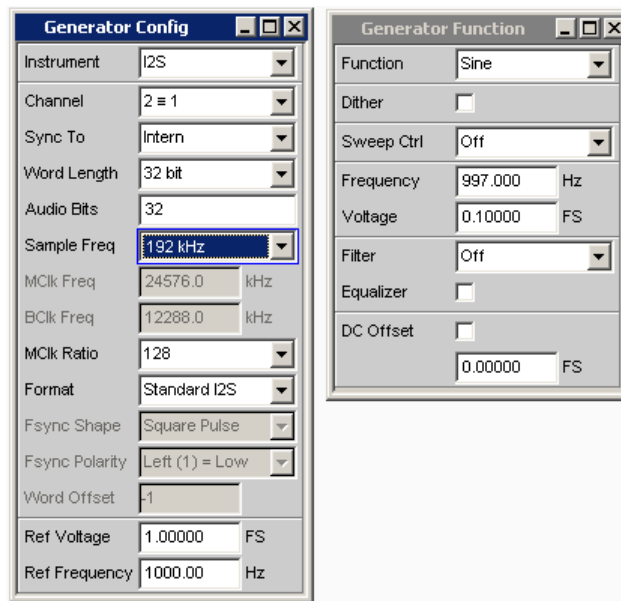
Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



2.2.4.1 I2S Generator

Frequency error**Set R&S UPP generator:**

Select the I2S generator instrument and choose a sampling rate of 192 kHz.

**Meas. instrument:**

Frequency counter

Measurement:

Connect the frequency counter to pin 25 of the I2S D-Sub connector of the R&S UPP.

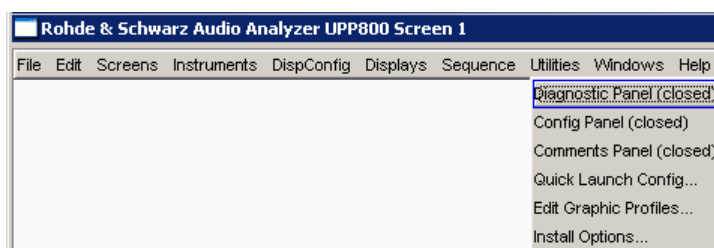
The measured value should be in the range defined by the test report.

Frequency error calibration:

If the frequency is out of range execute the following calibration steps.

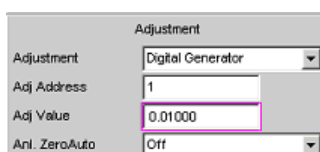
This procedure can only be performed by the R&S service.

Open the diagnostic panel from the menu bar.



Navigate to the adjustment section.

Modify the adjustment value at adjustment address "1" until the measured frequency is within 24.567000 MHz $\pm$ 10 Hz

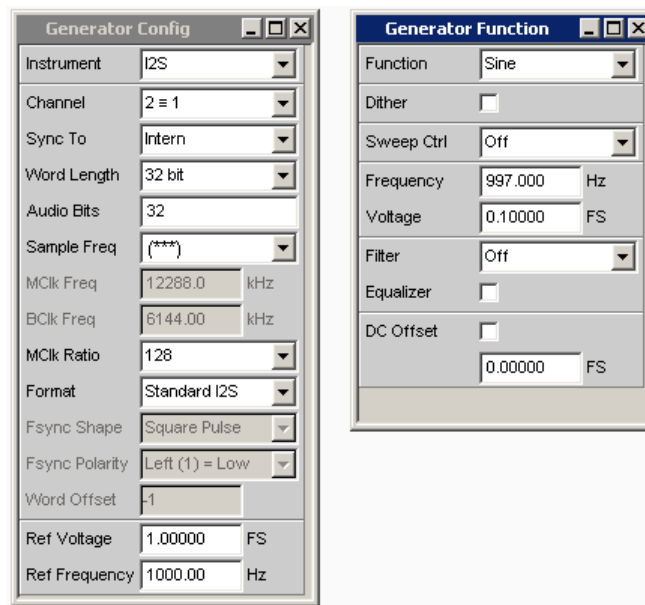


Store this factor in the EEPROM by hitting the ENTER button.

Internal Synchronisation

Set R&S UPP generator:

Leave all settings as default. During this measurement, the generator sampling frequency will be changed according to the test report.

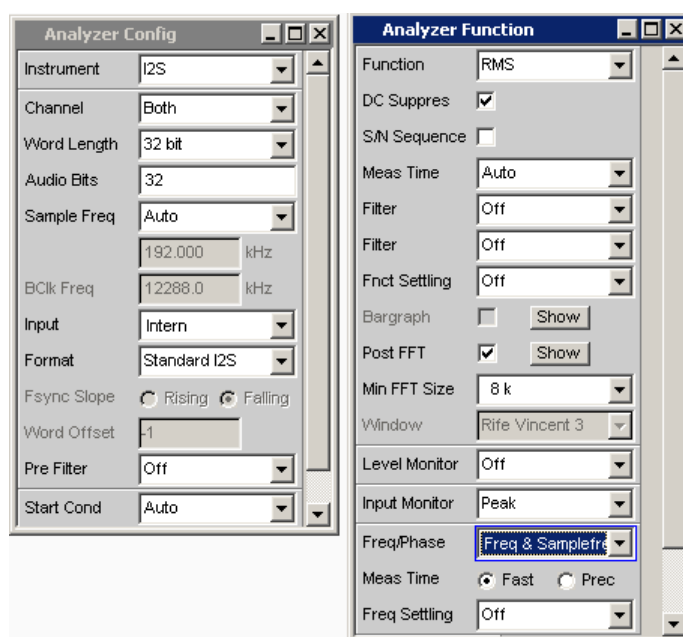


(***) Set according to test report.

Set R&S UPP analyzer:

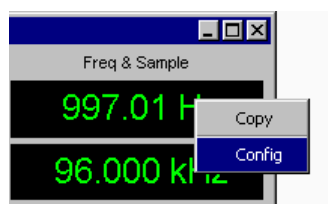
Select the "I2S" instrument from the "Analyzer Config" panel.

From the default state select "Input" = "Intern" in the "Analyzer Config" panel as well as "Freq/Phase" = "Freq & Samplefreq" in the "Analyzer Function" panel.



Measurement:

Configure the numeric display of the R&S UPP by clicking the right mouse button while hovering over the result field and select "Config":



In the "Freq/Phase Config" panel increase the resolution of the measurement results to 7 digits as shown below.

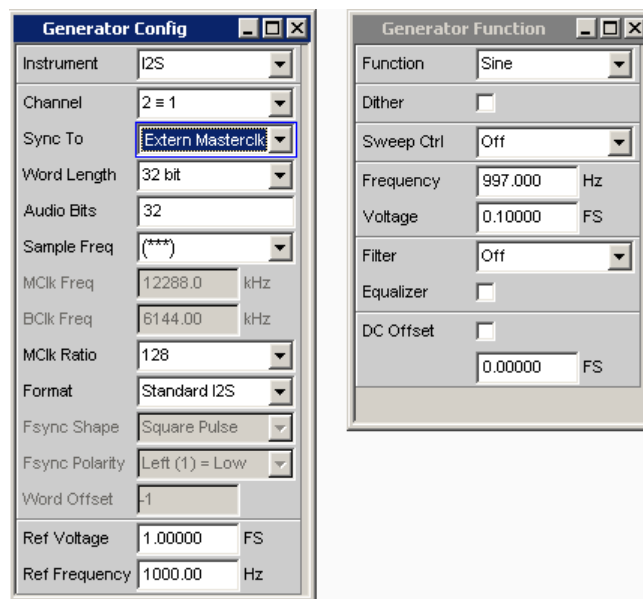


The measured values should be in the range defined by the test report.

External Synchronisation (Extern Masterclk)

Set R&S UPP generator:

Set the R&S UPP generator synchronisation mode to "Extern Masterclk". During this measurement, the generator sampling frequency will be changed.



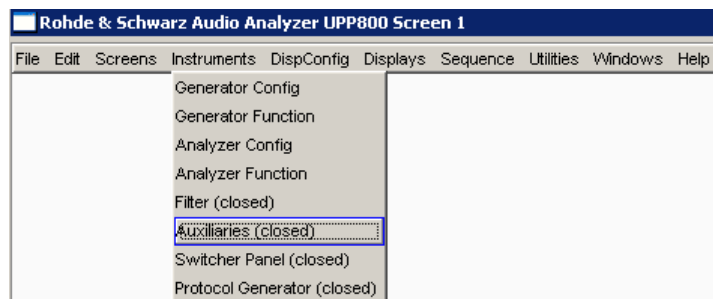
(***) Set according to test report.

Set R&S UPP analyzer:

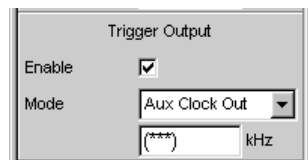
Maintain the settings from the previous subchapter:

Set R&S UPV:

Navigate to the "Auxiliaries Panel" using the menu bar.



Enable the Trigger Output and set the output frequency according to the test report.



(***) Set according to test report.

Meas. instrument:

Reference R&S UPV



If no reference R&S UPV is at hand, you can also use a clock generator. If the device cannot generate the 24.576 MHz defined by the test report, simply leave out this point and just perform the test with 1024 kHz

Measurement:

Connect the "Trig Out" BNC connector from the R&S UPV backplane with the R&S UPP "Sync In" BNC connector using a 50 Ω BNC cable.

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

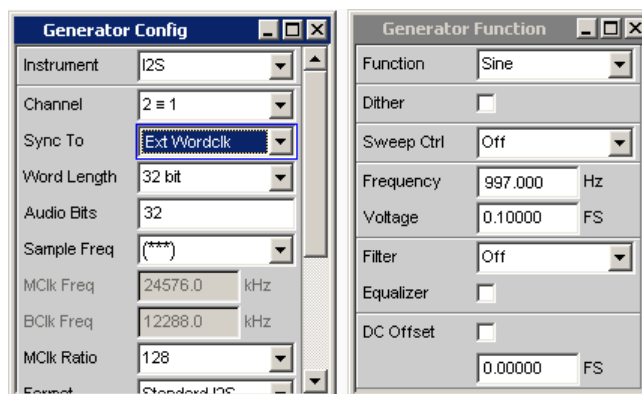
During this measurement, the frequency error of the reference R&S UPV contributes directly to the measurement error of the R&S UPP. Because of this, the tolerances are much more relaxed. This procedure is more of a function test.

Set both devices to the specified frequencies and samplingrates according to the test report.

External Synchronisation (Extern Wordclk)

Set R&S UPP generator:

Set the R&S UPP generator synchronisation mode to "Extern Wordclk".



(***) Set according to test report.

Set R&S UPV analyzer:

Maintain the previous settings.

Set R&S UPV:

Navigate to the "Auxiliaries Panel" using the menu bar as described before.

Enable the Trigger Output and set the output frequency according to the test report.

Meas. instrument:

Reference R&S UPV



If no reference R&S UPV is at hand, you can also use a clock generator.

Measurement:

Connect the "Trig Out" BNC connector from the R&S UPV backplane with the R&S UPP "Sync In" BNC connector using a 50 Ω BNC cable.

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

During this measurement, the frequency error of the reference R&S UPV contributes directly to the measurement error of the R&S UPP. Because of this, the tolerances are much more relaxed. This procedure is more of a function test.

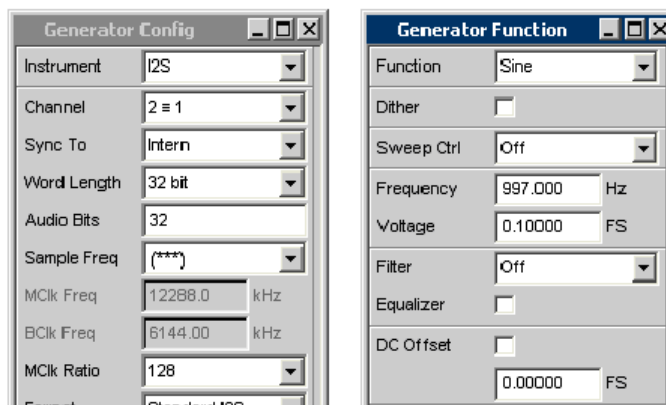
Set both devices to the specified frequencies and samplingrates according to the test report.

2.2.4.2 I2S Analyzer

Contrary to the previous internal measurements, now the physical I2S interface on the front plate will be tested.

Set R&S UPP generator:

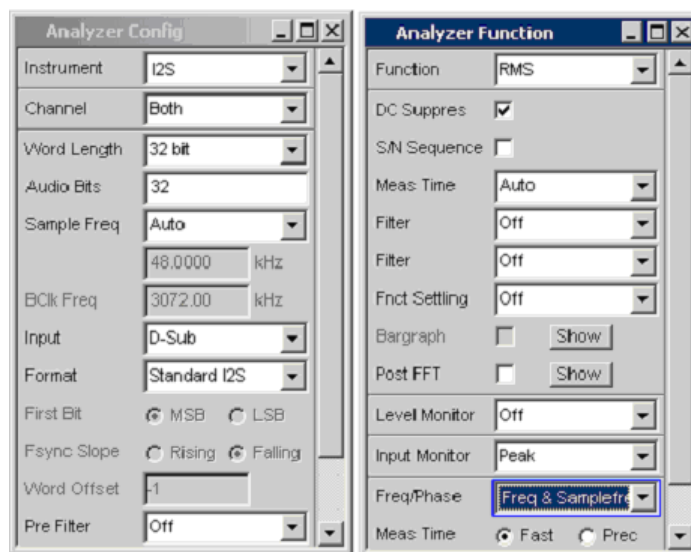
From the preset condition set the R&S UPP generator synchronisation mode to "Internal".



(***) Set according to test report.

Set R&S UPV analyzer:

From the preset condition select "Input" = "D-Sub" in the "Analyzer Config" panel as well as "Freq/Phase" = "Freq&Samplefreq" in the "Analyzer Function" panel.



Measurement:

Connect the following signals at the I2S D-Sub connector externally:

TX_SCK => RX_SCK

TX_FSYNC => RX_FSYNC

TX_DATA => RX_DATA

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

Set the generator to the specified samplingrates listed in the test report.

2.2.4.3 Digital Audio Generator

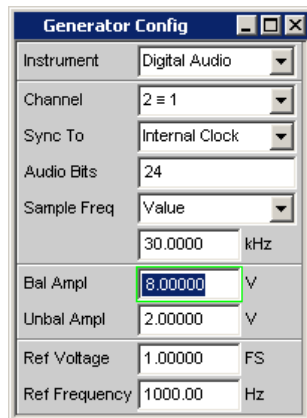
The level error calibration can be performed by two means, depending on the available equipment at hand: Using a oscilloscope or a Fluke PM6680 frequency counter.

Level error (Option 1: Oscilloscope)

Set R&S UPP generator:

Select the "Digital Audio" instrument from the "Generator Config" panel and set the "Bal. Ampl." to 8.0000 V.

Select a "Sample Freq" of 30 kHz.



The 'Generator Config' dialog box contains the following settings:

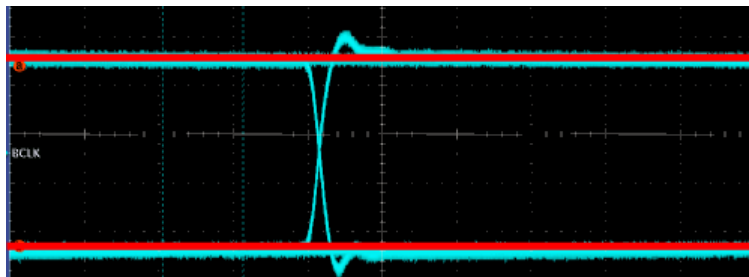
Parameter	Value	Unit
Instrument	Digital Audio	
Channel	2 $\equiv$ 1	
Sync To	Internal Clock	
Audio Bits	24	
Sample Freq	Value	
	30.0000	kHz
Bal Ampl	8.00000	V
Unbal Ampl	2.00000	V
Ref Voltage	1.00000	FS
Ref Frequency	1000.00	Hz

Meas. instrument:

Oscilloscope

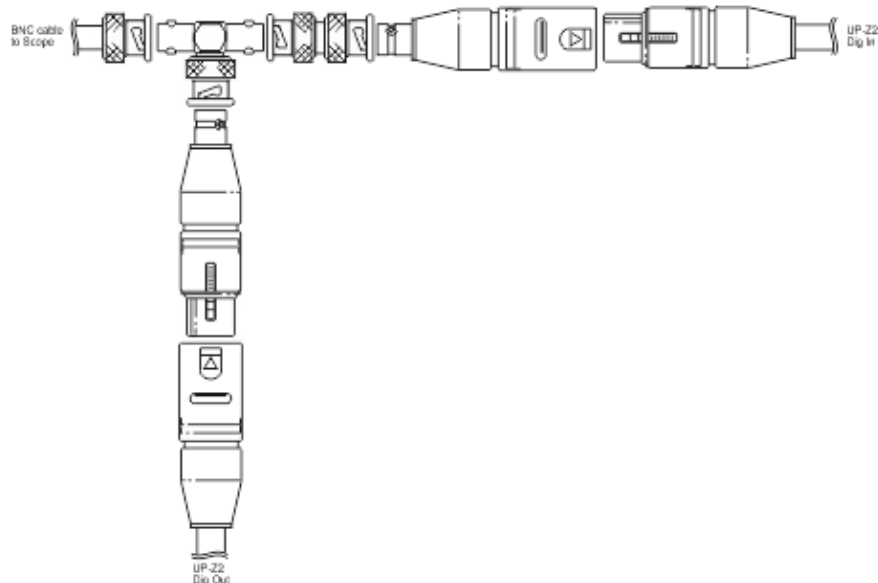
Measurement:

Connect the oscilloscope to the Bal output of the R&S UPP. Set the bandwidth of the scope to 20 MHz to eliminate short overshoots. Set the internal impedance to 1 M Ω . Measure the peak to peak amplitude of the signal using vertical cursors ignoring the overshoots as displayed in the picture below.



The measured value should be in the range defined in the test report.

To ensure that the digital output is correctly terminated with 110 Ω the following inter-connection is recommended:



For the interconnection shown above some material is necessary:

- AES/EBU cable UP-Z2: 1411.3406.02
- a BNC cable (the cable to the Scope should be as short as possible to avoid ringing)
- XLR/BNC Adapter Set Male/Female: 1411.3306.02
- BNC Tee piece: 0017.6588.00
- BNC male to male connector: 0018.4620.00

Level error calibration:

If the amplitude is out of range execute the following calibration steps. This procedure can only be performed by the R&S service.

Open the diagnostic panel and navigate to the adjustment region.

Adjustment	
Adjustment	Digital Generator
Adj Address	0
Adj Value	1.00000
Anl. ZeroAuto	Off

Modify the adjustment value at adjustment address 0, until the amplitude is $8\text{ V} \pm 50\text{ mV}$.

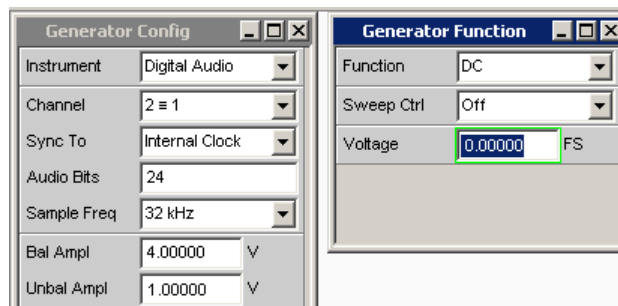
Store the modified value in the EEPROM by hitting the enter button.

Level error (Option 2: Frequency counter)

Set R&S UPP generator:

Select the "Digital Audio" instrument from the "Generator Config" panel and set the "Unbal Ampl." to 1.0000 V and the "sample Freq" to 32 kHz.

Choose the "Function" "DC" and a "Voltage" of "0.0 FS" in the "Generator Function Panel".



Meas. instrument:

Frequency counter Fluke PM6680

Measurement:

Connect the frequency counter with the unbalanced digital audio BNC output of the R&S UPP using a 50 Ω BNC cable. Set the counter to "Volt Max A", "Filter" = "Off" and select an input impedance of 50 Ω.

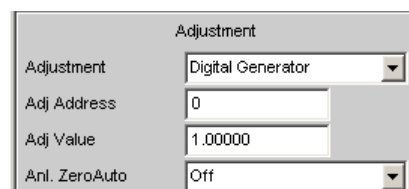
The measured value should be in the range defined in the test report.

Level error calibration:

If the amplitude is out of range execute the following calibration steps. This procedure can only be performed by the R&S service.

When using the frequency counter to perform the level calibration, the adjustment value can be calculated as: **Value = 0.8925/(Result_Counter/1.125)**

Open the diagnostic panel and navigate to the adjustment region.



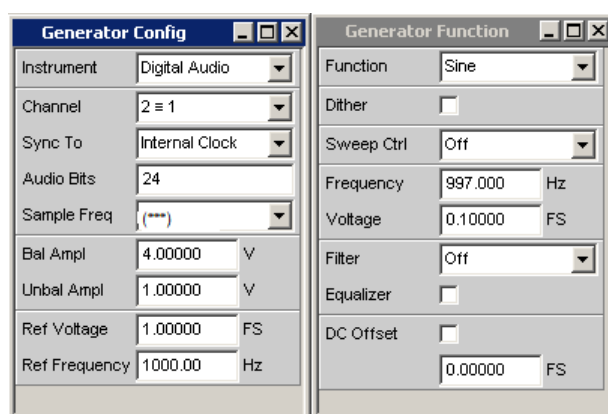
Insert the adjustment value at adjustment adress 0.

Store the modified value in the EEPROM by hitting the ENTER button.

Internal Synchronisation

Set R&S UPP generator:

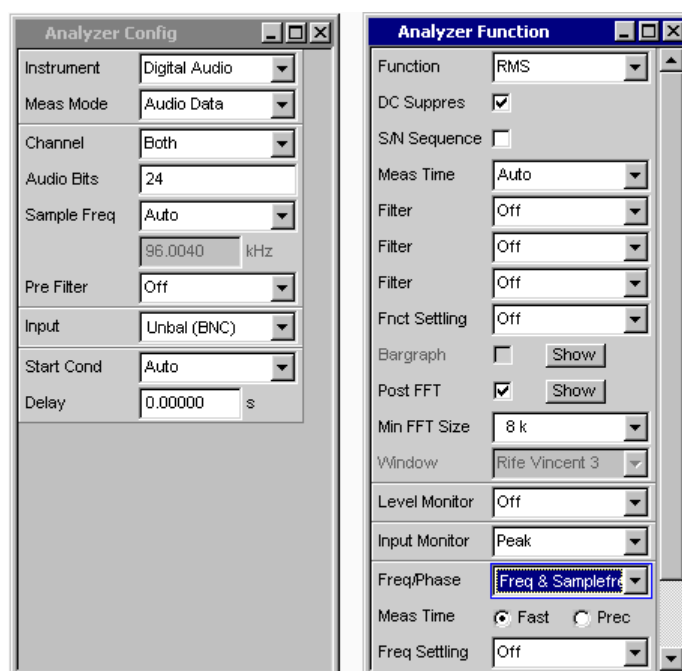
In the "Generator Config" panel scale the "Bal Ampl" back to 4.0000 V. During this test, the generator samplerate will be changed according to the test report.



(**) Set according to test report.

Set R&S UPP analyzer:

From the default state select the "Digital Audio" instrument from the "Analyzer Config" panel. Choose "Input" = "Unbal (BNC)" in the "Analyzer Config" panel as well as "Freq/Phase" = "Freq & Samplefreq" in the "Analyzer Function" panel.



Measurement:

Connect the unbalanced digital audio output with the unbalanced digital audio input using a 50 Ω BNC cable.

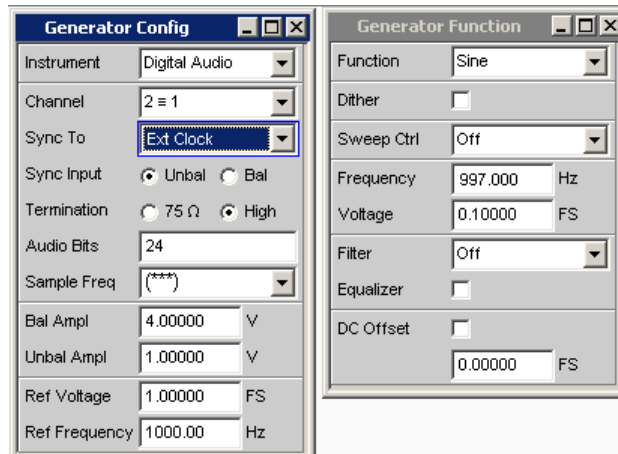
In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

The measured values should be in the range defined by the test report.

External Synchronisation (Ext Clock)

Set R&S UPP generator:

Set the R&S UPP generator synchronisation mode to "Ext_Clock" and set "Termination" = "High". During this test the generator samplerate will be changed.



(***) Set according to test report.

Set R&S UPP analyzer:

Keep the settings from the previous step.

Set R&S UPV:

Navigate to the "Auxiliaries Panel" using the menu bar as described before.

Enable the Trigger Output and set the output frequency according to the test report.

Meas. instrument:

Reference R&S UPV



If no reference R&S UPV is at hand, you can also use a clock generator.

Measurement:

Connect the "Trig Out" BNC connector from the R&S UPV backplane with the R&S UPP "Sync In" BNC connector using a 50 Ω BNC cable.

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

During this measurement, the frequency error of the reference R&S UPV contributes directly to the measurement error of the R&S UPP. Because of this, the tolerances are much more relaxed. This procedure is more of a function test.

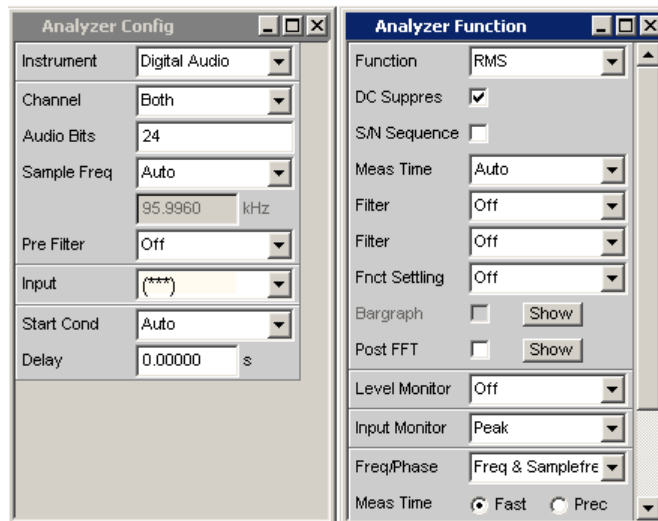
Set both devices to the specified frequencies and samplingrates according to the test report.

2.2.4.4 Digital Audio Analyzer

Digital Inputs Test

Set R&S UPP analyzer:

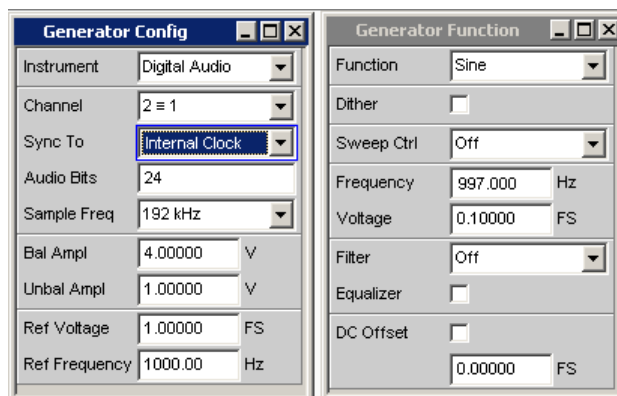
Keep the settings from the previous step. During this test, the "Input" source will be changed.



(***) Set according to test report.

Set R&S UPP generator:

Select "Sync To" = "Internal Clock" and "Sample Freq" = "192 kHz".



(***) Set according to test report.

Measurement:

Connect the individual digital inputs of the R&S UPP (Bal, Unbal, Optical) one after another to the corresponding digital output of the R&S UPP. Select the input to be tested on the analyzer. Compare the values displayed on the analyzer for RMS, input peak, sampling frequency and frequency (in the numeric display) with the settings on

the generator. Make the settings and perform the measurement according to the test report.

2.2.5 Performance Test R&S UPP-B4

Connect a monitor, mouse and keyboard to the R&S UPP or access it remote desktop connection.

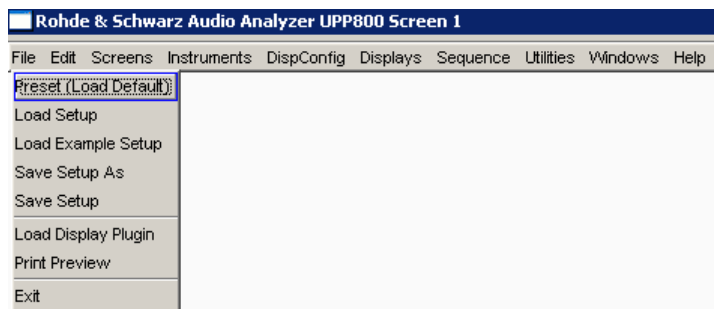
Before starting the test, set the R&S UPP to a defined initial status.

To do this, call up the default setting:

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.

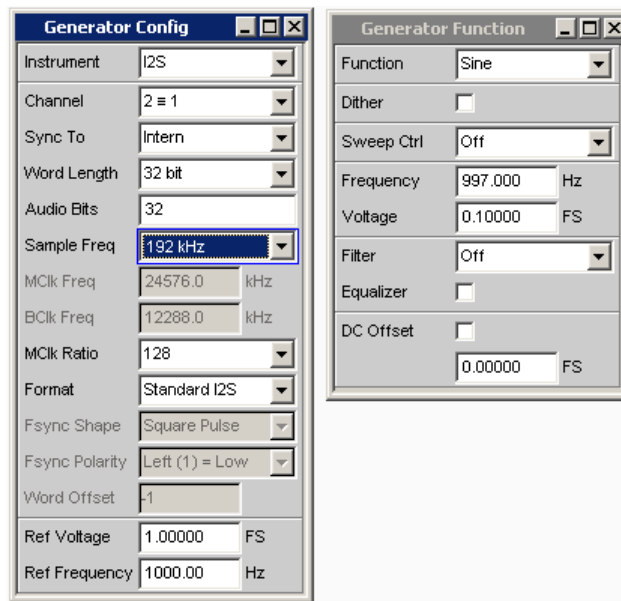


2.2.5.1 I2S Generator

Frequency error

Set R&S UPP generator:

Select the I2S generator instrument and choose a sampling rate of 192 kHz.

**Meas. instrument:**

Frequency counter

Measurement:

Connect the frequency counter to pin 10 of the I2S DSUB HD connector of the R&S UPP.

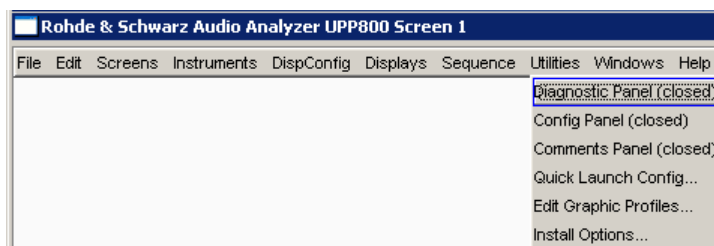
The measured value should be in the range defined by the test report.

Frequency error calibration:

If the frequency is out of range execute the following calibration steps.

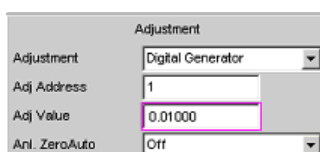
This procedure can only be performed by the R&S service.

Open the diagnostic panel from the menu bar.



Navigate to the adjustment section.

Modify the adjustment value at adjustment address "1" until the measured frequency is within 24.567000 MHz $\pm$ 10 Hz.

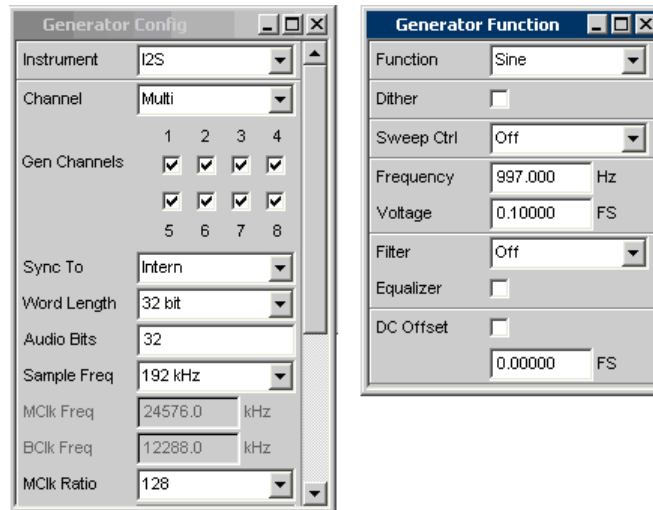


Store this factor in the EEPROM by hitting the ENTER button.

Internal Synchronisation

Set R&S UPP generator:

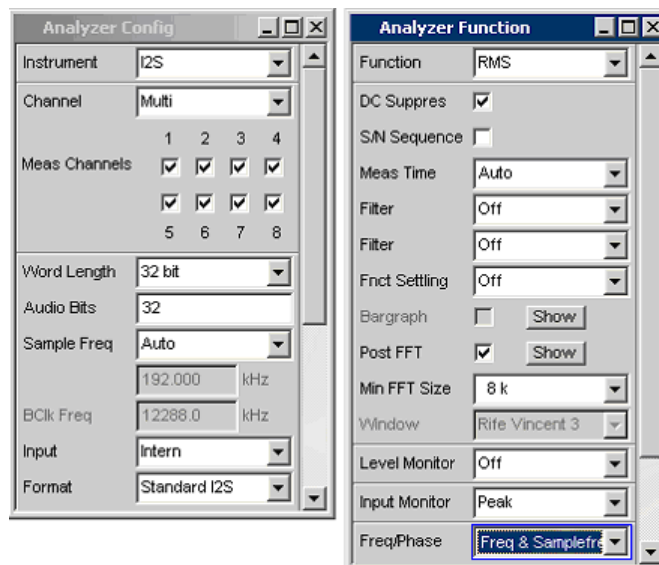
Starting from the preset settings, choose the I2S instrument. Change "Channel" to "Multi" and select all 8 channels from the checkbox matrix. During this measurement, the generator sampling frequency will be changed according to the test report.



Set R&S UPP analyzer:

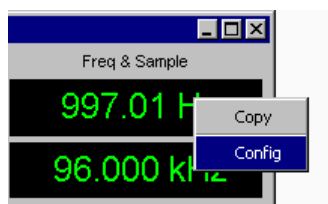
Select the "I2S" instrument from the "Analyzer Config" panel.

From the default state select "Channel" = "Multi" and select all 8 channels from the checkbox matrix. Select "Input" = "Intern" in the "Analyzer Config" panel as well as "Freq/Phase" = "Freq & Samplefreq" in the "Analyzer Function" panel.

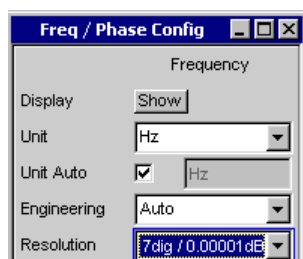


Measurement:

Configure the numeric display of the R&S UPP by clicking the right mouse button while hovering over the result field and select "Config":



In the "Freq/Phase Config" panel increase the resolution of the measurement results to 7 digits as shown below.

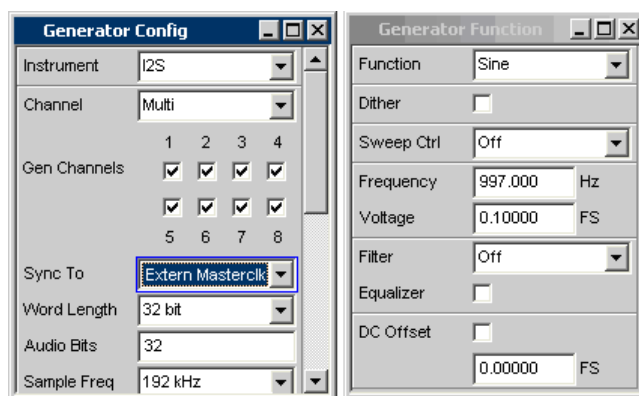


The measured values should be in the range defined by the test report.

External Synchronisation (Extern Masterclk)

Set R&S UPP generator:

Set "Sync To" to "Extern Masterclk" and leave all other settings. During this measurement, the generator sampling frequency will be changed.

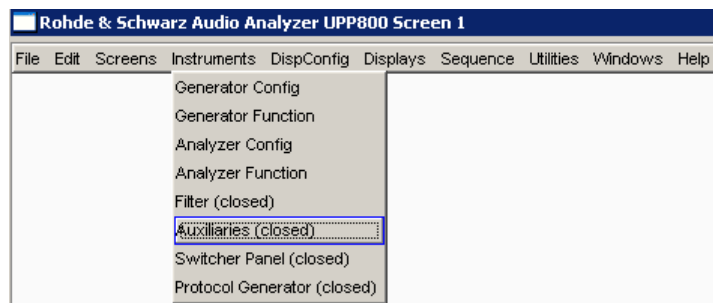


Set R&S UPP analyzer:

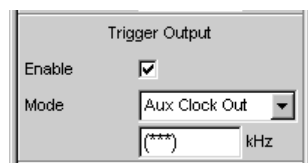
Maintain the settings from the previous subchapter:

Set R&S UPV:

Navigate to the "Auxiliaries Panel" using the menu bar.



Enable the Trigger Output and set the output frequency according to the test report.



(***) Set according to test report.

Meas. instrument:

Reference R&S UPV



If no reference R&S UPV is at hand, you can also use a clock generator. If the device cannot generate the 24.576 MHz defined by the test report, simply leave out this point and just perform the test with 1024 kHz.

Measurement:

Connect the "Trig Out" BNC connector from the R&S UPV backplane with the R&S UPP "Sync In" BNC connector using a 50 Ω BNC cable.

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

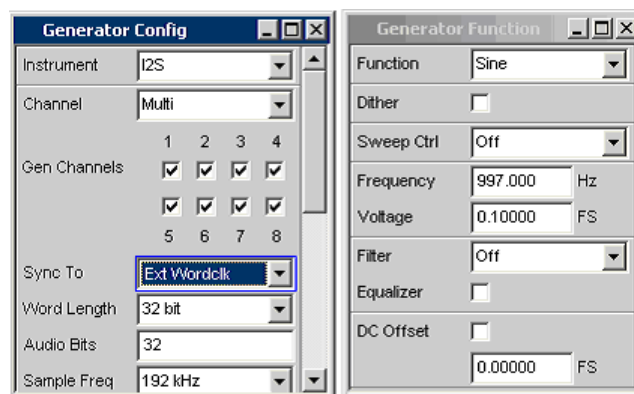
During this measurement, the frequency error of the reference R&S UPV contributes directly to the measurement error of the R&S UPP. Because of this, the tolerances are much more relaxed. This procedure is more of a function test.

Set both devices to the specified frequencies and sampling rates according to the test report.

External Synchronisation (Extern Wordclk)

Set R&S UPP generator:

Set "Sync To" to "Ext Wordclk" and leave all other settings.



Set R&S UPV analyzer:

Maintain the previous settings.

Set R&S UPV:

Navigate to the "Auxiliaries Panel" using the menu bar as described before.

Enable the Trigger Output and set the output frequency according to the test report.

Meas. instrument:

Reference R&S UPV



If no reference R&S UPV is at hand, you can also use a clock generator.

Measurement:

Connect the "Trig Out" BNC connector from the R&S UPV backplane with the R&S UPP "Sync In" BNC connector using a 50 Ω BNC cable.

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

During this measurement, the frequency error of the reference R&S UPV contributes directly to the measurement error of the R&S UPP. Because of this, the tolerances are much more relaxed. This procedure is more of a function test.

Set both devices to the specified frequencies and sampling rates according to the test report.

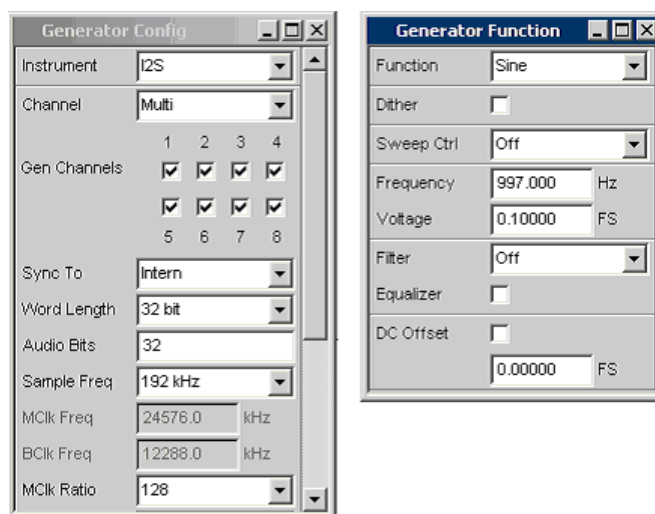
2.2.5.2 I2S Analyzer

Contrary to the previous internal measurements, now the physical I2S interface on the front plate will be tested.

Set R&S UPP generator:

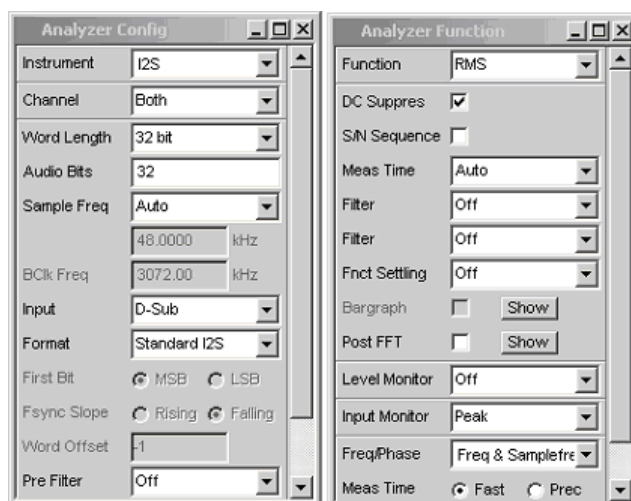
From the preset condition set the I2S generator synchronisation mode to "Internal". Change "Channel" to "Multi" and select all 8 channels from the checkbox matrix. Dur-

ing this measurement, the generator sampling frequency will be changed according to the test report.



Set R&S UPP analyzer:

From the default state select "Channel" = "Multi" and select all 8 channels from the checkbox matrix. Select "Input" = "D-Sub" in the "Analyzer Config" panel as well as "Freq/Phase" = "Freq & Samplefreq" in the "Analyzer Function" panel.



Measurement:

Connect the following signals at the I2S DSUB connector externally:

TX_SCK => RX_SCK

TX_FSYNC => RX_FSYNC

TX_DATA_12 => RX_DATA_12

TX_DATA_34 => RX_DATA_34

TX_DATA_56 => RX_DATA_56

TX_DATA_78 => RX_DATA_78

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

Set the generator to the specified samplingrates listed in the test report.

2.2.5.3 Digital Audio Generator

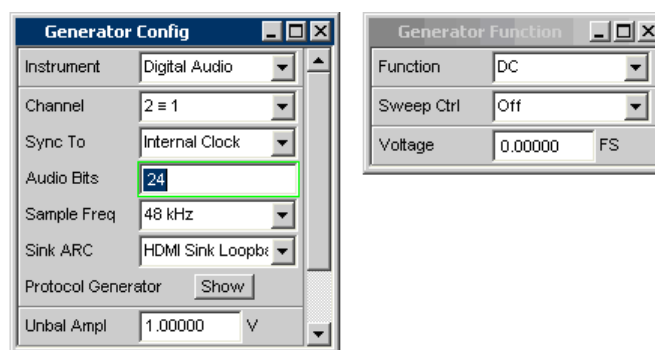
The level error calibration can be performed by two means, depending on the available equipment at hand: Using a oscilloscope or a Fluke PM6680 frequency counter.

Level error (Option 1: Oscilloscope)

Set R&S UPP generator:

Select the "Digital Audio" instrument from the "Generator Config" panel and set the "Unbal Ampl." to 1.0000 V.

Select a "Sample Freq" of 48 kHz as well as "Function" = "DC" with "Voltage" = "0.00000 FS" from the "Generator Function" panel.

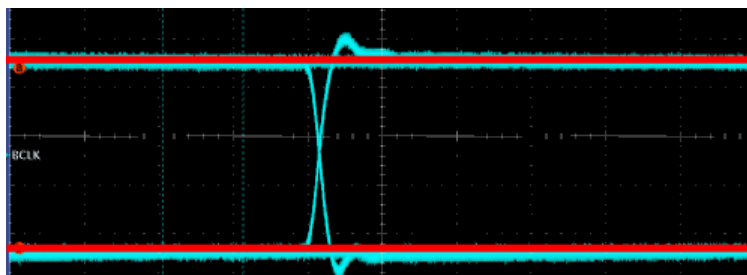


Meas. instrument:

Oscilloscope

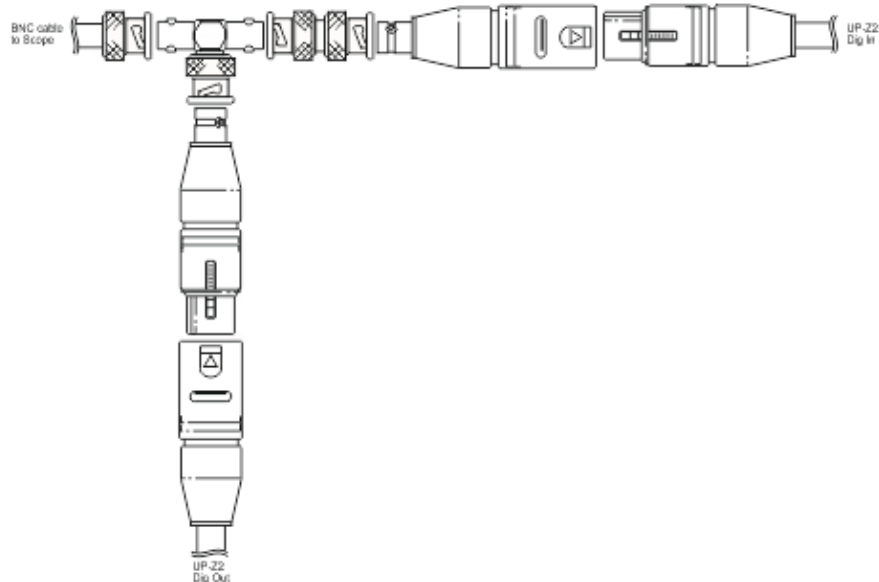
Measurement:

Connect the oscilloscope to the Bal output of the R&S UPP. Set the bandwidth of the scope to 20 MHz to eliminate short overshoots. Set the internal impedance to 1 MΩ. Measure the peak to peak amplitude of the signal using vertical cursors ignoring the overshoots as displayed in the picture below.



The measured value should be in the range defined in the test report.

To ensure that the digital output is correctly terminated with $110\ \Omega$ the following interconnection is recommended:



For the interconnection shown above some material is necessary:

- AES/EBU cable UP-Z2: 1411.3406.02
- a BNC cable (the cable to the Scope should be as short as possible to avoid ringing)
- XLR/BNC Adapter Set Male/Female: 1411.3306.02
- BNC Tee piece: 0017.6588.00
- BNC male to male connector: 0018.4620.00

Level error calibration:

If the amplitude is out of range execute the following calibration steps. This procedure can only be performed by the R&S service.

Open the diagnostic panel and navigate to the adjustment region.

Adjustment	
Adjustment	Digital Generator
Adj Address	0
Adj Value	1.00000
Anl. ZeroAuto	Off

Modify the adjustment value at adjustment address 0, till the amplitude is $8\text{ V} \pm 50\text{ mV}$.

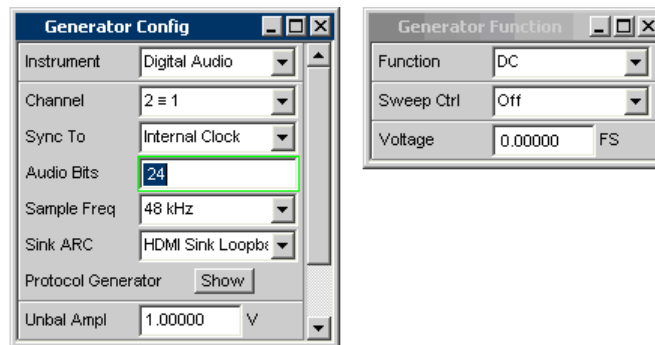
Store the modified value in the EEPROM by hitting the enter button.

Level error (Option 2: Frequency counter)

Set R&S UPP generator:

Select the "Digital Audio" instrument from the "Generator Config" panel and set the "Unbal Ampl." to 1.0000 V and the "sample Freq" to 32 kHz.

Choose the "Function" "DC" and a "Voltage" of "0.0 FS" in the "Generator Function Panel"



Meas. instrument:

Frequency counter Fluke PM6680

Measurement:

Connect the frequency counter with the unbalanced digital audio BNC output of the R&S UPP using a 50 Ω BNC cable. Set the counter to "Volt Max A", "Filter" = "Off" and select an input impedance of 50 Ω.

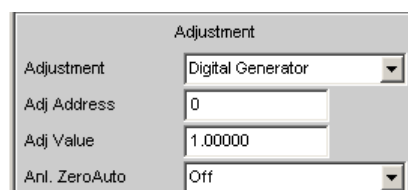
The measured value should be in the range defined in the test report.

Level error calibration:

If the amplitude is out of range execute the following calibration steps. This procedure can only be performed by the R&S service.

When using the frequency counter to perform the level calibration, the adjustment value can be calculated as: **Value = 0.8925/(Result_Counter/1.125)**

Open the diagnostic panel and navigate to the adjustment region.



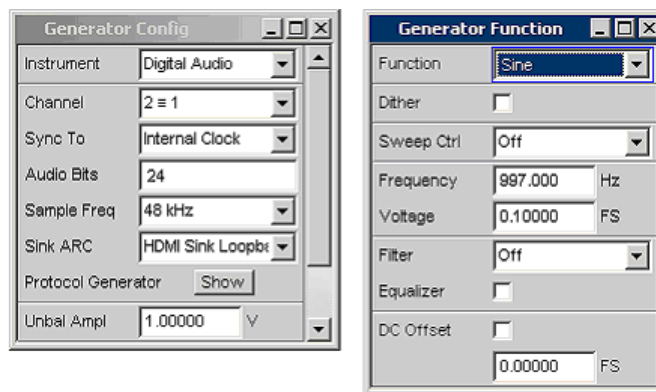
Insert the adjustment value at adjustment adress 0.

Store the modified value in the EEPROM by hitting the ENTER button.

Internal Synchronisation

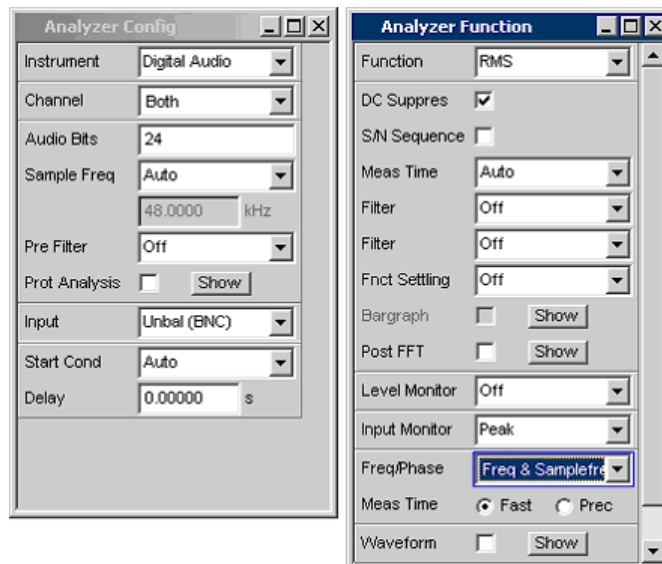
Set R&S UPP generator:

Maintain the previous settings and select "Function" = "Sine" from the "Generator Function" panel. During this test, the generator samplerate will be changed according to the test report.



Set R&S UPP analyzer:

From the default state select the "Digital Audio" instrument from the "Analyzer Config" panel. Choose "Input" = "Unbal (BNC)" in the "Analyzer Config" panel as well as "Freq/Phase" = "Freq & Samplefreq" in the "Analyzer Function" panel.



Measurement:

Connect the unbalanced digital audio output with the unbalanced digital audio input using a 50 Ω BNC cable.

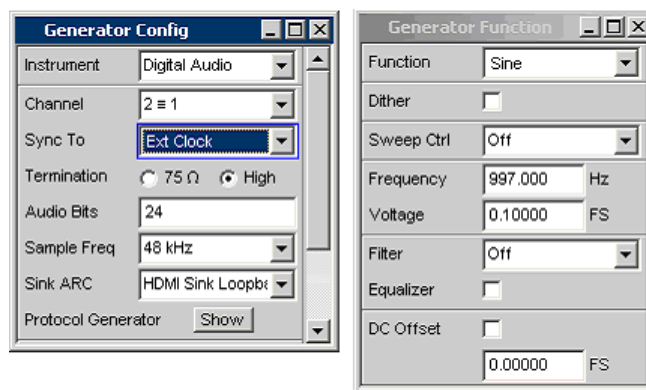
In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

The measured values should be in the range defined by the test report.

External Synchronisation (Ext Clock)

Set R&S UPP generator:

Set the R&S UPP generator synchronisation mode to "Ext_Clock" and set "Termination" = "High". During this test the generator samplerate will be changed.

**Set R&S UPP analyzer:**

Keep the settings from the previous step.

Set R&S UPV:

Navigate to the "Auxiliaries Panel" using the menu bar as described before.

Enable the Trigger Output and set the output frequency according to the test report.

Meas. instrument:

Reference R&S UPV



If no reference R&S UPV is at hand, you can also use a clock generator.

Measurement:

Connect the "Trig Out" BNC connector from the R&S UPV backplane with the R&S UPP "Sync In" BNC connector using a 50 Ω BNC cable.

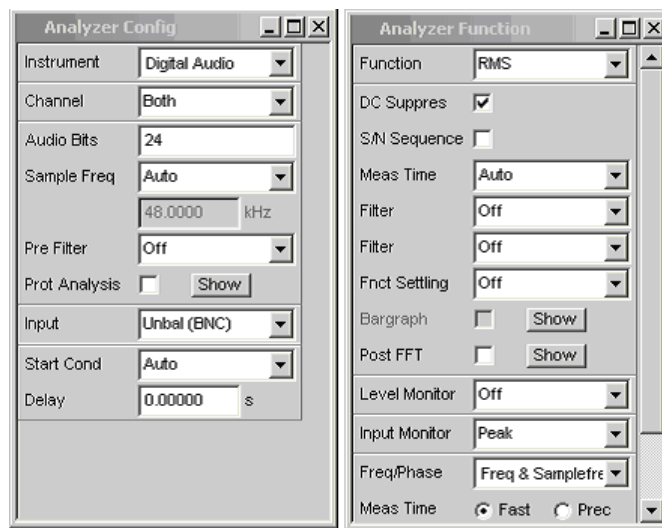
In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

During this measurement, the frequency error of the reference R&S UPV contributes directly to the measurement error of the R&S UPP. Because of this, the tolerances are much more relaxed. This procedure is more of a function test.

Set both devices to the specified frequencies and sampling rates according to the test report.

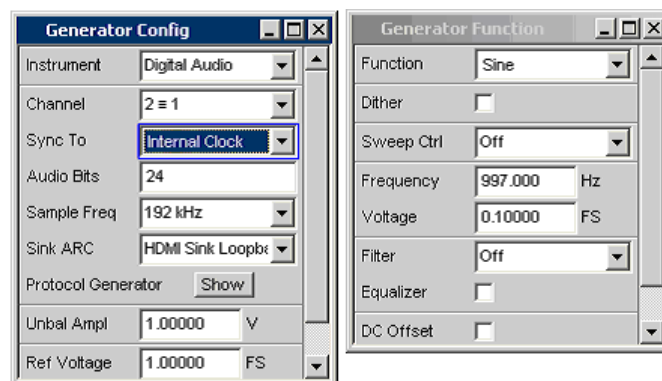
2.2.5.4 Digital Audio Analyzer**Digital Inputs Test****Set R&S UPP analyzer:**

Keep the settings from the previous step. During this test, the "Input" source will be changed.



Set R&S UPP generator:

Select "Sync To" = "Internal Clock" and "Sample Freq" = "192 kHz".



Measurement:

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

2.2.5.5 HDMI Interface

HDMI Sink - Source Connection

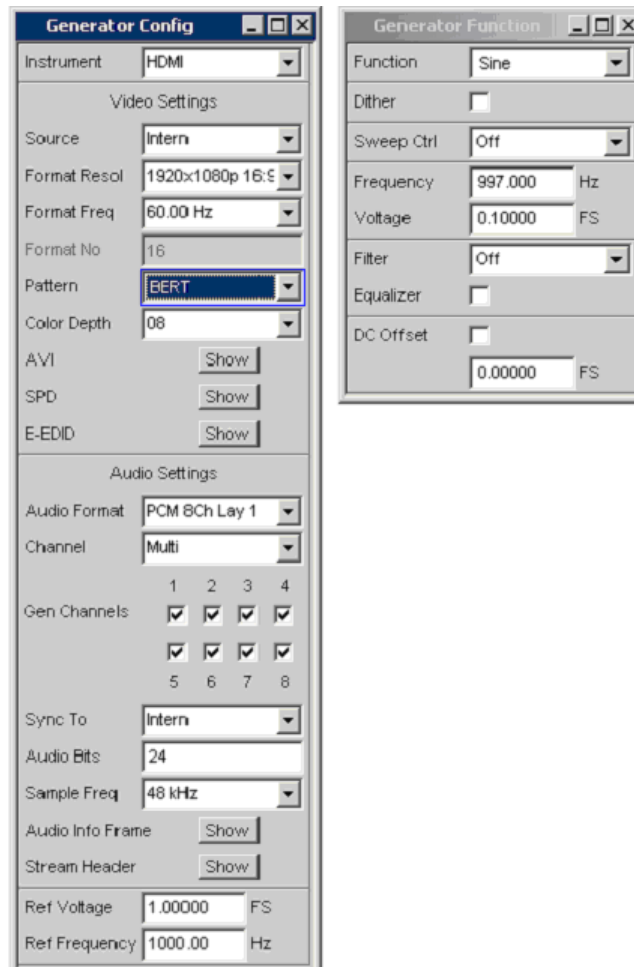
Connect the HDMI Sink input with the HDMI Source output using a HDMI 1.4 cable with ethernet support.

Set R&S UPP generator:

Starting from the preset settings, choose the HDMI instrument from the "Generator Config" panel. Select "Format Resol" = "1920x1080p 16:9" and "Pattern" = "BERT".

Under "Audio Format" select "PCM 8Ch Lay1" and "Channel" = "Multi". Select all 8 channels from the checkbox matrix.

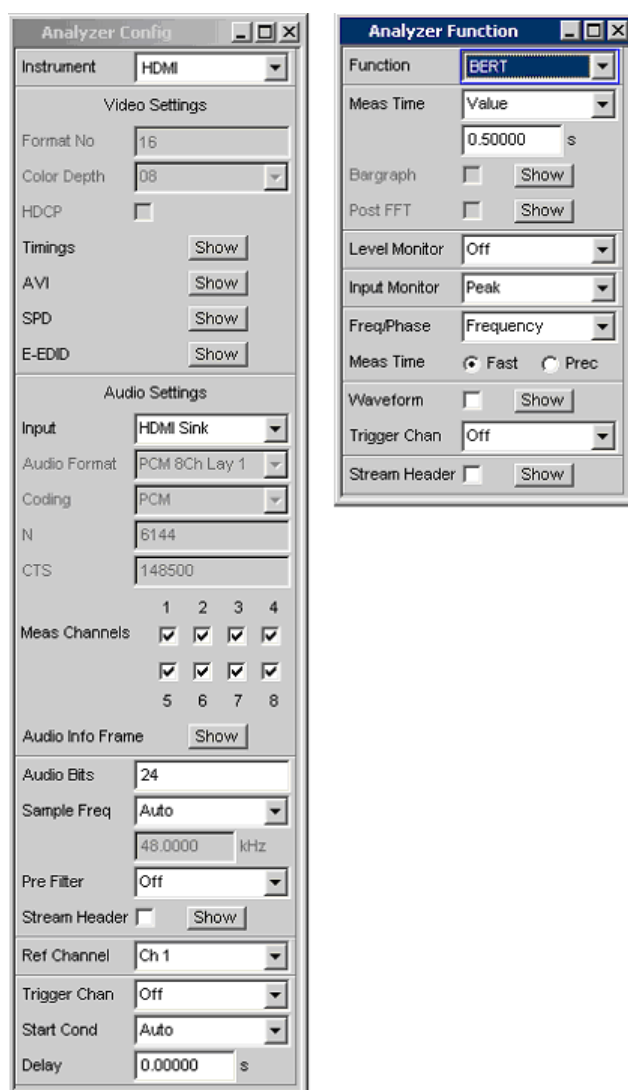
As generator signal, the default "Sine" is used.



Set R&S UPP analyzer:

Choose the HDMI instrument from the "Analyzer Config" panel. In the setting "Meas Channels" select all 8 analyzer channels by activating all checkboxes.

In the "Analyzer Function" panel select "BERT" as well as "Freq & Samplefreq" under "Freq/Phase".



Measurement:

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before and perform the measurement according to the test report.

HDMI ARC Test Sink Loopback

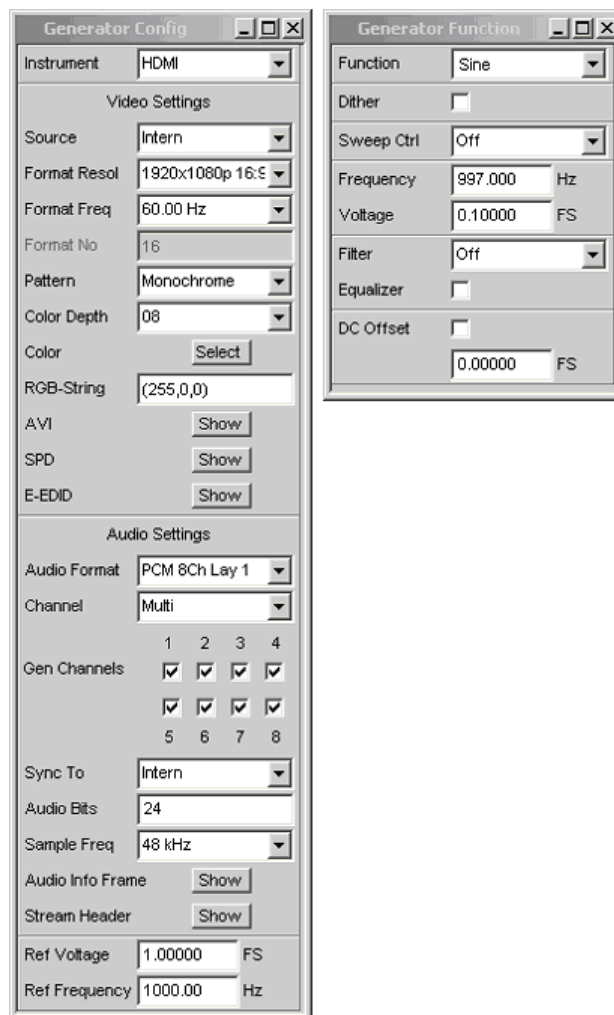
Connect the HDMI Sink input with the HDMI Source output using a HDMI 1.4 cable with ethernet support.

Set R&S UPP generator:

Starting from the preset settings, choose the HDMI instrument from the "Generator Config" panel. Select "Format Resol" = "1920x1080p 16:9". Leave all other settings.

Under "Audio Format" select "PCM 8Ch Lay1" and "Channel" = "Multi". Select all 8 channels from the checkbox matrix.

As generator signal, the default "Sine" is used.

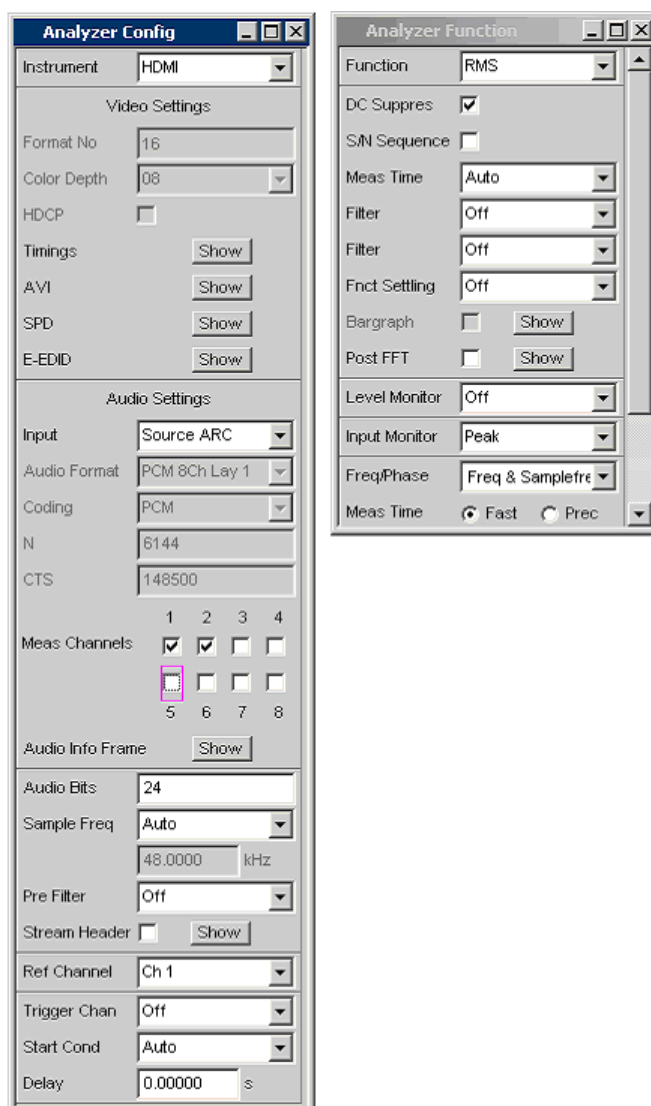


Set R&S UPP analyzer:

Choose the HDMI instrument from the "Analyzer Config" panel. In the setting "Meas Channels" select channels 1&2 only, by activating their corresponding checkboxes.

Select "Input" = "Source ARC".

In the "Analyzer Function" panel select "RMS" as well as "Freq & Samplefreq" under "Freq/Phase".



Measurement:

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before and perform the measurement according to the test report.

HDMI ARC Test Dig Audio Gen

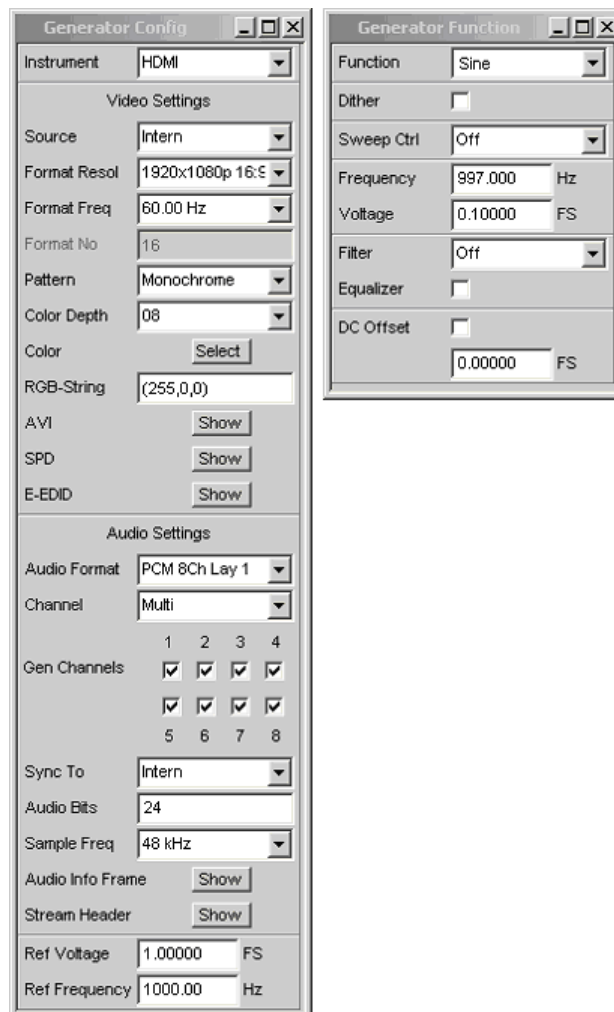
Connect the HDMI Sink input with the HDMI Source output using a HDMI 1.4 cable with ethernet support.

Set R&S UPP HDMI generator:

Starting from the preset settings, choose the HDMI instrument from the "Generator Config" panel. Select "Format Resol" = "1920x1080p 16:9". Leave all other settings.

Under "Audio Format" select "PCM 8Ch Lay1" and "Channel" = "Multi". Select all 8 channels from the checkbox matrix.

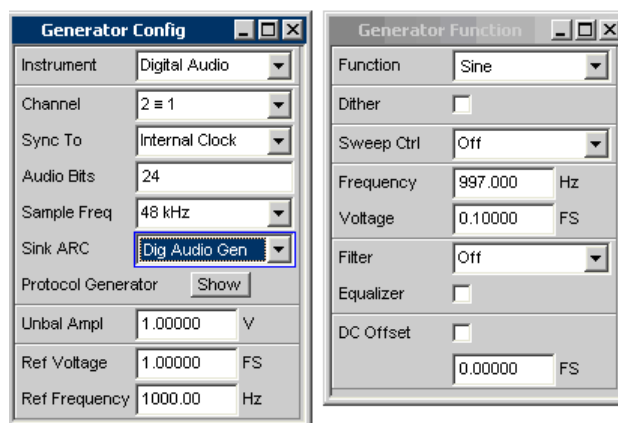
As generator signal, the default "Sine" is used.



Set R&S UPP Digital Audio generator:

Select the Digital Audio instrument from the "Generator Config" panel. Select "Sink ARC" = "Dig Audio Gen". Leave all other settings.

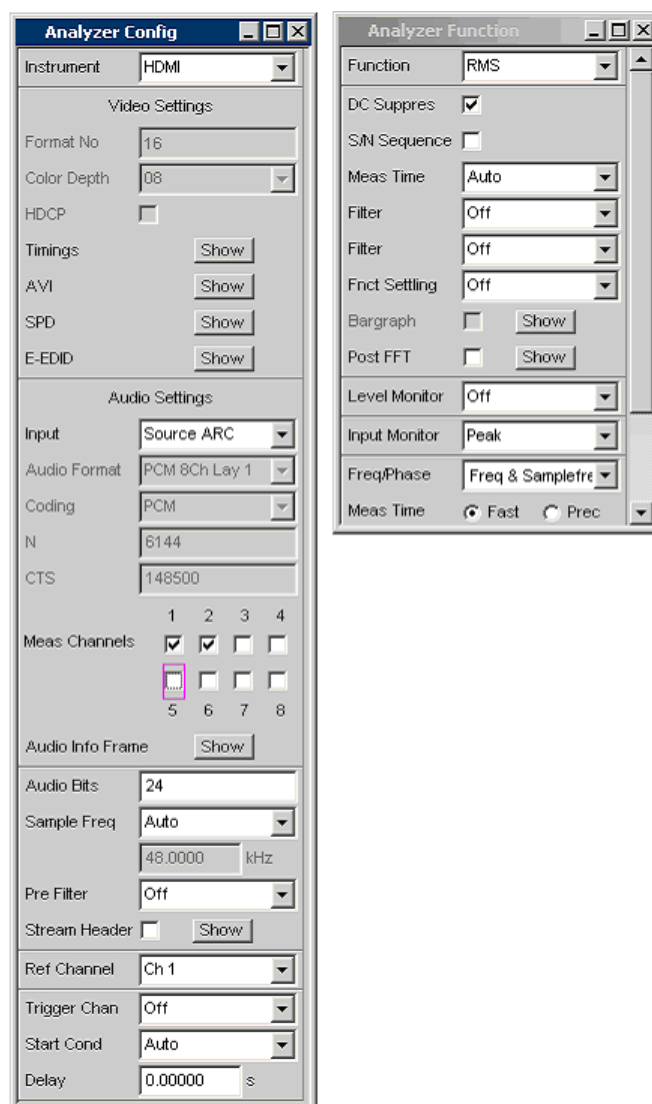
As generator signal, the default "Sine" is used.

**Set R&S UPP analyzer:**

Choose the HDMI instrument from the "Analyzer Config" panel. In the setting "Meas Channels" select channels 1&2 only, by activating their corresponding checkboxes.

Select "Input" = "Source ARC".

In the "Analyzer Function" panel select "RMS" as well as "Freq & Samplefreq" under "Freq/Phase".



Measurement:

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before and perform the measurement according to the test report.

HDMI DSP Test

Connect the HDMI Sink input with the HDMI Source output using a HDMI 1.4 cable with ethernet support.

Set R&S UPP HDMI generator:

Starting from the preset settings, choose the HDMI instrument from the "Generator Config" panel. Select "Audio Format" = "Dolby Digital". Leave all other settings.

In the "Generator Function" panel select "Play" and open the file "C:/UPV/Config/User/DSPTEST.wav".

Generator Config

Instrument: HDMI

Video Settings

Source: Intern

Format Resol: 640x480p 4:3

Format Freq: 60.00 Hz

Format No: 1

Pattern: Monochrome

Color Depth: 08

Color:

RGB-String: (255,0,0)

AVI:

SPD:

E-EDID:

Audio Settings

Audio Format: Dolby Digital

Sync To: Intern

Audio Bits: 24

Sample Freq: 48 kHz

Audio Info Frame:

Stream Header:

Ref Voltage: 1.00000 FS

Ref Frequency: 1000.00 Hz

Generator Function

Function: Play

File: \DSPTEST.WAV

Scale Pk to FS: ☐

Channel: Stereo

Restart: Auto

Play Mode: Total Cont

Time: 0.03200 s

ID: 544501094

Type: 1163280727

Channels: 2

Sample Rate: 48000

Byte Rate: 192000

BitsPerSample: 16

Volt Mode: ☒ Ch2/1 ☐ Ch1 & 2

Volt Peak Ch1: 1.00000 FS

Volt Ch2/1: 1.00000

Volt Peak Ch2: 1.00000 FS

Filter: ☒ Track ☐ Split

Filter: Off

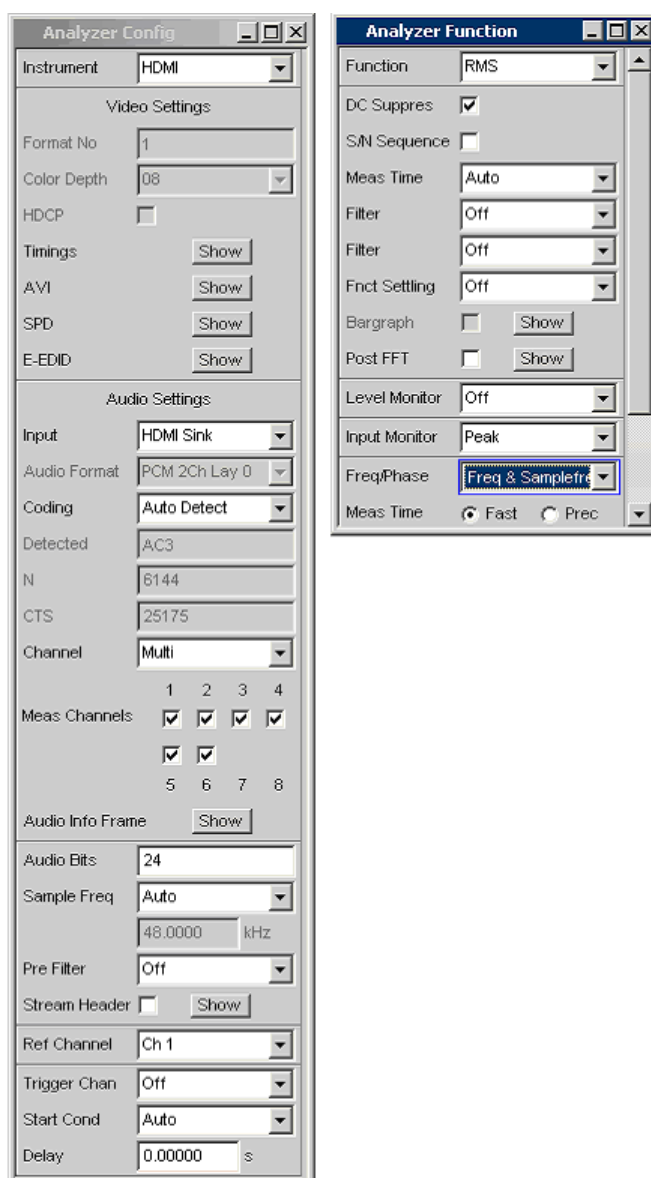
DC Offset: ☐

0.00000 FS

Set R&S UPP analyzer:

Choose the HDMI instrument from the "Analyzer Config" panel. In the setting "Coding" select "Auto Detect" and activate all 6 analyzer channels by clicking their corresponding checkbox.

In the "Analyzer Function" panel select "RMS" as well as "Freq & Samplefreq" under "Freq/Phase".



Measurement:

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before and perform the measurement according to the test report.

HDMI AUX_In - AUX_Out Test

Close the software. Browse to the directory "C:\UPV\bin" and rename the file "UPP_HDMI_VIDEO.jbc" to "UPP_HDMI_VIDEO.jbc_original". Now browse to the directory C:\UPV\Config\User" and copy the file "UPP_HDMI_VIDEO.jbc" into "C:\UPV\bin". Start the firmware.

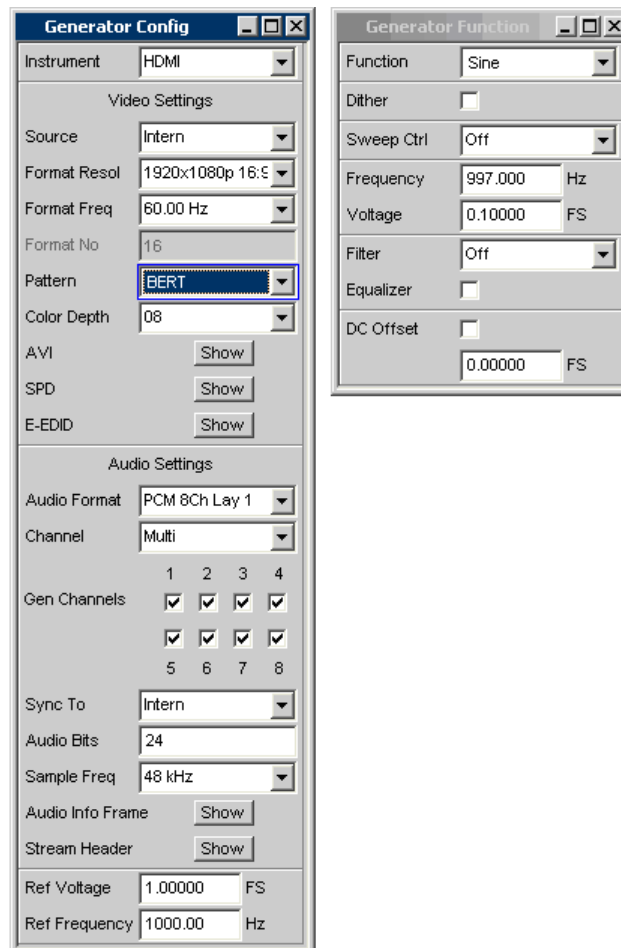
Connect the HDMI AUX_In input with the HDMI AUX_Out output using a HDMI 1.4 cable with ethernet support.

Set R&S UPP HDMI generator:

Starting from the preset settings, choose the HDMI instrument from the "Generator Config" panel. Select "Format Resol" = "1920x1080p 16:9" and "Pattern" = "BERT".

Under "Audio Format" select "PCM 8Ch Lay1" and "Channel" = "Multi". Select all 8 channels from the checkbox matrix.

As generator signal, the default "Sine" is used.

**Set R&S UPP analyzer:**

Choose the HDMI instrument from the "Analyzer Config" panel. In the setting "Meas Channels" select all 8 analyzer channels by activating all checkboxes.

In the "Analyzer Function" panel select "BERT" as well as "Freq & Samplefreq" under "Freq/Phase".

Analyzer Config

Instrument: HDMI

Video Settings

Format No: 16

Color Depth: 08

HDCP: ☐

Timings:

AVI:

SPD:

E-EDID:

Audio Settings

Input: HDMI Sink

Audio Format: PCM 8Ch Lay 1

Coding: PCM

N: 8144

CTS: 148500

Meas Channels: ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☒ 5 ☒ 6 ☒ 7 ☒ 8

Audio Info Frame:

Audio Bits: 24

Sample Freq: Auto

48.0000 kHz

Pre Filter: Off

Stream Header: ☐

Ref Channel: Ch 1

Trigger Chan: Off

Start Cond: Auto

Delay: 0.00000 s

Analyzer Function

Function: BERT

Meas Time: Value

0.50000 s

Bargraph: ☐

Post FFT: ☐

Level Monitor: Off

Input Monitor: Peak

Freq/Phase: Frequency

Meas Time: ☒ Fast ☐ Prec

Waveform: ☐

Trigger Chan: Off

Stream Header: ☐

Measurement:

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before and perform the measurement according to the test report.

NOTICE**Dont forget!**

After finishing this test, close the firmware, delete the file "UPP_HDMI_VIDEO.jbc" from "C:UPV/bin" and rename the file "UPP_HDMI_VIDEO.jbc_original" back to "UPP_HDMI_VIDEO.jbc".

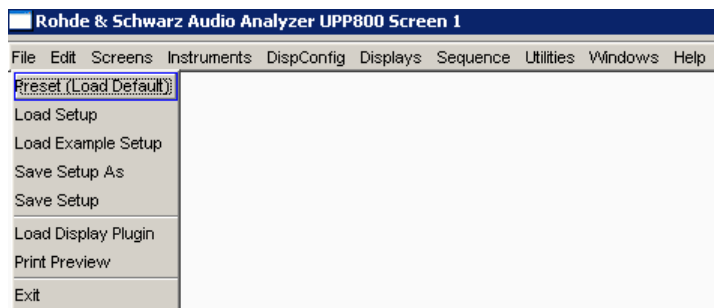
2.2.6 Performance Test R&S UPP-B8

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

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



2.2.6.1 Adapting instruments to the generator output

The option R&S UPP-B8 has its outputs via a 25 pole DSUB jack (analog section) and a 9 pole DSUB jack (digital section). The pin configuration of the 25 pole DSUB jack corresponds to the so called TASCAM standard. To get the common XLR connectors for the analog section use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02). To get the common BNC connectors for the digital section use a multicore cable (e.g. Rohde & Schwarz UP-Z8D 1411.3158.02)

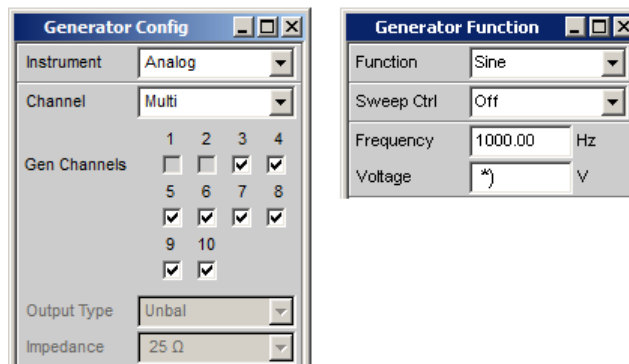
The inputs to the digital multimeter are banana jacks and the input to the frequency counter is a BNC female connector. This means that a direct connection is not possible using a commercially available cable. The easiest way of adaptation is as follows:

- Retrofit the outputs of the generator to BNC female using R&S UP-Z1MF (XLR/BNC adapter set, 1411.3306.02). Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors.
- Retrofit the input to the digital multimeter to BNC female using the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17.

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

2.2.6.2 Level Error Sine

Set R&S UPP:



*) according to test report

Meas. instrument:

AC voltmeter

Measurement:

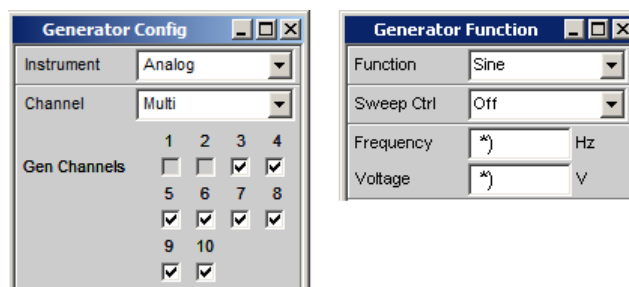
Connect the AC voltmeter to the output of the R&S UPP generator. Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors. You will additionally need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17. This is to be measured for all 8 channels. For the remaining R&S UPV settings and measurement procedure, see the test report.



This test item is affected by the level adjustment of the option.

2.2.6.3 Frequency Response

Set R&S UPP:



*) according to test report

Meas. instrument:

AC voltmeter

Measurement:

Connect the AC voltmeter to the output of the R&S UPP generator. Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the common XLR connectors. You will additionally need the test cable 3 for this purpose, see [Chapter 2.1.4,](#)

"Test cable 3", on page 17. This is to be measured for all 8 channels. Relative display in dB, reference is the voltage measured at 1 kHz. For the remaining R&S UPP settings and measurement procedure, see the test report.



This test item is affected by the adjustment of the lowpass filter after the main DACs of the option.

2.2.6.4 Frequency Uncertainty

Set R&S UPP:

Generator Function	
Function	Sine
Sweep Ctrl	Off
Frequency	1000.00 Hz
Voltage	1.00000 V

Meas. instrument:

Frequency counter

Measurement:

Connect the frequency counter to the output of the R&S UPP generator. Use a multi-core cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors. You will additionally need the test cable 4 for this purpose, see [Chapter 2.1.5, "Test cable 4"](#), on page 17. This is to be measured for all 8 channels.

2.2.6.5 THD Inherent Distortion

Set R&S UPP:

Generator Config																									
Instrument	Analog																								
Channel	Multi																								
Gen Channels	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> </tr> <tr> <td>☐</td><td>☐</td><td>☒</td><td>☒</td> </tr> <tr> <td>5</td><td>6</td><td>7</td><td>8</td> </tr> <tr> <td>☒</td><td>☒</td><td>☒</td><td>☒</td> </tr> <tr> <td>9</td><td>10</td><td></td><td></td> </tr> <tr> <td>☒</td><td>☒</td><td></td><td></td> </tr> </table>	1	2	3	4	☐	☐	☒	☒	5	6	7	8	☒	☒	☒	☒	9	10			☒	☒		
1	2	3	4																						
☐	☐	☒	☒																						
5	6	7	8																						
☒	☒	☒	☒																						
9	10																								
☒	☒																								

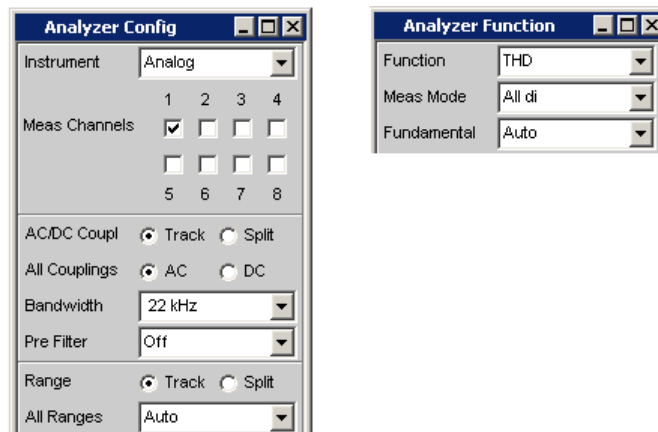
Generator Function	
Function	Sine
Sweep Ctrl	Off
Frequency	*') Hz
Voltage	*') V

*') according to test report

Meas. instrument:

Analyzer for THD: R&S UPP

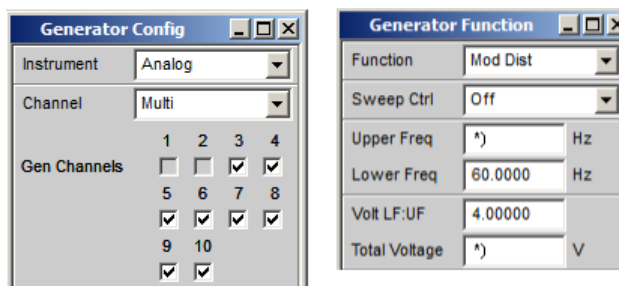
Set R&S UPP:

**Test setup:**

Connect the inputs of the R&S UPP analyzer to the output of the R&S UPP generator channels. Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors.

Measurement:

For the remaining R&S UPP settings and measurement procedure, see the test report. This is to be measured for all 8 channels.

2.2.6.6 MOD DIST Inherent Distortion**Set R&S UPP:**

*) according to test report

Meas. instrument:

Analyzer for Mod Dist: R&S UPP

Set R&S UPP:

Select the analyzer function "Mod Dist"

Test setup:

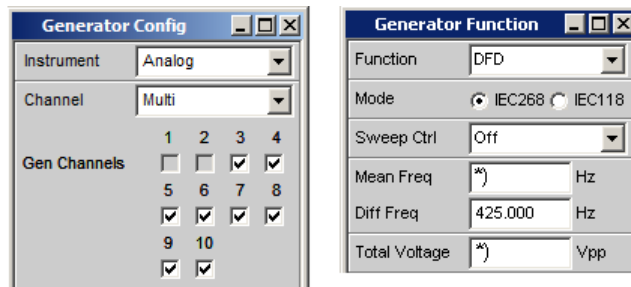
Connect a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) between the output of the R&S UPP-B8 generator and the inputs of the R&S UPP analyzer.

Measurement:

For the remaining R&S UPP settings and measurement procedure, see the test report. This is to be measured for all 8 channels.

2.2.6.7 DFD Inherent Distortion

Set R&S UPP:



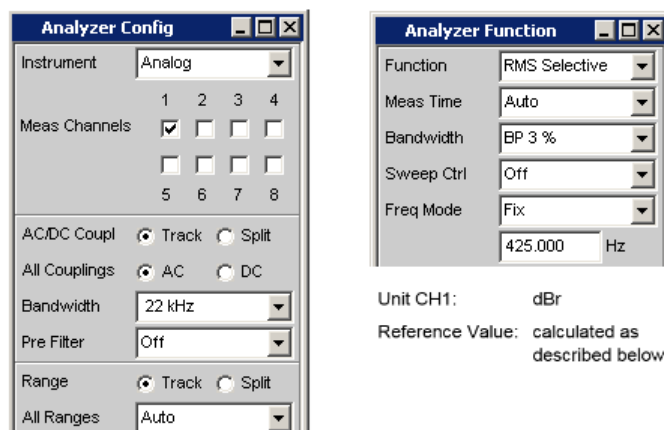
*) according to test report

For DFD d2:

Meas. instrument:

Selective voltmeter: R&S UPP

Set R&S UPP:



Accessories:

External RC lowpass: LP DFD, see [Chapter 2.1.1, "Difference-frequency distortion low-pass LP DFD"](#), on page 14.

Test method:

Connect the LP DFD between the outputs of the R&S UPP-B8 generator and inputs to the R&S UPP analyzer by using a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02). You will additionally 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 (max 5 dB) does affect the measurement and is taken into account in the reference value of the analyzer:

Analyzer Reference Value (Vrms) = Generator Total Voltage (Vpp) divided by 5.

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:

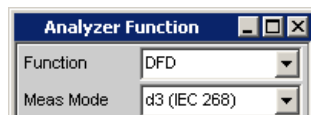
For the remaining R&S UPP settings and measurement procedure, see the test report. This is to be measured for all 8 channels.

For DFD d3:

Meas. instrument:

Analyzer for DFD d3: R&S UPP

Set R&S UPP:



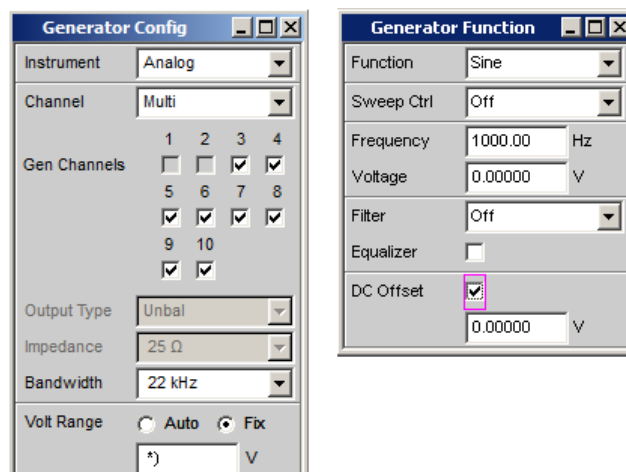
Measurement:

Connect the R&S UPP analyzer to the output of the R&S UPP-B8 generator by using a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02). For the remaining R&S UPP settings and measurement procedure, see the test report. This is to be measured for all 8 channels.

2.2.6.8 DC Offset

Residual Offset

Set R&S UPP:



*) according to test report

Meas. instrument:

DC voltmeter

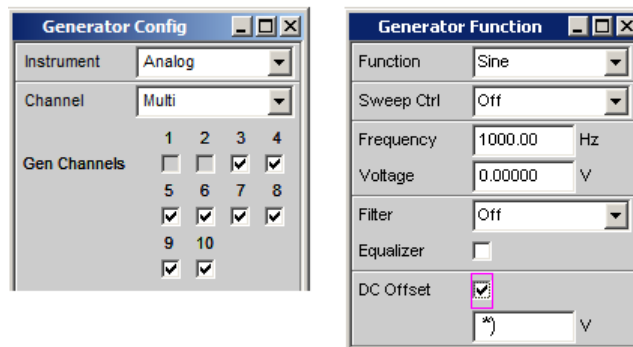
Measurement:

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.



This test item is affected by the DC offset adjustment.

Setting Error DC Offset**Set R&S UPP:**

*) according to test report

Meas. instrument:

DC voltmeter

Measurement:

Connect the DC voltmeter to the output of R&S UPP generator and measure the DC voltage at the output of the R&S UPP generator. Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors. You will additionally need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17. For the remaining R&S UPP settings and measurement procedure, see the test report.



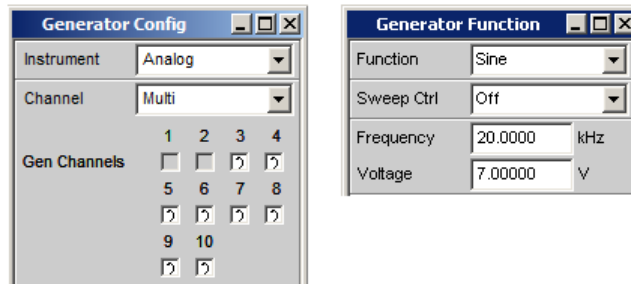
This test item is affected by the following adjustments.

- Level adjustment analog generator
- DC offset adjustment

2.2.6.9 Cross Talk Attenuation

Due to the high crosstalk attenuation of typ. 110 dB a very small voltage of only a few μV must be measured on the deactivated channel. For this purpose, a selective volt-meter like the one provided in the R&S UPP analyzer, for example, is required.

Set R&S UPP:

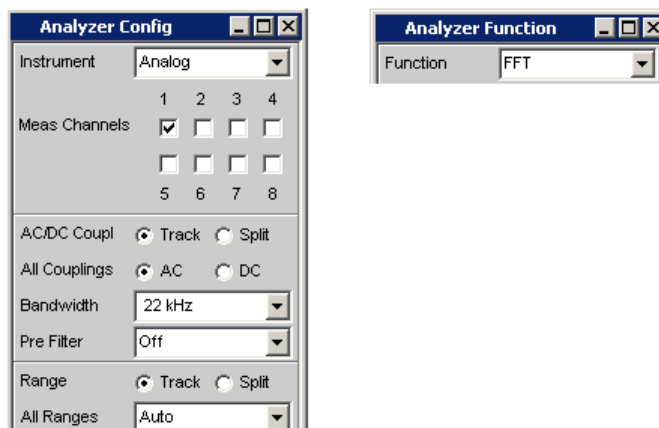


*) according to test report

Meas. instrument:

Audio analyzer: R&S UPP

Set R&S UPP:



Test setup:

Connect the R&S UPP analyzer to the output of the DUT R&S UPP generator via a shielded cable. Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors.

Measurement:

Set the R&S UPP generator according to the test report.

For improved legibility, scale the graphics panel from 19 kHz to 21 kHz.

All channels are switched off except one channel which is activated. The measurement is made from the activated channel into the two adjacent channels (the upper and the lower).

FFT measurement on the activated channel. The cursor must indicate a value of about 0 dBr (= 7 V) at 20 kHz.

FFT measurement on the deactivated channel. The crosstalk will be displayed directly.

Repeat the same measurement on all other channels.



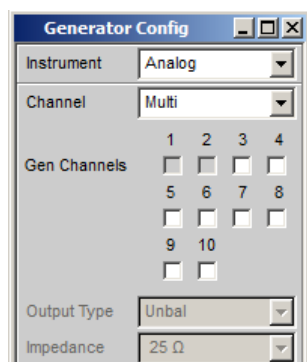
To avoid having the measurement result corrupted due to the internal coupling of the analyzer channels in the R&S UPP, we recommend measuring the crosstalk in a single-channel fashion one after another. Switch off the analog generator on the analog audio board.

Make the entry in the test report with a positive sign as the actual crosstalk attenuation.

2.2.6.10 Output Impedance

The output impedance R_{off} of the deactivated channel is measured using an ohmmeter.

Set R&S UPP:



Meas. instrument:

- Digital multimeter for impedance measurement (ohmmeter)

Test setup for measurement of R_{off} :

Connect the ohmmeter to the output of the R&S UPP 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 fourwire system.

Measurement:

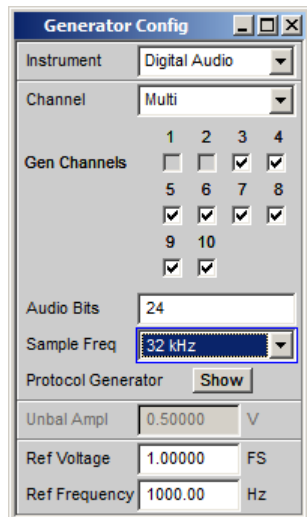
Set the R&S UPP generator according to the test report. Measure the impedance R_{off} of the deactivated channels using the ohmmeter.

2.2.6.11 Digital Audio Generator

The level measurement can be performed using an oscilloscope.

Level error (with Oscilloscope)**Set R&S UPP-B8 multi channel generator:**

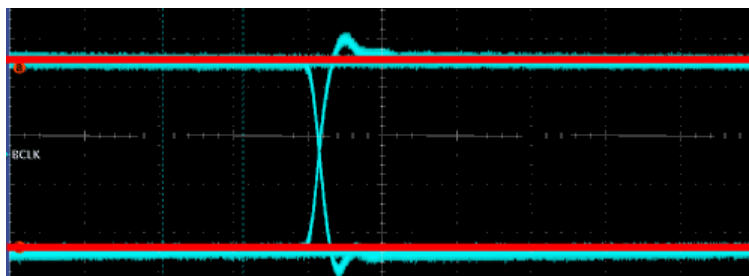
Select a "Sample Freq" of 32 kHz.

**Meas. instrument:**

Oscilloscope

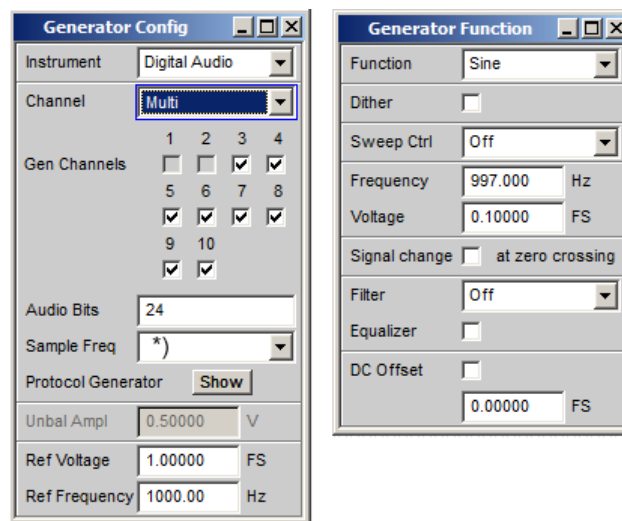
Measurement:

Connect the oscilloscope to the digital output of the R&S UPP-B8 using the UP-Z8D cable. Set the bandwidth of the scope to 20 MHz to eliminate short overshoots. Set the internal impedance to 1 M Ω . Measure the peak to peak amplitude of the signal using vertical cursors ignoring the overshoots as displayed in the picture below.



The measured value should be in the range defined in the test report.

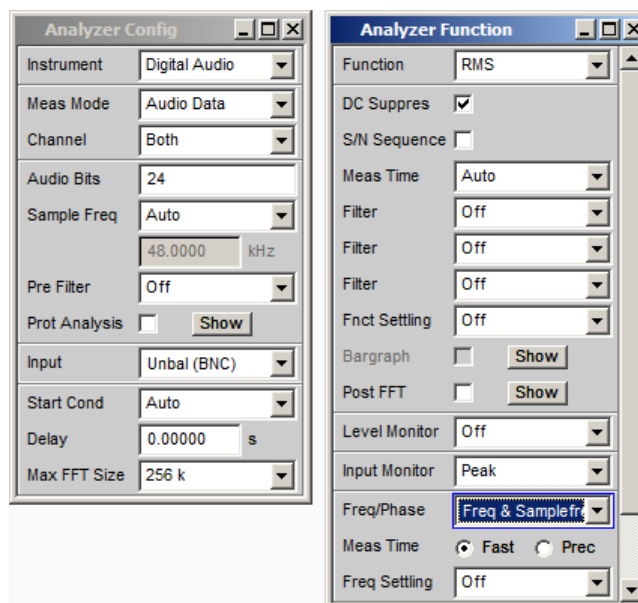
Measurement of Sample Frequency**Set R&S UPP-B8 multi channel generator:**



*) Set according to test report.

Set R&S UPV analyzer:

To measure the output signal from the R&S UPP-B8 digital outputs an R&S UPV with the option UPV-B2 has to be used. From the default state select the "Digital Audio" instrument from the "Analyzer Config" panel. Choose "Input" = "Unbal (BNC)" in the "Analyzer Config" panel as well as "Freq/Phase" = "Freq & Samplefreq" in the "Analyzer Function" panel.



Measurement:

Connect the digital audio output of UPP-B8 with the unbalanced digital audio input of the R&S UPV using the UP-Z8D cable.

In the "Freq/Phase Config" display increase the resolution of the measurement results to 7 digits as described before.

The measured values should be in the range defined by the test report.

2.3 Performance Test Report

Audio Analyzer R&S UPP

Order No. 1411.1003.....

Serial No:.....

Date:.....

Name:.....

2.3.1 Performance Test Report of Analog Generator

2.3.1.1 Level Error Sine

Measurement		Min	Act.	Max	Unit
Channel 1 UNBAL					
	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB
Channel 1 BAL					
	14.00 V	-0.05		+0.05	dB
	8.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB

Measurement		Min	Act.	Max	Unit
Channel 2 UNBAL					
	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB

	0.50 V	-0.05		+0.05	dB
Channel 2 BAL					
	14.00 V	-0.05		+0.05	dB
	8.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB

2.3.1.2 Frequency Response

Measurement		Min	Act.	Max	Unit
Output BAL Channel 1, 1 V					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB
Output UNBAL Channel 1, 1 V					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB

Measurement		Min	Act.	Max	Unit
Output BAL Channel 2, 1 V					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB

	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB
Output UNBAL Channel 2, 1 V					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB

2.3.1.3 Frequency Uncertainty

Measurement		Min	Act.	Max	Unit
Channel 1					
	1000.000 Hz	-10.00		+10.00	ppm
Channel 2					
	1000.000 Hz	-10.00		+10.00	ppm

2.3.1.4 THD Inherent Distortion

Measurement at 20 Hz		Min	Act.	Max	Unit
Channel 1 UNBAL					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 1 BAL					
	14.00 V			-100.00	dB
	5.00 V			-100.00	dB
Measurement at 1 kHz					
Channel 1 UNBAL					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 1 BAL					
	14.00 V			-100.00	dB
	5.00 V			-100.00	dB

Measurement at 7 kHz					
Channel 1 UNBAL					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 1 BAL					
	14.00 V			-100.00	dB
	5.00 V			-100.00	dB

Measurement at 20 Hz		Min	Act.	Max	Unit
Channel 2 UNBAL					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 2 BAL					
	14.00 V			-100.00	dB
	5.00 V			-100.00	dB
Measurement at 1 kHz					
Channel 2 UNBAL					
	7.00 V			-100.000	dB
	2.50 V			-100.00	dB
Channel 2 BAL					
	14.00 V			-100.00	dB
	5.00 V			-100.00	dB
Measurement at 7 kHz					
Channel 2 UNBAL					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 2 BAL					
	14.00 V			-100.00	dB
	5.00 V			-100.00	dB

2.3.1.5 MOD DIST Inherent Distortion

Measurement		Min	Act.	Max	Unit
Channel 1 UNBAL, Tot. Volt 19.7 VPP					
	4.00 kHz			-80.00	dB

	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 1 UNBAL, Tot. Volt 6VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 1 BAL, Tot. Volt 39.5 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 1 BAL, Tot. Volt 12 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB

Measurement		Min	Act.	Max	Unit
Channel 2 UNBAL, Tot. Volt 19.7 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 2 UNBAL, Tot. Volt 6VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 2 BAL, Tot. Volt 39.5 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB

	20.00 kHz			-80.00	dB
Channel 2 BAL, Tot. Volt 12 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB

2.3.1.6 DFD Inherent Distortion

DFD d2

Measurement		Min	Act.	Max	Unit
Channel 1 UNBAL, Tot. Volt 19.7 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 1 UNBAL, Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 1 BAL, Tot. Volt 39.5 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 1 BAL, Tot. Volt 12 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB

Measurement		Min	Act.	Max	Unit
Channel 2 UNBAL, Tot. Volt 19.7 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 2 UNBAL, Tot. Volt 6 VPP					

	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 2 BAL, Tot. Volt 39.5 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 2 BAL, Tot. Volt 12 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB

DFD d3

Measurement		Min	Act.	Max	Unit
Channel 1 UNBAL, Tot. Volt 19.7 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 1 UNBAL, Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 1 BAL, Tot. Volt 39.5 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 1 BAL, Tot. Volt 12 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB

Measurement		Min	Act.	Max	Unit
Channel 2 UNBAL, Tot. Volt 19.7 VPP					
	5.00 kHz			-90	dB

	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 2 UNBAL, Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 2 BAL, Tot. Volt 39.5 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 2 BAL, Tot. Volt 12 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB

2.3.1.7 DC Offset

Measurement		Min	Act.	Max	Unit
Residual Offset, Channel 1 UNBAL					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Residual Offset, Channel 1 BAL					
Volt Range	1.00 V	-10.00		+10.00	mV

Measurement		Min	Act.	Max	Unit
Residual Offset, Channel 2 UNBAL					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Residual Offset, Channel 2 BAL					
Volt Range	1.00 V	-10.00		+10.00	mV

Measurement		Min	Act.	Max	Unit
Setting Error DC Offset, Channel 1 UNBAL					

	+1.00 V	-2.00		+2.00	%
	-1.00 V	-2.00		+2.00	%
Setting Error DC Offset, Channel 1 BAL					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%

Measurement		Min	Act.	Max	Unit
Setting Error DC Offset, Channel 2 UNBAL					
	+1.00 V	-2.00		+2.00	%
	-1.00 V	-2.00		+2.00	%
Setting Error DC Offset, Channel 2 BAL					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%

2.3.1.8 Cross Talk Attenuation

Measurement		Min	Act.	Max	Unit
Channel 1 to 2 UNBAL					
	R = 25 Ω	115.00			dB
Channel 1 to 2 BAL					
	R = 25 Ω	115.00			dB

Measurement		Min	Act.	Max	Unit
Channel 2 to 1 UNBAL					
	R = 25 Ω	115.00			dB
Channel 2 to 1 BAL					
	R = 25 Ω	115.00			dB

2.3.1.9 Output Impedance

*) test this item only with UPPx00 from serial number 1x0100, x = 2, 4 or 8

Measurement		Min	Act.	Max	Unit
Output Impedances Channel 1					
Output Off	BAL	24.00		27.00	Ω
Output Off	UNBAL	24.00		27.00	Ω

Output Off	BAL *)	594.00		606.00	Ω
Output Off	UNBAL *)	594.00		606.00	Ω

Measurement		Min	Act.	Max	Unit
Output Impedances Channel 2					
Output Off	BAL	24.00		27.00	Ω
Output Off	UNBAL	24.00		27.00	Ω
Output Off	BAL *)	594.00		606.00	Ω
Output Off	UNBAL *)	594.00		606.00	Ω

2.3.2 Performance Test Report of Analog Analyzer

2.3.2.1 Level Error Sine

Measurement		Min	Act.	Max	Unit
Level Error Channel 1					
Range:	0.2 V	0.150 V	-0.050	0.050	dB
	0.8 V	0.600 V	-0.050	0.050	dB
	3.0 V	2.250 V	-0.050	0.050	dB
	12.0 V	9.000 V	-0.050	0.050	dB
	50.0 V	14.000 V	-0.050	0.050	dB

Measurement		Min	Act.	Max	Unit
Level Error Channel 2					
Range:	0.2 V	0.150 V	-0.050	0.050	dB
	0.8 V	0.600 V	-0.050	0.050	dB
	3.0 V	2.250 V	-0.050	0.050	dB
	12.0 V	9.000 V	-0.050	0.050	dB
	50.0 V	14.000 V	-0.050	0.050	dB

Measurement		Min	Act.	Max	Unit
Level Error Channel 3					
Range:	0.2 V	0.150 V	-0.050	0.050	dB
	0.8 V	0.600 V	-0.050	0.050	dB

	3.0 V	2.250 V	-0.050		0.050	dB
	12.0 V	9.000 V	-0.050		0.050	dB
	50.0 V	14.000 V	-0.050		0.050	dB

Measurement			Min	Act.	Max	Unit
Level Error Channel 4						
Range:	0.2 V	0.150 V	-0.050		0.050	dB
	0.8 V	0.600 V	-0.050		0.050	dB
	3.0 V	2.250 V	-0.050		0.050	dB
	12.0 V	9.000 V	-0.050		0.050	dB
	50.0 V	14.000 V	-0.050		0.050	dB

Measurement			Min	Act.	Max	Unit
Level Error Channel 5						
Range:	0.2 V	0.150 V	-0.050		0.050	dB
	0.8 V	0.600 V	-0.050		0.050	dB
	3.0 V	2.250 V	-0.050		0.050	dB
	12.0 V	9.000 V	-0.050		0.050	dB
	50.0 V	14.000 V	-0.050		0.050	dB

Measurement			Min	Act.	Max	Unit
Level Error Channel 6						
Range:	0.2 V	0.150 V	-0.050		0.050	dB
	0.8 V	0.600 V	-0.050		0.050	dB
	3.0 V	2.250 V	-0.050		0.050	dB
	12.0 V	9.000 V	-0.050		0.050	dB
	50.0 V	14.000 V	-0.050		0.050	dB

Measurement			Min	Act.	Max	Unit
Level Error Channel 7						
Range:	0.2 V	0.150 V	-0.050		0.050	dB
	0.8 V	0.600 V	-0.050		0.050	dB
	3.0 V	2.250 V	-0.050		0.050	dB

	12.0 V	9.000 V	-0.050		0.050	dB
	50.0 V	14.000 V	-0.050		0.050	dB

Measurement		Min	Act.	Max	Unit
Level Error Channel 8					
Range:	0.2 V	0.150 V	-0.050	0.050	dB
	0.8 V	0.600 V	-0.050	0.050	dB
	3.0 V	2.250 V	-0.050	0.050	dB
	12.0 V	9.000 V	-0.050	0.050	dB
	50.0 V	14.000 V	-0.050	0.050	dB

2.3.2.2 Frequency Response

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 1, Range 0.2 V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 1, Range 3.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 1, Range 12.0V					

	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 2, Range 0.2 V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 2, Range 3.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 2, Range 12.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB

	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 3, Range 0.2 V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 3, Range 3.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 3, Range 12.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 4, Range 0.2 V					

	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 4, Range 3.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 4, Range 12.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 5, Range 0.2 V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB

	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 5, Range 3.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 5, Range 12.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 6, Range 0.2 V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 6, Range 3.0V					

	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 6, Range 12.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 7, Range 0.2 V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 7, Range 3.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB

	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 7, Range 12.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 8, Range 0.2 V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 8, Range 3.0V					
	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

Measurement		Min	Act.	Max	Unit
Frequency Response, Channel 8, Range 12.0V					

	0.020 kHz	-0.100		0.100	dB
	0.100 kHz	-0.100		0.100	dB
	1.000 kHz	-0.100		0.100	dB
	10.000 kHz	-0.100		0.100	dB
	20.000 kHz	-0.100		0.100	dB
	40.000 kHz	-0.200		0.200	dB
	80.000 kHz	-0.200		0.200	dB

2.3.2.3 Phase synchronism

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 2, Range 3V					
	0.020 kHz	-0.50		+0.50	°
	1.000 kHz	-0.50		+0.50	°
	10.000 kHz	-0.50		+0.50	°
	20.000 kHz	-0.50		+0.50	°
	40.000 kHz	-1.00		+1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 2, Range 12V					
	0.020 kHz	-0.50		+0.50	°
	1.000 kHz	-0.50		+0.50	°
	10.000 kHz	-0.50		+0.50	°
	20.000 kHz	-0.50		+0.50	°
	40.000 kHz	-1.00		+1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 3, Range 3V					
	0.020 kHz	-0.50		+0.50	°
	1.000 kHz	-0.50		+0.50	°
	10.000 kHz	-0.50		+0.50	°
	20.000 kHz	-0.50		+0.50	°
	40.000 kHz	-1.00		+1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 3, Range 12V					
	0.020 kHz	-0.50		+0.50	°
	1.000 kHz	-0.50		+0.50	°
	10.000 kHz	-0.50		+0.50	°
	20.000 kHz	-0.50		+0.50	°
	40.000 kHz	-1.00		+1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 4, Range 3V					
	0.020 kHz	-0.50		+0.50	°
	1.000 kHz	-0.50		+0.50	°
	10.000 kHz	-0.50		+0.50	°
	20.000 kHz	-0.50		+0.50	°
	40.000 kHz	-1.00		+1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 4, Range 12V					
	0.020 kHz	-0.50		+0.50	°
	1.000 kHz	-0.50		+0.50	°
	10.000 kHz	-0.50		+0.50	°
	20.000 kHz	-0.50		+0.50	°
	40.000 kHz	-1.00		+1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 5, Range 3V					
	0.020 kHz	-0.50		+0.50	°
	1.000 kHz	-0.50		+0.50	°
	10.000 kHz	-0.50		+0.50	°
	20.000 kHz	-0.50		+0.50	°
	40.000 kHz	-1.00		+1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 5, Range 12V					
	0.020 kHz	-0.50		0.50	°

	1.000 kHz	-0.50		0.50	°
	10.000 kHz	-0.50		0.50	°
	20.000 kHz	-0.50		0.50	°
	40.000 kHz	-1.00		1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 6, Range 3V					
	0.020 kHz	-0.50		0.50	°
	1.000 kHz	-0.50		0.50	°
	10.000 kHz	-0.50		0.50	°
	20.000 kHz	-0.50		0.50	°
	40.000 kHz	-1.00		1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 6, Range 12V					
	0.020 kHz	-0.50		0.50	°
	1.000 kHz	-0.50		0.50	°
	10.000 kHz	-0.50		0.50	°
	20.000 kHz	-0.50		0.50	°
	40.000 kHz	-1.00		1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 7, Range 3V					
	0.020 kHz	-0.50		0.50	°
	1.000 kHz	-0.50		0.50	°
	10.000 kHz	-0.50		0.50	°
	20.000 kHz	-0.50		0.50	°
	40.000 kHz	-1.00		1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 7, Range 12V					
	0.020 kHz	-0.50		0.50	°
	1.000 kHz	-0.50		0.50	°
	10.000 kHz	-0.50		0.50	°

	20.000 kHz	-0.50		0.50	°
	40.000 kHz	-1.00		1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 8, Range 3V					
	0.020 kHz	-0.50		0.50	°
	1.000 kHz	-0.50		0.50	°
	10.000 kHz	-0.50		0.50	°
	20.000 kHz	-0.50		0.50	°
	40.000 kHz	-1.00		1.00	°

Measurement		Min	Act.	Max	Unit
Phase Synchronism, Channel 8, Range 12V					
	0.020 kHz	-0.50		0.50	°
	1.000 kHz	-0.50		0.50	°
	10.000 kHz	-0.50		0.50	°
	20.000 kHz	-0.50		0.50	°
	40.000 kHz	-1.00		1.00	°

2.3.2.4 THD&N Inherent Distortion

Measurement		Min	Act.	Max	Unit
Channel 1 bandwidth 22 kHz					
0.02 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.02 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	0.600 V (Range: 0.8 V)			-98.00	dB
0.10 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.10 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	0.600 V (Range: 0.8 V)			-98.00	dB
1.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
1.00 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB

1.00 kHz, UNBAL	0.600 V (Range: 0.8 V)			-98.00	dB
7.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
7.00 kHz, BAL	2.500 V (Range: 3V)			-100.00	dB
7.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
7.00 kHz, UNBAL	0.600 V (Range: 0.8 V)			-98.00	dB
bandwidth 40 kHz					
10.00 kHz, BAL	10.00 V (Range: 12 V)			-93.000	dB
10.00 kHz, BAL	2.500 V (Range: 3 V)			-93.000	dB
10.00 kHz, UNBAL	2.500 V (Range: 3 V)			-93.000	dB
10.00 kHz, UNBAL	0.600 V (Range: 0.8 V)			-93.000	dB
bandwidth 80 kHz					
20.00 kHz, BAL	10.00 V (Range: 12 V)			-90.000	dB
20.00 kHz, BAL	2.500 V (Range: 3 V)			-90.000	dB
20.00 kHz, UNBAL	2.500 V (Range: 3 V)			-90.000	dB
20.00 kHz, UNBAL	0.600 V (Range: 0.8 V)			-90.000	dB

Measurement		Min	Act.	Max	Unit
Channel 2					
bandwidth 22 kHz					
0.02 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.02 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
0.10 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.10 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
1.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
1.00 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
7.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
7.00 kHz, BAL	2.500 V (Range: 3V)			-100.00	dB
7.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
7.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB

bandwidth 40 kHz					
10.00 kHz, BAL	10.00 V (Range: 12 V)			-97.000	dB
10.00 kHz, BAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, UNBAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, BAL	0.600 V (Range: 0.8 V)			-97.000	dB
bandwidth 80 kHz					
20.00 kHz, BAL	10.00 V (Range: 12 V)			-94.000	dB
20.00 kHz, BAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, UNBAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, BAL	0.600 V (Range: 0.8 V)			-94.000	dB
40.00 kHz, BAL	10.00 V (Range: 12 V)			-90.000	dB
40.00 kHz, BAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, UNBAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, BAL	0.600 V (Range: 0.8 V)			-90.000	dB

Measurement		Min	Act.	Max	Unit
Channel 3					
bandwidth 22 kHz					
0.02 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.02 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
0.10 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.10 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
1.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
1.00 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
7.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
7.00 kHz, BAL	2.500 V (Range: 3V)			-100.00	dB
7.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
7.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
bandwidth 40 kHz					

10.00 kHz, BAL	10.00 V (Range: 12 V)			-97.000	dB
10.00 kHz, BAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, UNBAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, BAL	0.600 V (Range: 0.8 V)			-97.000	dB
bandwidth 80 kHz					
20.00 kHz, BAL	10.00 V (Range: 12 V)			-94.000	dB
20.00 kHz, BAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, UNBAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, BAL	0.600 V (Range: 0.8 V)			-94.000	dB
40.00 kHz, BAL	10.00 V (Range: 12 V)			-90.000	dB
40.00 kHz, BAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, UNBAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, BAL	0.600 V (Range: 0.8 V)			-90.000	dB

Measurement		Min	Act.	Max	Unit
Channel 4					
bandwidth 22 kHz					
0.02 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.02 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
0.10 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.10 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
1.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
1.00 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
7.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
7.00 kHz, BAL	2.500 V (Range: 3V)			-100.00	dB
7.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
7.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
bandwidth 40 kHz					
10.00 kHz, BAL	10.00 V (Range: 12 V)			-97.000	dB

10.00 kHz, BAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, UNBAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, BAL	0.600 V (Range: 0.8 V)			-97.000	dB
bandwidth 80 kHz					
20.00 kHz, BAL	10.00 V (Range: 12 V)			-94.000	dB
20.00 kHz, BAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, UNBAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, BAL	0.600 V (Range: 0.8 V)			-94.000	dB
40.00 kHz, BAL	10.00 V (Range: 12 V)			-90.000	dB
40.00 kHz, BAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, UNBAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, BAL	0.600 V (Range: 0.8 V)			-90.000	dB

Measurement		Min	Act.	Max	Unit
Channel 5					
bandwidth 22 kHz					
0.02 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.02 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
0.10 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.10 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
1.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
1.00 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
7.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
7.00 kHz, BAL	2.500 V (Range: 3V)			-100.00	dB
7.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
7.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
bandwidth 40 kHz					
10.00 kHz, BAL	10.00 V (Range: 12 V)			-97.000	dB
10.00 kHz, BAL	2.500 V (Range: 3 V)			-97.000	dB

10.00 kHz, UNBAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, BAL	0.600 V (Range: 0.8 V)			-97.000	dB
bandwidth 80 kHz					
20.00 kHz, BAL	10.00 V (Range: 12 V)			-94.000	dB
20.00 kHz, BAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, UNBAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, BAL	0.600 V (Range: 0.8 V)			-94.000	dB
40.00 kHz, BAL	10.00 V (Range: 12 V)			-90.000	dB
40.00 kHz, BAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, UNBAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, BAL	0.600 V (Range: 0.8 V)			-90.000	dB

Measurement		Min	Act.	Max	Unit
Channel 6					
bandwidth 22 kHz					
0.02 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.02 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
0.10 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.10 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
1.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
1.00 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
7.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
7.00 kHz, BAL	2.500 V (Range: 3V)			-100.00	dB
7.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
7.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
bandwidth 40 kHz					
10.00 kHz, BAL	10.00 V (Range: 12 V)			-97.000	dB
10.00 kHz, BAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, UNBAL	2.500 V (Range: 3 V)			-97.000	dB

10.00 kHz, BAL	0.600 V (Range: 0.8 V)			-97.000	dB
bandwidth 80 kHz					
20.00 kHz, BAL	10.00 V (Range: 12 V)			-94.000	dB
20.00 kHz, BAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, UNBAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, BAL	0.600 V (Range: 0.8 V)			-94.000	dB
40.00 kHz, BAL	10.00 V (Range: 12 V)			-90.000	dB
40.00 kHz, BAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, UNBAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, BAL	0.600 V (Range: 0.8 V)			-90.000	dB

Measurement		Min	Act.	Max	Unit
Channel 7					
bandwidth 22 kHz					
0.02 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.02 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
0.10 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.10 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
1.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
1.00 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
7.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
7.00 kHz, BAL	2.500 V (Range: 3V)			-100.00	dB
7.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
7.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
bandwidth 40 kHz					
10.00 kHz, BAL	10.00 V (Range: 12 V)			-97.000	dB
10.00 kHz, BAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, UNBAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, BAL	0.600 V (Range: 0.8 V)			-97.000	dB

bandwidth 80 kHz					
20.00 kHz, BAL	10.00 V (Range: 12 V)			-94.000	dB
20.00 kHz, BAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, UNBAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, BAL	0.600 V (Range: 0.8 V)			-94.000	dB
40.00 kHz, BAL	10.00 V (Range: 12 V)			-90.000	dB
40.00 kHz, BAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, UNBAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, BAL	0.600 V (Range: 0.8 V)			-90.000	dB

Measurement		Min	Act.	Max	Unit
Channel 8					
bandwidth 22 kHz					
0.02 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.02 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.02 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
0.10 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
0.10 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
0.10 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
1.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
1.00 kHz, BAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
1.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
7.00 kHz, BAL	10.00 V (Range: 12 V)			-100.00	dB
7.00 kHz, BAL	2.500 V (Range: 3V)			-100.00	dB
7.00 kHz, UNBAL	2.500 V (Range: 3 V)			-100.00	dB
7.00 kHz, BAL	0.600 V (Range: 0.8 V)			-100.00	dB
bandwidth 40 kHz					
10.00 kHz, BAL	10.00 V (Range: 12 V)			-97.000	dB
10.00 kHz, BAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, UNBAL	2.500 V (Range: 3 V)			-97.000	dB
10.00 kHz, BAL	0.600 V (Range: 0.8 V)			-97.000	dB
bandwidth 80 kHz					

20.00 kHz, BAL	10.00 V (Range: 12 V)			-94.000	dB
20.00 kHz, BAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, UNBAL	2.500 V (Range: 3 V)			-94.000	dB
20.00 kHz, BAL	0.600 V (Range: 0.8 V)			-94.000	dB
40.00 kHz, BAL	10.00 V (Range: 12 V)			-90.000	dB
40.00 kHz, BAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, UNBAL	2.500 V (Range: 3 V)			-90.000	dB
40.00 kHz, BAL	0.600 V (Range: 0.8 V)			-90.000	dB

2.3.2.5 MOD DIST Inherent Distortion

Measurement		Min	Act.	Max	Unit
Channel 1				-80.00	dB
Channel 2				-80.00	dB
Channel 3				-80.00	dB
Channel 4				-80.00	dB
Channel 5				-80.00	dB
Channel 6				-80.00	dB
Channel 7				-80.00	dB
Channel 8				-80.00	dB

2.3.2.6 DFD Inherent Distortion

Measurement		Min	Act.	Max	Unit
DFD d2					
Channel 1				-100.00	dB
Channel 2				-100.00	dB
Channel 3				-100.00	dB
Channel 4				-100.00	dB
Channel 5				-100.00	dB
Channel 6				-100.00	dB
Channel 7				-100.00	dB
Channel 8				-100.00	dB

Measurement		Min	Act.	Max	Unit
DFD d3					
Channel 1				-90.000	dB
Channel 2				-90.000	dB
Channel 3				-90.000	dB
Channel 4				-90.000	dB
Channel 5				-90.000	dB
Channel 6				-90.000	dB
Channel 7				-90.000	dB
Channel 8				-90.000	dB

2.3.2.7 Inherent Noise

Measurement		Min	Act.	Max	Unit
Channel 1	CCIR unwtd			2.00	µV
	A Weighting			1.50	µV
Channel 2	CCIR unwtd			2.00	µV
	A Weighting			1.50	µV
Channel 3	CCIR unwtd			2.00	µV
	A Weighting			1.50	µV
Channel 4	CCIR unwtd			2.00	µV
	A Weighting			1.50	µV
Channel 5	CCIR unwtd			2.00	µV
	A Weighting			1.50	µV
Channel 6	CCIR unwtd			2.00	µV
	A Weighting			1.50	µV
Channel 7	CCIR unwtd			2.00	µV
	A Weighting			1.50	µV
Channel 8	CCIR unwtd			2.00	µV
	A Weighting			1.50	µV

2.3.2.8 DC Measurement

Measurement Error

Measurement	Range 3 V	Min	Act.	Max	Unit
Channel 1					
	+3.00 V	-1.20		+1.20	%
	-3.00 V	-1.20		+1.20	%
	+0.30 V	-3.00		+3.00	%
	-0.30 V	-3.00		+3.00	%
Channel 2					
	+3.00 V	-1.20		+1.20	%
	-3.00 V	-1.20		+1.20	%
	+0.30 V	-3.00		+3.00	%
	-0.30 V	-3.00		+3.00	%
Channel 3					
	+3.00 V	-1.20		+1.20	%
	-3.00 V	-1.20		+1.20	%
	+0.30 V	-3.00		+3.00	%
	-0.30 V	-3.00		+3.00	%
Channel 4					
	+3.00 V	-1.20		+1.20	%
	-3.00 V	-1.20		+1.20	%
	+0.30 V	-3.00		+3.00	%
	-0.30 V	-3.00		+3.00	%
Channel 5					
	+3.00 V	-1.20		+1.20	%
	-3.00 V	-1.20		+1.20	%
	+0.30 V	-3.00		+3.00	%
	-0.30 V	-3.00		+3.00	%
Channel 6					
	+3.00 V	-1.20		+1.20	%
	-3.00 V	-1.20		+1.20	%
	+0.30 V	-3.00		+3.00	%
	-0.30 V	-3.00		+3.00	%
Channel 7					
	+3.00 V	-1.20		+1.20	%
	-3.00 V	-1.20		+1.20	%

	+0.30 V	-3.00		+3.00	%
	-0.30 V	-3.00		+3.00	%
Channel 8					
	+3.00 V	-1.20		+1.20	%
	-3.00 V	-1.20		+1.20	%
	+0.30 V	-3.00		+3.00	%
	-0.30 V	-3.00		+3.00	%

2.3.2.9 Cross Talk Attenuation

Measurement		Min	Act.	Max	Unit
other channels --> Ch 1					
	UNBAL	100.00			dB
	BAL	100.00			dB
other channels --> Ch 2					
	UNBAL	100.00			dB
	BAL	100.00			dB
other channels --> Ch 3					
	UNBAL	100.00			dB
	BAL	100.00			dB
other channels --> Ch 4					
	UNBAL	100.00			dB
	BAL	100.00			dB
other channels --> Ch 5					
	UNBAL	100.00			dB
	BAL	100.00			dB
other channels --> Ch 6					
	UNBAL	100.00			dB
	BAL	100.00			dB
other channels --> Ch 7					
	UNBAL	100.00			dB
	BAL	100.00			dB
other channels --> Ch 8					

	UNBAL	100.00			dB
	BAL	100.00			dB

2.3.2.10 Common Mode Rejection CMMR

Measurement		Min	Act.	Max	Unit
CMRR Channel 1					
range 0.200 V	frequency 1 kHz	50.00			dB
range 0.200 V	frequency 20 kHz	50.00			dB
range 3.000 V	frequency 1 kHz	50.00			dB
range 3.000 V	frequency 20 kHz	50.00			dB
CMRR Channel 2					
range 0.200 V	frequency 1 kHz	50.00			dB
range 0.200 V	frequency 20 kHz	50.00			dB
range 3.000 V	frequency 1 kHz	50.00			dB
range 3.000 V	frequency 20 kHz	50.00			dB
CMRR Channel 3					
range 0.200 V	frequency 1 kHz	50.00			dB
range 0.200 V	frequency 20 kHz	50.00			dB
range 3.000 V	frequency 1 kHz	50.00			dB
range 3.000 V	frequency 20 kHz	50.00			dB
CMRR Channel 4					
range 0.200 V	frequency 1 kHz	50.00			dB
range 0.200 V	frequency 20 kHz	50.00			dB
range 3.000 V	frequency 1 kHz	50.00			dB
range 3.000 V	frequency 20 kHz	50.00			dB
CMRR Channel 5					
range 0.200 V	frequency 1 kHz	50.00			dB
range 0.200 V	frequency 20 kHz	50.00			dB
range 3.000 V	frequency 1 kHz	50.00			dB
range 3.000 V	frequency 20 kHz	50.00			dB
CMRR Channel 6					
range 0.200 V	frequency 1 kHz	50.00			dB
range 0.200 V	frequency 20 kHz	50.00			dB
range 3.000 V	frequency 1 kHz	50.00			dB

range 3.000 V	frequency 20 kHz	50.00			dB
CMRR Channel 7					
range 0.200 V	frequency 1 kHz	50.00			dB
range 0.200 V	frequency 20 kHz	50.00			dB
range 3.000 V	frequency 1 kHz	50.00			dB
range 3.000 V	frequency 20 kHz	50.00			dB
CMRR Channel 8					
range 0.200 V	frequency 1 kHz	50.00			dB
range 0.200 V	frequency 20 kHz	50.00			dB
range 3.000 V	frequency 1 kHz	50.00			dB
range 3.000 V	frequency 20 kHz	50.00			dB

2.3.2.11 Input Impedance

*) test this item only with UPPx00 from serial number 1x0100, x = 2, 4 or 8

Measurement		Min	Act.	Max	Unit
Input Impedances					
Channel 1		198000		202000	Ω
Channel 2		198000		202000	Ω
Channel 3		198000		202000	Ω
Channel 4		198000		202000	Ω
Channel 5		198000		202000	Ω
Channel 6		198000		202000	Ω
Channel 7		198000		202000	Ω
Channel 8		198000		202000	Ω
Channel 1 *)		594		606	Ω
Channel 2 *)		594		606	Ω
Channel 3 *)		594		606	Ω
Channel 4 *)		594		606	Ω
Channel 5 *)		594		606	Ω
Channel 6 *)		594		606	Ω
Channel 7 *)		594		606	Ω
Channel 8 *)		594		606	Ω

2.3.3 Performance Test Report Audio Monitor

Measurement		Min	Act.	Max	Unit
Level Accuracy					
Channel 1					
until Ser. 1x0099, x = 2, 4 or 8	1.000 kHz	1.980		2.420	V
from Ser. 1x0100, x = 2, 4 or 8		2.160		2.640	V
Channel 2					
until Ser. 1x0099, x = 2, 4 or 8	1.000 kHz	1.980		2.420	V
from Ser. 1x0100, x = 2, 4 or 8		2.160		2.640	V

Measurement		Min	Act.	Max	Unit
Frequency response					
Channel 1					
	0.020 kHz	-1.00		0.00	dB
	1.000 kHz	0.00		0.00	dB
	20.000 kHz	-1.00		0.00	dB
	80.000 kHz	-3.00		0.00	dB
Channel 2					
	0.020 kHz	-1.00		0.00	dB
	1.000 kHz	0.00		0.00	dB
	20.000 kHz	-1.00		0.00	dB
	80.000 kHz	-3.00		0.00	dB

*) test this item only with UPPx from serial number 1x0100, x = 2, 4 or 8

Measurement		Min	Act.	Max	Unit
DC Voltage *)					
Channel 1					
		-5.05		-4.95	V
		+4.95		+5.05	V
Channel 2					

		-5.05		-4.95	V
		+4.95		+5.05	V

2.3.4 Performance Test of R&S UPP-B2

Audio Analyzer R&S UPP

Option R&S UPP-B2 (Digital Audio & I2S IO 192 kHz)

Order No. 1411.2300.02

Serial No:.....

Date:.....

Name:.....

I2S Performance Test					
Step	Measurement	Min.	Act.	Max.	Unit
Frequency Error Digital Masterclock					
UPP I2S Gen Global:					
• -					
UPP I2S Gen:	Frequency	24.575980		24.576020	MHz
• Sample Freq: 192.0000kHz					
Internal Synchronisation I2S					
UPP I2S Gen Global:					
• Signal Type: Sine					
• Frequency: 997Hz					
• Voltage: 01.FS					
UPP I2S Gen:	RMS:	-20.000		-20.000	dBFS
• Sample Freq: 8.0000kHz					
	Input Peak:	-20.000		-20.000	dBFS
	Frequency:	996.990		997.010	Hz
	Samplerate:	7.99992		8.00008	kHz
UPP I2S Gen:	RMS:	-20.000		-20.000	dBFS
• Sample Freq: 192.0000kHz					
	Input Peak:	-20.000		-20.000	dBFS
	Frequency:	996.990		997.010	Hz
	Samplerate:	191.99808		192.00198	kHz
External Synchronisation I2S (Extern Masterclock)					
UPP I2S Gen Global:					
• Signal Type: Sine					
• Frequency: 997Hz					
• Voltage: 01.FS					
UPP I2S Gen:	RMS:	-20.010		-19.990	dBFS
• Sample Freq: 8.0000kHz					
	Input Peak:	-20.000		-20.000	dBFS
UPV Trigger Output:	Frequency:	996.900		997.100	Hz
• Frequency: 1024kHz					
	Samplerate:	7.9990		8.0010	kHz

UPP I2S Gen: • Sample Freq: 192.0000kHz	RMS:	-20.010		-19.990	dBFS
UPV Trigger Output:	Input Peak:	-20.000		-20.000	dBFS
• Frequency: 24576kHz	Frequency:	996.900		997.100	Hz
	Samplerate:	191.9900		192.0100	kHz
External Synchronisation I2S (Extern Wordclk)					
UPP I2S Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP I2S Gen: • Sample Freq: 8.0000kHz	RMS:	-20.010		-19.990	dBFS
UPV Trigger Output:	Input Peak:	-20.000		-20.000	dBFS
• Frequency: 8.0000kHz	Frequency:	996.900		997.100	Hz
	Samplerate:	7.9990		8.0010	kHz
UPP I2S Gen: • Sample Freq: 192.0000kHz	RMS:	-20.010		-19.990	dBFS
UPV Trigger Output:	Input Peak:	-20.000		-20.000	dBFS
• Frequency: 192.0000kHz	Frequency:	996.900		997.100	Hz
	Samplerate:	191.9900		192.0100	kHz
I2S Analyzer					
UPP I2S Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP I2S Gen: • Sample Freq: 8.0000kHz	RMS:	-20.000		-20.000	dBFS
	Input Peak:	-20.000		-20.000	dBFS
	Frequency:	996.990		997.010	Hz
	Samplerate:	7.99992		8.00008	kHz
UPP I2S Gen: • Sample Freq: 192.0000kHz	RMS:	-20.000		-20.000	dBFS
	Input Peak:	-20.000		-20.000	dBFS
	Frequency:	996.990		997.010	Hz
	Samplerate:	191.99808		192.00198	kHz

Digital Audio Performance Test					
Step	Measurement	Min.	Act.	Max.	Unit
Level Error Digital Audio (Option 1: Oscilloscope)					
UPP Digital Audio Gen Global: • no load asymmetrical					
Bal Ampl: 8.0000V	Peak-Peak	7.95		8.05	VPP
Level Error Digital Audio (Option 2: Frequency counter)					
UPP Digital Audio Gen Global: • on a 50 Ω load resistance					
Unbal Ampl: 1.0000V	Peak-Peak	0.825		0.96	VPP
Internal Synchronisation Digital Audio					

UPP Digital Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP Digital Audio Gen: • Sample Freq: 32.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.000 -20.000 996.990 31.99997		-20.000 -20.000 997.010 32.00003	dBFS dBFS Hz kHz
UPP Digital Audio Gen: • Sample Freq: 192.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.000 -20.000 996.990 191.99808		-20.000 -20.000 997.010 192.00198	dBFS dBFS Hz kHz
External Synchronisation Digital Audio (Ext Clock)					
UPP Digital Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP Digital Audio Gen: • Sample Freq: 32.0000kHz UPV Trigger Output: • Frequency: 32.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 31.990		-19.990 -20.000 997.100 32.010	dBFS dBFS Hz kHz
UPP Digital Audio Gen: • Sample Freq: 192.0000kHz UPV Trigger Output: • Frequency: 192.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 191.9900		-19.990 -20.000 997.100 192.0100	dBFS dBFS Hz kHz
Analyzer Input Test Digital Audio					
UPP Digital Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP Digital Audio Gen: • Input: Unbal(BNC)	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.990 191.99808		-19.990 -20.000 997.010 192.00198	dBFS dBFS Hz kHz
UPP Digital Audio Gen: • Input: Bal	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.990 191.99808		-19.990 -20.000 997.010 192.00198	dBFS dBFS Hz kHz

UPP Digital Audio Gen: • Input: Optical	RMS:	-20.010		-19.990	dBFS
	Input Peak:	-20.000		-20.000	dBFS
	Frequency:	996.900		997.100	Hz
	Samplerate:	191.99808		192.00198	kHz
UPP Digital Audio Gen: • Input: Intern	RMS:	-20.010		-19.990	dBFS
	Input Peak:	-20.000		-20.000	dBFS
	Frequency:	996.900		997.100	Hz
	Samplerate:	191.99808		192.00198	kHz

2.3.5 Performance Test of R&S UPP-B4

Audio Analyzer R&S UPP

Option R&S UPP-B4 (Digital HDMI /Audio IO)

Order No. 1411.2500.02

Serial No:.....

Date:.....

Name:.....

I2S Performance Test					
Step	Measurement	Min.	Act.	Max.	Unit
Frequency Error Digital Masterclock					
UPP I2S Gen Global: • -					
UPP I2S Gen: • Sample Freq: 192.0000kHz	Frequency	24.575980		24.576020	MHz
Internal Synchronisation I2S					
UPP I2S Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP I2S Gen: • Sample Freq: 8.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.000 -20.000 996.990 7.99992		-20.000 -20.000 997.010 8.00008	dBFS dBFS Hz kHz
UPP I2S Gen: • Sample Freq: 192.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.000 -20.000 996.990 191.99808		-20.000 -20.000 997.010 192.00198	dBFS dBFS Hz kHz
External Synchronisation I2S (Extern Masterclock)					

UPP I2S Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP I2S Gen: • Sample Freq: 8.0000kHz UPV Trigger Output: • Frequency: 1024kHz	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 7.9990		-19.990 -20.000 997.100 8.0010	dBFS dBFS Hz kHz
UPP I2S Gen: • Sample Freq: 192.0000kHz UPV Trigger Output: • Frequency: 24576kHz	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 191.9900		-19.990 -20.000 997.100 192.0100	dBFS dBFS Hz kHz
External Synchronisation I2S (Extern Wordclk)					
UPP I2S Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP I2S Gen: • Sample Freq: 8.0000kHz UPV Trigger Output: • Frequency: 8.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 7.9990		-19.990 -20.000 997.100 8.0010	dBFS dBFS Hz kHz
UPP I2S Gen: • Sample Freq: 192.0000kHz UPV Trigger Output: • Frequency: 192.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 191.9900		-19.990 -20.000 997.100 192.0100	dBFS dBFS Hz kHz
I2S Analyzer					
UPP I2S Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP I2S Gen: • Sample Freq: 8.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.000 -20.000 996.990 7.99992		-20.000 -20.000 997.010 8.00008	dBFS dBFS Hz kHz
UPP I2S Gen: • Sample Freq: 192.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.000 -20.000 996.990 191.99808		-20.000 -20.000 997.010 192.00198	dBFS dBFS Hz kHz

Digital Audio Performance Test

Step	Measurement	Min.	Act.	Max.	Unit
Level Error Digital Audio (Option 1: Oscilloscope)					
UPP Digital Audio Gen Global: • no load asymmetrical					

Bal Ampl: 8.0000V	Peak-Peak	7.95		8.05	VPP
Level Error Digital Audio (Option 2: Frequency counter)					
UPP Digital Audio Gen Global: • on a 50 Ω load resistance					
Unbal Ampl: 1.0000V	Peak-Peak	0.825		0.96	VPP
Internal Synchronisation Digital Audio					
UPP Digital Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP Digital Audio Gen: • Sample Freq: 32.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.000 -20.000 996.990 31.99997		-20.000 -20.000 997.010 32.00003	dBFS dBFS Hz kHz
UPP Digital Audio Gen: • Sample Freq: 192.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.000 -20.000 996.990 191.99808		-20.000 -20.000 997.010 192.00198	dBFS dBFS Hz kHz
External Synchronisation Digital Audio (Ext Clock)					
UPP Digital Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP Digital Audio Gen: • Sample Freq: 32.0000kHz UPV Trigger Output: • Frequency: 32.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 31.990		-19.990 -20.000 997.100 32.010	dBFS dBFS Hz kHz
UPP Digital Audio Gen: • Sample Freq: 192.0000kHz UPV Trigger Output: • Frequency: 192.0000kHz	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 191.9900		-19.990 -20.000 997.100 192.0100	dBFS dBFS Hz kHz
Analyzer Input Test Digital Audio					
UPP Digital Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP Digital Audio Gen: • Input: Unbal(BNC)	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.990 191.99808		-19.990 -20.000 997.010 192.00198	dBFS dBFS Hz kHz

UPP Digital Audio Gen: • Input: Bal	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.990 191.99808		-19.990 -20.000 997.010 192.00198	dBFS dBFS Hz kHz
UPP Digital Audio Gen: • Input: Optical	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 191.99808		-19.990 -20.000 997.100 192.00198	dBFS dBFS Hz kHz
UPP Digital Audio Gen: • Input: Intern	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 191.99808		-19.990 -20.000 997.100 192.00198	dBFS dBFS Hz kHz

HDMI Performance Test					
Step	Measurement	Min.	Act.	Max.	Unit
HDMI Sink - Source Bit Error Test					
UPP HDMI Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP HDMI Audio Gen: • Sample Freq: 48.0000kHz UPP HDMI Video Gen: • Video Format: ID 16	BERT: Input Peak: Frequency: Samplerate:	0.000 -20.000 996.990 47.99997		0.000 -20.000 997.010 48.00003	% dBFS Hz kHz
HDMI ARC Sink Loopback					
UPP HDMI Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP HDMI Audio Gen: • Sample Freq: 48.0000kHz UPP HDMI Video Gen: • Video Format: ID 16	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 47.990		-19.990 -20.000 997.100 48.010	dBFS dBFS Hz kHz
HDMI ARC Dig Audio Gen					
UPP Digital Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP Digital Audio Gen: • Sample Freq: 48.0000kHz UPP HDMI Video Gen: • Video Format: ID 16	RMS: Input Peak: Frequency: Samplerate:	-20.010 -20.000 996.900 47.990		-19.990 -20.000 997.100 48.010	dBFS dBFS Hz kHz
HDMI DSP Test					

UPP HDMI Audio Gen Global: • Signal Type: Play • File: DSPTEST.wav					
UPP HDMI Video Gen: • Video Format: ID 1	RMS: Input Peak: Frequency: Samplerate:	-24.020 -24.020 156.240 47.990		-24.000 -24.000 156.260 48.010	dBFS dBFS Hz kHz
HDMI AUX_In- AUX_Out Bit Error Test					
UPP HDMI Audio Gen Global: • Signal Type: Sine • Frequency: 997Hz • Voltage: 01.FS					
UPP HDMI Audio Gen: • Sample Freq: 48.000kHz UPP HDMI Video Gen: • Video Format: ID 16	BERT:	0.000		0.000	%

2.3.6 Performance Test Report of R&S UPP-B8

Audio Analyzer R&S UPP

Option R&S UPP-B8 (Eight-Channel Generator)

Order No. 1411.2700.02

Serial No:.....

Date:.....

Name:.....

2.3.6.1 Level Error Sine

Measurement		Min	Act.	Max	Unit
Channel 3					
	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB
Channel 4					
	7.00 V	-0.05		+0.05	dB

	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB
Channel 5					
	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB
Channel 6					
	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB
Channel 7					
	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB
Channel 8					
	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB
Channel 9					

	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB
Channel 10					
	7.00 V	-0.05		+0.05	dB
	4.00 V	-0.05		+0.05	dB
	2.00 V	-0.05		+0.05	dB
	1.00 V	-0.05		+0.05	dB
	0.50 V	-0.05		+0.05	dB

2.3.6.2 Frequency Response

Measurement, 1 V		Min	Act.	Max	Unit
Output Channel 3					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB
Output Channel 4					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB
Output Channel 5					

	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB
Output Channel 6					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB
Output Channel 7					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB
Output Channel 8					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB

Output Channel 9					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB
Output Channel 10					
	0.01 kHz	-0.10		+0.10	dB
	0.10 kHz	-0.10		+0.10	dB
	1.00 kHz	-0.10		+0.10	dB
	10.00 kHz	-0.10		+0.10	dB
	20.00 kHz	-0.10		+0.10	dB
	40.00 kHz	-0.20		+0.20	dB
	80.00 kHz	-0.20		+0.20	dB

2.3.6.3 Frequency Uncertainty

Measurement		Min	Act.	Max	Unit
Channel 3					
	1000.000 Hz	-10.00		+10.00	ppm
Channel 4					
	1000.000 Hz	-10.00		+10.00	ppm
Channel 5					
	1000.000 Hz	-10.00		+10.00	ppm
Channel 6					
	1000.000 Hz	-10.00		+10.00	ppm

Channel 7					
	1000.000 Hz	-10.00		+10.00	ppm
Channel 8					
	1000.000 Hz	-10.00		+10.00	ppm
Channel 9					
	1000.000 Hz	-10.00		+10.00	ppm
Channel 10					
	1000.000 Hz	-10.00		+10.00	ppm

2.3.6.4 THD Inherent Distortion

Channel and Frequency		Min	Act.	Max	Unit
Channel 3					
Measurement at 20 Hz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 1 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 7 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 4					
Measurement at 20 Hz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 1 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 7 kHz					
	7.00 V			-100.00	dB

	2.50 V			-100.00	dB
Channel 5					
Measurement at 20 Hz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 1 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 7 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 6					
Measurement at 20 Hz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 1 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 7 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 7					
Measurement at 20 Hz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 1 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 7 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB

Channel 8					
Measurement at 20 Hz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 1 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 7 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 9					
Measurement at 20 Hz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 1 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 7 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Channel 10					
Measurement at 20 Hz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 1 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB
Measurement at 7 kHz					
	7.00 V			-100.00	dB
	2.50 V			-100.00	dB

2.3.6.5 MOD DIST Inherent Distortion

Measurement		Min	Act.	Max	Unit
Channel 3					
Tot. Volt 19.75 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Tot. Volt 6 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 4					
Tot. Volt 19.75 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Tot. Volt 6 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 5					
Tot. Volt 19.75 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB

Tot. Volt 6 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 6					
Tot. Volt 19.75 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Tot. Volt 6 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 7					
Tot. Volt 19.75 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Tot. Volt 6 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 8					

Tot. Volt 19.75 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Tot. Volt 6 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 9					
Tot. Volt 19.75 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Tot. Volt 6 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Channel 10					
Tot. Volt 19.75 VPP					
	4.00 kHz			-80.00	dB
	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB
Tot. Volt 6 VPP					
	4.00 kHz			-80.00	dB

	7.00 kHz			-80.00	dB
	10.00 kHz			-80.00	dB
	20.00 kHz			-80.00	dB

2.3.6.6 DFD Inherent Distortion

DFD d2

Measurement		Min	Act.	Max	Unit
Channel 3					
Tot. Volt 19.75 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 4					
Tot. Volt 19.75 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 5					
Tot. Volt 19.75 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB

	20.00 kHz			-110	dB
Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 6					
Tot. Volt 19.75 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 7					
Tot. Volt 19.75 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 8					
Tot. Volt 19.75 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB

Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 9					
Tot. Volt 19.75 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Channel 10					
Tot. Volt 19.75 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB
Tot. Volt 6 VPP					
	5.00 kHz			-110	dB
	10.00 kHz			-110	dB
	20.00 kHz			-110	dB

DFD d3

Measurement		Min	Act.	Max	Unit
Channel 3					
Tot. Volt 19.75 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB

	20.00 kHz			-90	dB
Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 4					
Tot. Volt 19.75 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 5					
Tot. Volt 19.75 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 6					
Tot. Volt 19.75 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB

Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 7					
Tot. Volt 19.75 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 8					
Tot. Volt 19.75 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 9					
Tot. Volt 19.75 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB

Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Channel 10					
Tot. Volt 19.75 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB
Tot. Volt 6 VPP					
	5.00 kHz			-90	dB
	10.00 kHz			-90	dB
	20.00 kHz			-90	dB

2.3.6.7 DC Offset

Measurement		Min	Act.	Max	Unit
Channel 3					
Residual Offset					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Setting Error DC Offset					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%
Channel 4					
Residual Offset					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV

Setting Error DC Offset					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%
Channel 5					
Residual Offset					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Setting Error DC Offset					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%
Channel 6					
Residual Offset					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Setting Error DC Offset					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%
Channel 7					
Residual Offset					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Setting Error DC Offset					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%

Channel 8					
Residual Offset					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Setting Error DC Offset					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%
Channel 9					
Residual Offset					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Setting Error DC Offset					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%
Channel 10					
Residual Offset					
Volt Range	7.00 V	-70.00		+70.00	mV
	4.00 V	-40.00		+40.00	mV
	0.50 V	-5.00		+5.00	mV
Setting Error DC Offset					
	+2.00 V	-2.00		+2.00	%
	-2.00 V	-2.00		+2.00	%

2.3.6.8 Cross Talk Attenuation

Measurement		Min	Act.	Max	Unit
Channel 3					
3 to 4		115.00			dB

Channel 4					
4 to 3		115.00			dB
4 to 5		115.00			dB
Channel 5					
5 to 4		115.00			dB
5 to 6		115.00			dB
Channel 6					
6 to 5		115.00			dB
6 to 7		115.00			dB
Channel 7					
7 to 6		115.00			dB
7 to 8		115.00			dB
Channel 8					
8 to 7		115.00			dB
8 to 9		115.00			dB
Channel 9					
9 to 8		115.00			dB
9 to 10		115.00			dB
Channel 10					
10 to 9		115.00			dB

2.3.6.9 Output Impedance

"Output Off" means no tick in the check box.

Measurement		Min	Act.	Max	Unit
Channel 3					
Output Off		24.00		27.00	Ω

Channel 4					
Output Off		24.00		27.00	Ω
Channel 5					
Output Off		24.00		27.00	Ω
Channel 6					
Output Off		24.00		27.00	Ω
Channel 7					
Output Off		24.00		27.00	Ω
Channel 8					
Output Off		24.00		27.00	Ω
Channel 9					
Output Off		24.00		27.00	Ω
Channel 10					
Output Off		24.00		27.00	Ω

2.3.6.10 Digital Audio

Step	Measurement	Min.	Act.	Max.	Unit
Physical Level Error Digital Audio (Oscilloscope)					
Unbal Ampl: 0.5000V	Peak-Peak	0.96		1.04	VPP
UPP Digital Audio Data Content: - Signal Type: Sine - Frequency: 997Hz - Voltage: 01.FS					
Channel 3					
Sample Freq: 32.0000kHz	RMS: Frequency: Samplerate:	-19.999 996.90 31.999		-20.001 997.10 32.001	dBFS Hz kHz
Sample Freq: 192.0000kHz	RMS: Frequency: Samplerate:	-19.999 996.90 191.994		-20.001 997.10 192.006	dBFS Hz kHz

Channel 4					
Sample Freq: 32.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	31.999		32.001	kHz
Sample Freq: 192.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	191.994		192.006	kHz
Channel 5					
Sample Freq: 32.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	31.999		32.001	kHz
Sample Freq: 192.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	191.994		192.006	kHz
Channel 6					
Sample Freq: 32.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	31.999		32.001	kHz
Sample Freq: 192.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	191.994		192.006	kHz
Channel 7					
Sample Freq: 32.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	31.999		32.001	kHz
Sample Freq: 192.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	191.994		192.006	kHz
Channel 8					
Sample Freq: 32.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	31.999		32.001	kHz
Sample Freq: 192.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	191.994		192.006	kHz
Channel 9					
Sample Freq: 32.0000kHz	RMS:	-19.999		-20.001	dBFS
	Frequency:	996.90		997.10	Hz
	Samplerate:	31.999		32.001	kHz

Sample Freq: 192.0000kHz	RMS: Frequency: Samplerate:	-19.999 996.90 191.994		-20.001 997.10 192.006	dBFS Hz kHz
Channel 10					
Sample Freq: 32.0000kHz	RMS: Frequency: Samplerate:	-19.999 996.90 31.999		-20.001 997.10 32.001	dBFS Hz kHz
Sample Freq: 192.0000kHz	RMS: Frequency: Samplerate:	-19.999 996.90 191.994		-20.001 997.10 192.006	dBFS Hz kHz

3 Adjustment

3.1 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 commonmode rejection).

This section describes how the adjustment measurements are to be performed and how the correction factors are calculated and stored in the R&S UPP.

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

Manual adjustment with additional tools

By varying the value of appropriate components (e.g. potentiometers) 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 UPP 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 UPP: 1 hour

3.2 Recommended Measuring Equipment

For the recommended measuring equipment refer to [Chapter 2.1, "Measuring Equipment and Accessories"](#), on page 13.

3.3 Manual Adjustment with Additional Tools

3.3.1 Analog Generator

Preparation:

- Open the R&S UPP.
 - Switch off the R&S UPP and disconnect the power cable.
 - Place the R&S UPP 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 UPP such that the analog audio board (AAB) points upward (place the R&S UPP upside down).
- All adjustment devices are to be found on the AAB unit.
- To simplify the operation of the R&S UPP in this position, we recommend that you connect an external monitor, external keyboard and a mouse.
- Switch on the R&S UPP.

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

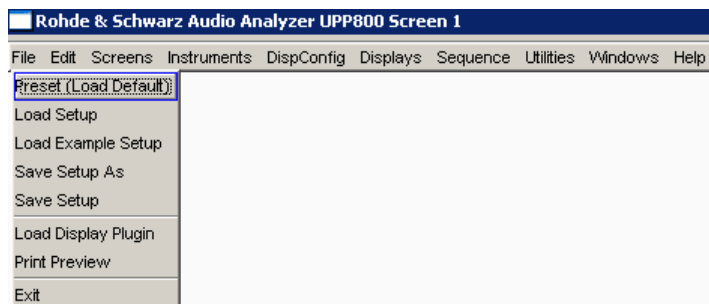
Before starting the adjustment, set the R&S UPP to a defined initial status.

To do this, call up the default setting:

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.

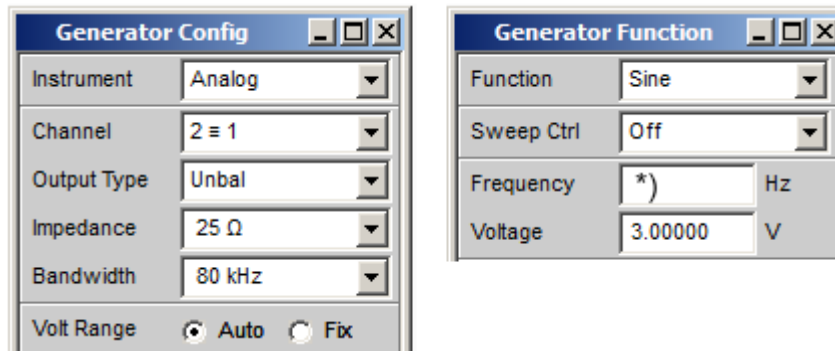


3.3.1.1 Adjustment of the Frequency Response

Note:

Other adjustment procedures are not affected by this adjustment.

Set R&S UPP:



*) Set the frequency to 1 kHz for reference measurement and to 70 kHz for adjustment.

Meas. instrument:

AC voltmeter.

Relative display in Δ dB, reference corresponding to adjustment instructions.

Setup:

Connect the AC voltmeter to the output of the R&S UPP generator. You will need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17.

Adjustment:

- Set the frequency of the R&S UPP generator to 1 kHz.
- Measure the AC voltage and note the measured value as the reference.
Set the frequency of the R&S UPP generator to 70 kHz.
- Use R760 (Channel 1) and R761 (Channel 2) to adjust to the reference, tolerance $0 \text{ dB} \pm 0.01 \text{ dB}$.

Control:

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

3.3.1.2 Position of Adjustment Components on AAB

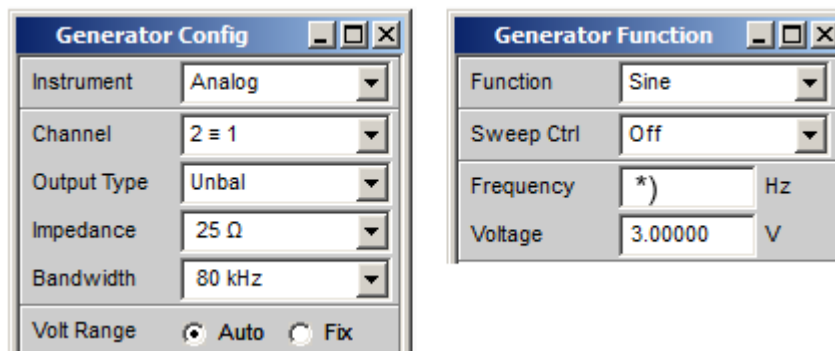


Figure 3-1: Trim resistors for frequency response adjustment

3.3.2 Option R&S UPP-B8 Multi Channel Generator

Preparation:

- Open the R&S UPP.
 - Switch off the R&S UPP and disconnect the power cable.
 - Place the R&S UPP 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 UPP such that the option R&S UPP-B8 points upward.
- All adjustment devices are to be found on the option unit.
- To simplify the operation, we recommend that you connect an external monitor, external keyboard and a mouse.
- Switch on the R&S UPP.

For a description of how to adapt the measuring instruments to the output of the generator, see section "R&S UPP-B8" in Chapter 1.

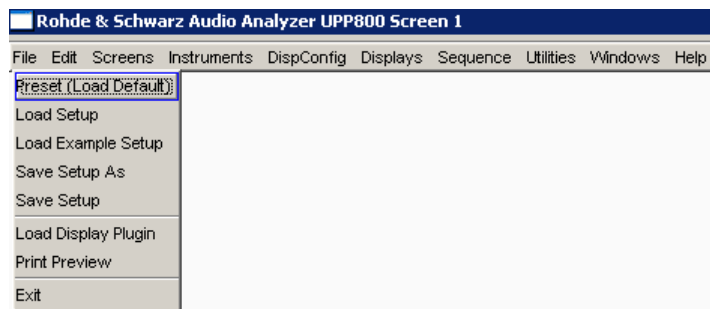
Before starting the adjustment, set the R&S UPP to a defined initial status.

To do this, call up the default setting:

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.

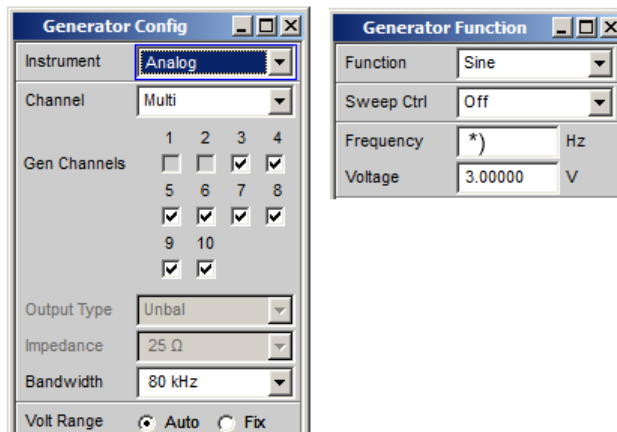


3.3.2.1 Adjustment of the Frequency Response

Note:

Other adjustment procedures are not affected by this adjustment.

Set R&S UPP:



*) Set the frequency to 1 kHz for reference measurement and to 70 kHz for adjustment.

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 UPP-B8 generator. Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors. You will additionally need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17.

Adjustment:

- Set the frequency of the R&S UPP-B8 generator to 1 kHz.
- Measure the AC voltage and note the measured value as the reference.
Set the frequency of the R&S UPP-B8 generator to 70 kHz.
- Use the following components for the different channels to adjust to the reference, tolerance $0 \text{ dB} \pm 0.01 \text{ dB}$.

- Channel 3: R12056
- Channel 4: R12057
- Channel 5: R13056
- Channel 6: R13057
- Channel 7: R14056
- Channel 8: R14057
- Channel 9: R15056
- Channel 10: R15057

Control:

Check frequency response at 2 V, all eight channels as described under Performance Test.

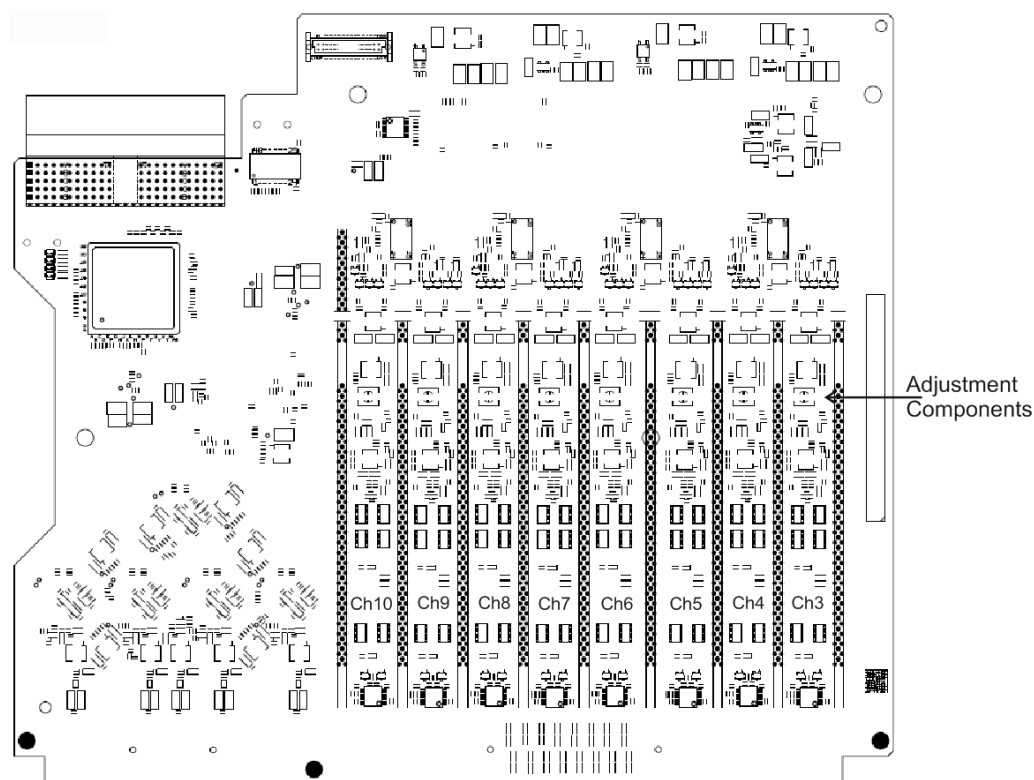
3.3.2.2 Position of Adjustment Components on R&S UPP-B8

Figure 3-2: Trim resistors for frequency response adjustment

3.4 Software Adjustment

3.4.1 Procedure

In the R&S UPP, 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 UPP 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 UPP on an EEPROM and also on the hard disk for the sake of redundancy. The EEPROMs are located on the analog audio board (AAB) and on the digital audio board (options R&S UPP-B2 and R&S UPP-B4) as well as on the multi channel generator (option R&S UPP-B8). 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.

The file C:\leeprom_anaaudio.bin is the backup file which contains all of the above adjustment parameters for the audio board including the options R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8. For the binary file, a file C:\leepromdump.txt is also saved which can be used to check the entries in text format for the EEPROM. This file is not updated when the adjustment values are changed until you close and reopen the R&S UPP software.

Besides the entries for the analog audio board, the dump file eepromdump.txt also contains the corresponding information for software adjustment of the options R&S UPP-B2 (Digital Audio I/O 192 kHz), R&S UPP-B4 (Digital Audio/HDMI I/O) or R&S UPP-B8 (Multi channel generator). The associated binary file eeprom_digaudio.bin is also a backup of the EEPROM in the R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 unit.

NOTICE

Halt of all measurement functions required for diagnostic mode

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 four groups of correction data:

Group	Correction data for	Backup file
Anlg Generator	Analog Generator	eeeprom_anaaudio.bin + eeeprom-dump.txt
Anlg Analyzer	Analog Analyzer	eeeprom_anaaudio.bin + eeeprom-dump.txt
Digital Generator	Digital Generator	eeeprom_digaudio.bin + eeeprom-dump.txt
Multi Channel Generator	Multi Channel Generator	eeeprom_upp8chaudio.bin + eeepromdump.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.

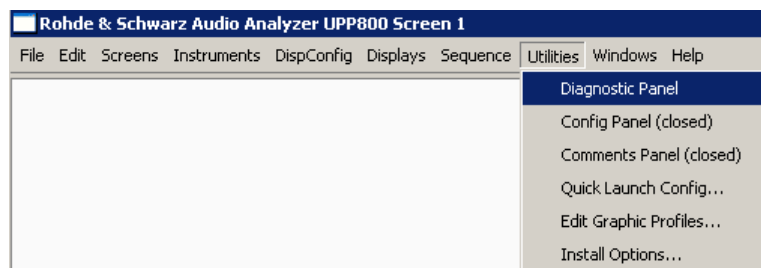
3.4.1.1 Diagnostic Mode

Diagnostic mode allows extensive intervention in the hardware of the R&S UPP. Its use should be reserved for personnel employed by R&S representatives who are trained in how to service the R&S UPP.

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 UPP 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 UPP, 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 ?".

Open Diagnostic Mode:

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "Utilities" selection tree and select the "Diagnostic Panel" option in the drop-down list.

Enter the password 1.4142 in the first line.

The Diagnostic Panel window displays the following fields:

- Diagnostic:** 1.4142
- Test Output:**
 - SCPI Cmd: SYST:ERR?
 - Exec Macro: xxx.exe
- Master/Slave:**
 - I am: Single Master
 - SCPI Assignmt: All
 - Master Serial: -----

When opened, the diagnostic panel looks as shown below:

The Diagnostic Panel window displays the following fields:

- Diagnostic:** Passwrd ok
- Instrument:** Generator (T)
- Device:** EEPROM BASE
- Hardw. Code:** 0
- Serial Number:** 100000000
- Product Index:** 201
- Status Registers:**
 - Oper Bit No: 0
 - Oper Value: 0
 - Ques Bit No: 0
 - Ques Value: 0
 - QuesUr Bit No: 0
 - QuesUr Value: 0
 - QuesOr Bit No: 0
 - QuesOr Value: 0
 - QuesMe Bit No: 0
 - QuesMe Value: 0
 - XQues Bit No: 0
 - XQues Value: 0
- Adjustment:**
 - Adjustment: Anlg Generator
 - Adj Address: 0
 - Adj Value: 1.00000

3.4.1.2 Software Adjustment Procedure

Analyzer and generator always use the currently valid correction factors stored in the EEPROM.

Before performing a correction measurement, the correction factor must be set to the value of 1 (0 in the case of offset or phase correction).

Software Adjustment Procedure:

1. Set old correction factors to 1 (0): *)

- Switch off the R&S UPP.
 - Slide on the instrument casing.
 - Screw the rear panel feet back on (Torx screwdriver, size 20).
 - Put the R&S UPP back into its normal operating position and switch it on.
2. Perform the correction measurement and calculate the new correction factor **cfnew**. Prior to a correction measurement, the default setup of the R&S UPP is loaded in most cases, causing the diagnostic mode to be terminated.
3. Enter new correction factor **cfnew** into the EEPROM:
- Open diagnostic mode.
 - Select the desired adjustment group for "Adjustment".
 - Enter the number of the correction factor for "Adj. Address".
 - Enter the value **cfnew** 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 EEPROM and becomes effective for the hardware. The next time the R&S UPP is started, a backup copy of the correction data in the EEPROM is made on the hard disk. The old, previously valid redundant correction data are overwritten on the hard disk.

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 and phase correction for the analog generator

3.4.2 Correction Factors in the EEPROM

Adjustment = Anlg Generator

Address	Value	Meaning
0	cf_agen [0]	Analog Generator Level Channel 1
1	cf_agen [1]	Analog Generator Level Channel 2
2	cf_phase [0]	Generator Phase Offset @ 1 kHz
3	cf_phase [1]	Generator Phase Offset @ 10 kHz
4	cf_phase [2]	Generator Phase Offset @ 20 kHz
5	cf_phase [3]	Generator Phase Offset @ 30 kHz
6	cf_phase [4]	Generator Phase Offset @ 40 kHz
7	cf_phase [5]	Generator Phase Offset @ 50 kHz
8	cf_phase [6]	Generator Phase Offset @ 60 kHz

Address	Value	Meaning
9	cf_phase [7]	Generator Phase Offset @ 70 kHz
10	cf_phase [8]	Generator Phase Offset @ 80 kHz
11	cf_dcoffset [0][0]	Generator Channel 1 Level Offset Range 1 (7 V...4.5 V)
12	cf_dcoffset [0][1]	Generator Channel 1 Level Offset Range 2 (4.5 V...2.25 V)
13	cf_dcoffset [0][2]	Generator Channel 1 Level Offset Range 3 (2.25 V...1.125 V)
14	cf_dcoffset [0][3]	Generator Channel 1 Level Offset Range 4 (1.125 V...0.5 V)
15	cf_dcoffset [1][0]	Generator Channel 2 Level Offset Range 1 (7 V...4.5 V)
16	cf_dcoffset [1][1]	Generator Channel 2 Level Offset Range 2 (4.5 V...2.25 V)
17	cf_dcoffset [1][2]	Generator Channel 2 Level Offset Range 3 (2.25 V...1.125 V)
18	cf_dcoffset [1][3]	Generator Channel 2 Level Offset Range 4 (1.125 V...0.5 V)
19	cf_atten[0]	Generator Channel 1 Attenuator
20	cf_atten[1]	Generator Channel 2 Attenuator

Adjustment = Anlg Analyzer

Address	Value	Meaning
0	cal_range[0][0]	Level Channel 1
1	cal_range[1][0]	Level Channel 2
2	cal_range[2][0]	Level Channel 3
3	cal_range[3][0]	Level Channel 4
4	cal_range[4][0]	Level Channel 5
5	cal_range[5][0]	Level Channel 6
6	cal_range[6][0]	Level Channel 7
7	cal_range[7][0]	Level Channel 8
8	cal_dcoffset[0][0]	DC Offset Channel 1
9	cal_dcoffset[1][0]	DC Offset Channel 2
10	cal_dcoffset[2][0]	DC Offset Channel 3
11	cal_dcoffset[3][0]	DC Offset Channel 4
12	cal_dcoffset[4][0]	DC Offset Channel 5
13	cal_dcoffset[5][0]	DC Offset Channel 6
14	cal_dcoffset[6][0]	DC Offset Channel 7
15	cal_dcoffset[7][0]	DC Offset Channel 8

Adjustment = Option R&S UPP-B8 Multi Channel Anlg Generator

Address	Value	Meaning
0	cf_agen [2]	Analog Generator Level Channel 3
1	cf_agen [3]	Analog Generator Level Channel 4
2	cf_agen [4]	Analog Generator Level Channel 5
3	cf_agen [5]	Analog Generator Level Channel 6
4	cf_agen [6]	Analog Generator Level Channel 7
5	cf_agen [7]	Analog Generator Level Channel 8
6	cf_agen [8]	Analog Generator Level Channel 9
7	cf_agen [9]	Analog Generator Level Channel 10
8	cf_phas [1][0]	Generator Phase Offset Channel 3 @ 1 kHz
9	cf_phas [1][1]	Generator Phase Offset Channel 3 @ 10 kHz
10	cf_phas [1][2]	Generator Phase Offset Channel 3 @ 20 kHz
11	cf_phas [1][3]	Generator Phase Offset Channel 3 @ 30 kHz
12	cf_phas [1][4]	Generator Phase Offset Channel 3 @ 40 kHz
13	cf_phas [1][5]	Generator Phase Offset Channel 3 @ 50 kHz
14	cf_phas [1][6]	Generator Phase Offset Channel 3 @ 60 kHz
15	cf_phas [1][7]	Generator Phase Offset Channel 3 @ 70 kHz
16	cf_phas [1][8]	Generator Phase Offset Channel 3 @ 80 kHz
17	cf_phas [1][0]	Generator Phase Offset Channel 4 @ 1 kHz
18	cf_phas [2][1]	Generator Phase Offset Channel 4 @ 10 kHz
19	cf_phas [2][2]	Generator Phase Offset Channel 4 @ 20 kHz
20	cf_phas [2][3]	Generator Phase Offset Channel 4 @ 30 kHz
21	cf_phas [2][4]	Generator Phase Offset Channel 4 @ 40 kHz
22	cf_phas [2][5]	Generator Phase Offset Channel 4 @ 50 kHz
23	cf_phas [2][6]	Generator Phase Offset Channel 4 @ 60 kHz
24	cf_phas [2][7]	Generator Phase Offset Channel 4 @ 70 kHz
25	cf_phas [2][8]	Generator Phase Offset Channel 4 @ 80 kHz
26	cf_phas [3][0]	Generator Phase Offset Channel 5 @ 1 kHz
27	cf_phas [3][1]	Generator Phase Offset Channel 5 @ 10 kHz
28	cf_phas [3][2]	Generator Phase Offset Channel 5 @ 20 kHz
29	cf_phas [3][3]	Generator Phase Offset Channel 5 @ 30 kHz
30	cf_phas [3][4]	Generator Phase Offset Channel 5 @ 40 kHz
31	cf_phas [3][5]	Generator Phase Offset Channel 5 @ 50 kHz
32	cf_phas [3][6]	Generator Phase Offset Channel 5 @ 60 kHz

Address	Value	Meaning
33	cf_phas [3][7]	Generator Phase Offset Channel 5 @ 70 kHz
34	cf_phas [3][8]	Generator Phase Offset Channel 5 @ 80 kHz
35	cf_phas [4][0]	Generator Phase Offset Channel 6 @ 1 kHz
36	cf_phas [4][1]	Generator Phase Offset Channel 6 @ 10 kHz
37	cf_phas [4][2]	Generator Phase Offset Channel 6 @ 20 kHz
38	cf_phas [4][3]	Generator Phase Offset Channel 6 @ 30 kHz
39	cf_phas [4][4]	Generator Phase Offset Channel 6 @ 40 kHz
40	cf_phas [4][5]	Generator Phase Offset Channel 6 @ 50 kHz
41	cf_phas [4][6]	Generator Phase Offset Channel 6 @ 60 kHz
42	cf_phas [4][7]	Generator Phase Offset Channel 6 @ 70 kHz
43	cf_phas [4][8]	Generator Phase Offset Channel 6 @ 80 kHz
44	cf_phas [5][0]	Generator Phase Offset Channel 7 @ 1 kHz
45	cf_phas [5][1]	Generator Phase Offset Channel 7 @ 10 kHz
46	cf_phas [5][2]	Generator Phase Offset Channel 7 @ 20 kHz
47	cf_phas [5][3]	Generator Phase Offset Channel 7 @ 30 kHz
48	cf_phas [5][4]	Generator Phase Offset Channel 7 @ 40 kHz
49	cf_phas [5][5]	Generator Phase Offset Channel 7 @ 50 kHz
50	cf_phas [5][6]	Generator Phase Offset Channel 7 @ 60 kHz
51	cf_phas [5][7]	Generator Phase Offset Channel 7 @ 70 kHz
52	cf_phas [5][8]	Generator Phase Offset Channel 7 @ 80 kHz
53	cf_phas [6][0]	Generator Phase Offset Channel 8 @ 1 kHz
54	cf_phas [6][1]	Generator Phase Offset Channel 8 @ 10 kHz
55	cf_phas [6][2]	Generator Phase Offset Channel 8 @ 20 kHz
56	cf_phas [6][3]	Generator Phase Offset Channel 8 @ 30 kHz
57	cf_phas [6][4]	Generator Phase Offset Channel 8 @ 40 kHz
58	cf_phas [6][5]	Generator Phase Offset Channel 8 @ 50 kHz
59	cf_phas [6][6]	Generator Phase Offset Channel 8 @ 60 kHz
60	cf_phas [6][7]	Generator Phase Offset Channel 8 @ 70 kHz
61	cf_phas [6][8]	Generator Phase Offset Channel 8 @ 80 kHz
62	cf_phas [7][0]	Generator Phase Offset Channel 9 @ 1 kHz
63	cf_phas [7][1]	Generator Phase Offset Channel 9 @ 10 kHz
64	cf_phas [7][2]	Generator Phase Offset Channel 9 @ 20 kHz
65	cf_phas [7][3]	Generator Phase Offset Channel 9 @ 30 kHz

Address	Value	Meaning
66	cf_phas [7][4]	Generator Phase Offset Channel 9 @ 40 kHz
67	cf_phas [7][5]	Generator Phase Offset Channel 9 @ 50 kHz
68	cf_phas [7][6]	Generator Phase Offset Channel 9 @ 60 kHz
69	cf_phas [7][7]	Generator Phase Offset Channel 9 @ 70 kHz
70	cf_phas [7][8]	Generator Phase Offset Channel 9 @ 80 kHz
71	cf_phas [8][0]	Generator Phase Offset Channel 10 @ 1 kHz
72	cf_phas [8][1]	Generator Phase Offset Channel 10 @ 10 kHz
73	cf_phas [8][2]	Generator Phase Offset Channel 10 @ 20 kHz
74	cf_phas [8][3]	Generator Phase Offset Channel 10 @ 30 kHz
75	cf_phas [8][4]	Generator Phase Offset Channel 10 @ 40 kHz
76	cf_phas [8][5]	Generator Phase Offset Channel 10 @ 50 kHz
77	cf_phas [8][6]	Generator Phase Offset Channel 10 @ 60 kHz
78	cf_phas [8][7]	Generator Phase Offset Channel 10 @ 70 kHz
79	cf_phas [8][8]	Generator Phase Offset Channel 10 @ 80 kHz
80	cf_dcoffset [2][0]	Generator DC Offset Channel 3 Range 0 (7 V...4.5 V)
81	cf_dcoffset [2][1]	Generator DC Offset Channel 3 Range 1 (4.5 V...2.25 V)
82	cf_dcoffset [2][2]	Generator DC Offset Channel 3 Range 2 (2.25 V...1.125 V)
83	cf_dcoffset [2][3]	Generator DC Offset Channel 3 Range 3 (1.125 V...0.5 V)
84	cf_dcoffset [3][0]	Generator DC Offset Channel 4 Range 0 (7 V...4.5 V)
85	cf_dcoffset [3][1]	Generator DC Offset Channel 4 Range 1 (4.5 V...2.25 V)
86	cf_dcoffset [3][2]	Generator DC Offset Channel 4 Range 2 (2.25 V...1.125 V)
87	cf_dcoffset [3][3]	Generator DC Offset Channel 4 Range 3 (1.125 V...0.5 V)
88	cf_dcoffset [4][0]	Generator DC Offset Channel 5 Range 0 (7 V...4.5 V)
89	cf_dcoffset [4][1]	Generator DC Offset Channel 5 Range 1 (4.5 V...2.25 V)
90	cf_dcoffset [4][2]	Generator DC Offset Channel 5 Range 2 (2.25 V...1.125 V)
91	cf_dcoffset [4][3]	Generator DC Offset Channel 5 Range 3 (1.125 V...0.5 V)
92	cf_dcoffset [5][0]	Generator DC Offset Channel 6 Range 0 (7 V...4.5 V)
93	cf_dcoffset [5][1]	Generator DC Offset Channel 6 Range 1 (4.5 V...2.25 V)
94	cf_dcoffset [5][2]	Generator DC Offset Channel 6 Range 2 (2.25 V...1.125 V)
95	cf_dcoffset [5][3]	Generator DC Offset Channel 6 Range 3 (1.125 V...0.5 V)
96	cf_dcoffset [6][0]	Generator DC Offset Channel 7 Range 0 (7 V...4.5 V)
97	cf_dcoffset [6][1]	Generator DC Offset Channel 7 Range 1 (4.5 V...2.25 V)
98	cf_dcoffset [6][2]	Generator DC Offset Channel 7 Range 2 (2.25 V...1.125 V)

Address	Value	Meaning
99	cf_dcoffset [6][3]	Generator DC Offset Channel 7 Range 3 (1.125 V...0.5 V)
100	cf_dcoffset [7][0]	Generator DC Offset Channel 8 Range 0 (7 V...4.5 V)
101	cf_dcoffset [7][1]	Generator DC Offset Channel 8 Range 1 (4.5 V...2.25 V)
102	cf_dcoffset [7][2]	Generator DC Offset Channel 8 Range 2 (2.25 V...1.125 V)
103	cf_dcoffset [7][3]	Generator DC Offset Channel 8 Range 3 (1.125 V...0.5 V)
104	cf_dcoffset [8][0]	Generator DC Offset Channel 9 Range 0 (7 V...4.5 V)
105	cf_dcoffset [8][1]	Generator DC Offset Channel 9 Range 1 (4.5 V...2.25 V)
106	cf_dcoffset [8][2]	Generator DC Offset Channel 9 Range 2 (2.25 V...1.125 V)
107	cf_dcoffset [8][3]	Generator DC Offset Channel 9 Range 3 (1.125 V...0.5 V)
108	cf_dcoffset [9][0]	Generator DC Offset Channel 10 Range 0 (7 V...4.5 V)
109	cf_dcoffset [9][1]	Generator DC Offset Channel 10 Range 1 (4.5 V...2.25 V)
110	cf_dcoffset [9][2]	Generator DC Offset Channel 10 Range 2 (2.25 V...1.125 V)
111	cf_dcoffset [9][3]	Generator DC Offset Channel 10 Range 3 (1.125 V...0.5 V)
112	cf_atten[2]	Generator Channel 3 Attenuator
113	cf_atten[3]	Generator Channel 4 Attenuator
114	cf_atten[4]	Generator Channel 5 Attenuator
115	cf_atten[5]	Generator Channel 6 Attenuator
116	cf_atten[6]	Generator Channel 7 Attenuator
117	cf_atten[7]	Generator Channel 8 Attenuator
118	cf_atten[8]	Generator Channel 9 Attenuator
119	cf_atten[9]	Generator Channel 10 Attenuator

3.4.3 Analog Generator

Preparation:

After performing the hardware adjustment, the R&S UPP must be reassembled:

- Switch off the R&S UPP.
- Slide on the instrument casing.
- Screw the rear panel feet back on (Torx screwdriver, size 20).
- Put the R&S UPP back into its normal operating position and switch it on.

NOTICE**Warm up required for determining correction factors**

Prior to starting the measurement to determine the correction factors, the R&S UPP must warm up for at least one hour with the housing closed.

The ambient temperature must be in the range 23 -3/+7°C.

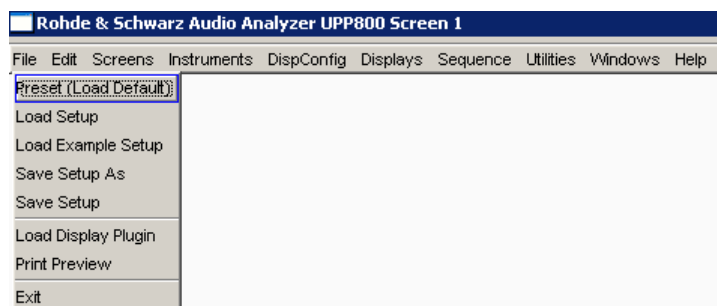
Before starting the correction measurement, set the R&S UPP to a defined status.

To do this, call up the default setting:

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



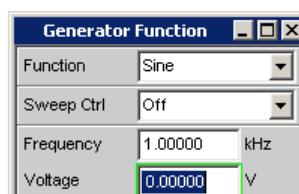
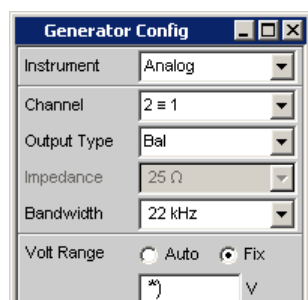
Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



3.4.3.1 Software Adjustment, DC Offset



Other adjustment procedures are not affected by this adjustment.

Set R&S UPP:

*) according to the following values

Meas. instrument:

DC voltmeter

Setup:

Connect the DC voltmeter to the output of the R&S UPP generator. You will need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17.

AC level:

To measure the DC offset level, set the AC level in the Generator Function Panel to 0 V.

Adjustment:

Expand the Diagnostic Panel by entering the password 1.4142. Select "Anlg Genera-tor" in the adjustment block.

- Generator Config Panel: Set Volt Range Fix to 5.0 V.
- Diagnostic Panel: Set the old Adj. Value to zero (Adj. Address 11).
- Measure the DC output voltage of analog generator channel 1.
- Diagnostic Panel: Write the measured value as "Adj. Value" to Adj. Address 11.

Execute the same procedure at Volt Range Fix 3.0 V (address 12), 1.5 V (address 13) and 0.75 V (address 14).

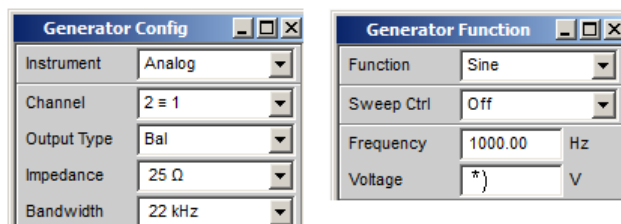
The same has to be done for channel 2 at Volt Range Fix 5.0 V (address 15), 3.0 V (address 16), 1.5 V (address 17) and 0.75 V (address 18).

Control:

Check the offset error as described under Performance Test.

3.4.3.2 Software Adjustment, Sinewave Level

Set R&S UPP:



*) according to the following values

Meas. instrument:

AC voltmeter (e.g. calibrated R&S UPP analyzer)

Setup:

Connect the AC voltmeter to the output of the R&S UPP generator. You will need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17. As an alternative, you can use an XLR connection from the generator to the analyzer.

Measurement:

Measure the AC level of 4.75 V from Channel 1. This is U_{act} (actual).

Adjustment:

Compute the correction factor:

$$cf_agen [0] = \frac{4.750 \text{ V}}{U_{act}}$$

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®UPP:

DIAGnostic:ADJustment AAGE

DIAGnostic:ADJust-
ment:ADDRes 0

DIAGnostic:ADJustment:FDATa n = Correction factor
<n>

Tolerance: $cf_agen [0] = 1 \pm 0.04$

Control:

The AC voltmeter (numeric display on the R&S UPP analyzer) should now display a value of $4.750 \pm 0.001 \text{ V}$

Do the same for channel 2: $cf_agen [1]$ (address 1).

As next calibrate the analog generator with activated output attenuator in channel 1. To do so choose an output voltage of 0.3 V in generator function panel.

Measurement:

Measure the AC level of 0.30 V from Channel 1. This is U_{act} (actual).

Adjustment:

Compute the correction factor:

$$cf_atten [0] = \frac{0.300 \text{ V}}{U_{act}}$$

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®UPP:

DIAGnostic:ADJustment AAGE

DIAGnostic:ADJust-
ment:ADDress 19

DIAGnostic:ADJustment:FDATA n = Correction factor
<n>

Tolerance: cf_atten [0] = 1 ± 0.04

Control:

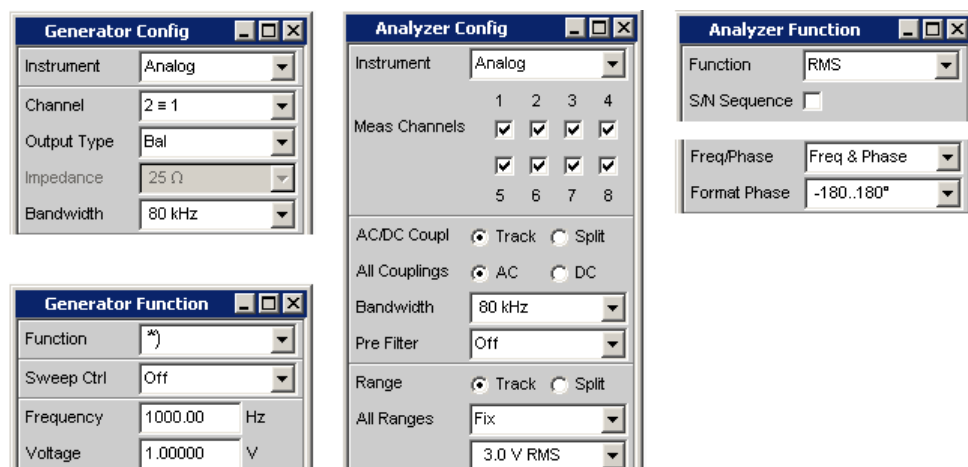
The AC voltmeter (numeric display on the R&S UPP analyzer) should now display a value of 0.300 ± 0.001 V

Do the same for channel 2: cf_atten [1] (address 20).

3.4.3.3 Software Adjustment, Interchannel Phase with Stereo Sine

With generator function "Stereo Sine" and identical frequencies in both channels the phase between them can be adjusted. This has to be done for minimum error because of the two DAC lowpasses which are independent from each other. Their frequency response adjustment influences the frequency dependent phase between the two generator channels.

Set R&S UPP:



*) Measurement 1: "Sine", Measurement 2: "Stereo Sine"

Expand the Diagnostic Panel by entering the password 1.4142. Select "Anlg Generator" in the adjustment block.

- Connect generator output channel 1 with both analyzer inputs channel 1 and channel 2 (for example with use of an output switcher UPZ) via XLR cables.
- Set the old Adj Values to zero (Adj Addresses 2 to 10).
- Select Generator Function "Sine"
Measurement 1: In this first shot the phase between the analyzer channels will be measured.

- Connect generator output channel 1 with analyzer input channel 1 and generator output channel 2 with analyzer input channel 2 via XLR cables.
- Select Generator Function "Stereo Sine"
Measurement 2: In this second shot the phase sum of generator plus analyzer will be measured.
- Calculation: measured phase from the second shot minus measured phase from the first shot equals the phase difference between the generator channels alone.
- Enter this calculated value with opposite sign under "Adj Address" **2** in the line "Adj Value".

Execute the same procedure for the frequencies 10 kHz (Adj Address 3), 20 kHz (Adj Address 4), 30 kHz (Adj Address 5), 40 kHz (Adj Address 6), 50 kHz (Adj Address 7), 60 kHz (Adj Address 8), 70 kHz (Adj Address 9) and 80 kHz (Adj Address 10).

Deactivate all unused analyzer channels for higher measurement speed.

3.4.4 Analog Analyzer

NOTICE

Warm up required for determining correction factors

Prior to starting the measurement to determine the correction factors, the R&S UPP must warm up for at least one hour with the housing closed.

The ambient temperature must be in the range 23 -3/+7°C.

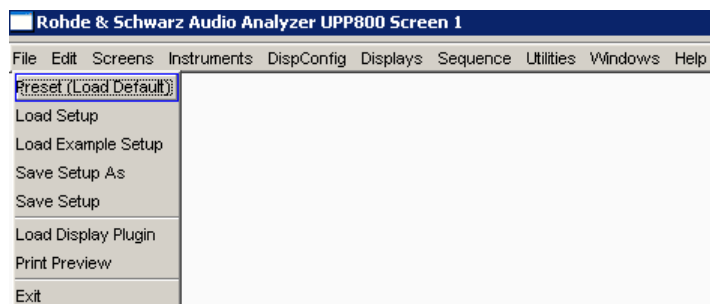
Before starting the correction measurement, set the R&S UPP to a defined status.

To do this, call up the default setting:

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.

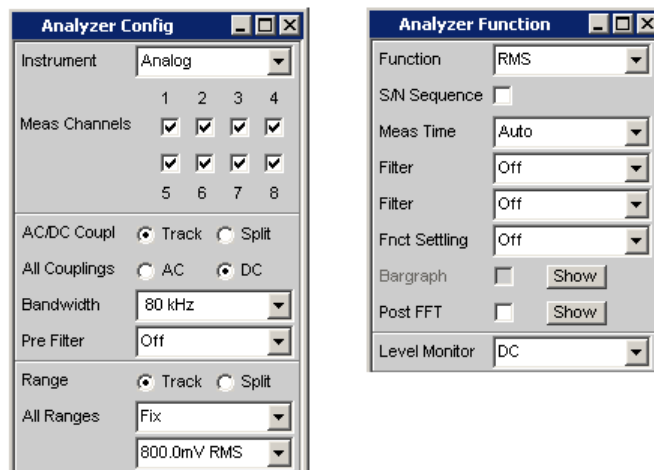


Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



3.4.4.1 Software Adjustment, DC Offset

Test setup:



The eight inputs must be terminated. To do that there are two possibilities:

- Connect all inputs with the deactivated generator output (Channel = Off on Generator Config Panel) via output switcher UPZ and XLR cables or
- Use two XLR/BNC Adapter Sets R&S®UP-Z1M and 50 Ω BNC termination resistors.

Measurement:

- Expand the Diagnostic Panel by entering the password 1.4142. Select "Anlg Analyzer" in the adjustment block.
- Set the old Adj Values to zero (Adj Addresses 8 to 15).
- Measure the DC voltage in the measurement ranges 200 mV and 800 mV on Ch1 to Ch8 with the Level Monitor.
- Average both values and multiply the result with -1.
- Enter the calculated DC value as correction factors manually into the EEPROM in the Diagnostic Panel under "Adj Value" for addresses 8 (channel 1) to 15 (channel 8).

Use the following IEC/IEEE bus commands to transfer the correction values to the R&S®UPP:

DIAGnostic:ADJustment AANLr0

DIAGnostic:ADJustment:ADDRess <n> n = 8 (Ch1) to n = 15 (Ch8)

DIAGnostic:ADJustment:FDATa <x> x = Correction factor of the selected channel n

After the adjustment the residual DC offset should be less than ± 0.5 mV in each channel in the 800 mV range.

3.4.4.2 Software Adjustment, Sinewave Level

Set R&S UPP:

The image shows four software adjustment windows for the R&S UPP instrument.

- Generator Config:**
 - Instrument: Analog
 - Channel: 2 = 1
 - Output Type: Bal
 - Impedance: 25 Ω
 - Bandwidth: 22 kHz
- Generator Function:**
 - Function: Sine
 - Sweep Ctrl: Off
 - Frequency: 1000.00 Hz
 - Voltage: 3.00000 V
- Analyzer Config:**
 - Instrument: Analog
 - Meas Channels: 1, 2, 3, 4 (all checked)
 - AC/DC Coupl: ☒ Track ☐ Split
 - All Couplings: ☒ AC ☐ DC
 - Bandwidth: 22 kHz
 - Pre Filter: Off
 - Range: ☒ Track ☐ Split
 - All Ranges: Fix
 - 3.0 V RMS
- Analyzer Function:**
 - Function: RMS
 - S/N Sequence: ☐
 - Meas Time: Auto

Meas. instrument:

AC voltmeter

Setup:

Connect the AC voltmeter to an output of the R&S UPP generator. You will need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17. The test signal from the generator is fed via a XLR cable to the analyzer input which will be adjusted.

Measurement:

Measure the AC voltage from generator channel 1 with the AC voltmeter. This is U_{nom_Ch1} .

Measure the AC voltage from generator Channel 2 with R&S UPP analyzer channel 1. This is U_{act_Ch1} .

Do so for all other channels 2 to 8

Determine the correction factors:

For channel 1:

$$\text{cal_range}[0][0] = \frac{U_{\text{act}} - \text{Ch1}}{U_{\text{nom}} - \text{Ch1}}$$

For Channel 2:

$$\text{cal_range}[1][0] = \frac{U_{\text{act}} - \text{Ch2}}{U_{\text{nom}} - \text{Ch2}}$$

Do 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 Config Panel function under the "Reference" parameter. Set the numeric display for relative display units of "V/Vr".

Enter the correction factors you determined manually into the EEPROM in the Diagnostic Panel under "Adjustment" for addresses 0 to 7 (for an explanation, see [Chapter 3.4.1, "Procedure"](#), on page 159).

Use the following IEC/IEEE bus command to transfer the correction values to the R&S UPP:

DIAG:CAL:CANLr0

DIAG:CAL:ADDRess <n> n = 0 (Ch1), 7 (Ch8)

DIAG:CAL:FDATA <n> n = Correction factor

Toleranz:

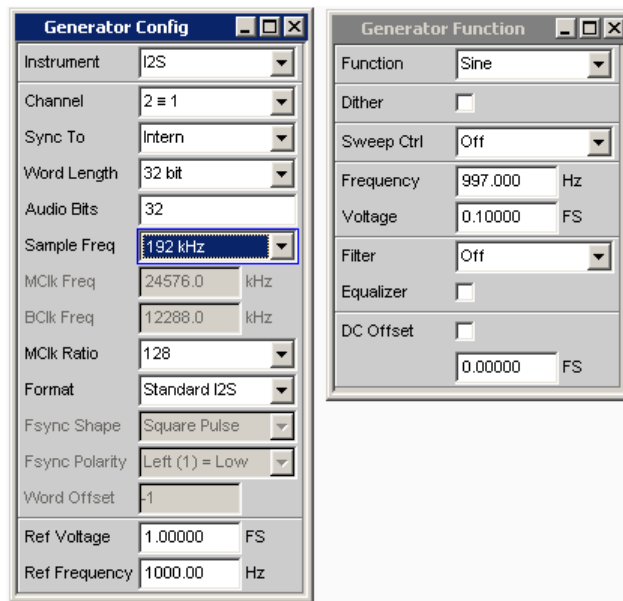
$$\text{cal_range}[n][0] = 1 \pm 0.05$$

3.4.5 Digital Generator

3.4.5.1 Frequency error

Set R&S UPP generator:

Select the I2S generator instrument and choose a sampling rate of 192 kHz.

**Meas. instrument:**

Frequency counter

Measurement:

Connect the frequency counter to pin 25 of the I2S DSUB connector of the UPP.

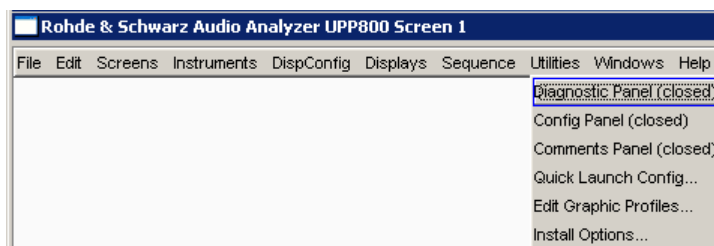
The measured value should be in the range between **24.575980 MHz** and **24.576020 MHz**.

Frequency error calibration:

If the frequency is out of range execute the following calibration steps.

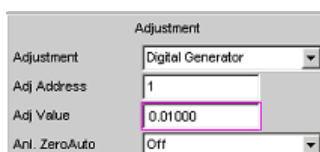
This procedure can only be performed by the R&S service.

Open the diagnostic panel from the menu bar.



Navigate to the adjustment section.

Modify the adjustment value at adjustment address "1" until the measured frequency is within 24.567000 MHz $\pm$ 20 Hz



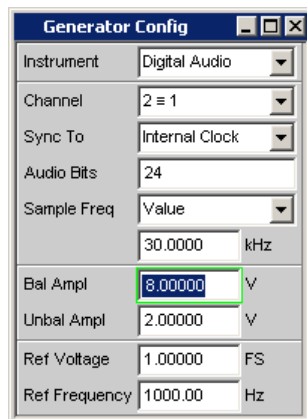
Store this factor in the EEPROM by hitting the enter button.

3.4.5.2 Level error (Option 1: Oscilloscope)

Set R&S UPP generator:

Select the "Digital Audio" instrument from the "Generator Config" panel and set the "Bal. Ampl." to 8.0000 V.

Select a "Sample Freq" of 30 kHz.

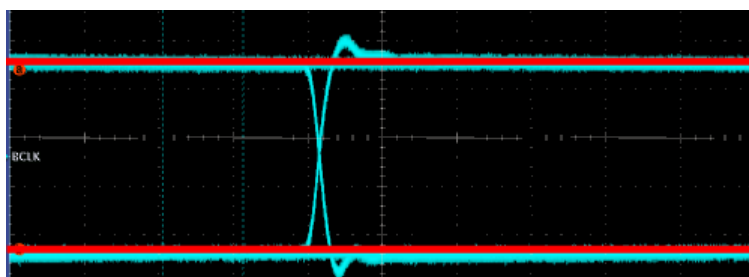


Meas. instrument:

Oscilloscope

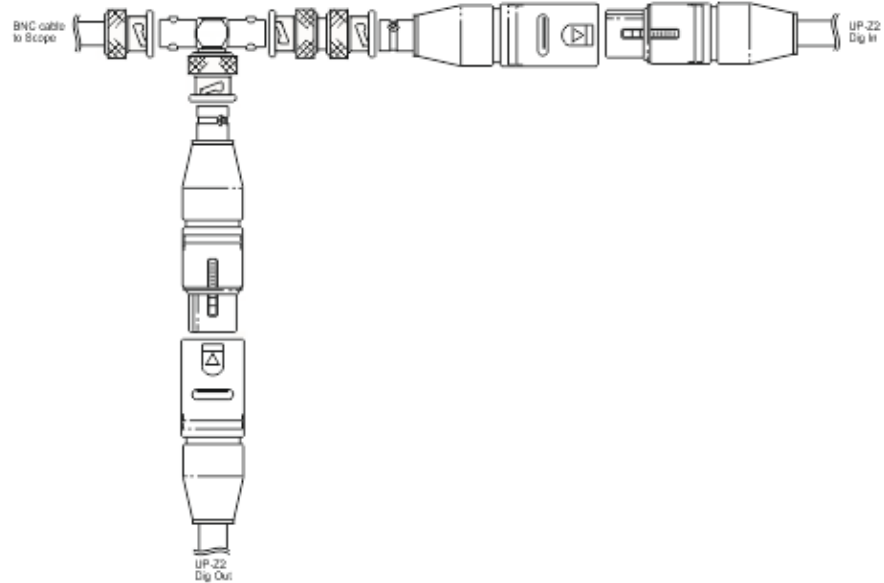
Measurement:

Connect the oscilloscope to the Bal output of the R&S UPP. Set the bandwidth of the scope to 20 MHz to eliminate short overshoots. Set the internal impedance to 1 M Ω . Measure the peak to peak amplitude of the signal using vertical cursors ignoring the overshoots as displayed in the picture below.



The measured value should be 8.0 Vpp $\pm$ 50 mV.

To ensure that the digital output is correctly terminated with 110 Ω the following inter-connection is recommended:



For the interconnection shown above some material is necessary:

- AES/EBU cable UP-Z2: 1411.3406.02
- a BNC cable (the cable to the Scope should be as short as possible to avoid ringing)
- XLR/BNC Adapter Set Male/Female: 1411.3306.02
- BNC Tee piece: 0017.6588.00
- BNC male to male connector: 0018.4620.00

Level error calibration:

If the amplitude is out of range execute the following calibration steps. This procedure can only be performed by the R&S service.

Open the diagnostic panel and navigate to the adjustment region.

Adjustment	
Adjustment	Digital Generator
Adj Address	0
Adj Value	1.00000
Anl. ZeroAuto	Off

Modify the adjustment value at adjustment address 0, until the amplitude is $8\text{ V} \pm 50\text{ mV}$.

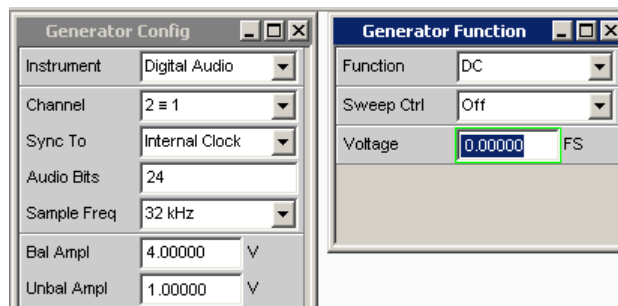
Store the modified value in the EEPROM by hitting the enter button.

3.4.5.3 Level error (Option 2: Frequency counter)

Set R&S UPP generator:

Select the "Digital Audio" instrument from the "Generator Config" panel and set the "Unbal Ampl." to 1.0000 V and the "sample Freq" to 32 kHz.

Choose the "Function" "DC" and an "Voltage" of "0.0 FS" in the "Generator Function Panel"



Meas. instrument:

Frequency counter Fluke PM6680

Measurement:

Connect the frequency counter with the unbalanced digital audio BNC output of the UPP using a 50 Ω BNC cable. Set the counter to "Volt Max A", "Filter" = "Off" and select an input impedance of 50 Ω.

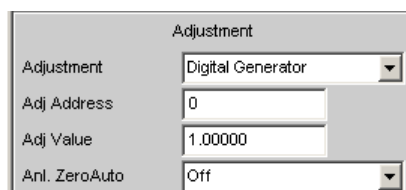
The measured value should be 0.825 Vpp to 0.960 Vpp (because of load resistance 50 Ω instead of 75 Ω).

Level error calibration:

If the amplitude is out of range execute the following calibration steps. This procedure can only be performed by the R&S service.

When using the frequency counter to perform the level calibration, the adjustment value can be calculated as: **Value = 0.8925/(Result_Counter/1.125)**

Open the diagnostic panel and navigate to the adjustment region.



Insert the adjustment value at adjustment address 0.

Store the modified value in the EEPROM by hitting the enter button.

3.4.6 R&S UPP-B8 Multi Channel Generator

Preparation:

After performing the hardware adjustment, the R&S UPP must be reassembled:

- Switch off the R&S UPP.
- Slide on the instrument casing.

- Screw the rear panel feet back on (Torx screwdriver, size 20).
- Put the R&S UPP back into its normal operating position and switch it on.

NOTICE**Warm up required for determining correction factors**

Prior to starting the measurement to determine the correction factors, the R&S UPP must warm up for at least one hour with the housing closed.

The ambient temperature must be in the range 23 -3/+7°C.

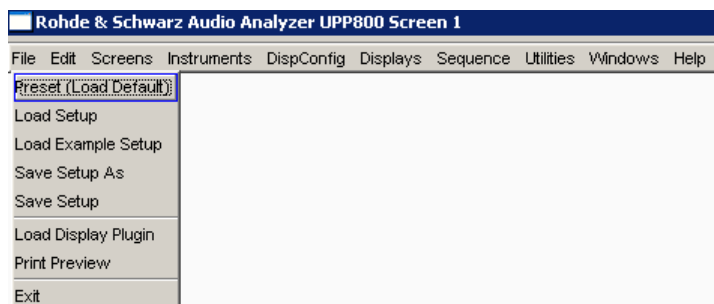
Before starting the correction measurement, set the R&S UPP to a defined status.

To do this, call up the default setting:

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.

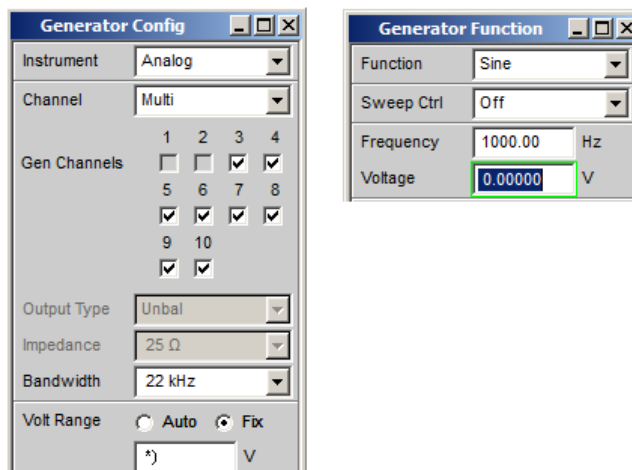


3.4.6.1 Software Adjustment, DC Offset



Other adjustment procedures are not affected by this adjustment.

Set R&S UPP:



*) according to the following values

Meas. instrument:

DC voltmeter

Setup:

Connect the DC voltmeter to the output of the R&S UPP-B8 generator. Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors. You will additionally need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17.

AC level:

To measure the DC offset level, set the AC level in the Generator Function Panel to 0 V.

Adjustment:

Expand the Diagnostic Panel by entering the password 1.4142. Select "Multi Channel Generator" in the adjustment block.

- Generator Config Panel: Set Volt Range Fix to 5.0 V.
- Diagnostic Panel: Set the old Adj. Value to zero (Adj. Address 80).
- Measure the DC output voltage of analog generator channel 3.
- Diagnostic Panel: Write the measured value as "Adj. Value" to Adj. Address 80.

Execute the same procedure at Volt Range Fix 3.0 V (address 81), 1.5 V (address 82) and 0.75 V (address 83).

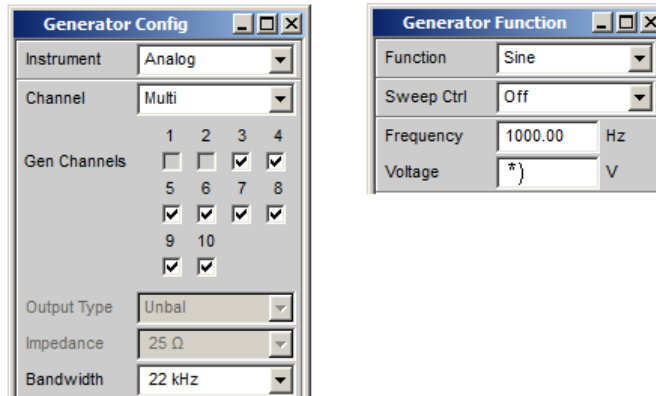
The same has to be done for channels 4 to 10 at Volt Ranges Fix 5.0 V, 3.0 V, 1.5 V and 0.75 V.

Control:

Check the offset error as described under Performance Test.

3.4.6.2 Software Adjustment, Sinewave Level

Set R&S UPP:



*) according to the following values

Meas. instrument:

AC voltmeter (e.g. calibrated R&S UPP analyzer)

Setup:

Connect the AC voltmeter to the output of the R&S UPP-B8 generator. Use a multicore cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors. You will additionally need the test cable 3 for this purpose, see [Chapter 2.1.4, "Test cable 3"](#), on page 17.

Measurement:

Measure the AC level of 4.75 V from Channel 3. This is U_{act} (actual).

Adjustment:

Compute the correction factor:

$$cf_agen [2] = \frac{4.750 \text{ V}}{U_{act}}$$

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®UPP:

```
DIAGnostic:ADJustment
MCGen
```

```
DIAGnostic:ADJust-
ment:ADDRess 0
```

```
DIAGnostic:ADJustment:FDATa n = Correction factor
<n>
```

Tolerance: $cf_agen [2] = 1 \pm 0.04$

Control:

The AC voltmeter (numeric display on the R&S UPP analyzer) should now display a value of 4.750 ± 0.001 V

As next step calibrate the R&S UPP-B8 generator with activated output attenuator in channel 3. To do so choose an output voltage of 0.3 V in generator function panel.

Measurement:

Measure the AC level of 0.30 V from Channel 3. This is U_{act} (actual).

Adjustment:

Compute the correction factor:

$$cf_atten [2] = \frac{0.300 \text{ V}}{U_{act}}$$

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®UPP:

```
DIAGnostic:ADJustment
MCGen
```

```
DIAGnostic:ADJust-
ment:ADDRess 112
```

```
DIAGnostic:ADJustment:FDATa n = Correction factor
<n>
```

Tolerance: $cf_atten [2] = 1 \pm 0.04$

Control:

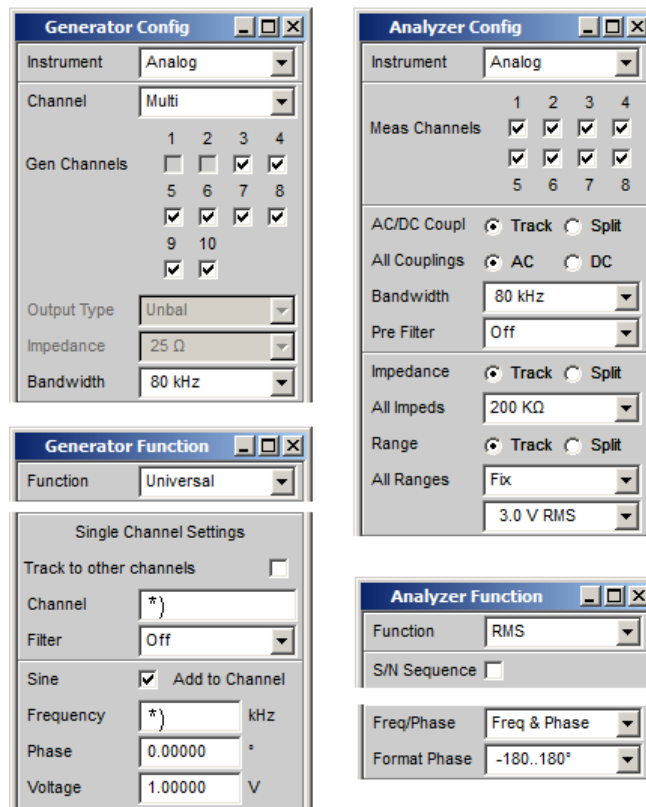
The AC voltmeter (numeric display on the R&S UPP analyzer) should now display a value of 0.300 ± 0.001 V

Do the same for channels 4 to 10: $cf_agen [3]$ to $cf_agen [9]$ as well as $cf_atten [3]$ to $cf_atten [9]$ (addresses see the corresponding table above).

3.4.6.3 Software Adjustment, Interchannel Phase

With generator function "Universal" and identical frequencies in all channels the phase between them can be adjusted. This has to be done for minimum error because all of the DAC lowpasses are independent from each other. Their frequency response adjustment influences the frequency dependent phase between the eight generator channels.

Set R&S UPP:



*) according to the following values

Expand the Diagnostic Panel by entering the password 1.4142. Select "MultiCh Generator (UPP-B8)" in the adjustment block.

- Connect generator output channel 3 with both analyzer inputs channel 1 and channel 2 (for example with use of an input switcher UPZ) via XLR cables. Use a multi-core cable (e.g. Rohde & Schwarz UP-Z8A 1411.3206.02) to get the XLR connectors.
- Set the old Adj Values to zero (Adj Addresses 8 to 79).
- Set the generator frequency to 1 kHz.
- **Measurement 1:** In this first shot the phase between the analyzer channels will be measured.
- Connect generator output channel 3 with analyzer input channel 1 and generator output channel 4 with analyzer input channel 2 via XLR cables.
- **Measurement 2:** In this second shot the phase sum of generator plus analyzer will be measured.
- Calculation: measured phase from the second shot minus measured phase from the first shot equals the phase difference between the generator channels 3 and 4 alone.
- Enter this calculated value with opposite sign under "Adj Address" **17** in the line "Adj Value".

Execute the same procedure for the frequencies 10 kHz (Adj Address 18), 20 kHz (Adj Address 19), 30 kHz (Adj Address 20), 40 kHz (Adj Address 21), 50 kHz (Adj Address

22), 60 kHz (Adj Address 23), 70 kHz (Adj Address 24) and 80 kHz (Adj Address 25) and for the remaining channels 5 to 10 (addresses from 26 to 79).

Execute the same procedure for all the other channels 5 to 10 in relation to channel 3 (for the corresponding Adj Addresses see the table above).

Deactivate all unused analyzer channels for higher measurement speed.

4 Repair

4.1 Instrument Design and Functional Description

In terms of the basic instrument, the R&S UPP is essentially an eight-channel audio analyzer for making measurements on analog interfaces. The frequency range of the analyzer is DC to 80 kHz. The frequency range of the generator is 0.1 Hz to 80 kHz.

The basic instrument consists of eight main subassemblies:

- Base Board (BB)
- PC Board (IPS1 or IPS2)
- IPS Adapterboard
- Switching Power Supply (SPS)
- Analog Audio Board (AAB)
- Analog Front Panel (AFP)
- Push Button and Switch Board
- USB Hub Board

The SPS, the IPS1 or IPS2 with its HDD, the IPS adapter board and the USB hub board including the switching power supply are located in the upper part of the instrument. The BB and the AAB are located in the lower part.

The basic instrument can be extended by adding the following hardware options:

- R&S UPP-B2 (Digital Audio I/O 192 kHz)
- R&S UPP-B4 (Digital Audio/HDMI I/O)
- R&S UPP-B8 (Multi Channel Generator)

4.1.1 Complete Instrument

The Audio Analyzer R&S UPP can be operated from an AC voltage from 90 V to 264 V. No switching is needed for different power supply voltages.

The block diagram of the R&S UPP shows how all of the boards in the instrument are interconnected. The central function of the base board (BB) for digital signal processing is clear. It receives its supply voltage from the switching power supply, provides the connection to the controller module and controls the analog and digital audio boards. It is equipped with two FPGAs as processing units for the digital data streams.

The analog audio board (AAB) receives its supply voltages from the BB. The generator outputs and analyzer inputs are fed to the AAB via the analog front panel (AFP).

The two fans receive their supply voltages from the switching power supply via the BB.

The two digital options R&S UPP-B2 (Digital Audio I/O) and R&S UPP-B4 (Digital Audio/HDMI I/O) and the analog option R&S UPP-B8 (Multi Channel Generator) are

installed from above. They receive their supply voltages and control signals from the BB via the AAB.

4.1.2 Base Board

Essentially, the base board comprises the following blocks:

- PCI interface to the R&S IPS (on the PAF module)
- SDRAM (as DDR2 SODIMM)
- FPGA SFB: SDRAM controller, real time algorithms, filter bank
- Diagnostics
- USB 2.0 device functionality
- General functions such as voltage generation, FAN control.

The controller is inserted indirectly via the IPS adapter board into the base board on the soldering side. On the component side, there are two connectors for the analog audio board. The PAF is connected to the SFB via a local bus interface; the SPI and JTAG buses go to the plug-in boards.

A temperature sensor on the baseboard monitors the temperature of the intake air, and the instrument switches off the power supply if a certain limit is exceeded (e.g. if one the fans is defective). This automatic switch-off can be disabled with a jumper (any orientation) in X19.

The base board also accommodates a flash EEPROM which contains the instrument data (device key, installed SW options, etc).

The supply voltages from the power supply are, first of all, fed to the base board (MOLEX connectors) and are then distributed to the R&S IPS, hard disk and analog audio board (AAB). Each of the voltages from the power supply is fused and assigned an LED indicator (individual labeling).

LED H7 (PAF BOOTED) comes on immediately after switch-on to indicate that the PCI interface has started successfully. When the firmware has been booted up, LED H5 (SFB BOOTED) comes on to indicate that the main FPGA has started successfully.

The main FPGA and the output memory is done via the air coming from the two fans. If the main FPGA overheats, an automatic cut-out is activated.

There are two different versions of base board:

- 1411.1903.02: This older type of base board has monitor outputs with an impedance of 600 Ω .
- 1411.1903.03: This newer type of base board has monitor outputs with an impedance of approximately 0 Ω . It can be modified to the older version .02 by changing the component values on both monitor outputs.

4.1.3 Analog Audio Board (AAB)

4.1.3.1 Analog Generator

The complete circuitry for the analog audio generator is housed on the analog audio board (AAB).

All of the signals are generated by a $\Sigma\Delta$ 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 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.

This lowpass filter is followed by the "range amplifier" stage. Here, the output level of the generator is determined along with the attenuator.

The final stage consists of several opamps and high current drivers. Its amplification is at about $g = 0$ dB. Independent of the choice of output type (Unbal or Bal in the Generator Config Panel) the output stage is always balanced. Only the level at pin 2 and pin 3 of output XLR connectors is different and created so, that a balanced or unbalanced output signal is created. The outputs of the analog generator is so-called "electronically" floating. This means, that the generator circuit is **not** galvanically separated from housing ground. All the supply voltages are referenced to ground. But the output pins 2 and 3 are separated from ground so that a DC voltage which will be supplied on one pin will appear on the other (with certain limits!).

An 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 250 mA. The final stage is followed by a balanced one-stage attenuator which is switched on from approx. 0.6 V and lower. The output divider attenuates the signal by -24 dB. The output impedance is selectable either 25 Ω or 600 Ω (only the newer version 1411.1649.02) balanced or unbalanced.

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.

Table 4-1: Table for generator leveling for Unbal

Output voltage		Hardware setting		
Peak to peak	Vrms (for sinewave)	DAC leveling	Amplifier stage	Attenuator
19.80 - 12.67 V	7.00 - 4.481 V	0 - -6 dB	+2.1 dB	0 dB
12.67 - 6.35 V	4.480 - 2.246 V	0 - -6 dB	-3.9 dB	0 dB

6.35 - 3.18 V	2.245 - 1.126 V	0 - -6 dB	-9.9 dB	0 dB
3.18 - 1.13 V	1.125 - 0.400 V	0 - -9 dB	-15.9 dB	0 dB
1.13 - 0.80 V	0.400 - 0.284 V	0 - -3 dB	+2.1 dB	-24 dB
0.80 - 0.40 V	0.283 - 0.142 V	0 - -6 dB	-3.9 dB	-24 dB
0.40 - 0.20 V	0.141 - 0.072 V	0 - -6 dB	-9.9 dB	-24 dB
200 - 0.57 mV	71 - 0.2 mV	0 - -51 dB	-15.9 dB	-24 dB

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.

4.1.3.2 Analog Analyzer

The complete circuitry for the analog analyzer is housed on the analog audio board (AAB).

The R&S UPP is equipped with an analog analyzer with three selectable bandwidths (22 kHz, 40 kHz and 80 kHz). The analog analyzer has a eight-channel structure in all its function.

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 up to eight 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 all measurement channels, either by default or fully automatically.

The following table shows range nominal values from 200 mV to 50 V, divided into 12 dB increments:

Table 4-2: Table for analyzer leveling

Range No.	Nominal value	Input divider	Amplifier stage
0	50 V	-24 dB	0 dB
1	12 V	-24 dB	+12 dB
2	3.0 V	0 dB	0 dB
3	0.8 V	0 dB	+12 dB
4	0.2 V	0 dB	+24 dB

The max. 8 channels involve five ranges as shown above with a bandwidth from DC to 80 kHz. The inputs can be ac coupled alternatively to suppress superimposed dc voltages.

An antialiasing lowpass in front of ADC limits the input spectrum to maximum 80 kHz.

The input signal is monitored by a peak detector independent for each channel. These detectors can report overrange as well as underrange condition.

Analog bandwidths 22 kHz / 40 kHz / 80 kHz

Data is acquired after analog signal processing in the eight channels with four dual-channel audio A/D converters at different sampling rates:

Table 4-3: Table for analyzer bandwidths

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 $\Sigma\Delta$ with a resulting resolution of 24 bits. It runs in the slave mode, where the master clock, the bit clock and data frame signals are generated from the FPGA synchronously and supplied to the digital logic. The digital dual-channel data stream in I2S format is serially read in to the FPGA of the AAB in line with the bit clock rate for further digital signal processing in the FPGA on BB.

The links to the following digital section on AAB are four stereo AD converters described above, which convert the measured analog signals into the digital domain.

4.1.3.3 Digital Section on AAB

The digital section consists of a FPGA, a 24.576 MHz crystal oscillator, a DDS and an EEPROM.

The FPGA is the main control center of the board. This component controls the output level of the generator via the relays, the gain of each analyzer channel via the relays, transmits the digital signals to the DACs, receives the digital signals from the ADCs and manages the audio data between AAB and the FPGA on the BB. The FPGA on BB can handle the data for all 8 channels at a time. Additionally the over- or under-range informations from analog analyzer are led to the BB FPGA via the FPGA on AAB.

The EEPROM contains the board ID and all of the calibration factors for gain, phase and dc offset. By reading out the R&S UPP recognizes the installed option and read out the necessary calibration factors to give the exact signal level out on generator connectors and show the exact measurement results on numeric display.

The 24,576 MHz crystal oscillator is the main clock source of the device. It clocks all FPGAs directly and is used to derive clocks for the analyzer and generator function blocks on all boards.

The DDS clock generator is used to generate clocks and control signals for the generator part inside the base board FPGA.

4.1.3.4 Supply Section on AAB

There are a lot of different supply voltages for the generator and the analyzer on the AAB.

The switching power supply delivers +3.3 V, +5 V and ± 12 V, which are used to create the supply voltages for the analog section.

The analog generator needs ± 15 V to supply its operational amplifiers. So two switching regulators boost the ± 12 V up to approx. ± 16 V. To clean up the voltages for the analog signal chain two linear regulators fix it to the final ± 15 V.

± 11 V are required for the opamps of the 8 analog channels (until Ser. 1x0099, from Ser. 1x0100 ± 9 V!). These voltages are created by linear regulators out of ± 12 V, which are delivered directly from the switching power supply. Each analog channel use its own pair of linear regulators.

The digital section needs a lot of different voltages to provide the different parts:

- +5 V for the DACs and the relays in the analog generator.
- +5 V for the ADCs and the relays in the analog analyzer.
- +3.3 V for the clock distribution.
- +1.2 V for the FPGA.
- +1.8 V for the DDS clock generation.
- +2.5 V for the I/O circuits of FPGA

All of these voltages are generated from switching power modules or linear regulators respectively. For more details see circuit drawing of AAB.

4.1.4 Analog Front Panel (AFP)

The analog front panel (AFP) is a small separate board which houses the XLR male connectors for the generator outputs and the XLR female connectors for the analyzer inputs.

It is connected directly to the analog audio board using three plug-in connections (one for the generator and two for the analyzer).

4.1.4.1 Connectors for the Analog Generator

The two generator outputs use the balanced XLR connectors which are common in professional audio 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 carefully separated from other circuits and wired with small capacitors which lead to instrument ground.

4.1.4.2 Connectors for the Analog Analyzer

The up to eight analyzer inputs use the balanced XLR jacks which are common in professional audio applications. Pin 2 represents the signal and pin 3 the reference point. Until Ser. 1x0099 pin 1 is connected to instrument ground directly, from Ser. 1x0100 pin 1 is connected to instrument ground via a 1 nF capacitor.

To avoid problems with high-frequency interference from the analyzer inputs, all of the signal pins are fitted with small capacitors.

From Ser. 1x0100 the R&S UPP is equipped with the newer board version (1411.1749.02) which also contains the relays to select the analyzer input impedance between 600 Ω and 200 k Ω .

4.1.5 Switching Power Supply (SPS)

The switching power supply is responsible for supplying power to the R&S UPP. It is a highly efficient primary switching power supply with power factor correction. It provides the following output voltages:

- +3.3 V
- +5.2 V
- +12.0 V
- -12.0 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 base board (BB).

4.1.6 Audio Monitor (Auxiliaries)

You can use the monitoring output to observe an externally supplied audio signal which might have undergone digital processing. This is not a separate board. The signal processing is distributed among two boards (AAB and BB).

The heart of the monitoring output is formed by the monitoring DAC on the AAB via which all signals to be monitored must pass. It receives its digital input signal from an FPGA. 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. Higher signal frequencies than 80 kHz 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 output impedance is 600 Ω (until Ser. 1x0099) or approximately 0 Ω (from Ser. 1x0100) and the maximum output level reaches 5 V peak.

4.1.7 R&S UPP-B2

This optional board enriches the functionality of the R&S UPP by providing two common digital audio interfaces: I2S and SPDIF (Digital Audio).

The board consists of several functional blocks which are all controlled by a single FPGA:

4.1.7.1 Digital Audio section

Two digital audio chips from AKM realize the generator and analyzer functionalities by transforming the internally used I2S format into an SPDIF signal and vice versa.

Several inputs and outputs are available for generating and analyzing SPDIF signals as can be seen on the front panel. The generator and analyzer each have an unbalanced I / O via a BNC connector as well as a balanced I / O via a D-sub connector and an optical interface.

The output voltage level of the unbalanced and balanced interfaces can be adjusted by the OPAMP section which is controlled by the FPGA.

4.1.7.2 I2S section

The inputs and outputs for I2S signals are realized by a 25 pin D-sub connector.

The core functionality of the I2S signal processing is located inside the FPGA.

The analyzer uses a PLL to regenerate the masterclock from a received signal which is needed to transport the data to the base board.

4.1.7.3 Sync In control

The I2S generator as well as the digital audio generator can be synchronized to an external source which can be connected to the unbalanced BNC sync in connector or to the balanced pin pair on the 9 pin DSUB connector.

In case of an external synchronization of the I2S generator, a PLL is used to generate the suitable masterclock frequency for the generator inside the baseboard FPGA.

External synchronization of the digital audio generator is performed by a digital audio receiver chip which hosts an internal PLL to generate this masterclock.

4.1.8 R&S UPP-B4

This optional board enriches the functionality of the R&S UPP by providing three common digital audio interfaces: I2S, SPDIF (Digital Audio) and HDMI 1.4.

The board consists of several functional blocks which are all controlled by two FPGAs:

4.1.8.1 Digital Audio section

Two digital audio chips from AKM realize the generator and analyzer functionalities by transforming the internally used I2S format into an SPDIF signal and vice versa.

Several inputs and outputs are available for generating and analyzing SPDIF signals as can be seen on the front panel. The generator and analyzer each have an unbalanced I / O via a BNC connector as well as an optical interface.

The output voltage level of the unbalanced interface can be adjusted by the OPAMP section which is controlled by the smaller Cyclone III FPGA.

4.1.8.2 I2S section

The inputs and outputs for I2S signals are realized by a 26 pin Dsub HD connector.

The core functionality of the I2S signal processing is located inside the larger Stratix II FPGA.

The analyzer uses a PLL to regenerate the masterclock from a received signal which is needed to transport the data to the base board.

4.1.8.3 Sync In control

The I2S generator as well as the digital audio generator can be synchronized to an external source which can be connected to the unbalanced BNC sync in connector.

In case of an external synchronization of the I2S generator, a PLL is used to generate the suitable masterclock frequency for the generator inside the baseboard FPGA.

External synchronization of the digital audio generator is performed by a digital audio receiver chip which hosts an internal PLL to generate this masterclock.

4.1.8.4 HDMI Section

The UPP-B4 offers two HDMI interfaces for generating and analyzing HDMI signals which are named "Source" and "Sink" on the front plate.

Additionally an auxiliary input "Aux_In" as well as an auxiliary output "Aux_Out" are provided. The "Aux_In" input is used for looping external video signals to the "Source" interface, while the "Aux_Out" output copies the analyzed video signal on the "Sink" interface for displaying it on an external display device.

The HDMI signals are generated inside the larger Stratix II FPGA. The HDMI outputs "Source" and "Aux_Out" each use one SIL9334 transmitter chip while the inputs "Sink" and "Aux_In" each need a combination of one SIL9389 port processor and a subsequent SIL9233 receiver chip.

The clocking of the HDMI section is provided by a SI5338 clock synthesizer.

4.1.9 R&S UPP-B8

This optional board enriches the functionality of the R&S UPP by providing eight analog generator channels and ten digital channels with unbalanced SPDIF format.

The board consists of several functional blocks:

4.1.9.1 Analog section

The complete circuitry for the eight channel analog generator is housed on the option R&S UPP-B8. For the circuit description see chapter 4.1.3.1. In contrary to the analog generator on the AAB are the DACs not interconnected in "mono mode". Each two channels of one stereo DAC are used for two output channels.

In difference to the generator on the AAB the eight channels on the option R&S UPP-B8 have no current amplifier, so the maximum output current is much lower in comparison to it. To save space on the board, the output channels have only one output impedance with about 25 Ω and are only unbalanced configured.

Almost all other specifications are the same as the two channel generator on the AAB.

4.1.9.2 Digital section

The digital section contains a FPGA to control the complete board via SPI, a clock distribution and five I2S converter to generate ten SPDIF output signals.

4.1.9.3 Supply voltages

The switching power supply delivers +3.3 V, +5 V and ± 12 V, which are used to create the supply voltages for the board.

The analog generator needs ± 12 V to supply its operational amplifiers.

The digital section needs a lot of different voltages to provide the different parts:

- +5 V for the DACs and the relays in the analog generator.
- +3.3 V for the clock distribution.
- +1.2 V for the FPGA.
- +2.5 V for the I/O circuits of FPGA

All of these voltages are generated from switching power modules or linear regulators respectively. For more details see circuit drawing of R&S UPP-B8.

4.2 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 as much 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.

4.2.1 Self Test

Check the AC supply voltage on the wall socket and whether the R&S UPP supports this voltage. Then connect the instrument with the AC supply.

The external monitor display must 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 check

Next, the operating system is booted. Subsequently the R&S UPP application program starts up and performs the following:

- Checks the BB, reads out the board ID
- Checks the firmware version
- Loads the FPGAs for controlling the analog modules
- Runs a plausibility check of the correction factors in the EEPROMs
- 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.

4.2.2 Short test of analog interfaces

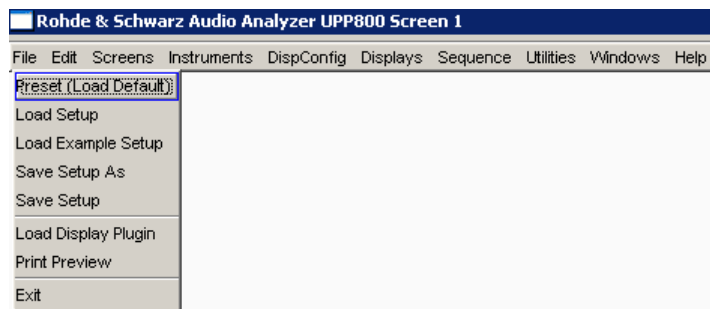
This short test lets you quickly check the analog interfaces of the R&S UPP. XLR cables are required to connect the generator outputs to the analyzer inputs.

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

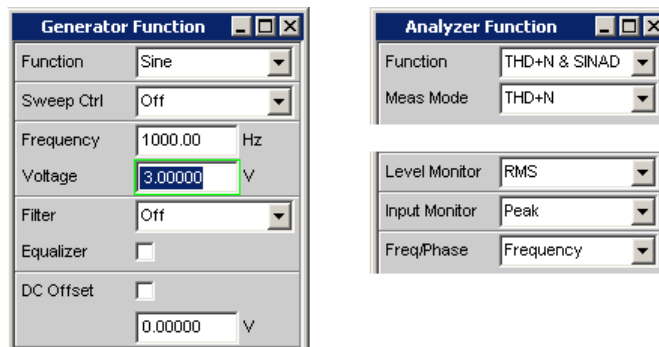
Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.



Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



Set R&S UPP:



Test the specifications for THD+N, RMS level and frequency in line with the valid data sheet. To check both generator channels and all eight analyzer channels connect the appropriate outputs with the corresponding inputs via XLR cables.

To complete the short test, it is advisable to test the monitoring output. You can use the setting from chapter 1 "Performance Test Audio Monitor" for this test.

If this test yields a positive result, the following modules are functioning properly:

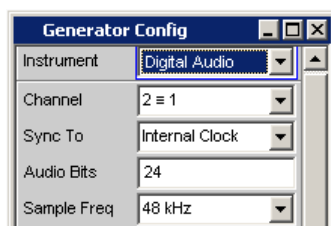
- The monitoring output and the part of the BB and AAB which are responsible for the control of the analog section
- Analog generator and analyzer (AAB)

4.2.3 Short test of UPP-B2 digital interfaces

Digital Audio

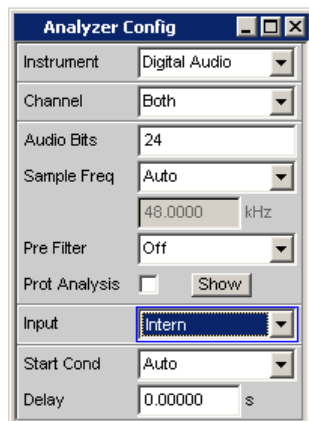
Set R&S UPP Generator:

Starting from the preset condition select the "Digital Audio" generator:



Set R&S UPP Analyzer:

Starting from the preset condition select the "Digital Audio" analyzer and select "Input" = "Intern":



The results displayed in the numeric display should read the following values:

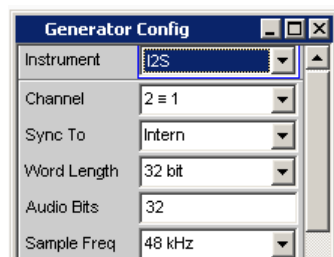
	RMS	Input Peak	Frequency
Ch1	-20.000 dBFS	-20.000 dBFS	997.00 Hz
Ch2	-20.000 dBFS	-20.000 dBFS	997.00 Hz

If this test yields a positive result, the following modules are functioning properly:

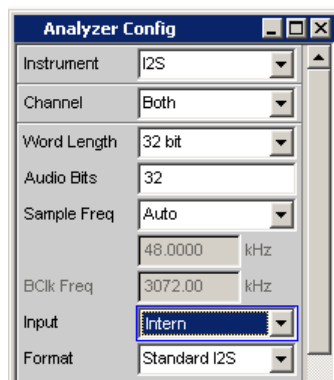
- The digital audio transceiver chip
- The digital audio generator and analyzer inside the UPP-B2 FPGA
- The digital audio generator and analyzer inside the UPP Baseboard FPGA

I2S**Set R&S UPP Generator:**

Starting from the preset condition select the "I2S" generator:

**Set R&S UPP Analyzer:**

Starting from the preset condition select the "I2S" analyzer and select "Input" = "Intern":



The results displayed in the numeric display should read the following values:

	RMS	Input Peak	Frequency
Ch1	-20.000 dBFS	-20.000 dBFS	997.00 Hz
Ch2	-20.000 dBFS	-20.000 dBFS	997.00 Hz

If this test yields a positive result, the following modules are functioning properly:

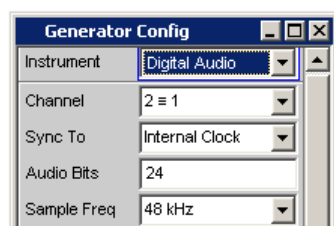
- The I2S audio generator and analyzer inside the UPP-B2 FPGA
- The I2S audio generator and analyzer inside the UPP Baseboard FPGA

4.2.4 Short test of UPP-B4 digital interfaces

Digital Audio

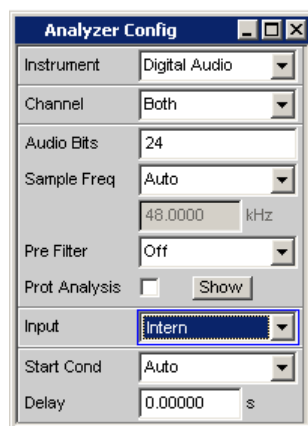
Set R&S UPP Generator:

Starting from the preset condition select the "Digital Audio" generator:



Set R&S UPP Analyzer:

Starting from the preset condition select the "Digital Audio" analyzer and select "Input" = "Intern":



The results displayed in the numeric display should read the following values:

	RMS	Input Peak	Frequency
Ch1	-20.000 dBFS	-20.000 dBFS	997.00 Hz
Ch2	-20.000 dBFS	-20.000 dBFS	997.00 Hz

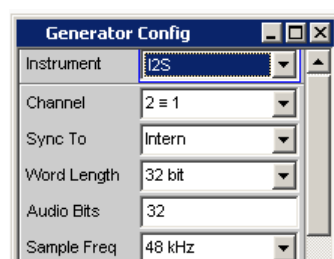
If this test yields a positive result, the following modules are functioning properly:

- The digital audio transceiver chip
- The digital audio generator and analyzer inside the UPP-B4 Cyclone III FPGA
- The digital audio generator and analyzer inside the UPP Baseboard FPGA

I2S

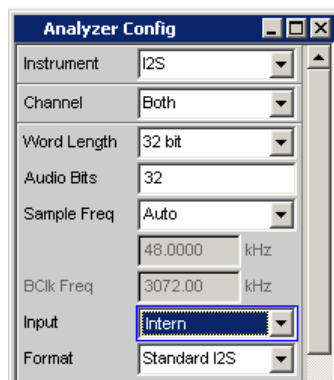
Set R&S UPP Generator:

Starting from the preset condition select the "I2S" generator:



Set R&S UPP Analyzer:

Starting from the preset condition select the "I2S" analyzer and select "Input" = "Intern":



The results displayed in the numeric display should read the following values:

	RMS	Input Peak	Frequency
Ch1	-20.000 dBFS	-20.000 dBFS	997.00 Hz
Ch2	-20.000 dBFS	-20.000 dBFS	997.00 Hz

If this test yields a positive result, the following modules are functioning properly:

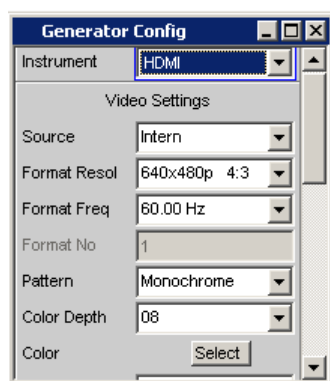
- The I2S audio generator and analyzer inside the UPP-B4 Stratix III FPGA
- The I2S audio generator and analyzer inside the UPP Baseboard FPGA

HDMI

Connect the "Source" output with the "Sink" input using a HDMI 1.4 cable with ethernet support.

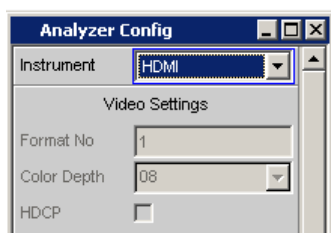
Set R&S UPP Generator:

Starting from the preset condition select the "HDMI" generator:



Set R&S UPP Analyzer:

Starting from the preset condition select the "HDMI" analyzer:



The results displayed in the numeric display should read the following values:

	RMS	Input Peak	Frequency
Ch1	-20.000 dBFS	-20.000 dBFS	997.00 Hz
Ch2	-20.000 dBFS	-20.000 dBFS	997.00 Hz

If this test yields a positive result, the following modules are functioning properly:

- The HDMI audio generator and analyzer inside the UPP-B4 Stratix III FPGA
- The HDMI "Source" SIL9334 transmitter and the HDMI "Sink" SIL9389 port processor and SIL9233 receiver chips.
- The HDMI audio generator and analyzer inside the UPP Baseboard FPGA

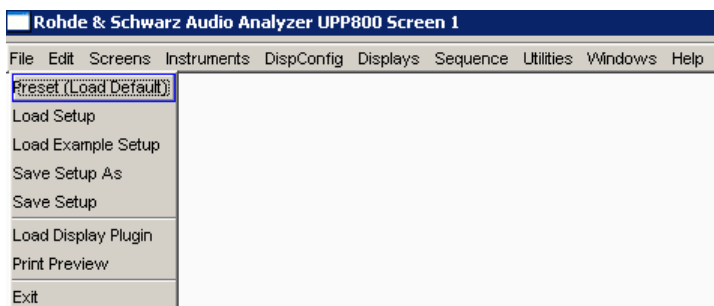
4.2.5 Short test of UPP-B8 analog and digital interfaces

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

Hover the mouse cursor right under the window icon in the upper left corner of the graphical user interface. By doing so, the menu bar appears as shown in the picture below.

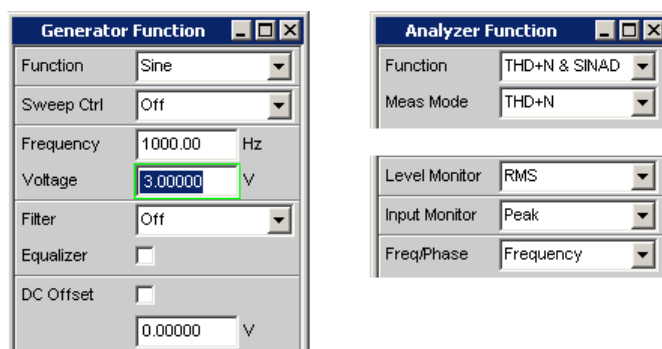


Select the "File" selection tree and select the "Preset (Load Default)" option in the dropdown list.



Set R&S UPP:

Select "Analog" or "Digital Audio" as instrument and "Multi" as channel in the generator config panel.



Test the specifications for THD+N, RMS level and frequency in line with the valid data sheet. To check all eight analog and ten digital generator channels connect the appropriate outputs with the corresponding inputs via special cables (UP-Z8A for testing the analog outputs and UP-Z8D for testing the digital outputs). To test the digital outputs a device with digital SPDIF inputs must be used (for example the audio analyzer R&S UPV with option UPV-B2).

If this test yields a positive result, the following modules are functioning properly:

- The digital parts of the UPP-B8 which are responsible for the control of the complete board
- The complete analog section including the DACs
- The complete digital section including the SPDIF converter

4.3 Troubleshooting

4.3.1 Measuring equipment and accessories

For the recommended measuring equipment refer to [Table 2-1](#) in [Chapter 2.1, "Measuring Equipment and Accessories"](#), on page 13.

4.3.2 Power-up problems

Symptom	Possible cause
The R&S UPP fails to boot after switching on, and the HDD cannot be heard running.	Is the power cable connected? Fuses OK?!

For any further troubleshooting open the instrument and proceed as follows:

- Is the cable from the mains input to the switching power supply plugged in?

- Measure the output voltage from the switching power supply (see relevant chapter).
- Take measurements on the BB.

4.3.3 Boot problems

Symptom	Possible cause
The R&S UPP 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 IPS or the IPS adapterboard? Is the SATA control cable plugged in?
The R&S UPP boots correctly, but hangs when the R&S UPP application program starts.	Fault on the BB? (For troubleshooting instructions see Troubleshooting tip)

Troubleshooting tip:

If the R&S UPP hangs during the boot phase when the application program is displayed, the cause may be on the BB or in a FPGA module. To receive detailed error messages, it is recommended that you proceed as follows:

- Switch the R&S UPP 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 UPP 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 directory `c:\` 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.

4.3.4 Error messages

The first hint of possible operating problems in the R&S UPP 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.

4.3.5 Front-panel LEDs

The LEDs on the front panel have various meanings.

Warnings: GEN OVLD, ANLR OVRG

Status message: ERROR, REMOTE, BUSY, READY

Toolbar action	Effect
	Icons from left to right: START, SINGLE, STOP/CONT, PRINT, OUTPUT OFF, OPEN, SAVE
STOP / CONT	The BUSY must be changing its illumination on each action.
SINGLE	The BUSY must be flashing.
OUTPUT OFF	The GEN OVLD LED must be flashing in yellow color. 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, feed in an external voltage into the generator outputs causes the output stage to be switched off and the Generator OVLD LED to illuminate in red color to indicate that the generator has been switched off.

If the voltage to the analyzer inputs is too high, the ANLR OVRG LED will illuminate in red color. If the peak voltage measured on the analyzer input is very slow in respect to the selected range, this LED will illuminate in yellow (UNDERRANGE).

Pressing the key has no effect?

- Are the green flexible conductor tracks connected to the Base Board? 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 UPP 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 UPP 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 X80 on the Base Board with a 16 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 Base Board), if it is plugged in correctly.
- The LEDs shine wrong or partly not at all. One possibility is an incorrect FW (for example the version for R&S UPV, but not for R&S UPP). In this case there is no HW error, but the LEDs are driven in a different way and don't reproduce the R&S UPP condition.

4.3.6 External keyboard

You can connect an external keyboard via one of the USB interfaces.

No response?

- 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 IPS adapterboard. The two USB interfaces on the front are connected directly to the IPS adapterboard via an USB 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.



If you connect the external keyboard while the instrument is running, problems in detecting it as an USB device may occur. Therefore, connect the keyboard before you switch on the R&S UPP.

4.3.7 Mouse

A standard mouse can be connected to one of the USB interfaces, allowing you to operate the R&S UPP 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 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.

4.3.8 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.

4.3.9 Fault in the switching power supply

As a rule the only measuring instrument needed is a digital DC voltmeter.

An error on SPS have an effect to the complete device, the R&S UPP shows no reaction to the ON button:

- the R&S UPP can not boot, because the supply voltages to the IPS are missing.
- the AAB can not be controlled, because the Base Board has no supply voltages.

Checking the switching power supply consists of no more than measuring the output voltages. The first test will be executing the Self Test which first will check for the voltages. As a second, the voltages are available on the Base Board near the corresponding control LEDs and can be measured with a DC voltmeter.

Voltages for Base Board are missing?

- are all cables plugged in at the mains input? is one of the flat connectors at mains input interrupted, is the circuit delivered by no or too low voltage?
- is the cable from Base Board to SPS (X10) plugged in? This connection delivers the input voltage to the Base Board.

NOTICE

Possible damage of the power supply

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 BB.

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.

4.3.10 Performing the Self Test

The R&S UPP has a built in function called "Self Test" which is available through the Diagnostic Panel. When executing the self test, several internal checks are performed:

1. measuring the power supply voltages +5 V, +3.3 V, +12 V, -12 V
2. measuring the internal BB voltages +2.5 V, +1.25 V

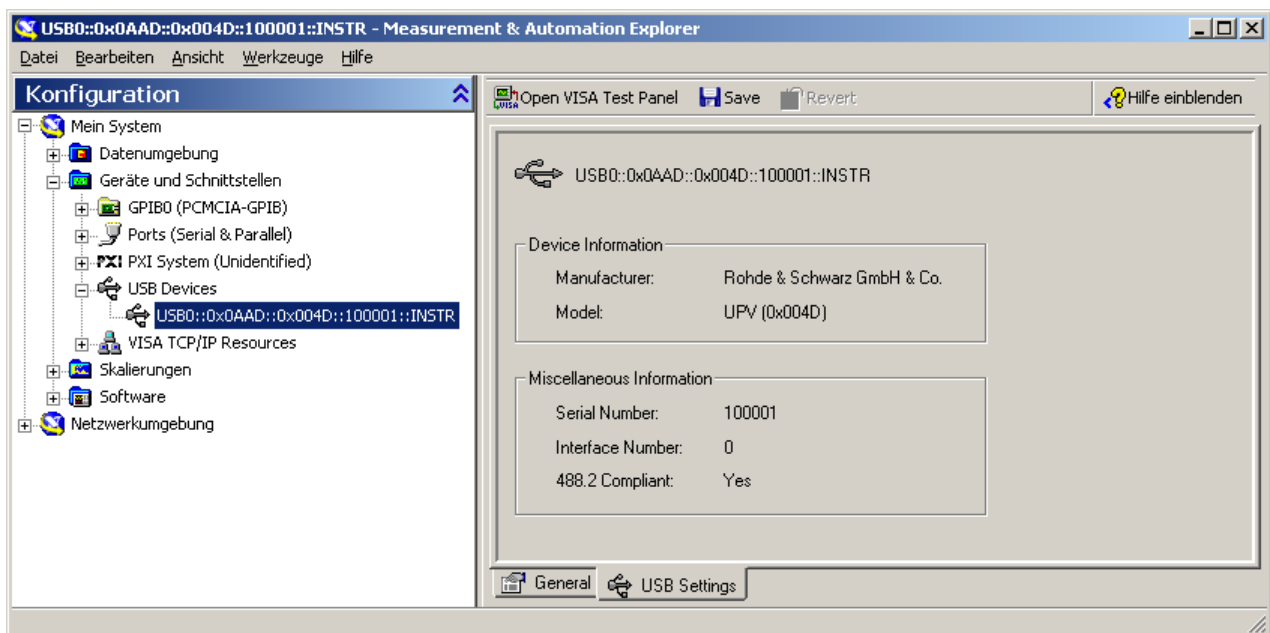
3. checking several randomly selected DRAM blocks of 64 kByte distributed around the whole address range
4. generating a digital sine signal and measuring with internal BB loop back
5. analyzing this digital sine signal with different measurement methods with internal BB loop back
6. analyzing DFD and MOD DIST signal with internal BB loop back
7. routing the sine signal through the AAB and measuring with internal analog audio loop back
8. routing the sine signal through the analog connectors and measuring with external loop back.
At R&S UPP with Ser. 1x0100 (x = 2,4, or 8) and higher the 600 Ω output and input impedances will also be checked.
9. UPP-B2/B4 only: routing a sine signal through the board and measuring the internal digital audio loop back
10. UPP-B2/B4 only: routing a sine signal through the digital audio connectors and measuring with external loop back
11. UPP-B2/B4 only: routing a sine signal through the board and measuring the internal I2S loop back
12. UPP-B2/B4 only: routing a sine signal through the I2S connectors and measuring with external loop back
13. UPP-B4 only: routing a sine signal through the HDMI connectors and measuring with external loop back
14. UPP-B8 only: routing a sine signal through the analog audio connectors and measuring with external loop back

4.3.11 Errors on the Base Board

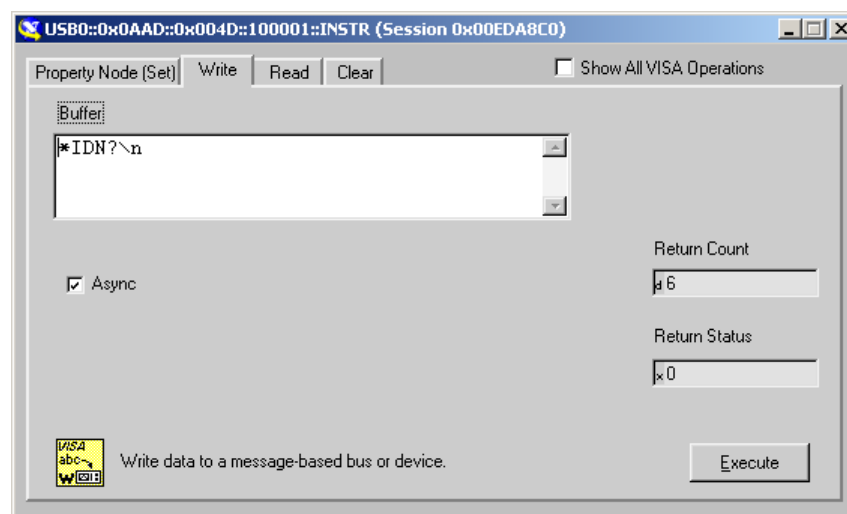
Performing the built in Self Test (see [Chapter 4.3.10, "Performing the Self Test"](#), on page 207) will check the BB and give some more information on where the error occurs.

4.3.12 Fault in USB Device Interface

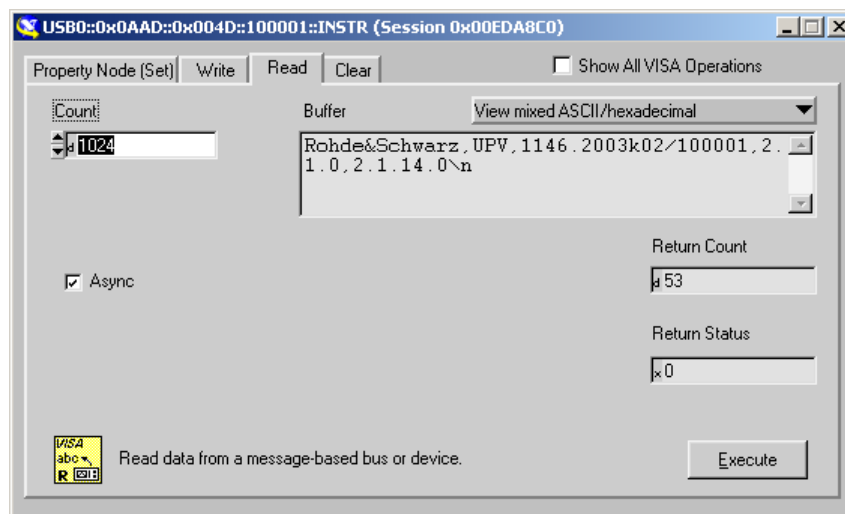
The R&S UPP can be controlled via this interface. To check the connection use the NI-Visa-Tool with Version 3.4 or higher. Is an UPP connected, the program recognizes it as an USB-Device:



To build up a communication between the controlling PC and the R&S UPP, click „Open VISA Test Panel“:



Select tab „Write“. In the new window the user can write a command, which will be sent to the R&S UPP by „Execute“. After that select tab „Read“ and press „Execute“ once again. In the window „Buffer“ the answer of R&S UPP appears like following example from UPV:



Is no connection to the R&S UPP possible by this test, so check first the cable from USB board inside and Base Board. Is the cable o.k. a high probability for a defective IPS exists.

4.3.13 Faulty CASCADE / LAN Reset Button

The R&S UPP is fitted with a reset button for LAN connections. 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. The device carries out „Shut Down“ and boots again. Therefore the time for LED „Ready“ to be ON is longer. This is no indication for an error!
2. Press the button short. This operation brings the R&S UPP in „Waiting for Slave“ operation mode. The LED „CASCADE“ must flash as an indication, that the device is waiting for other devices. Pressing the button again resets the UPP to its former state.

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 the base board is defective or not plugged in.

4.3.14 Defective analog audio board (AAB)

The analog 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 an external 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.

The first troubleshooting action is to perform the built in Self Test (see [Chapter 4.3.10, "Performing the Self Test"](#), on page 207) which will give some more information on where the error occurs. 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 analog audio board (AAB) or on the base board (BB).

4.3.14.1 Defective analog signal generation

An initial criterion for correct control of the AAB from the BB is whether you can hear individual relays while the R&S UPP application program is being started. If not, the BB may be defective, the control signals may not be valid or the supply voltages from BB 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 UPP.

Measure the supply voltages

- +5V-G1/2R for relay of channel 1/2 okay? (P8/10)
- +5VA-G for analog part of signal D/A converter okay? (P12)
- ± 15 V-G1/2 for the operational amplifier okay? (P110 to P114)

If any of the voltages above is missing check the supply voltages from the BB to the AAB.

- +5V_BB and +5V respectively okay? (P94/96)
- +3V3_BB and +3V3 respectively okay? (P69/84)
- +12V_BB okay? (P68)
- -12V_BB okay (P59)

Is one or more of the voltages missing, this may be caused by the AAB (short circuit) or the BB.

At least it is recommended to control the clock to the signal D/A converter on pin 27. It must be 12.288 MHz.

If the output voltage 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)?
- Did a short circuit or an external signal fed in to the generator cause the generator output to switch off? (Check the "Generator OVLD" LED on the front panel of the R&S UPP.)
- 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 level with the selected frequency!

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 frequency 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)?

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 BB 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 FPGA) or on the BB without thorough testing.

If the output signal is distorted or noisy

Operating error? (in the Generator Config or Function Panel)

- Is the Volt Range set to Fix 14 V, and is a very low level selected?
Despite the very low level (e.g. 1 mV), the generator hardware is set for 14 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 and the error is on the AAB. If the signal is in order, the instru-

ment 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.

4.3.14.2 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. The steps must be performed in the specified sequence, for otherwise the troubleshooting result may be incorrect.

- Are all analyzer channels defective in the same way?
If yes, then continue with the next step. Otherwise continue further below.
- Do the relays click when the R&S UPP 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".
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 all channels and for all bandwidth settings?
If yes, see below under "Detailed tests for deciding whether to replace a board".
If not, continue with the next step.
- Are the RMS display values incorrect for all channels?
If yes, see below under "Detailed tests for deciding whether to replace a board".
Otherwise replace AAB immediately.
- Is autoranging defective in all 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".
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

- +5V-CH1R to +5V-CH8R for relays okay? (P72 to P79)
- For Ser. until 1x0099: +11V-CH1 to +11V-CH8 for operational amplifier okay? (P51 to P58)
For Ser. from 1x0100: +9V-CH1 to +9V-CH8 for operational amplifier okay? (P51 to P58)
All these test points are located on the bottom side of AAB and therefore difficult to measure. Check the voltage instead of this point on an opamp inside the analyzer chamber (N40, N43, N46, N49, N52, N55, N58 and N61 for the channels 1 to 8 each on pin 8).
- For Ser. until 1x0099: -11V-CH1 to -11V-CH8 for operational amplifier okay? (P60 to P67)

For Ser. from 1x0100: -9V-CH1 to -9V-CH8 for operational amplifier okay? (P60 to P67)

All these test points are located on the bottom side of AAB and therefore difficult to measure. Check the voltage instead of this point on an opamp inside the analyzer chamber (N40, N43, N46, N49, N52, N55, N58 and N61 for the channels 1 to 8 each on pin 4).

- +3V3-ADC for the digital section of A/D converters okay? (P81)
- +5V-ADC12 for the analog section of A/D converters for channels 1 to 4 okay? (P83)
- +5V-ADC34 for the analog section of A/D converters for channels 5 to 8 okay? (P98)



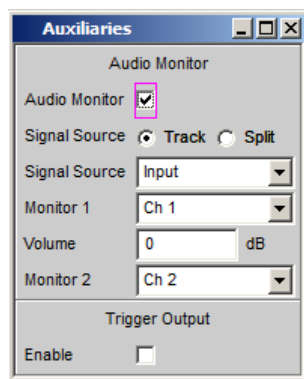
All voltages for the analyzer are referenced to the casing ground.

If one or more supply voltages are faulty, the cause of the problem must be the AAB.

4.3.15 Error on the audio monitoring output

To allow monitoring of audio signals, you have to activate the audio monitoring function in the Auxiliaries panel.

Set R&S UPP:



If you have not enabled the Audio Monitor, the entire audio monitoring function is deactivated.

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.
- 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 another one is monitored, the monitor output shows no output voltage.

- 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 seen on an oscilloscope.
- 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.

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 the monitor output.
If the analyzer range has been selected correctly, the cause may be in the audio-monitoring D/A converter on the AAB.

If everything is correctly set and connected, go to the next test. For this test, you have to open the R&S UPP.

Measure the supply volages

- +5V_MON_DAC for analog section monitor D/A converter okay? (P106)
This test point is located on the bottom side of AAB and therefore difficult to measure. Check the voltage instead of this point on the via at pin 28 of the audio-monitoring D / A converter.
- +12V_MON_DAC for lowpass opamps okay? (P107)
This test point is located on the bottom side of AAB and therefore difficult to measure. Check the voltage instead of this point on C15.
- -12V_MON_DAC for lowpass opamps okay? (P108)
This test point is located on the bottom side of AAB and therefore difficult to measure. Check the voltage instead of this point on C16.

If any of the voltages above is missing check the ferrite cores L16 to L19.

4.3.16 Position of Voltage Test Points

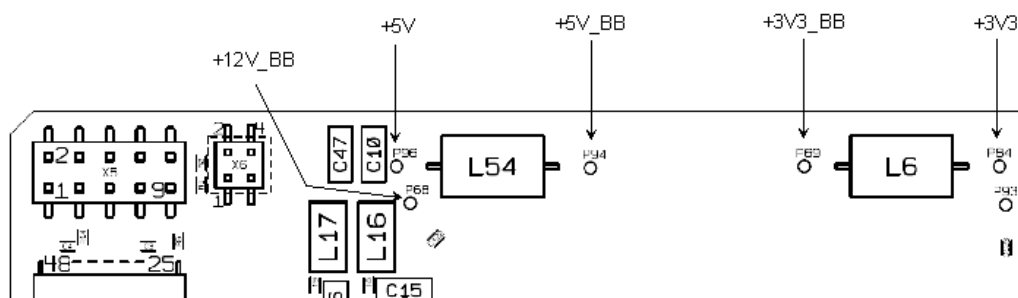


Figure 4-1: VCC Testpoints from Baseboard to the Analog Audio Board

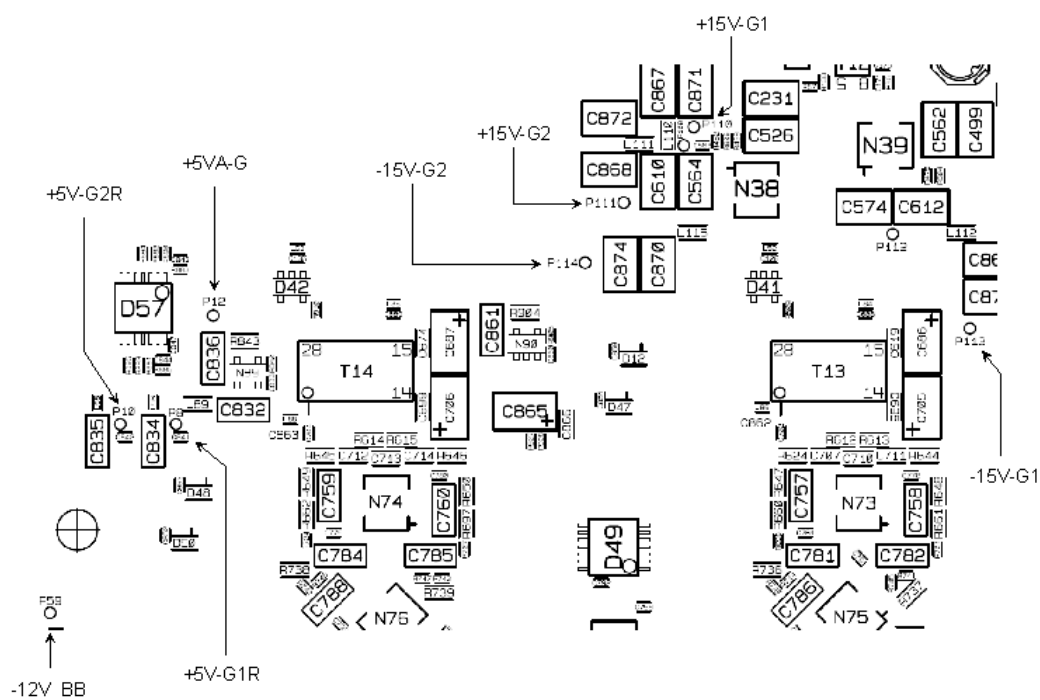


Figure 4-2: VCC Testpoints for the Analog Generator

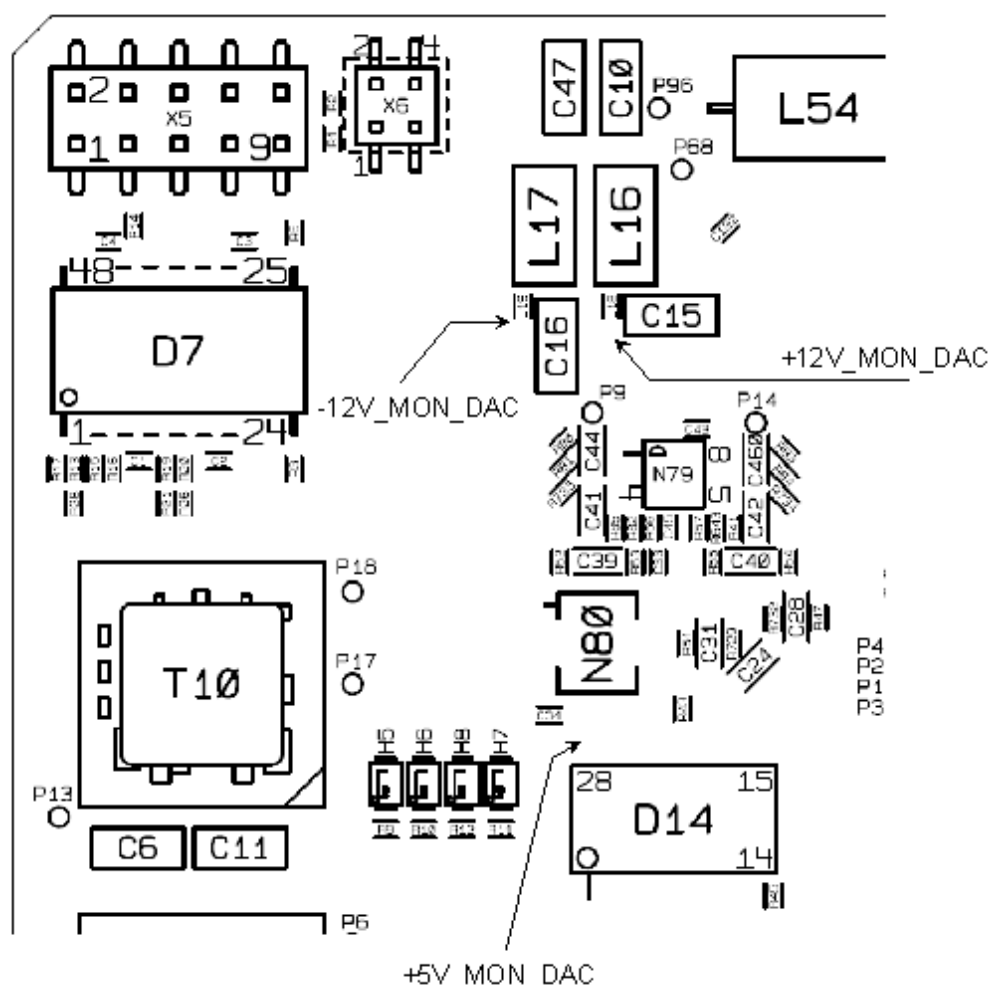


Figure 4-3: VCC Testpoints for the Audio Monitor

4.3.17 Errors in Options R&S UPP-B2/B4

Performing the built in Self Test (see [Chapter 4.3.10, "Performing the Self Test"](#), on page 207) will check the board and give some more information on where the error occurs.

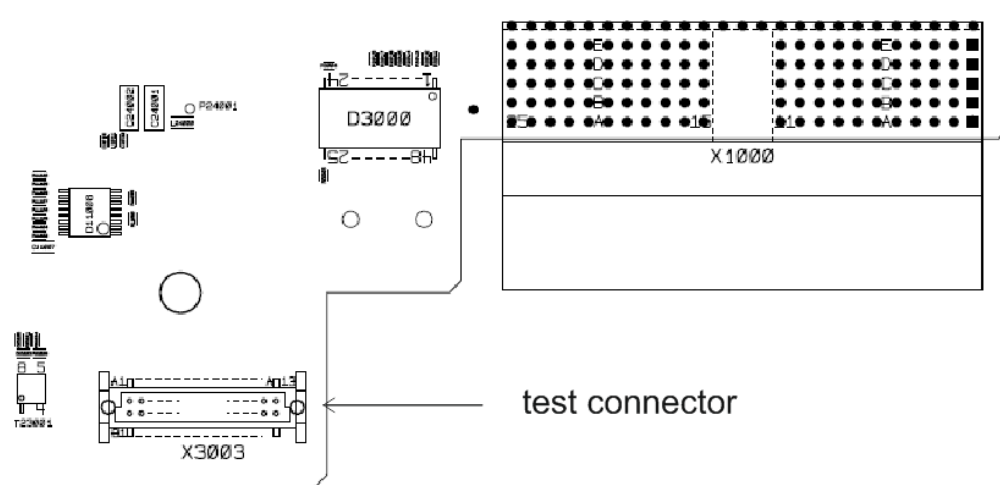
Nevertheless, there may be a possibility left that missing connections between the Base Board and either the Analog Audio Board or Digital Audio Board still results in misfunction of the device. This may happen although the Self Test tells that everything is OK.

4.3.18 Errors in Option R&S UPP-B8

Performing the built in Self Test (see [Chapter 4.3.10, "Performing the Self Test"](#), on page 207) will check the board and give some more information on where the error occurs.

To troubleshoot the analog part on the board see functional description and troubleshooting of generator section on AAB. To troubleshoot the digital part on the board see functional description of digital audio section on UPP-B2.

As the first step check the different voltages via the test connector called "DIAGNOSE" on the board.



4.4 Module Replacement

The following section describes module replacement in detail. Chapter 5 provides information on how to order spare parts. It includes a list of mechanical parts and their order numbers together with drawings illustrating module replacement.

Modules:

Controller module IPS1 or IPS2	A6
Lithium battery	
Hard disk	A5
IPS adapterboard	A9
Power supply	A1
Switching board	A8
USB 2.0 adapter	A7
XLR Frontpanel	A40
Fans	E1 and E2

Analog audio board	A4
Base board	A10
DDR2 1GB 533 MHz	A11
Digital audio board B2	A20
Digital audio board B4	A20
Multi Channel Generator board B8	A20

References to the "left side" and the "right side" relate to the front view of the instrument.

⚠ CAUTION**Risk of shock hazard and module damage**

- Disconnect the instrument from the power source before opening the cabinet.
 - Please take note of the additional safety instructions at the beginning of this manual.
 - The instrument should only be opened on an anti-static workbench to ensure that the electronic components in the instrument are not damaged by electrostatic discharges.
The following methods can be used separately or in combination to protect against electrostatic discharges:
 - Protective wrist strap with ground conductor
 - Conductive floor covering with heel strap
-

4.4.1 Opening the instrument

- Switch off instrument and disconnect from power.



- Remove the four screws from the rear wall feet Pos. 1050 and remove them together with the feet.
- Remove the enclosure Pos. 1030.

4.4.2 Replacing the Controller Module IPS A6

The controller module is located near the rear panel of the instrument

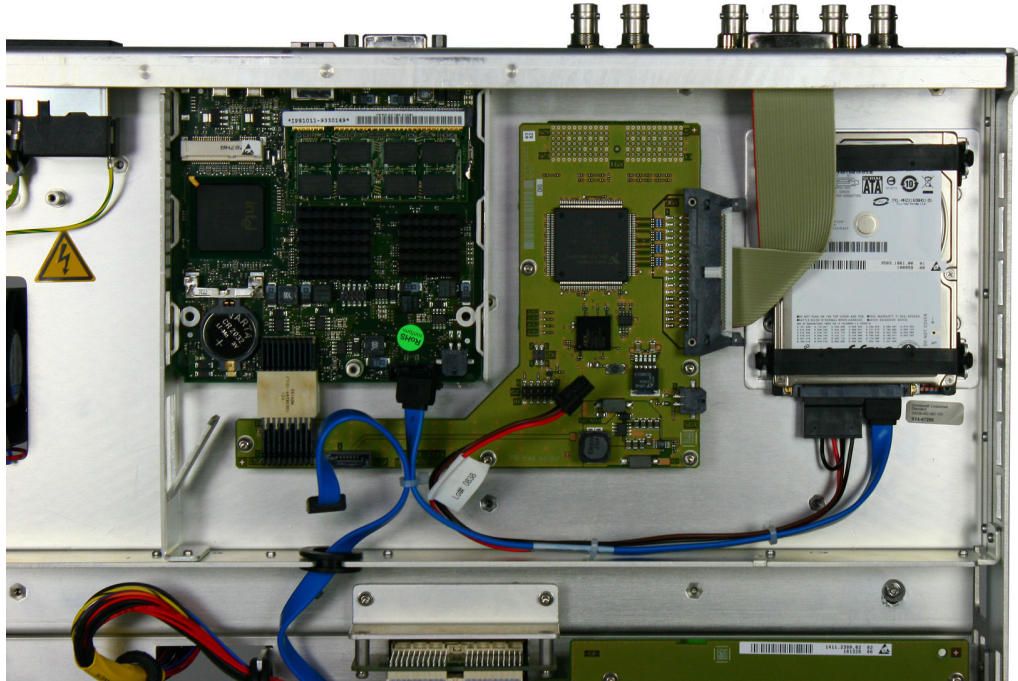
Removing the controller module

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).

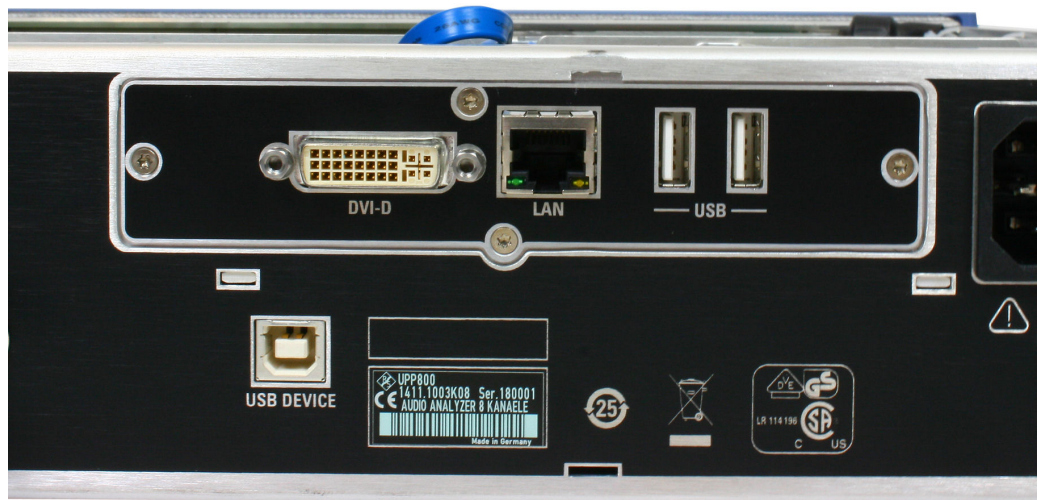


The connecting cables are still connected to the controller module.

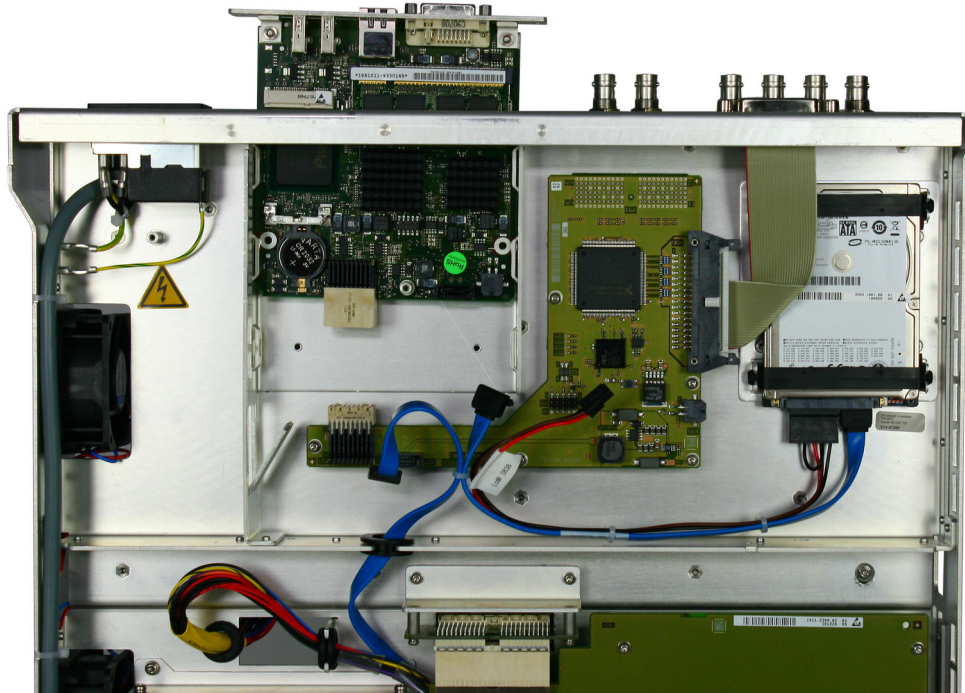
- Disconnect the cables to the hard disk - the SATA data cable W5 Pos. 390 and the SATA power cable W95 Pos. 370 - from the controller A6 Pos. 300, 301 or 302.



- Remove the four screws Pos. 330 from the rear of the unit.



- Remove the controller A6 Pos. 300, 301 or 302. For the controller IPS2 draw it in a downward movement because of the higher heat sink.



The controller module and the IPS adapter board A9 Pos. 230 are firmly connected. Remove the controller module by pulling it upwards.

Installing the new controller module and reassembling the instrument

- Carefully fit the new controller module IPS A6 Pos. 300, 301 or 302 onto the IPS adapter board A9 Pos. 230 and fasten it to the rear with the four screws Pos. 330.
- Carefully reconnect all cables to the controller module.

NOTICE

Possible cable damage

Cables must not be jammed and must be neatly arranged.

- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power.
- Check the BIOS version and update if necessary (see BIOS update).

4.4.3 Replacing the Lithium Battery on the Controller Module

The lithium battery is located on the controller module at the rear of the instrument.

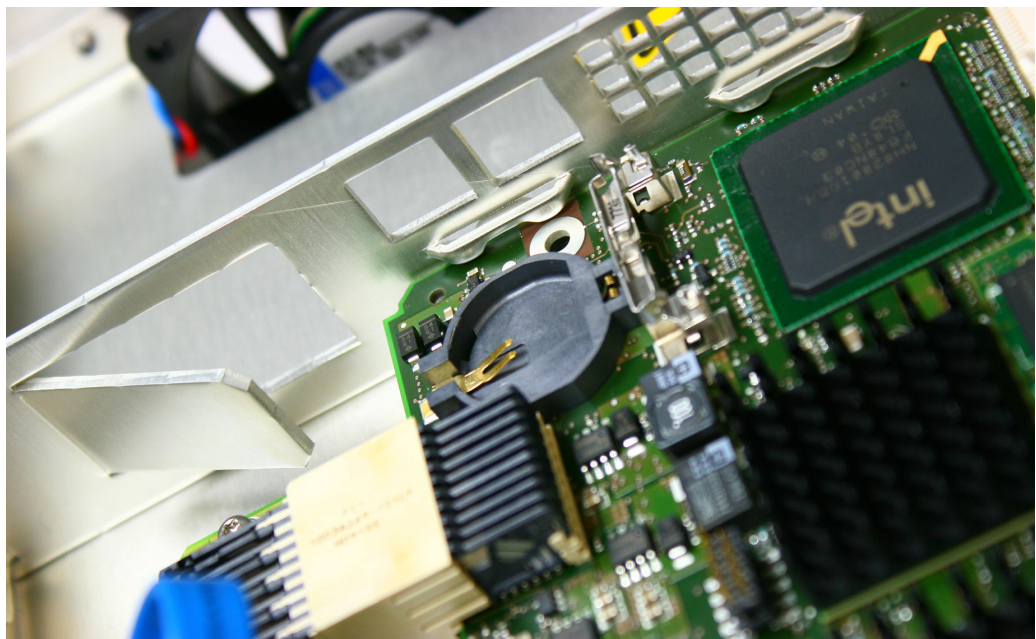
⚠ CAUTION**Danger of explosion or intoxication**

Lithium batteries present a potential health risk. Therefore, the following measures must be taken:

- Do not expose them to high temperatures or fire to avoid danger of explosion.
- Keep all batteries away from children to avoid intoxication.
- Replace batteries correctly and do not short-circuit them, otherwise there is danger of explosion. Replace the battery only with R&S type, see below.
- Lithium batteries are hazardous waste. Observe local regulations regarding waste container disposal.

Removing the lithium battery

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Carefully lift out the battery. Pull it slightly forward and lift it up.



Installing the new battery and reassembling the instrument

CAUTION

Danger of injury caused by explosion

To avoid danger of explosion

- Only use a 3.4 V lithium battery from Rohde & Schwarz (diameter 20 mm * 3 mm), order number 0858.2049.00.
- Replace the battery correctly.
- Never short-circuit the battery.

- Slip the battery under the spring in the holder.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.

Putting into operation

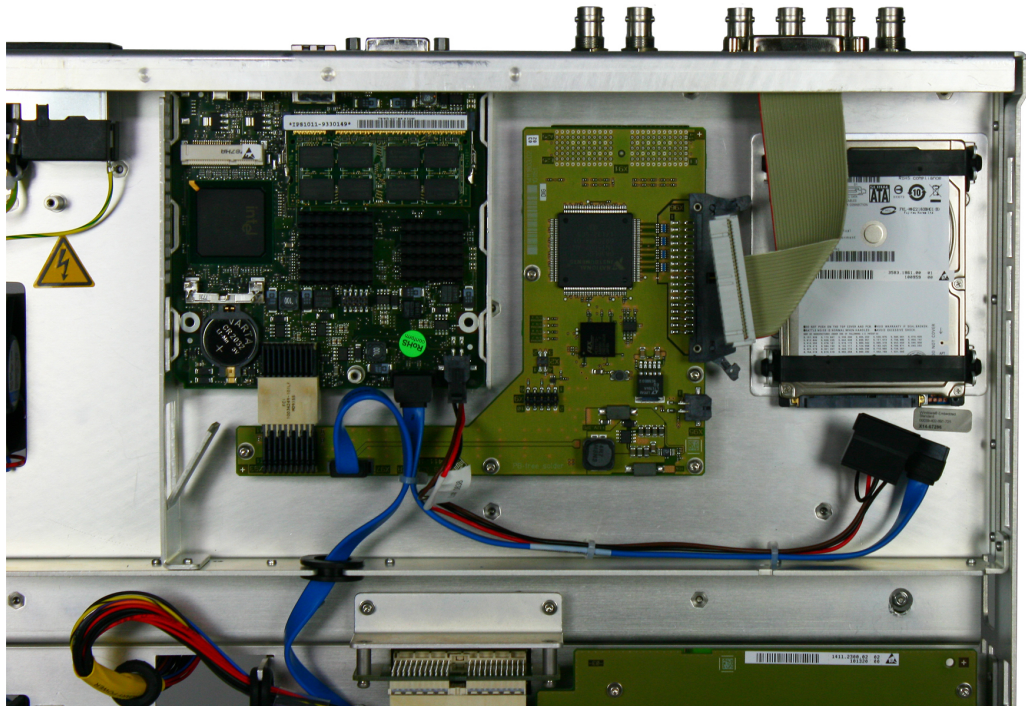
- Connect the AC supply cable and switch on the power. The instrument will boot now.
- The instrument can now be used immediately.

4.4.4 Replacing the Hard Disk A5

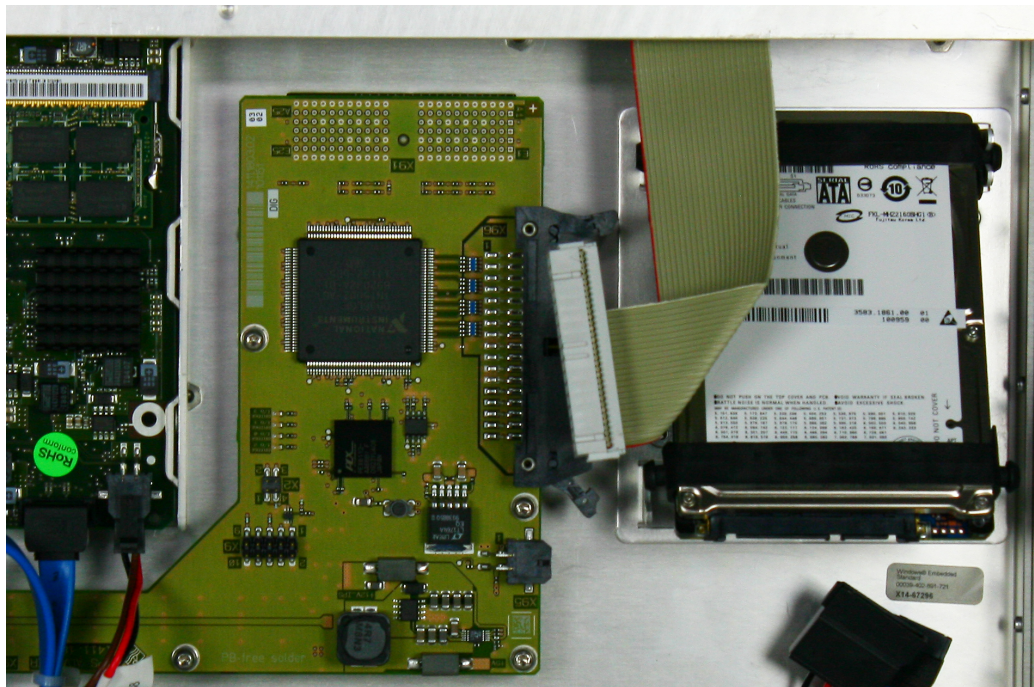
The hard disk is located at the rear of the instrument, near the controller. The spare part is supplied with pre-installed software.

Removing the hard disk

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Disconnect the SATA data cable W5 Pos. 390 from the hard disk A5 Pos. 250, 251 or 252.
- Disconnect the SATA power cable W95 Pos. 370 from the hard disk A5 Pos. 250, 251 or 252.



- Remove the hard disk A5 Pos. 250, 251 or 252 with the holder Pos. 260.



Installing the new hard disk and putting it into operation



Slip the two holders onto the hard disk and put it back into the instrument.

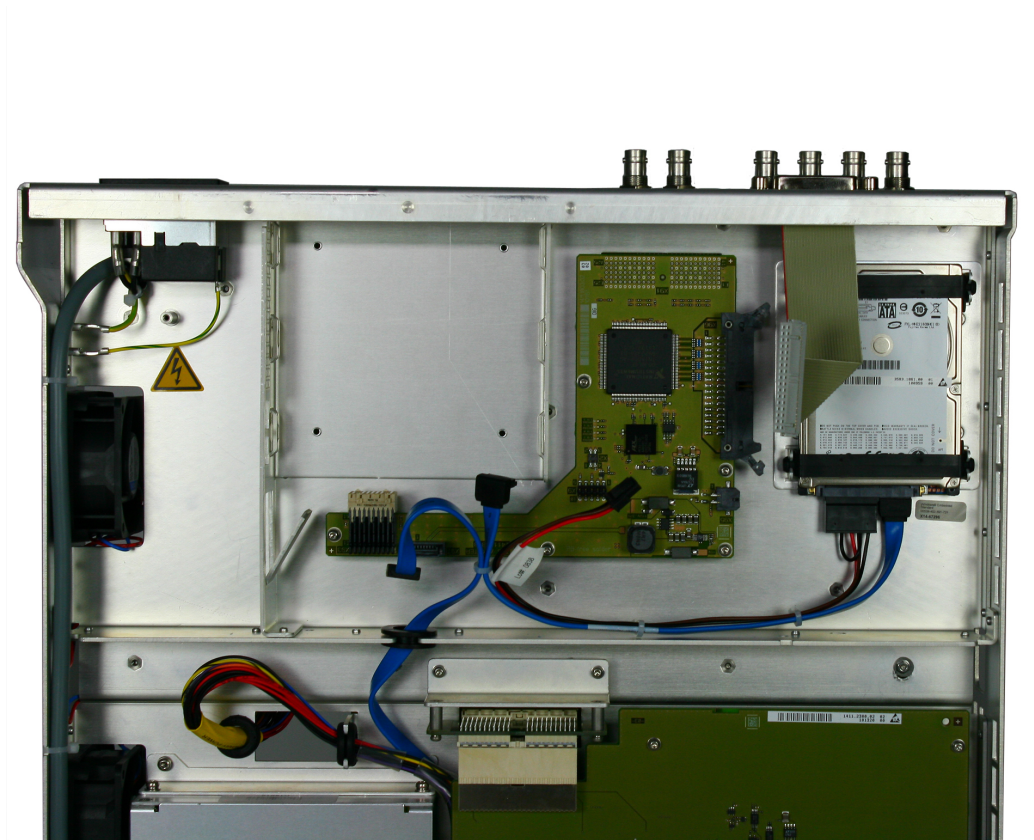
- Place the hard disk A5 Pos. 250, 251 or 252 with the holder Pos. 260 back into the R&S UPP.
- Connect the SATA data cable W5 Pos. 390 from the hard disk A5 Pos. 250, 251 or 252.
- Connect the SATA power cable W95 Pos. 370 from the hard disk A5 Pos. 250, 251 or 252.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.
- After starting the instrument, update the firmware if necessary (see firmware update).

4.4.5 Replacing the IPS adapter board A9

The IPS adapter board is located at the rear of the instrument, near the controller.

Removing the IPS adapter board

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the controller module (see [Chapter 4.4.2, "Replacing the Controller Module IPS A6"](#), on page 220).
- Disconnect the IEC bus cable W96 Pos. 190 from the IPS adapter board A9 Pos. 230.
- Disconnect the SATA data cable W97 Pos. 795 from the IPS adapter board A9 Pos. 230.
- Unfasten the five screws Pos. 240.



- Remove the IPS adapterboard A9 Pos. 230 upwards.

NOTICE

Risk of module damage

Be careful when removing the IPS adapterboard as it is connected to the base board A10 from the other side.

Installing the new IPS adapter

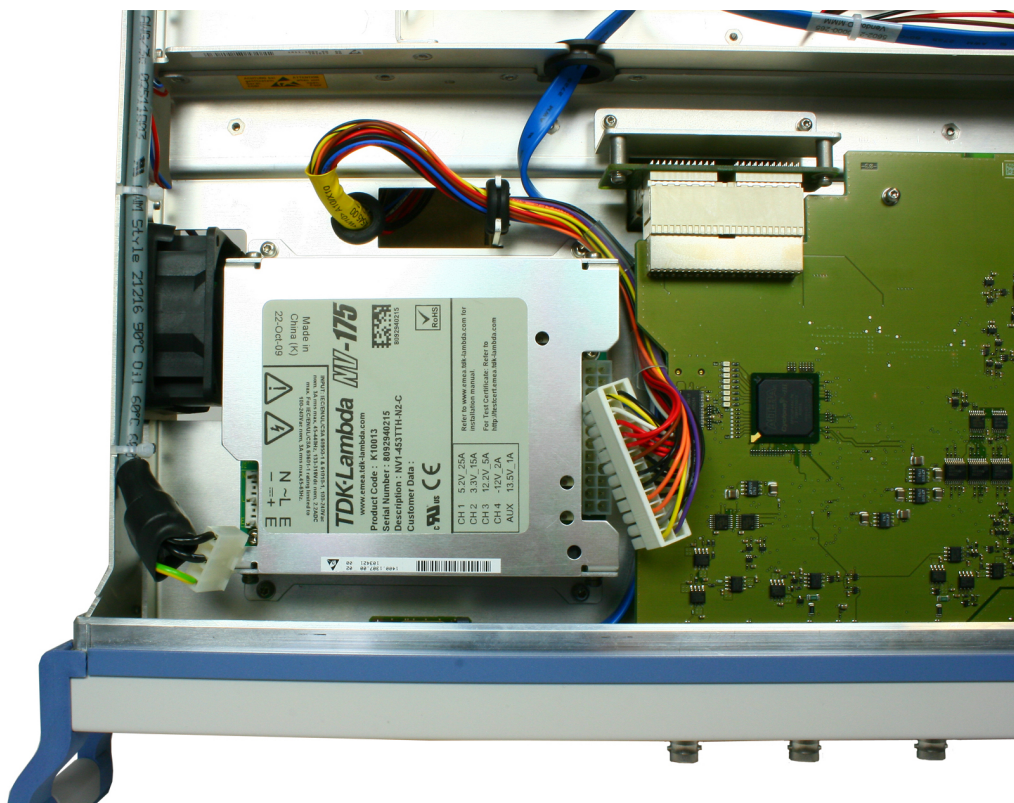
- Place the IPS adapter board A9 Pos. 230 back in the instrument and connect it to the base board A10.
- Fasten the five screws Pos. 240.
- Connect the IEC bus cable W96 Pos. 190 from the IPS adapter board A9 Pos. 230.
- Connect the SATA data cable W97 Pos. 795 from the IPS adapter board A9 Pos. 230.
- Replace the IPS controller board A6 Pos. 300, 301 or 302.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.6 Replacing the Power Supply Unit A1

The power supply unit is located toward the front of the instrument.

Removing the power supply unit

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Disconnect the primary power cable W1 Pos. 430 and the secondary power cable W10 Pos. 440 from the power supply A1 Pos. 400.
- Remove the four screws Pos. 420 from the fastening brackets Pos. 410 at the bottom and lift the power supply A1 Pos. 400 up.



Installing the new power supply unit

- Install the new power supply unit in reverse order.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.7 Replacing the Push-Button Board

The push-button board is located behind the front cover, on the rear of the mounting tray.

Removing the push-button board

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.

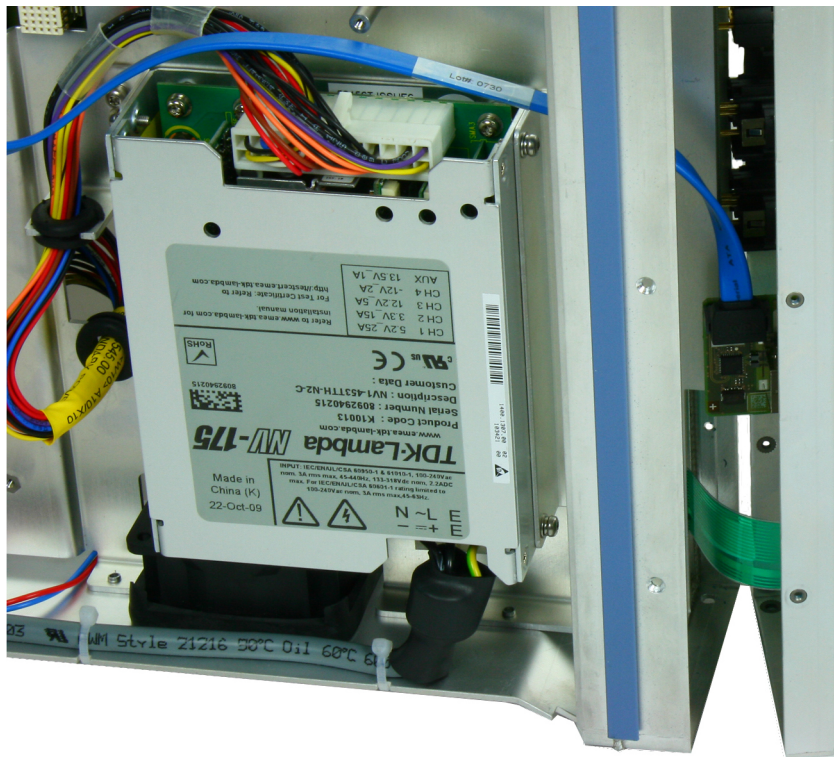


- Pull the front cover forward and remove it.
 - Pos. 1000 front cover VAR 08
 - Pos. 1001 front cover VAR 04
 - Pos. 1002 front cover VAR 02

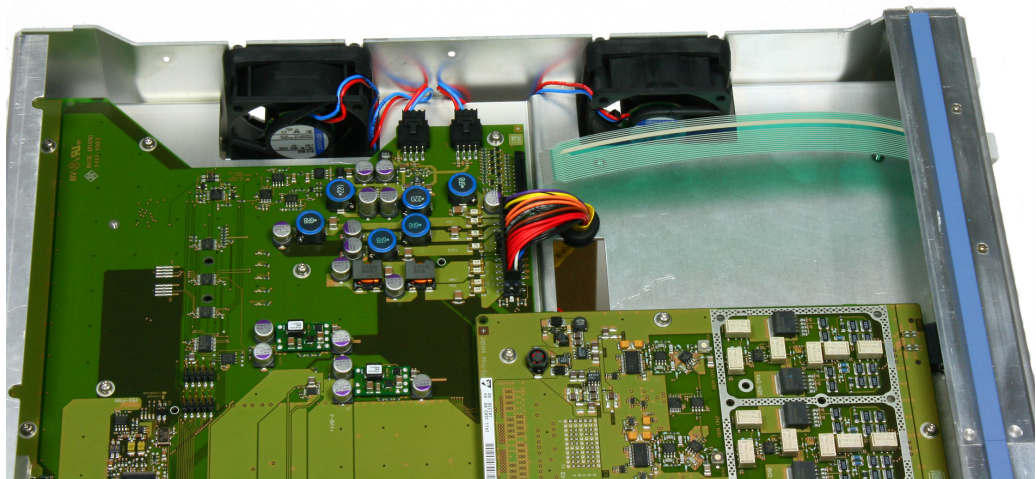
**NOTICE****Additional step if any hardware option is installed**

If the option R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 is installed, it must be removed first (see [Chapter 4.4.15, "Replacing Option B2 - Digital Audio Board \(A20\)"](#), on page 250).

- Remove the eight countersunk screws Pos. 640 from both the top and bottom of the front frame.
- Disconnect the SATA cable W97 Pos. 795 from the USB 2.0 hub A7 Pos. 770.



- Disconnect the flexible push-button board cable A8 Pos. 700 from the base board A10.



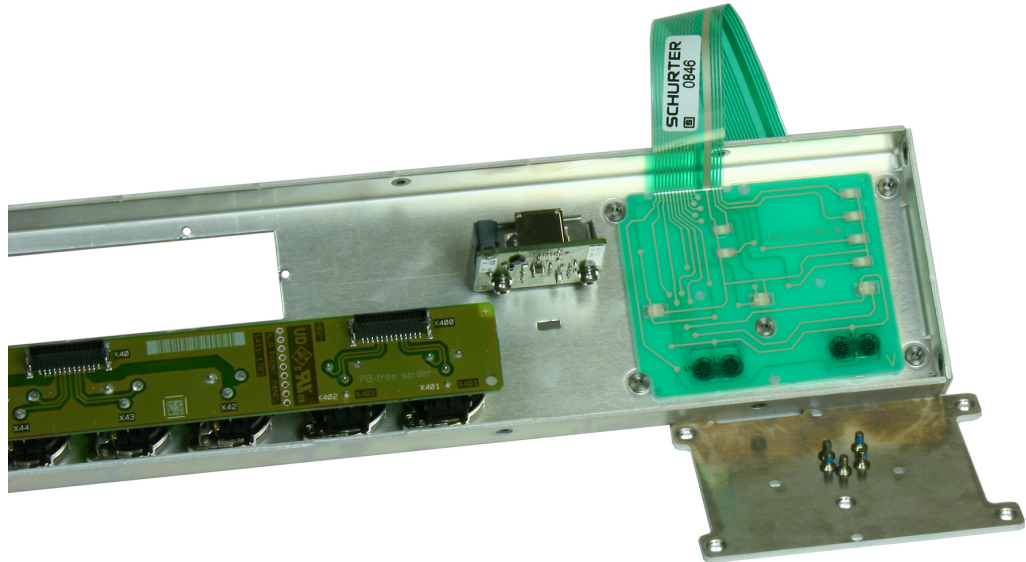
- Pull the mounting through Pos. 600 and remove it.

NOTICE

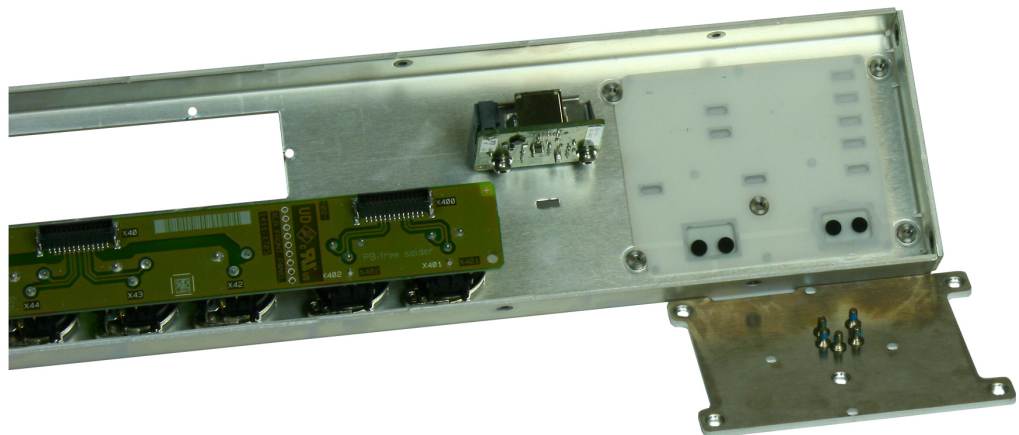
Risk of module damage

Use caution when pulling the mounting through as it is connected to the audio analog board.

- Remove the five screws Pos. 740 from the holding plate Pos. 730.
- Remove the holding plate Pos. 730.



- Remove the flexible push-button board cable A8 Pos. 700.



- Remove the push-button board Pos. 710.

Installing a new push-button board and reassembling the instrument

NOTICE

Risk of module damage

The positioning pins must be inserted into the holes in the mounting tray.

- Place the new push-button board set on the mounting Pos. 600.

- Place the flexible push-button board Pos. 700 on the back of the push-button board set.
- Reattach the holding plate Pos. 730 back and fasten it with the five screws Pos. 740.

NOTICE**Risk of pin damage**

Arrange the switching board cable connector so that it faces in the direction of the base board (A10). The push-button board must be positioned so that the pins on the push-button pad pass through the holes in the push-button board.

-
- Plug the front unit back into the R&S UPP and fasten it to the front frame with eight countersunk screws Pos. 640.

NOTICE**Additional step if any hardware option was installed**

If the option R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 was installed, it must be reinstalled (see [Chapter 4.4.15, "Replacing Option B2 - Digital Audio Board \(A20\)"](#), on page 250).

-
- Put the front cover Pos. 1000 back in place.
 - Use four screws to reinstall the two front feet Pos. 1010.
 - Connect the SATA cable W 97 Pos. 795 from the USB 2.0 hub A7 Pos. 770.
 - Connect the flexible push-button cable A8 Pos. 700 from the base board A10 Pos 100 or 101.
 - Replace the enclosure Pos. 1030.
 - Use four screws to reinstall the rear feet Pos. 1050.
 - Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.8 Replacing the USB 2.0 Hub A7

The USB board is located behind the front cover, on the rear of the mounting tray.

Removing the USB 2.0 hub

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.



- Pull the front cover forward and remove it.
 - Pos. 1000 front cover VAR 08
 - Pos. 1001 front cover VAR 04
 - Pos. 1002 front cover VAR 02

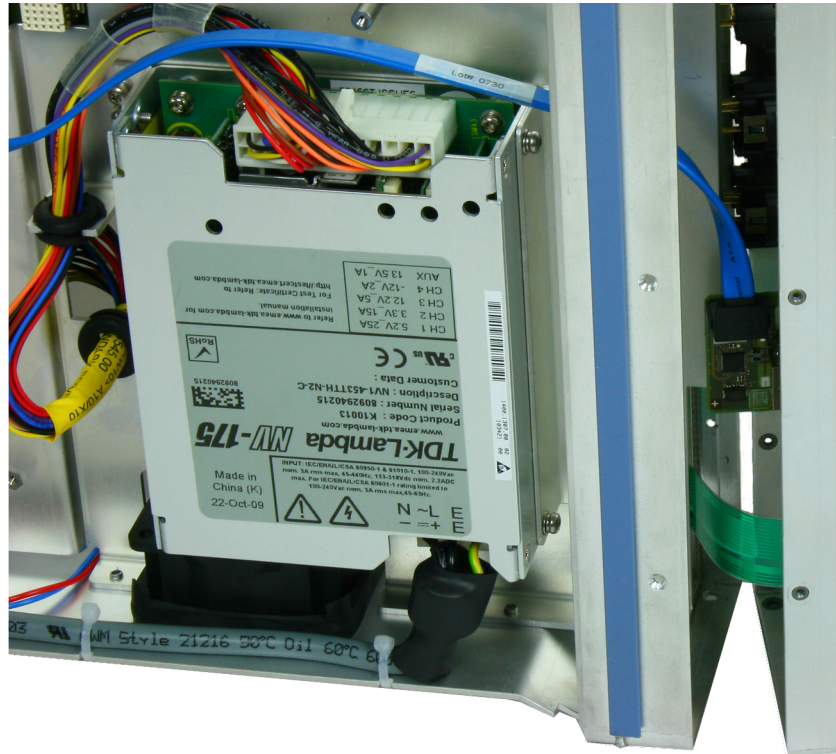


NOTICE

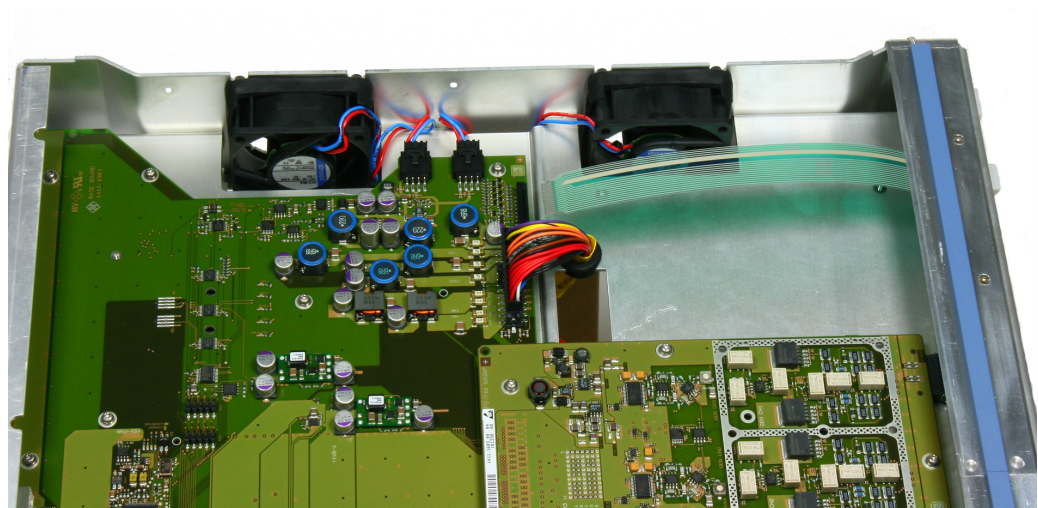
Additional step if any hardware option is installed

If the option R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 is installed, it must be removed first (see [Chapter 4.4.15, "Replacing Option B2 - Digital Audio Board \(A20\)"](#), on page 250).

- Remove the eight countersunk screws Pos. 640 from both the top and the bottom of the front frame.
- Disconnect the SATA cable W 97 Pos. 795 from the USB 2.0 hub A7 Pos. 770.



- Disconnect the flexible push-button board cable A8 Pos. 700 from the base board A10.

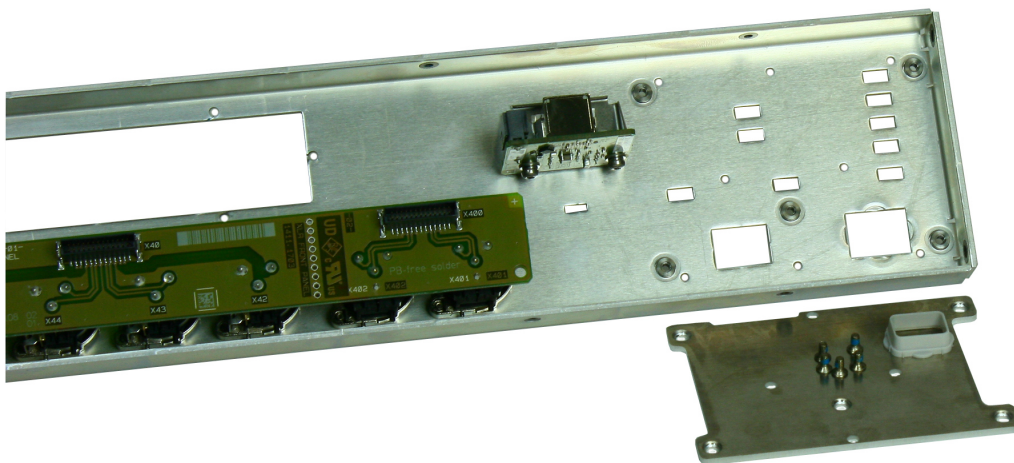


- Pull the mounting through Pos. 600 and remove it.

NOTICE**Possible damage to module**

Use caution when pulling the mounting through as it is connected to the audio analog board. Remove the five screws Pos. 740 from the holding plate Pos. 730.

- Remove the two screws Pos. 780 from the USB 2.0 Hub A7 Pos. 770 and remove the USB 2.0 Hub.

**Installing a new USB 2.0 hub and reassembling the instrument**

- Place the new USB 2.0 hub A7 Pos. 770 and fasten it with the two screws Pos. 780.
- Plug the front unit back into the R&S UPP and fasten it to the front frame with the eight countersunk screws Pos. 640.

NOTICE**Additional step if any hardware option was installed**

If the option R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 was installed, it must be reinstalled (see [Chapter 4.4.15, "Replacing Option B2 - Digital Audio Board \(A20\)"](#), on page 250).

- Put the front cover Pos. 1000 back in place.
- Use four screws to reinstall the two front handles Pos. 1010.
- Connect the SATA cable W 97 Pos. 795 from the USB 2.0 hub A7 Pos. 770.
- Connect the flexible push-button board cable A8 Pos. 700 from the base board A10.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.

- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.9 Replacing the XLR Frontpanel A40

The XLR front panel is located behind the front cover in attached to the front of the analog audio board.

Removing the XLR front panel

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.

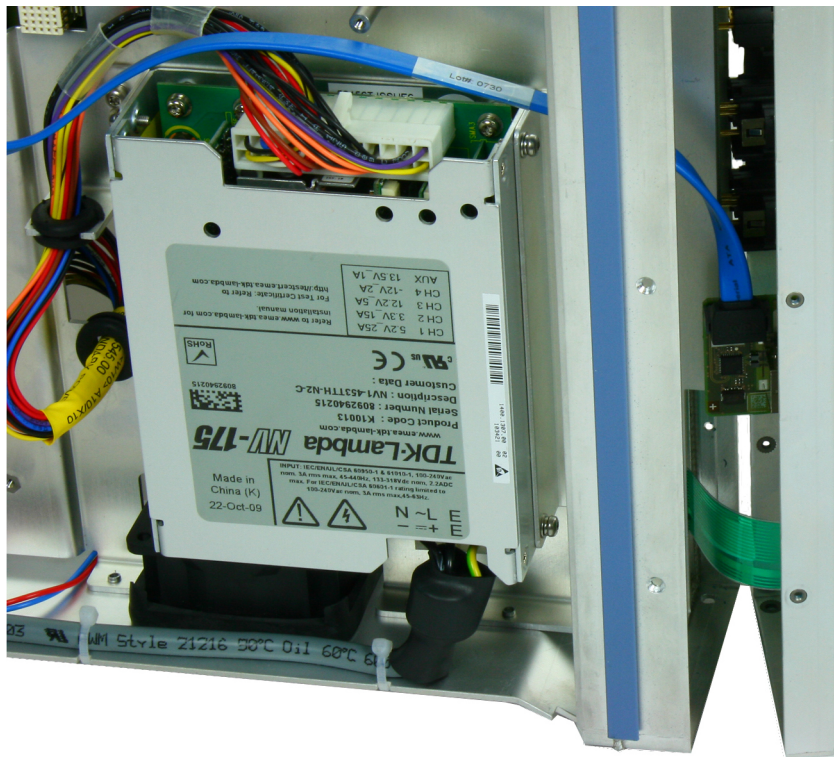


- Pull the front cover forward and remove it.
 - Pos. 1000 front cover VAR 08
 - Pos. 1001 front cover VAR 04
 - Pos. 1002 front cover VAR 02

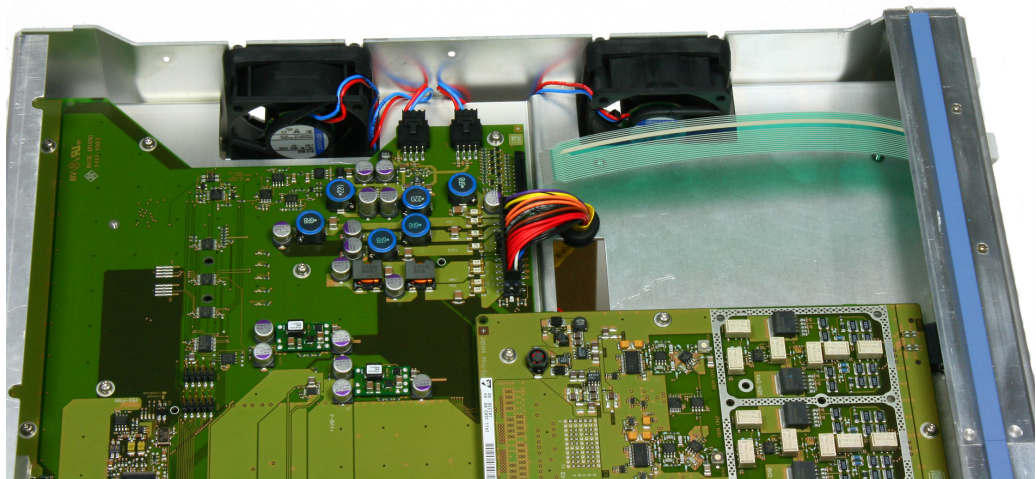
**NOTICE****Additional step if any hardware option is installed**

If the option R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 is installed, it must be removed first (see [Chapter 4.4.15, "Replacing Option B2 - Digital Audio Board \(A20\)"](#), on page 250).

- Remove the eight countersunk screws Pos. 640 from both the top and the bottom of the front frame.
- Disconnect the SATA cable W 97 Pos. 795 from the USB 2.0 hub A7 Pos. 770.



- Disconnect the flexible push-button board cable A8 Pos. 700 from the base board A10.



- Pull the mounting through Pos. 600 and remove it.

NOTICE

Risk of module damage

Use caution when pulling the mounting forward as it is connected to the audio analog board.

VAR 08:

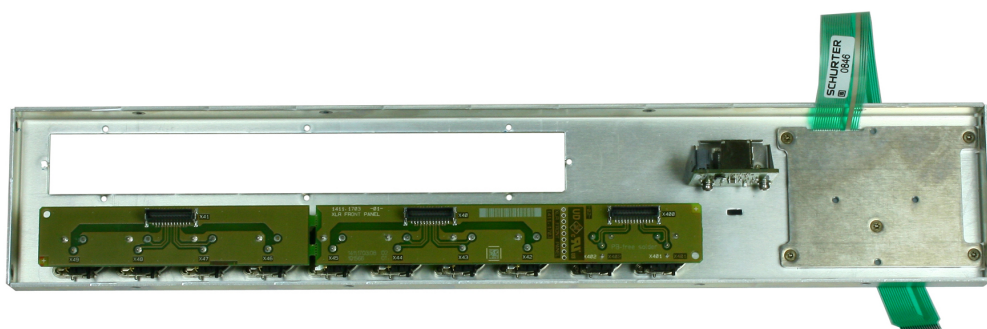
- Remove the 20 screws Pos. 850 from the XLR Front panel A40 Pos. 820 or 821 and remove the XLR front panel.

VAR 04:

- Remove the 12 screws Pos. 840 from the XLR Front panel A40 Pos. 810 or 811 and remove the XLR front panel.

VAR 02:

- Remove the 8 screws Pos. 830 from the XLR Front panel A40 Pos. 800 or 801 and remove the XLR front panel.

**Installing a new XLR front panel and reassembling the instrument****VAR 08:**

- Place the new XLR front panel Pos. 820 or 821 and fasten it with the 20 screws Pos. 850.

VAR 04:

- Place the new XLR front panel Pos. 810 or 811 and fasten it with the 12 screws Pos. 840.

VAR 02:

- Place the new XLR front panel Pos. 800 or 801 and fasten it with the 8 screws Pos. 830.
- Plug the front unit back into the R&S UPP and fasten it to the front frame with the eight countersunk screws Pos. 640.

NOTICE**Additional step if any hardware option was installed**

If the option R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 was installed, it must be reinstalled (see [Chapter 4.4.15, "Replacing Option B2 - Digital Audio Board \(A20\)"](#), on page 250).

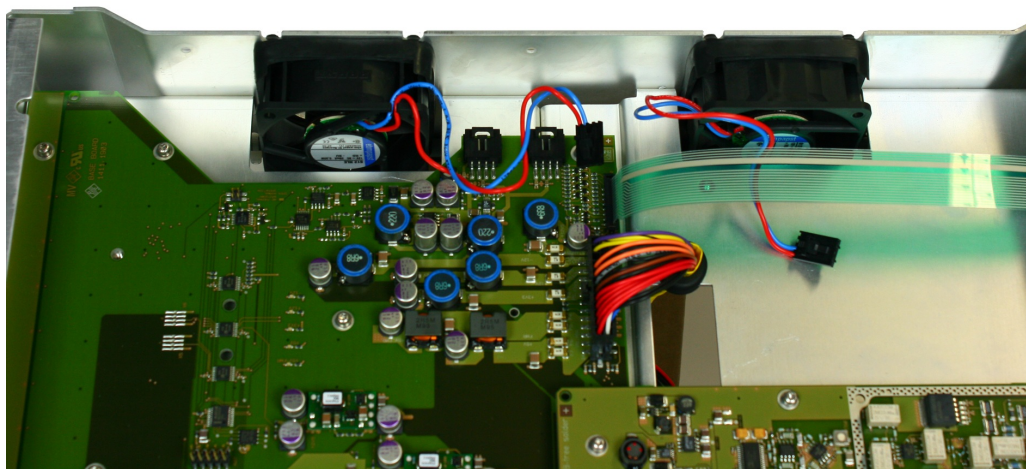
- Put the front cover Pos. 1000 back in place.
- Use four screws to reinstall the two front feet Pos. 1010.
- Connect the SATA cable W 97 Pos. 795 from the USB 2.0 hub A7 Pos. 770.
- Connect the flexible push-button board cable A8 Pos. 700 from the baseband board A10 Pos 100 or 101.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.10 Replacing the Fans E1 and E2

The fans are located on the left side on the inner panel.

Removing the fans E1 and/or E2

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Disconnect the fan cable from the base board A10 Pos. 100 or 101 connector X1 or X2.



- Remove the fan (E1 or E2) by detaching the fan collar including the fan.

Installing a new fan and reassembling the instrument

- Install a new fan using the fan collar.

NOTICE

Risk of damage of fan cables

The direction of the arrow indicates the installation position. The fan draws air into the instrument. Arrange the fan cable so that it cannot reach into the fan.

- Connect the fan cable to the baseband board A10 Pos. 100 or 101 connector X1 or X2.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect power cable and switch on the power. The instrument will boot now.

4.4.11 Replacing the Analog Audio Board A4

The module is located behind the front cover in the lower chamber behind the XLR adapter board.

Removing the analog audio board

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.

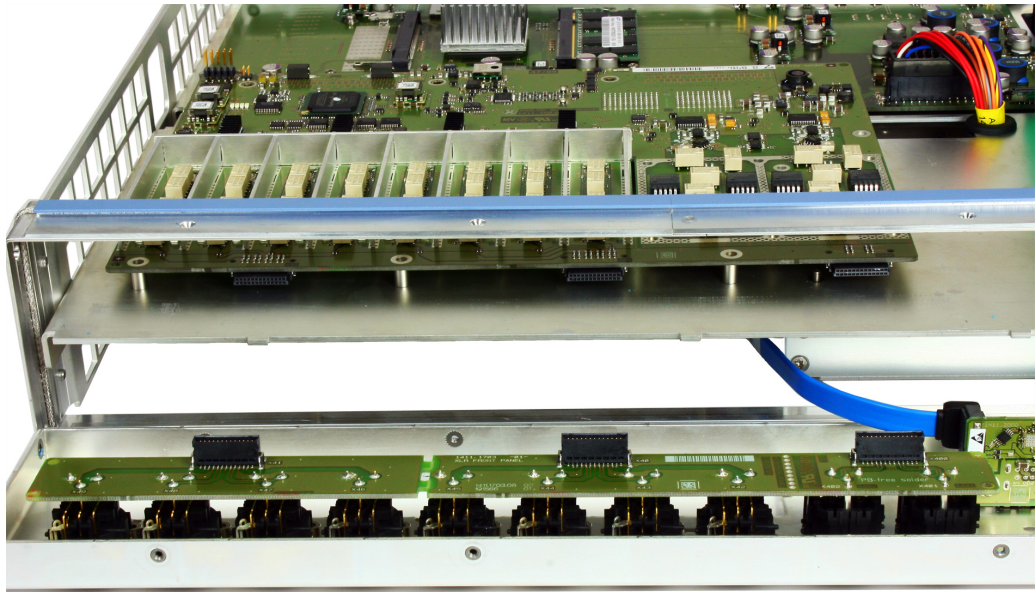


- Pull the front cover forward and remove it.
 - Pos. 1000 front cover VAR 08
 - Pos. 1001 front cover VAR 04
 - Pos. 1002 front cover VAR 02

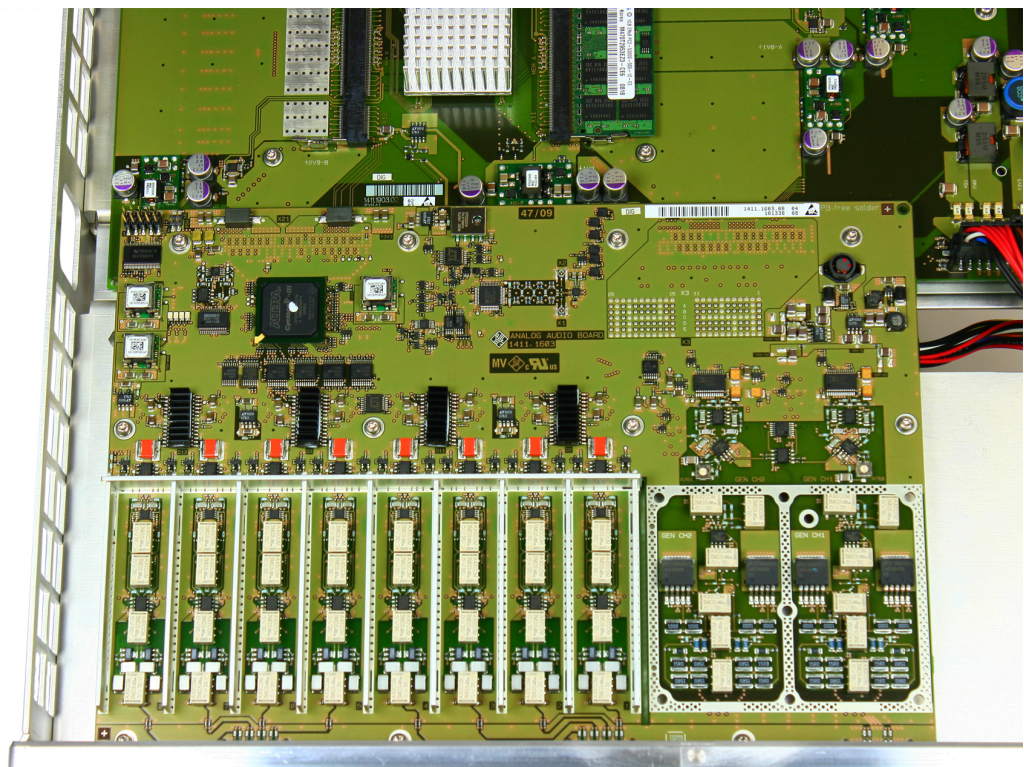
**NOTICE****Additional step if any hardware option is installed**

If the option R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 is installed, it must be removed first (see [Chapter 4.4.15, "Replacing Option B2 - Digital Audio Board \(A20\)"](#), on page 250).

- Remove the eight countersunk screws Pos. 640 from both the top and the bottom of the front frame.
- Pull the mounting through Pos. 600.



- Remove the seven combination screws Pos. 170 in the front and the four combination screws Pos. 180 on the back of the analog audio board.



- Pull the analog audio board A4 upwards.

Installing a new analog audio board and reassembling the instrument

- Install the new analog audio board A4.

VAR 08:

- A4 Pos. 160 or 161.

VAR 02/04:

- A4 Pos. 150 or 151.
- Fasten the seven combination screws Pos. 170 in the front and the four combination screws Pos. 180 on the back of the analog audio board A4.

NOTICE**Additional step if any hardware option was installed**

If the option R&S UPP-B2, R&S UPP-B4 or R&S UPP-B8 was installed, it must be reinstalled (see [Chapter 4.4.15, "Replacing Option B2 - Digital Audio Board \(A20\)"](#), on page 250).

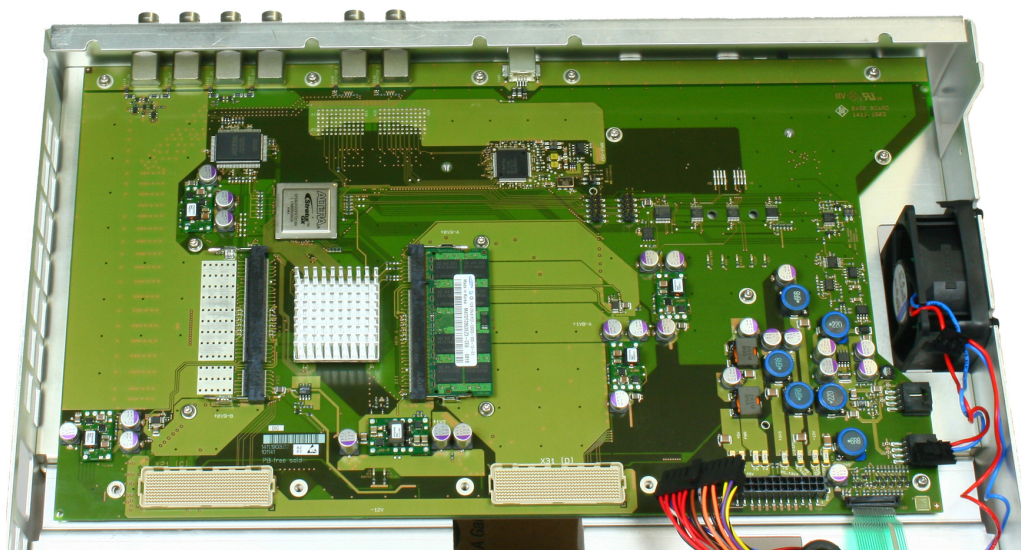
- Put the mounting back through Pos. 600.
- Put the front cover back on Pos. 1000.
- Move the front handles Pos. 1010 and screw the four screws on the front handles Pos. 1020 on the left and right.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.12 Replacing the Base Board A10

The module is located at the bottom rear of the instrument.

Removing the base board

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the controller module IPS1 (see [Chapter 4.4.2, "Replacing the Controller Module IPS A6"](#), on page 220).
- Remove the IPS adapter board (see [Chapter 4.4.5, "Replacing the IPS adapter board A9"](#), on page 226).
- Remove the analog audio board (see [Chapter 4.4.11, "Replacing the Analog Audio Board A4"](#), on page 242).



- Remove the 13 combination screws Pos. 140 on the base board A10 Pos. 100 or 101.
- Disconnect the secondary power cable W10 Pos. 440, the flexible push-button board cable A8 Pos. 700 and the two fan cables Pos. 230 from the base board A10 Pos. 100 or 101.
- Remove the six hex-14 nuts Pos. 130 and the six serrated lock washers Pos. 120 from the BNC connectors at the rear of the R&S UPP.



- Slightly lift the base board A10 Pos. 100 or 101, pull it toward the front of the instrument and remove it.

Installing a new base board and reassembling the instrument

- Feed the new base board A10 Pos. 100 or 101 and the BNC connectors into the rear of the instrument and position it.
- Refit 13 screws Pos. 140 into the base board A10 Pos. 100 or 101.

- Refit six serrated lock washers Pos. 120 and the 6 hex-14 nuts Pos. 130 on the BNC connectors at the rear of the R&S UPP.
- Reconnect the secondary power cable W10 Pos. 440, the flexible push-button board cable A8 Pos. 700 and the two fan cables Pos. 230 on the base board A10 Pos. 100 or 101.
- Install the analog audio board (see [Chapter 4.4.11, "Replacing the Analog Audio Board A4"](#), on page 242).
- Install the the IPS adapterboard (see [Chapter 4.4.5, "Replacing the IPS adapter board A9"](#), on page 226).
- Install the controller module IPS (see [Chapter 4.4.2, "Replacing the Controller Module IPS A6"](#), on page 220).
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

NOTICE**Risk of damage**

Replace only base boards with identical numbers! Do not replace a base board 1411.1903.02 by a base board 1411.1903.03 and vice versa!

Putting into operation

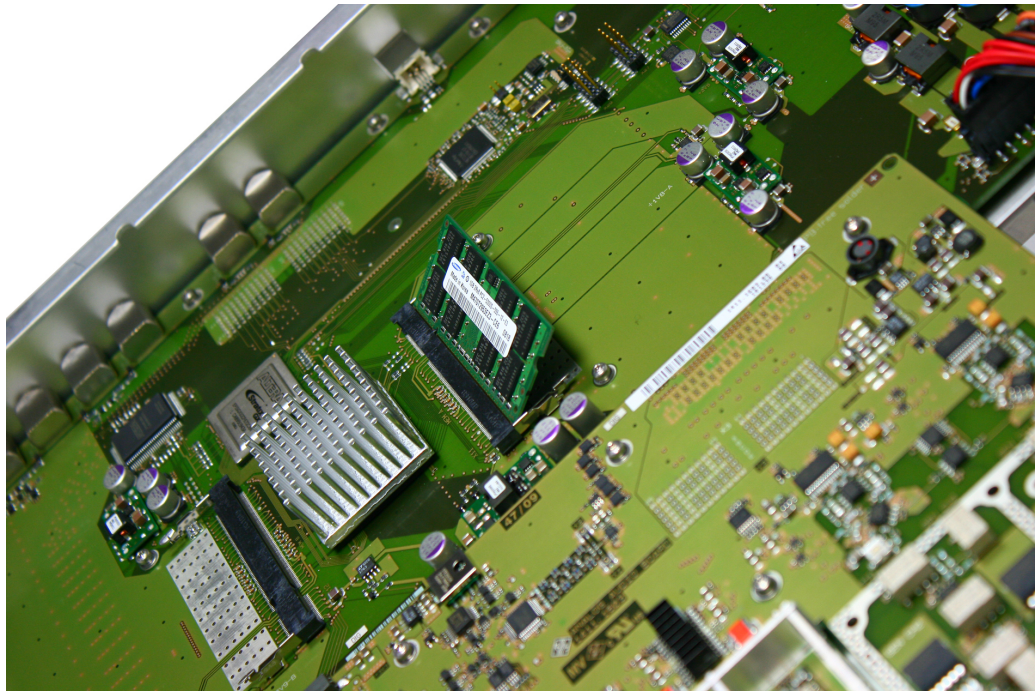
- Connect the AC supply cable and switch on the power. The instrument will boot now.
- Perform selftest.
- Restore device key and installed software options.

4.4.13 Installing DDR2 SDRAM A11

The DDR2 SDRAM is located on the base board A10.

Replacing the DDR2 SDRAM A11

- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Plug the DDR2 SDRAM A11 Pos. 110 into the slot (X11) on the base board A10 Pos. 100 or 101 and lock it in place.



- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.14 Installing Option B2 - Digital Audio Board (A20)

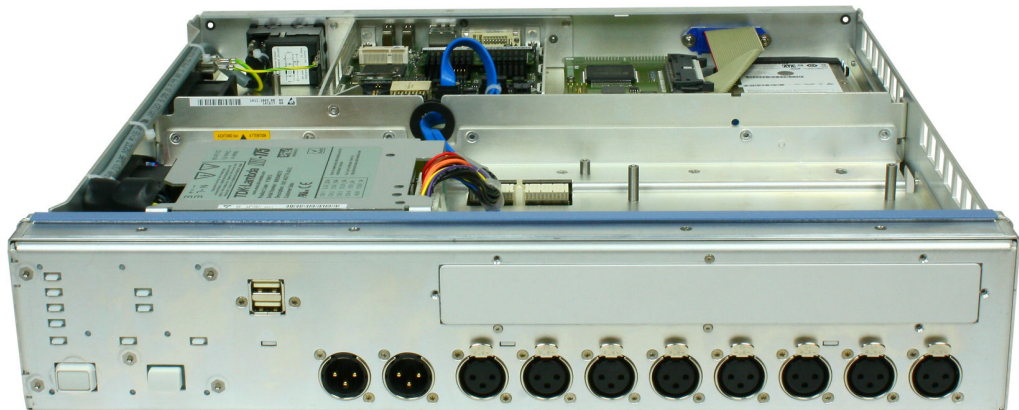
The module is located in the upper chamber behind the front of the instrument.

The digital adapter Pos. 450 is mounted on the digital audio board A20 Pos. 460 with the two combination screws Pos. 230.

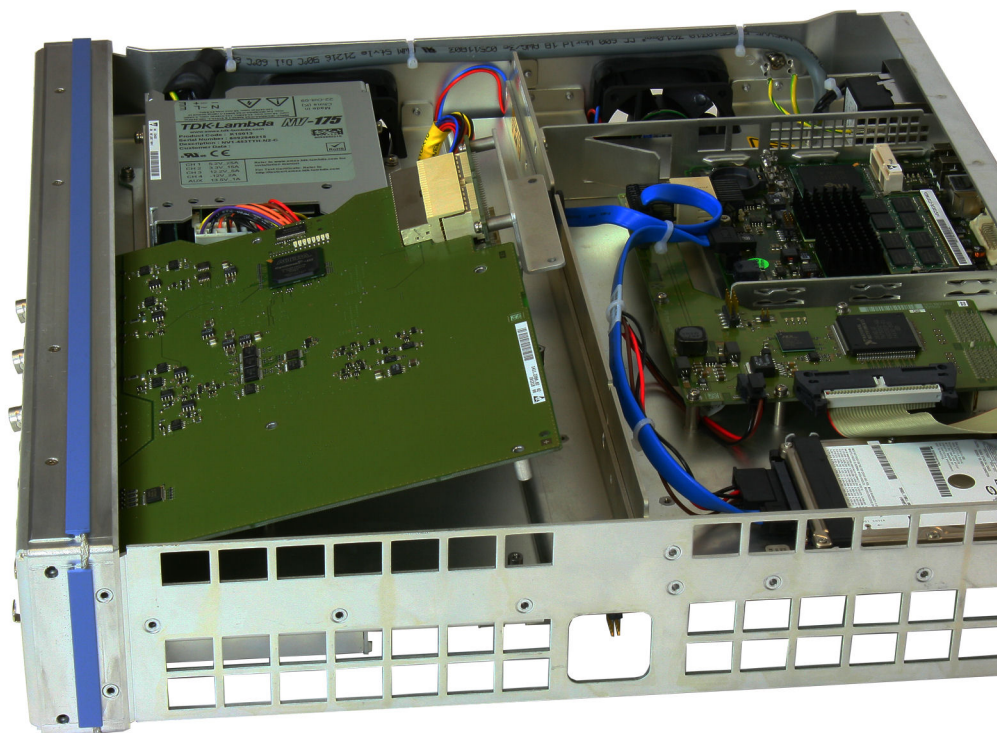
- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.



- Pull the front cover forward Pos. 1000 and remove it.
- Disconnect the eight countersunk screws Pos. 2020 and remove the holding plate Pos. 1510.



- Slide in the digital audio board A20 Pos. 460 from the rear through the mounting Pos. 600 and plug the connector from the digital audio board A20 Pos. 460 into the connector from the audio analog board A4 Pos. 160 or 161.



- Fasten the digital audio board A20 Pos. 460 to the bottom of the instrument with the two combination screws Pos. 2030 and the four combination screws Pos. 2040.
- Fasten the digital audio board A20 Pos. 460 to the mounting Pos. 600 with the eight countersunk screws Pos. 2020.
- Put the front cover back on Pos. 1000.
- Move the front handles Pos. 1010 and fasten the four screws on the front handles Pos. 1020 on the left and right.

- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.15 Replacing Option B2 - Digital Audio Board (A20)

The module is located in the upper chamber behind the front of the instrument.

The digital adapter Pos. 450 is mounted on the digital audio board A20 Pos. 460 with the two combination screws Pos. 230.

Removing option B2

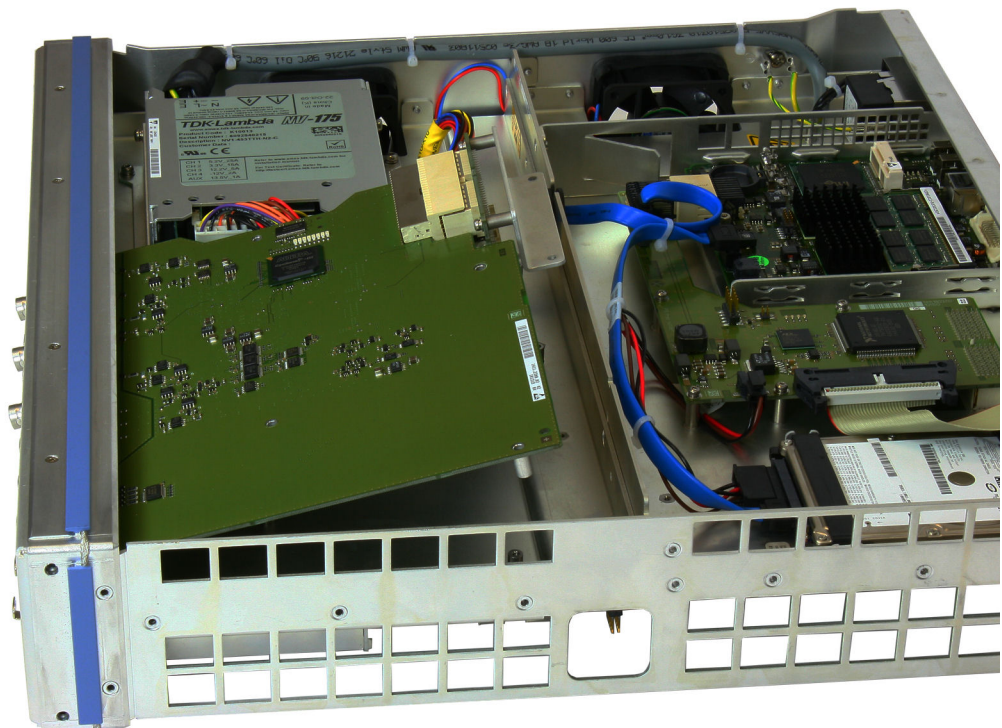
- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010. Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.



- Pull the front cover forward Pos. 1000 and remove it.
 - Pos. 1000 front cover VAR 08
 - Pos. 1001 front cover VAR 04
 - Pos. 1002 front cover VAR 02



- Unfasten the digital audio board A20 Pos. 460 from the bottom of the instrument by removing the two combination screws Pos. 2030 and the four combination screws Pos. 2040.



- Disconnect the digital audio board A20 Pos. 460 from the audio analog board connector A4 Pos. 160 or 161 and remove the digital audio board.

Installing a new option R&S UPP-B2 and reassembling the instrument

- Slide in the new digital audio board A20 Pos. 460 through the mounting on the rear Pos. 600 and plug the connector from the digital audio board A20 Pos. 460 into the connector from the audio analog board A4 Pos. 160 or 161.
- Fasten the digital audio board A20 Pos. 460 to the bottom of the instrument with the two combination screws Pos. 2030 and the four combination screws Pos. 2040.
- Screw the digital audio board A20 Pos. 460 to the mounting Pos. 600 with the eight countersunk screws Pos. 2020.
- Put the front cover back on Pos. 1000.
- Move the front handles Pos. 1010 and screw the four screws on the front handles Pos. 1020 on the left and right.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.
- Perform selftest.

4.4.16 Installing Option B4 - Digital Audio/HDMI Board (A20)

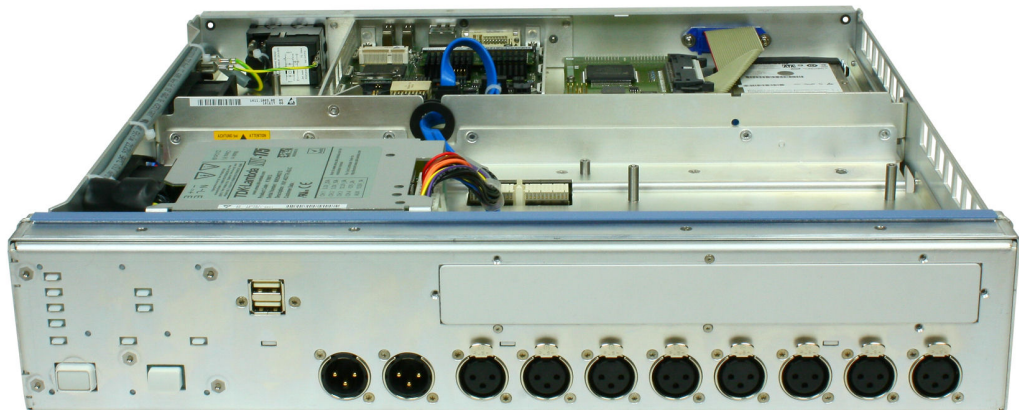
The module is located in the upper chamber behind the front of the instrument.

The digital adapter Pos. 450 is mounted on the hdmi board A20 Pos. 460 with the two combination screws Pos. 230.

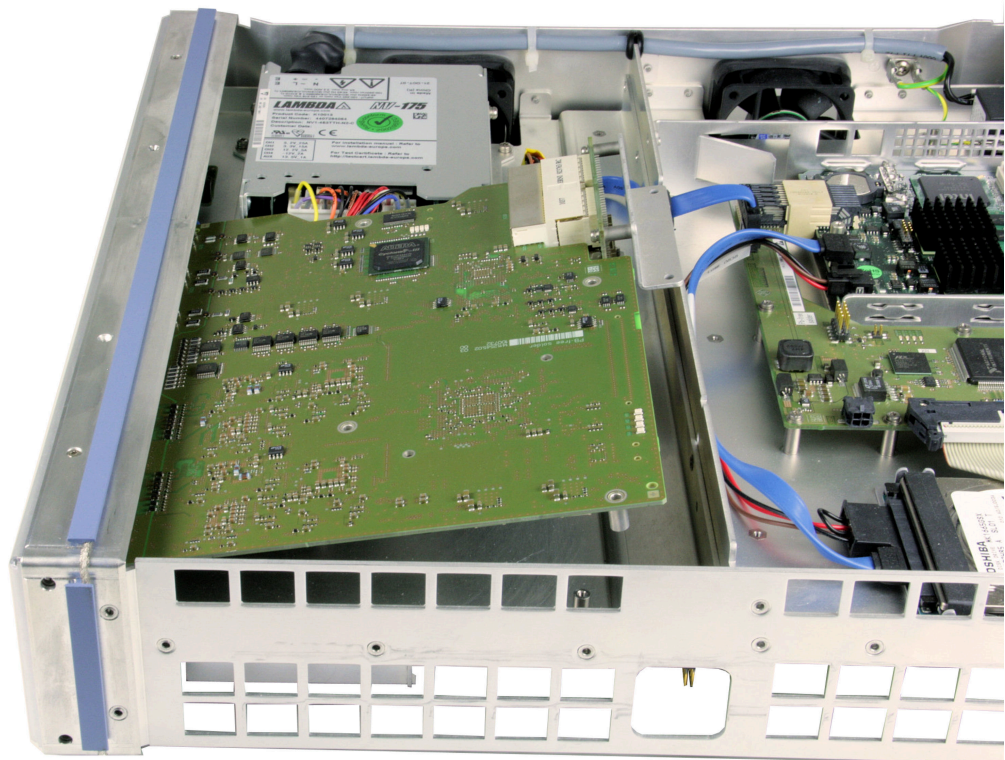
- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.



- Pull the front cover forward Pos. 1000 and remove it.
- Disconnect the eight countersunk screws Pos. 2020 and remove the holding plate Pos. 1510.



- Slide in the hdmi board A20 Pos. 460 from the rear through the mounting Pos. 600 and plug the connector from the hdmi board A20 Pos. 460 into the connector from the audio analog board A4 Pos. 160 or 161.



- Fasten the hdmi board A20 Pos. 460 to the bottom of the instrument with the two combination screws Pos. 2030 and the four combination screws Pos. 2040.
- Fasten the hdmi board A20 Pos. 460 to the mounting Pos. 600 with the eight countersunk screws Pos. 2020.
- Put the front cover back on Pos. 1000.
- Move the front handles Pos. 1010 and fasten the four screws on the front handles Pos. 1020 on the left and right.

- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.17 Replacing Option B4 - Digital Audio/HDMI Board (A20)

The module is located in the upper chamber behind the front of the instrument.

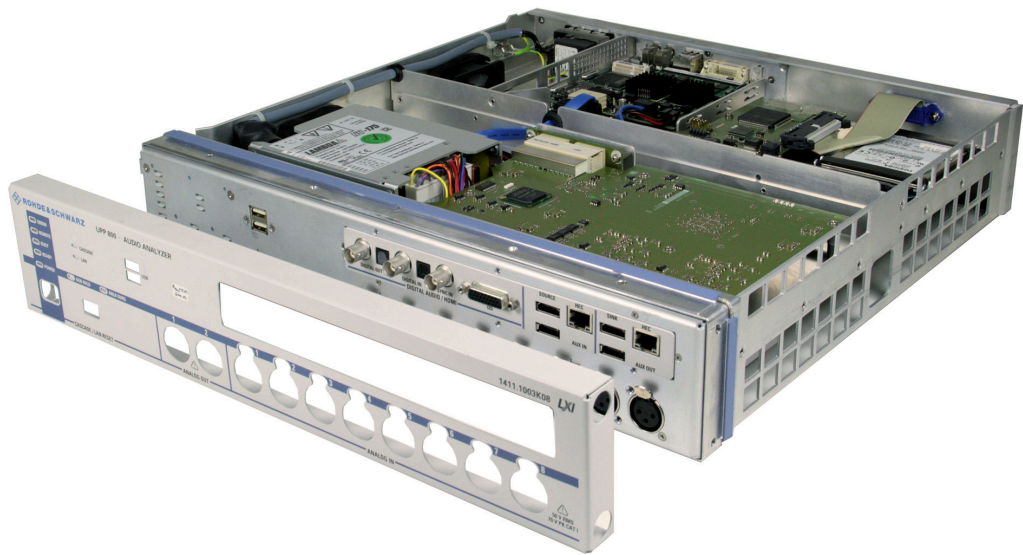
The digital adapter Pos. 450 is mounted on the hdmi board A20 Pos. 460 with the two combination screws Pos. 230.

Removing option B4

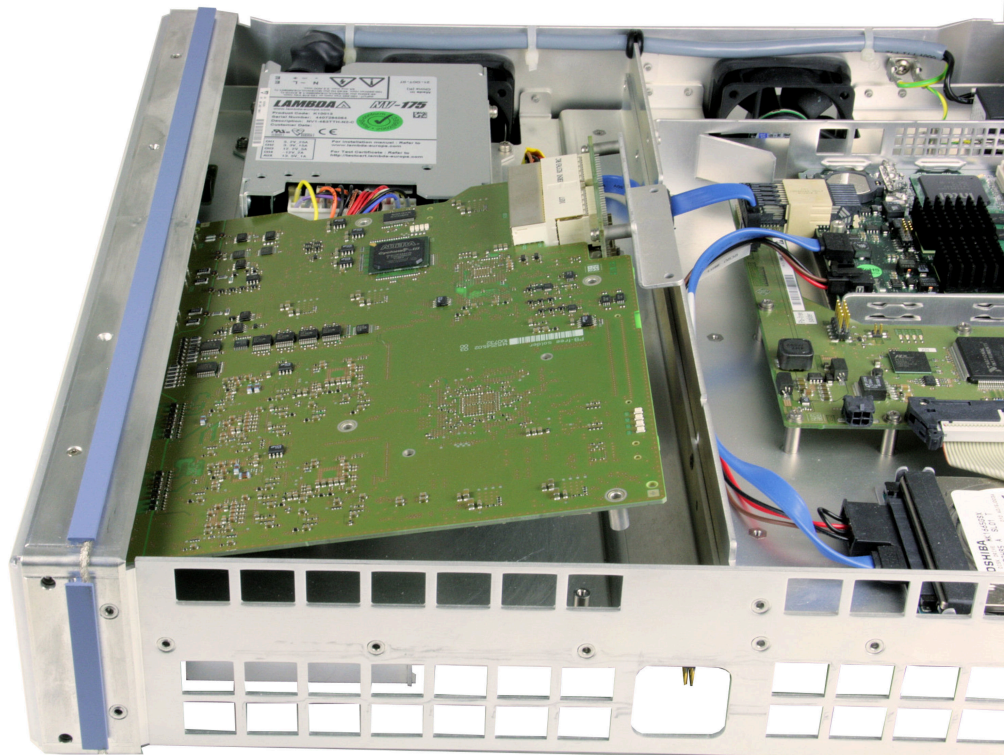
- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010. Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.



- Pull the front cover forward Pos. 1000 (1411.1110) and remove it.
 - Pos. 1000 front cover VAR 08
 - Pos. 1001 front cover VAR 04
 - Pos. 1002 front cover VAR 02



- Unfasten the hdmi board A20 Pos. 460 from the bottom of the instrument by removing the two combination screws Pos. 2030 and the four combination screws Pos. 2040.



- Disconnect the digital audio board A20 Pos. 460 from the audio analog board connector A4 Pos. 160 or 161 and remove the hdmi board.

Installing a new option R&S UPP-B4 and reassembling the instrument

- Slide in the new hdmi board A20 Pos. 460 through the mounting on the rear Pos. 600 and plug the connector from the digital audio board A20 Pos. 460 into the connector from the audio analog board A4 Pos. 160 or 161.
- Fasten the hdmi board A20 Pos. 460 to the bottom of the instrument with the two combination screws Pos. 2030 and the four combination screws Pos. 2040.
- Screw the hdmi board A20 Pos. 460 to the mounting Pos. 600 with the eight countersunk screws Pos. 2020.
- Put the front cover back on Pos. 1000.
- Move the front handles Pos. 1010 and screw the four screws on the front handles Pos. 1020 on the left and right.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.
- Perform selftest.

4.4.18 Installing Option B8 - Multi Channel Generator (A20)

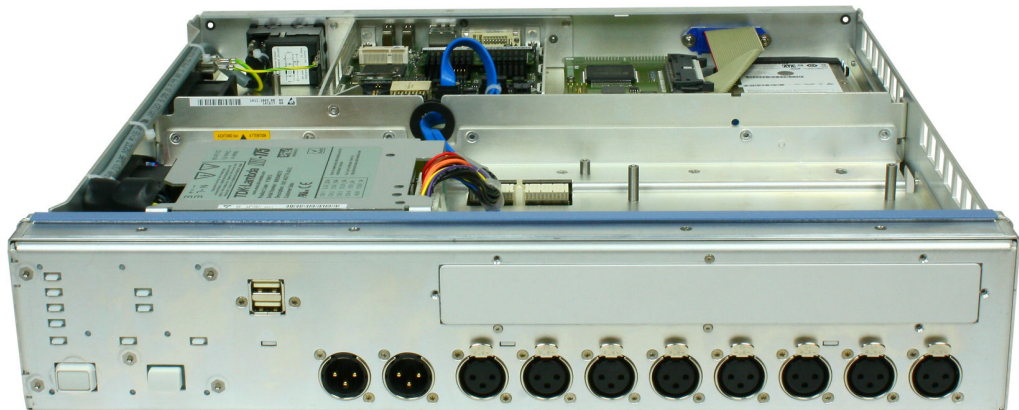
The module is located in the upper chamber behind the front of the instrument.

The digital adapter Pos. 450 is mounted on the multi channel generator board A20 Pos. 460 with the two combination screws Pos. 230.

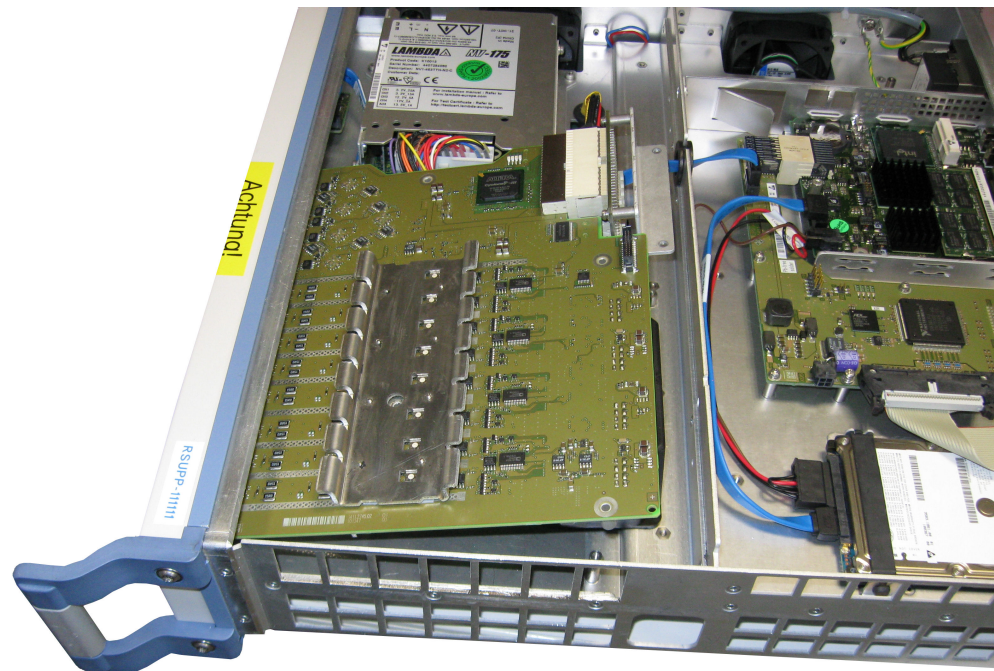
- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.



- Pull the front cover forward Pos. 1000 and remove it.
- Disconnect the eight countersunk screws Pos. 2020 and remove the holding plate Pos. 730.



- Slide in the multi channel generator board A20 Pos. 460 from the rear through the mounting Pos. 600 and plug the connector from the multi channel generator board A20 Pos. 460 into the connector from the audio analog board A4 Pos. 160 or 161.



- Fasten the multi channel generator board A20 Pos. 460 to the bottom of the instrument with the two combination screws Pos. 2030 and the four combination screws Pos. 2040.
- Fasten the multi channel generator board A20 Pos. 460 to the mounting Pos. 600 with the eight countersunk screws Pos. 2020.
- Put the front cover back on Pos. 1000.

- Move the front handles Pos. 1010 and fasten the four screws on the front handles Pos. 1020 on the left and right.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.19 Replacing Option B8 - Multi Channel Generator (A20)

The module is located in the upper chamber behind the front of the instrument.

The digital adapter Pos. 450 is mounted on the multi channel generator board A20 Pos. 460 with the two combination screws Pos. 230.

Removing option B8

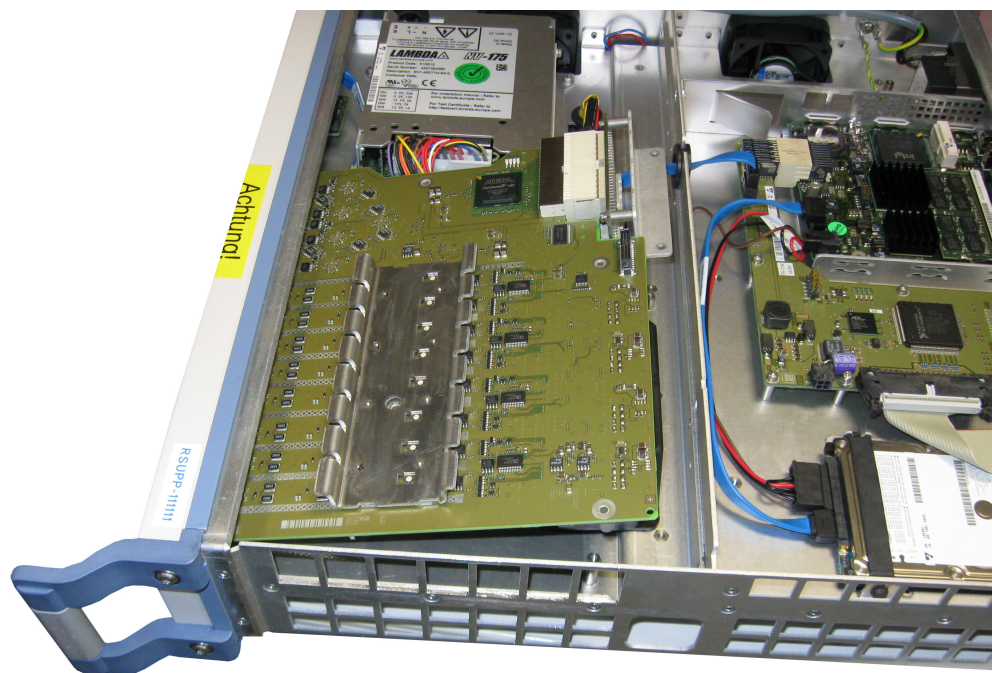
- Open the instrument (see [Chapter 4.4.1, "Opening the instrument"](#), on page 219).
- Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010. Remove the four screws from the front handles Pos. 1020 on the left and right. Remove the front handles Pos. 1010.



- Pull the front cover forward Pos. 1000 and remove it.
 - Pos. 1000 front cover VAR 08
 - Pos. 1001 front cover VAR 04
 - Pos. 1002 front cover VAR 02



- Unfasten the multi channel generator board A20 Pos. 460 from the bottom of the instrument by removing the two combination screws Pos. 2030 and the four combination screws Pos. 2040.



- Disconnect the multi channel generator board A20 Pos. 460 from the audio analog board connector A4 Pos. 160 or 161 and remove the multi channel generator board.

Installing a new option R&S UPP-B8 and reassembling the instrument

- Slide in the new multi channel generator board A20 Pos. 460 through the mounting on the rear Pos. 600 and plug the connector from the multi channel generator board A20 Pos. 460 into the connector from the audio analog board A4 Pos. 160 or 161.
- Fasten the multi channel generator board A20 Pos. 460 to the bottom of the instrument with the two combination screws Pos. 2030 and the four combination screws Pos. 2040.
- Screw the multi channel generator board A20 Pos. 460 to the mounting Pos. 600 with the eight countersunk screws Pos. 2020.
- Put the front cover back on Pos. 1000.
- Move the front handles Pos. 1010 and screw the four screws on the front handles Pos. 1020 on the left and right.
- Replace the enclosure Pos. 1030.
- Use four screws to reinstall the rear feet Pos. 1050.
- Connect the AC supply cable and switch on the power. The instrument will boot now.
- Perform selftest.

4.4.20 Replacing the Fuses

The fuses are located on the back of the R&S UPP.

Replacing the fuses

- Open the fuse holder and remove the fuses.



- Install the new fuses.
- Connect the AC supply cable and switch on the power. The instrument will boot now.

4.4.21 Module Overview

Module replacement overview

Module	Steps to take following a replacement		
	Function tests and system error correction	Adjustment	Miscellaneous
controller module A6			DOS/BIOS update
Lithium battery			
Hard disk A5			FW update
Push-button board A8			
Front cover			
Power supply unit A1	SELFTEST		
Fans E1/E2			
Base board A10	SELFTEST		install SW options
Analog audio board A4	SELFTEST		
USB adapter			

DDR2 SDRAM A11	SELFTEST		option key
Option R&S UPP-B2 A20	SELFTEST		
Option R&S UPP-B4 A20	SELFTEST		
Option R&S UPP-B8 A20	SELFTEST		

4.5 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 EEPROM 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.

Brief performance test for the analog generator: (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

Brief performance test for the analog analyzer (with the bandwidths 22/40 and 80 kHz and all 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, filter CCIR unwd: min. 0.9 μ V, typ. 1 μ V, max. see test report and data sheet.

Option R&S UPP-B8

If the R&S UPP is fitted with a new option R&S UPP-B8 and a firmware is installed which can control all 10 analog generator channels (two on AAB and 8 on option R&S UPP-B8) a software adjustment has to be done.

All channels 4 to 10 are referenced to channel 3. To reference all eight channels of R&S UPP-B8 to generator channel 1 on AAB a phase adjustment is necessary. To perform this software adjustment see Chapter 2 (Software Adjustment, Interchannel Phase) for description and replace the channel 3 by the channel 1 and Channel 4 by channel 3 of the R&S UPP-B8. So the channel 3 on R&S UPP-B8 is referenced to channel 1 on AAB and therefore the channel 1 is the reference channel for all others (2 to 10).

Brief performance test for the analog generator: (The measurements are described in Chapter 1, "Performance Test of R&S UPP-B8") - Level accuracy for sinewave, 1 V,

1 kHz, channel 3 - THD+N for 2.5 V, 1 kHz, channel 3 - Frequency response for 2 V, channel 3.

5 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 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 will deinstall the old firmware completely and after that reinstall the new firmware.
Minor update	The Installer detects that it is possible to update the installed firmware by just replacing files. It therefore will update the old software completely.

5.1 Troubleshooting

5.1.1 Troubleshooting During a Firmware Update

The two most common problems that can occur when installing the software (or during a major update) are these:

- 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 it occasionally happens that an error message appears followed by a second message, and the firmware is then not installed. This problem can normally be solved by carrying out the setup again. If the error occurs again, this can be for two reasons:

- 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).

- When the installation has finished and the instrument does a reboot, a special startup screen appears for exactly one time. Here a check is done if the PCI device EEPROM has to be updated. Here too it occasionally happens that the startup process does not continue, sometimes even without error message. If this happens, power down and on again the instrument.

5.1.2 EEPROM Data Management

In the R&S UPP, important data which must not be lost is managed in the EEPROMs 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
- Versions (hardware options)

This data management takes place in the firmware, in a central unit which ensures that the contents are consistent and protected.

5.1.2.1 Handling the EEPROMs

There is an EEPROM on each of the larger modules: base board, analog audio board and on each option R&S UPP-B2, R&S UPP-B4 and R&S UPP-B8. However, the EEPROM management does not detect expansion cards in detail, but only whether or not a HW option is built in.

In this way the management detects the following EEPROMs:

base board	It stores the serial number of the R&S UPP and the enabled software options.
analog audio board	Analog generator and analyzer. The calibration values for the analog generator and analyzer are stored here.
Option R&S UPP-B2	Digital generator and analyzer. The calibration values for digital audio are stored here.
Option R&S UPP-B4	Digital generator and analyzer plus hdmi. The calibration values for digital audio are stored here.
Option R&S UPP-B8	Analog and digital generator. The calibration values for the analog generator are stored here.

In order to ensure as far as possible that this data does not become lost, EEPROM data management has a built-in backup mechanism which combines a number of protection mechanisms:

- The data in the EEPROM is stored in blocks, each of which forms a logical unit. Each block is protected by a checksum (CRC).
- The blocks in an EEPROM 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 EEPROMs, the data management scans this block structure and verifies the checksum each time. This immediately detects bit errors that can result from defective EEPROMs or faulty access points (such as dry joints).

After every firmware start or write operation in an EEPROM a further scan takes place. If this scan is successful, the firmware stores a bit-compatible copy of the contents on the hard disk. Each EEPROM has its own dedicated file.

base board	C:\eeprom_mainboard.bin
analog audio board	C:\eeprom_anaaudio.bin
Option R&S UPP-B2	C:\eeprom_digaudio.bin
Option R&S UPP-B4	C:\eeprom_digaudio.bin
Option R&S UPP-B8	C:\eeprom_upp8chaudio.bin

If the EEPROM management detects a problem in a subsequent firmware start, it can react positively:

- If the EEPROM is blank but there is a backup on disk, then very probably the EEPROM 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 EEPROM. The firmware cannot detect this, but in practice it should not occur. Even so, in this case you can prevent the contents of the EEPROM from being restored.
- If the EEPROM is erroneous (checksum error), there is probably a hardware fault (EEPROM defective or wiring problems such as a dry joint). The firmware can attempt to restore the correct content to the EEPROM.

Even a change of hard drive is no problem: At the first subsequent power-up the EEPROMs are scanned and the EEPROM contents are copied to the hard disk again.

5.1.2.2 Data Structure in the EEPROM

The data structure of the EEPROMs 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 UPP:

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. 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

UPP_ANLR_CAL	M	Contains the correction data for the analog analyzer
UPP_AGEN_CAL	M	Contains the correction data for the analog generator
UPP_DIG_CAL	M	Contains the correction data for the digital board
UPP_B8_CAL	M	Contains the correction data for the multi channel 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.

5.1.2.3 Recording the Contents

Every time the firmware starts, a full scan of all detected EEPROMs takes place. The purpose of this scan is to detect modules, their associated hardware options and to read in valid calibration values and to detect options.

This scan creates a copy of the EEPROM 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 EEPROMs. For example:

main board eeprom contains following blocks:

```

contents of block ident_2:
  eeprom size      : 1048576
  material number  : 14111903
  variant          : 2
  hardware code    : 0
  product index    : 201
  serial number    : 101121
  production date   : 15250
  read code        : 0
  test instruction  : 100
  name             : UPP_BASEBOARD

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 swplatform:
  devicekey size      : 0
  devicedataset size  : 0
  devicemac size      : 0
  installed sw options : 0
```

digital audio board eeprom contains following blocks:

```
contents of block ident_2:
  eeprom size      : 16384
  material number  : 14112400
  variant          : 2
  hardware code    : 0
  product index    : 304
  serial number    : 101391
  production date  : 15420
  read code        : 0
  test instruction : 302
  name             : UPP B2
```

```
contents of undefined block:
  id           : 200
  offset in eeprom : 44
  size         : 24
```

```
contents of undefined block:
  id           : 300
  offset in eeprom : 68
  size         : 12
```

```
contents of block UPP_DIG_CAL:
  description of block : // --- Correction data of digital generator --- //
  number of values     : 2
    calibration value  0: 1.00000000 // 0 output level
    calibration value  1: 0.00000000 unspecified
```

analog audio board eeprom contains following blocks:

contents of block ident_2:

```

eeprom size      : 16384
material number  : 14111603
variant         : 2
hardware code    : 0
product index    : 101
serial number    : 100000002
production date  : 15012
read code       : 0
test instruction : 100
name            : UPP Anlg

```

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 UPP_AGEN_CAL:

```

description of block : // --- Correction data of analog generator --- //
number of values     : 21
calibration value 0: 1.00000000 // 0  cf_agen_0
    Analog Generator Level Channel 1
calibration value 1: 1.00000000 // 1  cf_agen_1
    Analog Generator Level Channel 2
calibration value 2: 0.00000000 // 2  cf_phas[0]
    Generator Phase Offset @ 1  kHz
calibration value 3: 0.00000000 // 3  cf_phas[1]
    Generator Phase Offset @ 10 kHz
calibration value 4: 0.00000000 // 4  cf_phas[2]
    Generator Phase Offset @ 20 kHz
calibration value 5: 0.00000000 // 5  cf_phas[3]
    Generator Phase Offset @ 30 kHz

```

```

calibration value 6: 0.00000000 // 6 cf_phas[4]
    Generator Phase Offset @ 40 kHz
calibration value 7: 0.00000000 // 7 cf_phas[5]
    Generator Phase Offset @ 50 kHz
calibration value 8: 0.00000000 // 8 cf_phas[6]
    Generator Phase Offset @ 60 kHz
calibration value 9: 0.00000000 // 9 cf_phas[7]
    Generator Phase Offset @ 70 kHz
calibration value 10: 0.00000000 // 10 cf_phas[8]
    Generator Phase Offset @ 80 kHz
calibration value 11: 0.00000000 // 11 cf_dcOffset[0][0]
    Generator Channel 1 Level Offset Range 1
calibration value 12: 0.00000000 // 12 cf_dcOffset[0][1]
    Generator Channel 1 Level Offset Range 2
calibration value 13: 0.00000000 // 13 cf_dcOffset[0][2]
    Generator Channel 1 Level Offset Range 3
calibration value 14: 0.00000000 // 14 cf_dcOffset[0][3]
    Generator Channel 1 Level Offset Range 4
calibration value 15: 0.00000000 // 15 cf_dcOffset[1][0]
    Generator Channel 2 Level Offset Range 1
calibration value 16: 0.00000000 // 16 cf_dcOffset[1][1]
    Generator Channel 2 Level Offset Range 2
calibration value 17: 0.00000000 // 17 cf_dcOffset[1][2]
    Generator Channel 2 Level Offset Range 3
calibration value 18: 0.00000000 // 18 cf_dcOffset[1][3]
    Generator Channel 2 Level Offset Range 4
calibration value 19: 0.99000001 // 19 cf_atten[0]
    Generator Channel 1 Attenuator
calibration value 20: 1.00000000 // 20 cf_atten[1]
    Generator Channel 2 Attenuator

```

contents of block UPP_ANLR_CAL:

```

description of block : // --- Correction data of 8 channel analog analyzer --- //
number of values    : 16
    calibration value 0: 1.00000000 // 0 level Ch 1
    calibration value 1: 1.00000000 // 1 level Ch 2
    calibration value 2: 1.00000000 // 2 level Ch 3
    calibration value 3: 1.00000000 // 3 level Ch 4
    calibration value 4: 1.00000000 // 4 level Ch 5
    calibration value 5: 1.00000000 // 5 level Ch 6
    calibration value 6: 1.00000000 // 6 level Ch 7
    calibration value 7: 1.00000000 // 7 level Ch 8
    calibration value 8: 0.00000000 // 8 DC offset Ch 1
    calibration value 9: 0.00000000 // 9 DC offset Ch 2
    calibration value 10: 0.00000000 // 10 DC offset Ch 3
    calibration value 11: 0.00000000 // 11 DC offset Ch 4
    calibration value 12: 0.00000000 // 12 DC offset Ch 5
    calibration value 13: 0.00000000 // 13 DC offset Ch 6
    calibration value 14: 0.00000000 // 14 DC offset Ch 7

```



```
calibration value 15: 0.00000000 // 15 DC offset Ch 8
```

This memory extract is recreated whenever the content of an EEPROM changes, such as when a calibration value is rewritten or a change in a serial number takes place via the diagnostics panel.

5.1.2.4 Troubleshooting During EEPROM 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 UPP 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 EEPROM 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 EEPROM of a module is blank even though a backup file exists for this EEPROM. This case should only occur when a module has been used as a design model.
rescan operation of the ... eeprom failed!	This message appears when a checksum violation is found in the EEPROM. It indicates a defective EEPROM 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. If the hardware is OK, this error may otherwise indicate a problem within the firmware when the data is being prepared for writing, and should be reported to a Rohde & Schwarz representative.
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 EEPROM 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 EEPROM content that is not consistent.
write operation of the ... eeprom failed!	When attempting to write a block or part of a block to the EEPROM, 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 EEPROM 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 EEPROM, but the subsequent read operation failed. This error indicates a defective EEPROM or a dry joint.

write operation for ... file failed!	The firmware has tried to create a backup file for an EEPROM, but was unable to create the file on the hard disk. This error can occur if the file already exists and is protected.
... 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 EEPROM, the firmware discovered that the EEPROM 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.

5.1.3 Windows XP Recovery and Backup Partition

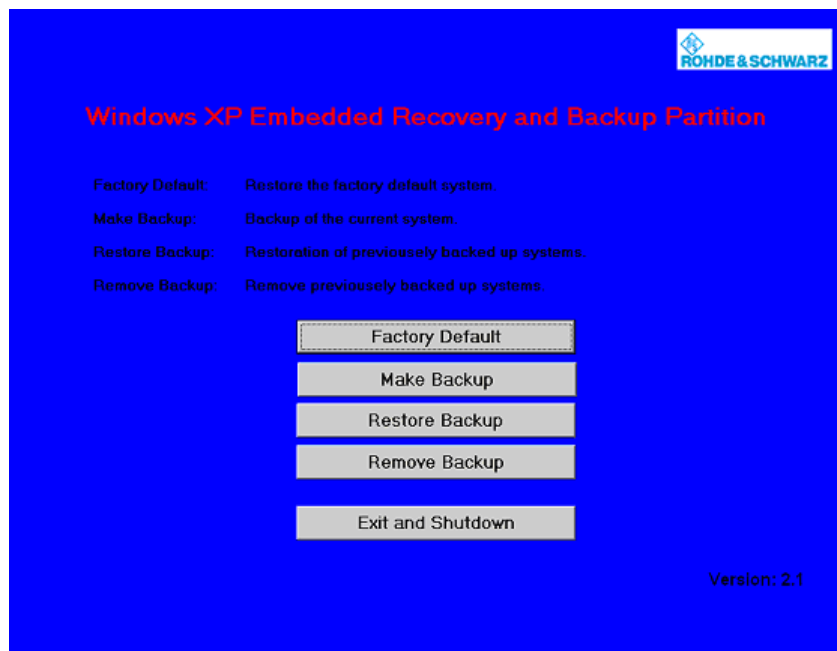
R&S UPP provides a backup and recovery partition. A backup of the factory system partition (C:\) is stored per default and can be recovered in case of a system crash. In addition, backups of up to 5 firmware versions can be stored on this partition. It is e.g. possible to backup the current system partition 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.

5.1.3.1 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:

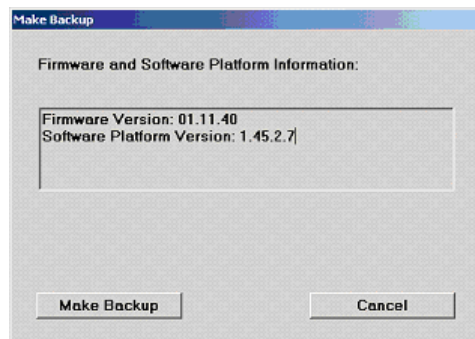


If already several backups are stored on the disk the remaining space might not be sufficient for an additional backup. In this case a warning is indicated in the **Windows XP Recovery and Backup Partition** menu and the user is requested to remove an old backup before making a new one.



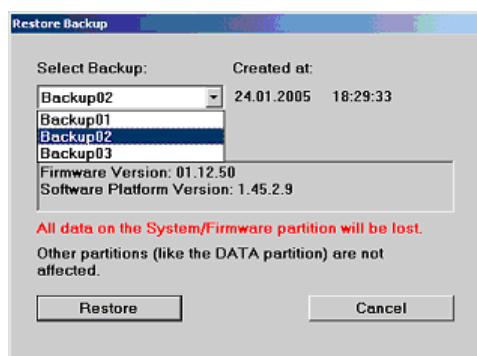
5.1.3.2 Backup Current System Partition

1. Select the **Make Backup** button in the **Windows XP Recovery and Backup Partition** menu.
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.
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.
6. Exit and shut down with the ENTER key.



5.1.3.3 Recover Selected Version of System Partition

1. Select the **Restore Backup** button in the **Windows XP Recovery and Backup Partition** menu 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.
4. Select the backup to be restored with the up/down cursor keys and the ENTER key.
5. Select the **Restore** button.
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.



5.1.3.4 Recover Factory Default

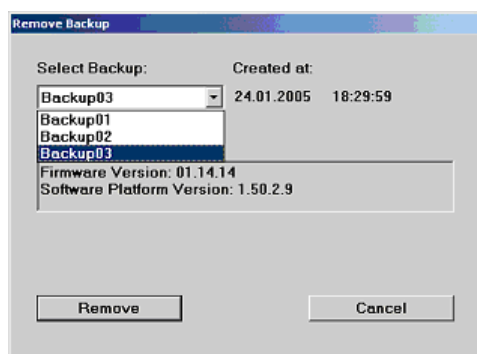
1. Select the **Factory Default** button in the **Windows XP Recovery and Backup Partition** menu to recover the factory version of the system partition.
2. Open the **Factory Default** menu with the ENTER key. The menu shows the versions of the firmware and the software platform on delivery.
3. Select the **Recover now** button.
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.



5.1.3.5 Delete Backups

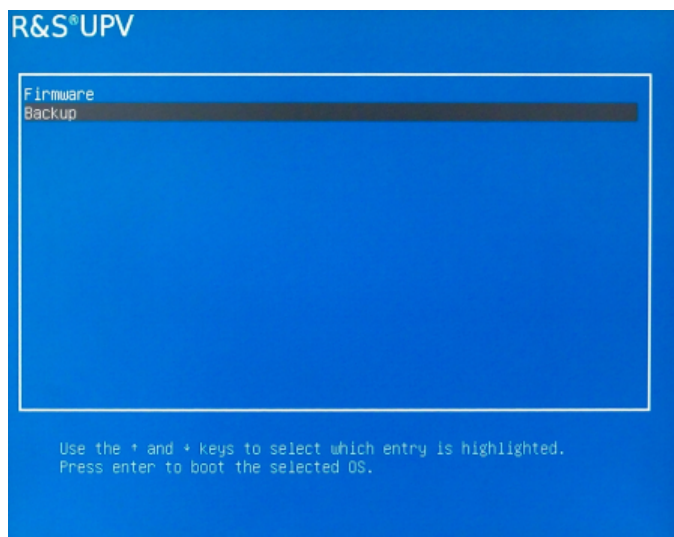
Up to five backups in addition to the factory default can be stored on the recovery partition. To provide space for new backups it might be necessary to remove older backups. The factory default cannot be deleted.

1. Select the **Remove Backup** button in the **Windows XP Recovery and Backup Partition** menu 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.
4. Select the backup to be deleted with the up/down cursor keys and the ENTER key.
5. Select the **Remove** button.
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.
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.
10. Exit the menu and shutdown the instrument with the ENTER key.

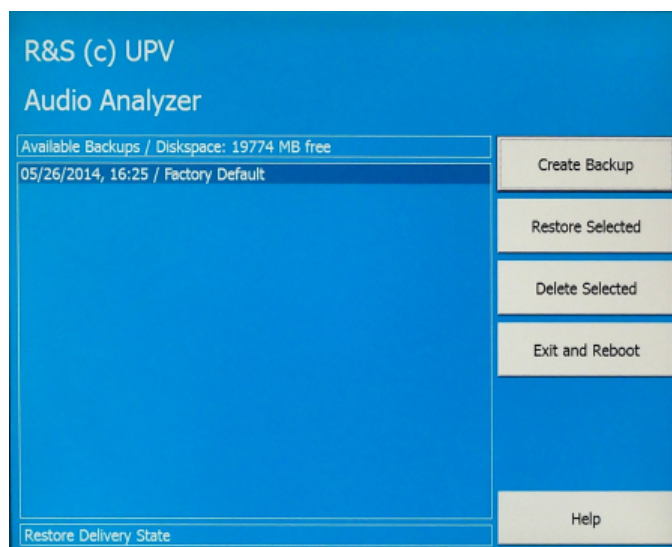


5.1.4 Windows 7 Backup / Recovery System

The Backup / Recovery system of Windows 7 has a slightly different user interface, but still may be operated with an external keyboard. The following pictures show the Backup / Recovery System for the R&S UPV. They are similar valid for the R&S UPP. Every time the device is rebooted, the following window is shown. It can be chosen between “Firmware” and “Backup” like it was already possible with Windows XP. If not doing anything the instrument chooses “Firmware” after about 2 seconds.



To manage the Backups you have to choose “Backup” with the direction keys within the 2 seconds. After a while following screen appears:



5.1.4.1 Restoring Factory Default

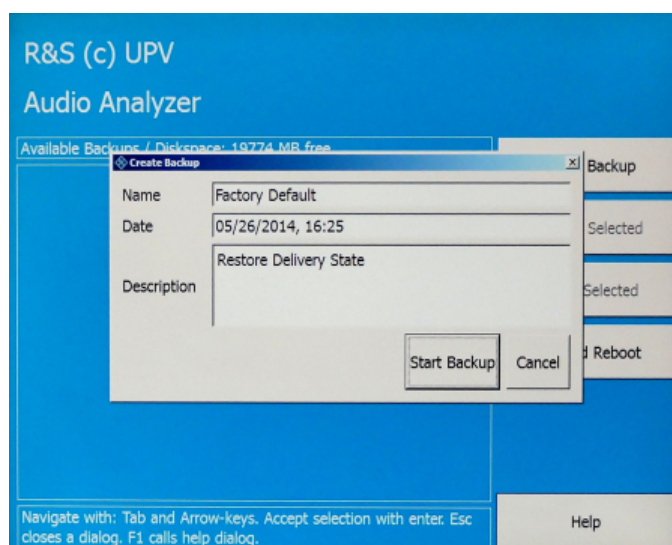
For restoring the factory default, take the selected "Factory Default" entry. Select "Restore Selected" with the Tab key and confirm with ENTER.

5.1.4.2 Restoring User Backup

For restoring another backup, navigate to the selection list with the Shift Tab key and select the desired backup with cursor up / down keys. Select "Restore Selected" with the Tab key and confirm with ENTER.

5.1.4.3 Creating User Backup

For creating a backup, choose "Create Backup" with Tab and confirm with ENTER:



The "Name" and "Description" entries (except date and time, which will be entered automatically) should be made. Afterwards choose "Start Backup" with Tab and confirm with ENTER.

5.2 Installing Options

5.2.1 Hardware Options

5.2.1.1 Option R&S UPP-B2 (Digital Audio and I2S I/O)

Please refer to [Chapter 4.4.14, "Installing Option B2 - Digital Audio Board \(A20\)"](#), on page 248.

5.2.1.2 Option R&S UPP-B4 (Digital Audio/HDMI Board)

Please refer to [Chapter 4.4.16, "Installing Option B4 - Digital Audio/HDMI Board \(A20\)"](#), on page 252.

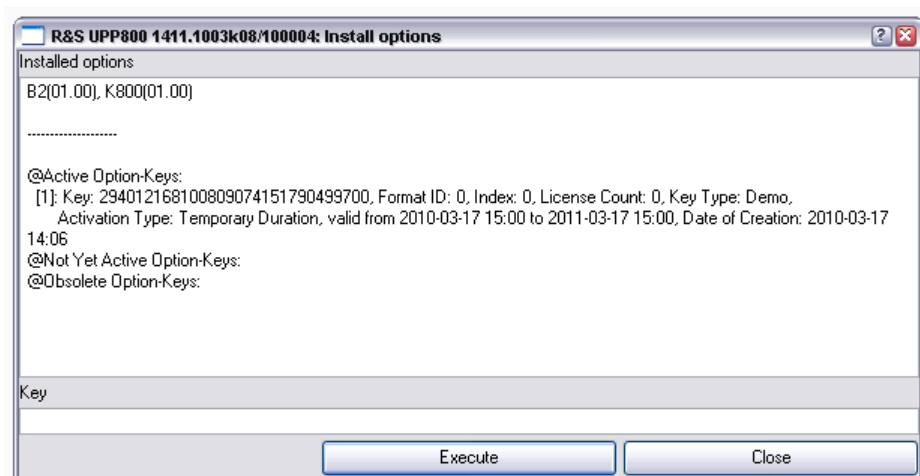
5.2.1.3 Option R&S UPP-B8 (Eight-Channel Generator)

Please refer to [Chapter 4.4.18, "Installing Option B8 - Multi Channel Generator \(A20\)"](#), on page 256.

5.2.2 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".

5.2.2.1 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 UPP. On the R&S UPP 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.

5.2.2.2 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-R4"
  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 UPP. On the R&S UPP 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.

5.2.2.3 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 E2PROMs 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.

6 Documents

6.1 Spare Parts List, Mechanical Drawings and Block Diagrams

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.

6.1.1 Available Power Cables

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	

Spare Parts 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 VARIANTS *VAR02=UPP200 AUDIO ANALYZER 2_KANÄLE +VAR02=UPP200 AUDIO ANALYZER 2_CHANNELS *VAR04=UPP400 AUDIO ANALYZER 4_KANÄLE +VAR04=UPP400 AUDIO ANALYZER 4_CHANNELS *VAR08=UPP800 AUDIO ANALYZER 8_KANÄLE +VAR08=UPP800 AUDIO ANALYZER 8_CHANNELS					
5	0	S		PH BEMERKUNG NOTE ## Ersatzteilliste gueltig fuer ## UPP200/-400/-800 = 1411.1003.02/.04/.08 ## Spare Parts List valid for ## UPP200/-400/-800 = 1411.1003.02/.04/.08		0999.9610.00		B	O
30	1	S		MM BW2 GERAETEFUSS BW2 FOOT ## Verwendet in / used in: ## 1400.0481.00		1096.2506.00		B	T
40	1	S		KR BW2-AUFSTELLFUSS BW2 FOOT ## Verwendet in / used in: ## 1400.0481.00		1096.2529.00		B	T
70	1	S		KR BW2-TRAGEGR.SEITL.T450 BW SIDE HANDLE ## Verwendet in / used in: ## 1400.0481.00	Z	1096.2670.00		M	V
100	1	S	A10	ED BASE BOARD BASE BOARD ## Verwendet in / used in: ## 1411.1003.01 ## up to serial number 1x0099 ## Einbau durch Servicestelle ## Installation by service center	Z	1411.1903.02		M	B
101	1	S	A10	ED BASE BOARD BASE BOARD ## Verwendet in / used in: ## 1411.1003.01 ## from serial number 1x0100 ## Einbau durch Servicestelle ## Installation by service center	Z	1411.1903.03		M	P
110	0	S	A11	BR M470T2953BY3-CD5 DDR2 1GB 533MHZ ## Verwendet in / used in: ## 1411.1003.01 ## Ersatz durch 3592.0870.00 (Lfd.Nr.111) ## Replaced by 3592.0870.00 (Pos.111)		1155.6595.00		B	N
111	0	S	A11	BR MT8HTF12864HDZ-800 1GB DDR2 SODIMM DDR2 SDRAM SODIMM ## Verwendet in / used in: ## 1411.1003.01 ## from serial number 1x0100 ## Einbau durch Servicestelle ## Installation by service center		3592.0870.00		B	A
150	1	S	A4	ED ANALOG AUDIO BOARD ANALOG AUDIO BOARD VAR 02 04	Z	1411.1603.04		M	P



ROHDE & SCHWARZ

Benennung/Designation

ERSATZTEILLISTE UPP
SPAREPARTS UPP

Sprach./Lang
de en

Ä.I. / C.I
16.00

Blatt/Sheet
1 of 5

Dokument Nr. / Document No.

1411.1026.01 ST

UPP

Datum/
Date

2018-04-18

Abt. /
Dept.

3MTEK

Name /
Name

EI

Pos.-Nr. ItemNo	Menge Quantity	ME Unit	El.Kennz Ref.Des.	Benennung / Bezeichnung Designation	Z	Sachnummer Stock No.	Ersatzteil Subst.part	BA	VH		
151	1	S	A4	## Verwendet in / used in: ## 1411.1003.01 ## up to serial number 1x0099 ## Einbau durch Servicestelle ## Installation by service center ED ANALOG AUDIO BOARD 2 ANALOG AUDIO BOARD 2 VAR 02 04 ## Verwendet in / used in: ## 1411.1003.01 ## from serial number 1x0100 ## Einbau durch Servicestelle ## Installation by service center	Z	1411.1649.04		M	P		
160	1	S	A4	ED ANALOG AUDIO BOARD ANALOG AUDIO BOARD VAR 08 ## Verwendet in / used in: ## 1411.1003.01 ## up to serial number 1x0099 ## Einbau durch Servicestelle ## Installation by service center	Z	1411.1603.08		M	W		
161	1	S	A4	ED ANALOG AUDIO BOARD 2 ANALOG AUDIO BOARD 2 VAR 08 ## Verwendet in / used in: ## 1411.1003.01 ## from serial number 1x0100 ## Einbau durch Servicestelle ## Installation by service center	Z	1411.1649.08		M	V		
190	1	S	W96	DY IEC BUS CABLE IEC BUS CABLE ## Verwendet in / used in: ## 1411.1003.01	Z	1411.4760.00		M	P		
200	1	S		FN SCHUBLADE EXTRA SAFE FUSE DRAWER EXTRA SAFE ## Verwendet in / used in: ## 1411.1149.00		1160.2994.00		B	O		
210	1	S	F1 OR F2	SS SCHMELZS. 4A T IEC60127-2/V FUSE 4A T IEC60127-2/V ## Verwendet in / used in: ## 1411.1149.00		0020.7600.00		B	O		
220	1	S	E1 OR E2	DX LUEFTER FAN ## Verwendet in / used in: ## 1411.1149.00	Z	1401.3290.00		M	P		
230	1	S	A9	ED IPS ADAPTERBOARD IPS ADAPTERBOARD ## Verwendet in / used in: ## 1411.1003.01 Fuer UPP200 mit Seriennr. >=121000 Fuer UPP400 mit Seriennr. >=141000 Fuer UPP800 mit Seriennr. >=181000 1411.1803.02 >=TAZ05.01 erforderlich For UPP200 with serial no. >=121000 For UPP400 with serial no. >=141000 For UPP800 with serial no. >=181000 1411.1803.02 >=TAZ05.01 necessary	Z	1411.1803.02		M	P		
250	0	S	A5	NM HDD 2.5 SATA 160GB MHZ2160BH HDD 2.5 SATA 160GB MHZ2160BH ## Verwendet in / used in: ## 1411.1003.01 ## with this A5.2 = 1411.2051.00 ## A5.2 = MS WIN-XP EMB, REC DVD ## Ersatz durch 3586.5680.00 (Lfd.Nr.251) ## Replaced by 3586.5680.00 (Pos.251)		3583.1861.00		B	A		
ROHDE&SCHWARZ Benennung/Designation ERSATZTEILLISTE UPP SPAREPARTS UPP				Sprach./Lang de en		Ä.I. / C.I 16.00	Blatt/Sheet 2 of 5				
UPP				Datum/ Date	2018-04-18	Abt. / Dept.	3MTEK	Name / Name	EI	Dokument Nr. / Document No. 1411.1026.01 ST	



Pos.-Nr. ItemNo	Menge Quantity	ME Unit	El.Kennz Ref.Des.	Benennung / Bezeichnung Designation	Z	Sachnummer Stock No.	Ersatzteil Subst.part	BA	VH	
795	1	S	A97	## Verwendet in / used in: ## 1411.1003.01 DL SATA DATENKABEL 420 SATA DATACABLE 420 ## Verwendet in / used in: ## 1411.1003.01		1091.3456.00		B	T	
800	1	S	A40	ED XLR FRONT PANEL XLR FRONT PANEL VAR 02 ## Verwendet in / used in: ## 1411.1003.01 ## up to serial number 120099	Z	1411.1703.02		M	W	
801	1	S	A40	ED XLR FRONT PANEL 2 XLR FRONT PANEL 2 VAR 02 ## Verwendet in / used in: ## 1411.1003.01 ## from serial number 120100	Z	1411.1749.02		M	B	
810	1	S	A40	ED XLR FRONT PANEL XLR FRONT PANEL VAR 04 ## Verwendet in / used in: ## 1411.1003.01 ## up to serial number 140099	Z	1411.1703.04		M	B	
811	1	S	A40	ED XLR FRONT PANEL 2 XLR FRONT PANEL 2 VAR 04 ## Verwendet in / used in: ## 1411.1003.01 ## from serial number 140100	Z	1411.1749.04		M	P	
820	1	S	A40	ED XLR FRONT PANEL XLR FRONT PANEL VAR 08 ## Verwendet in / used in: ## 1411.1003.01 ## up to serial number 180099	Z	1411.1703.08		M	G	
821	1	S	A40	ED XLR FRONT PANEL 2 XLR FRONT PANEL 2 VAR 08 ## Verwendet in / used in: ## 1411.1003.01 ## from serial number 180100	Z	1411.1749.08		M	P	
1010	1	S		MM BW2-FRONTGRIFF 2E FRONT HANDLE 2U ## Verwendet in / used in: ## 1411.1003.01		1096.1468.00		B	V	
1030	1	S		MZ TUBUS, VORMONT. TUBE, MOUNTED ## Verwendet in / used in: ## 1411.1003.01 ## incl. 1096.2506.00 (foot) ## incl. 1096.2529.00 (mounting foot) ## incl. 1096.2670.00 (side handle)	Z	1400.0481.00		M	P	
1050	1	S		MM BW2-RUECKWANDFUSS BW2-REAR WALL FOOT ## Verwendet in / used in: ## 1411.1003.01		1096.2487.00		B	V	
ROHDE&SCHWARZ				Benennung/Designation ERSATZTEILLISTE UPP SPAREPARTS UPP			Sprach./Lang de en	Ä.I. / C.I 16.00	Blatt/Sheet 5 of 5	
UPP				Datum/ Date	2018-04-18	Abt. / Dept.	3MTEK	Name / Name	EI	Dokument Nr. / Document No. 1411.1026.01 ST

Pos.-Nr. ItemNo	Menge Quantity	ME Unit	EI.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	A20	ED DIGITAL AUDIO BOARD DIGITAL AUDIO BOARD ## Verwendet in: ## 1411.2339.01	Z	1411.2400.02		M	P
20	1	S	A2	EE DIGITAL ADAPTER DIGITAL ADAPTER ## Verwendet in: ## 1411.2339.01	Z	1411.2345.02		M	W
ROHDE&SCHWARZ Benennung/Designation ERSATZTEILLISTE UPP-B2 SPAREPARTS UPP-B2 Datum/ Date 2013-08-29 Abt. / Dept. MTEK Name / Name EI Sprach./Lang de en Ä.I. / C. / 01.00 Blatt/Sheet 1 of 1 Dokument Nr. / Document No. 1411.2322.01 ST									

Pos.-Nr. ItemNo	Menge Quantity	ME Unit	EI.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	A2	EE DIGITAL ADAPTER DIGITAL ADAPTER ## Verwendet in: ## 1411.2539.01	Z	1411.2345.02		M	W
20	1	S	A20	ED HDMI AUDIO BOARD HDMI AUDIO BOARD ## Verwendet in: ## 1411.2539.01	Z	1411.2545.02		M	B

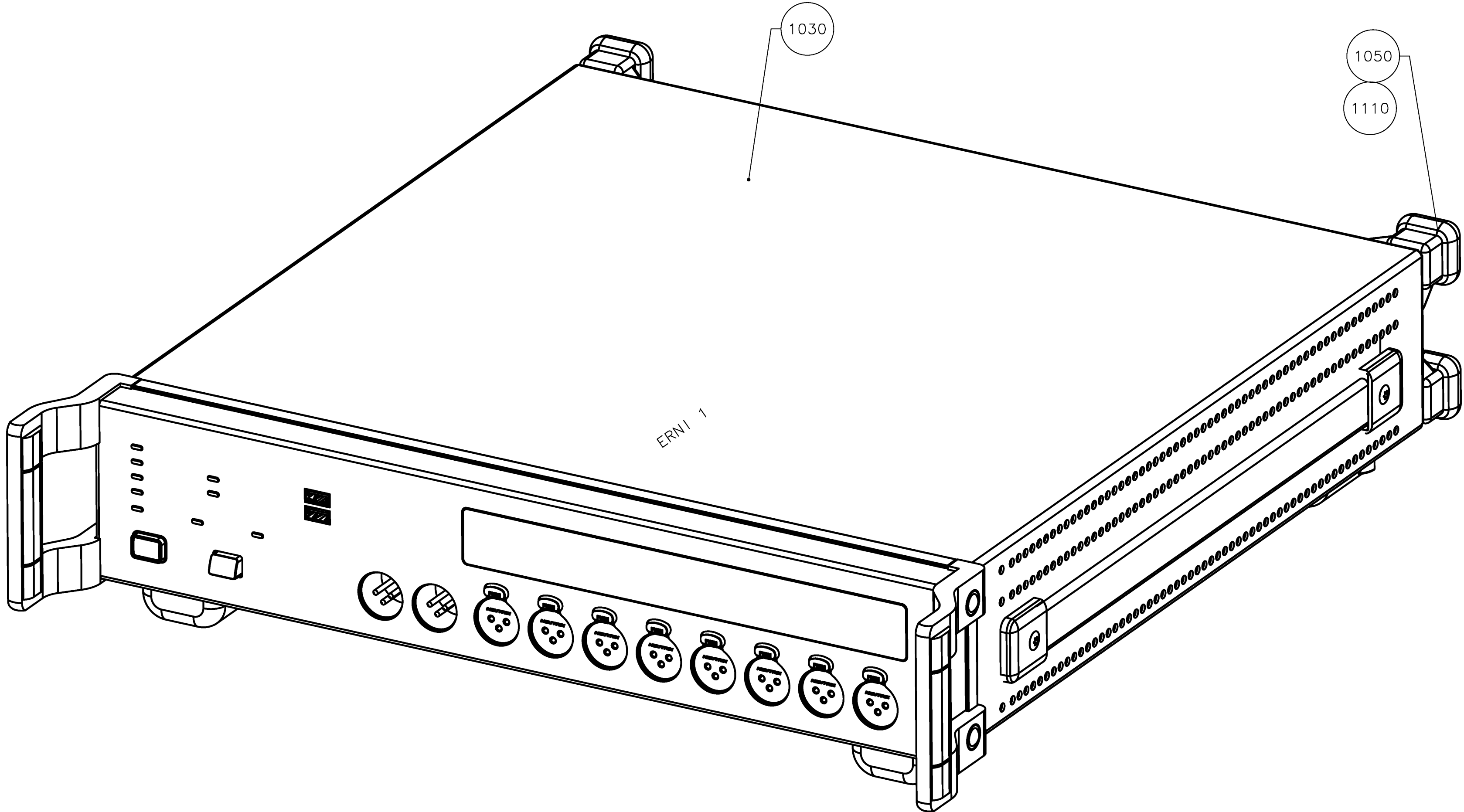
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	UPP-B4	Datum/ Date 2013-08-29	Abt. / Dept. MTEK	Name / Name EI	Dokument Nr. / Document No. 1411.2522.01 ST		

Pos.-Nr. ItemNo	Menge Quantity	ME Unit	EI.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	A2	EE DIGITAL ADAPTER DIGITAL ADAPTER ## Verwendet in: ## 1411.2700.01	Z	1411.2345.02		M	W
20	1	S	A20	ED GENERATOR 8CH BOARD GENERATOR 8CH BOARD ## Verwendet in: ## 1411.2739.01	Z	1411.2745.02		M	P

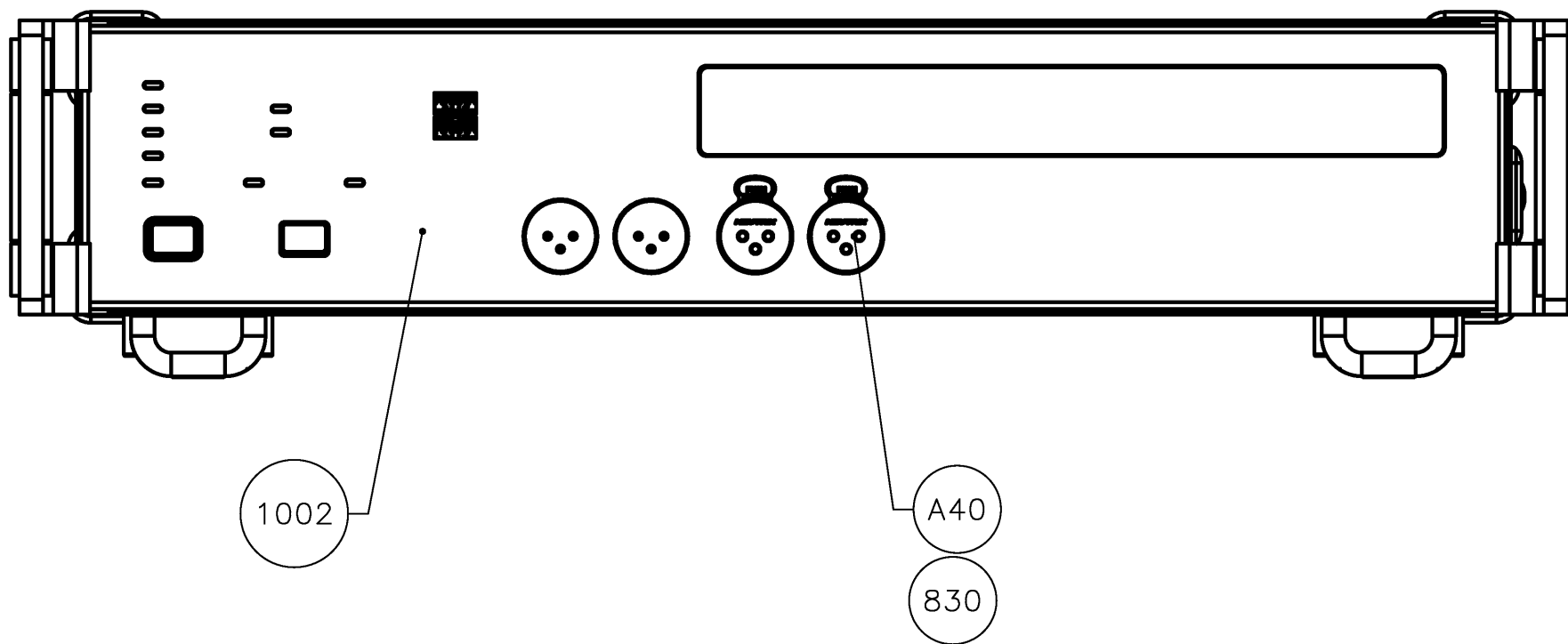
Mechanical Drawings

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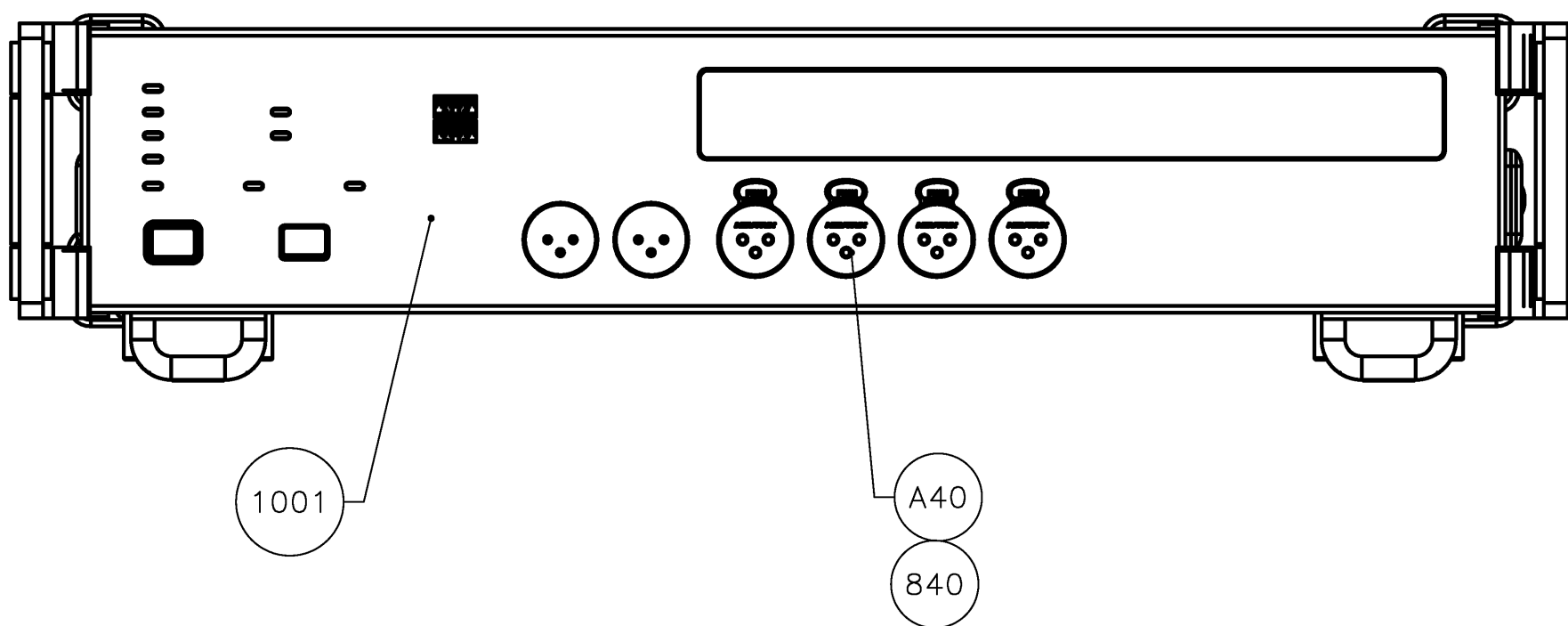
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methode
Projection
Method



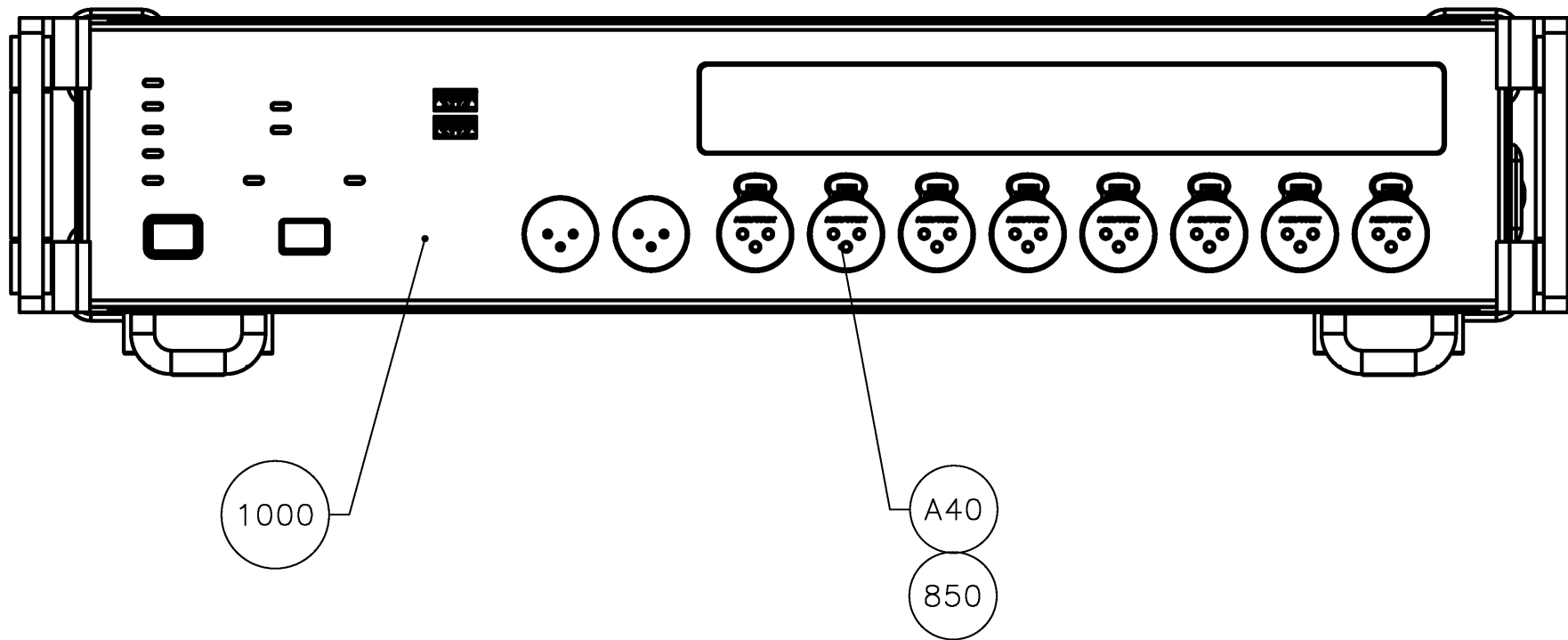
VAR02 = UPP200 AUDIO ANALYZER 2 KANAELE
MOD02 = UPP200 AUDIO ANALYZER 2 CHANNELS



VAR04 = UPP400 AUDIO ANALYZER 4 KANAELE
MOD04 = UPP400 AUDIO ANALYZER 4 CHANNELS



VAR08 = UPP200 AUDIO ANALYZER 8 KANAELE
MOD08 = UPP200 AUDIO ANALYZER 8 CHANNELS



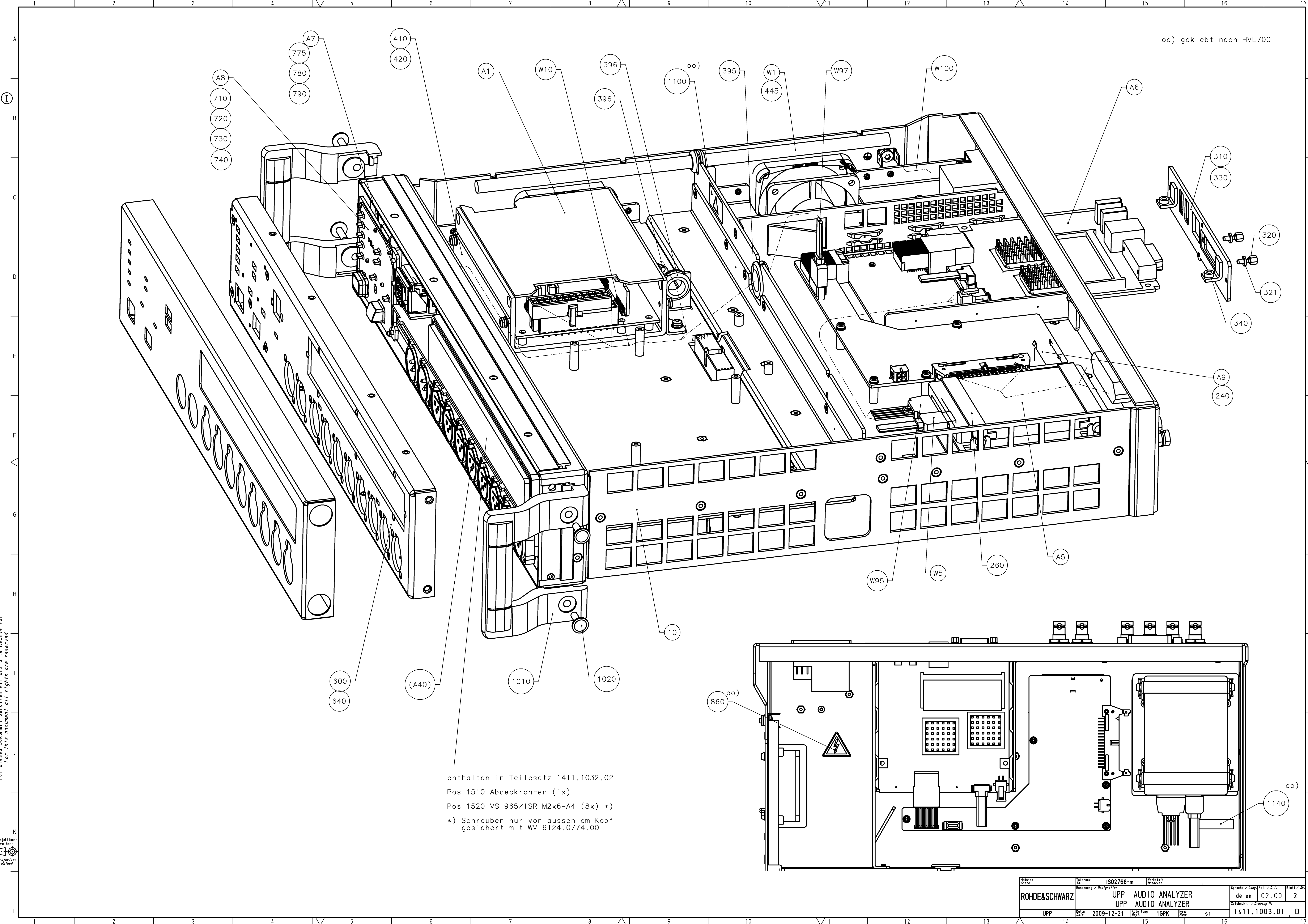
VARIANTENERKLÄRUNG
EXPLANATION OF MODELS

VAR02 = UPP200 AUDIO ANALYZER 2 KANAELE
MOD02 = UPP200 AUDIO ANALYZER 2 CHANNELS

VAR04 = UPP400 AUDIO ANALYZER 4 KANAELE
MOD04 = UPP400 AUDIO ANALYZER 4 CHANNELS

VAR08 = UPP200 AUDIO ANALYZER 8 KANAELE
MOD08 = UPP200 AUDIO ANALYZER 8 CHANNELS

Modell Code	Skizzen Zust.	Werkstoff Material	Sprache / Lang. Lang. / C.L.	Blatt / Stk. Blatt / Stk.
ROHDE&SCHWARZ	UPP AUDIO ANALYZER		de en	02.00 1
UPP	UPP AUDIO ANALYZER			
UPP	2009-12-21	16PK	sr	1411.1003.01 D



oo) geklebt nach HVL700

enthalten in Teilesatz 1411.1032.02
Pos 1510 Abdeckrahmen (1x)
Pos 1520 VS 965/ISR M2x6-A4 (8x) *)
*) Schrauben nur von aussen am Kopf
gesichert mit WV 6124.0774.00

Modell Serie	Schwarz Typ.	IS02768-m	Werkstoff Material	Sprache / Lang. / Art. / C.I.	Blatt / 26
ROHDE&SCHWARZ	Benennung / Designation	UPP AUDIO ANALYZER		de en	02.00
UPP	Zeichn. Nr. / Drawing No.	UPP AUDIO ANALYZER		1411.1003.01	D
	Datum Date	2009-12-21	Abt./Lang. Dept.	16PK	sr

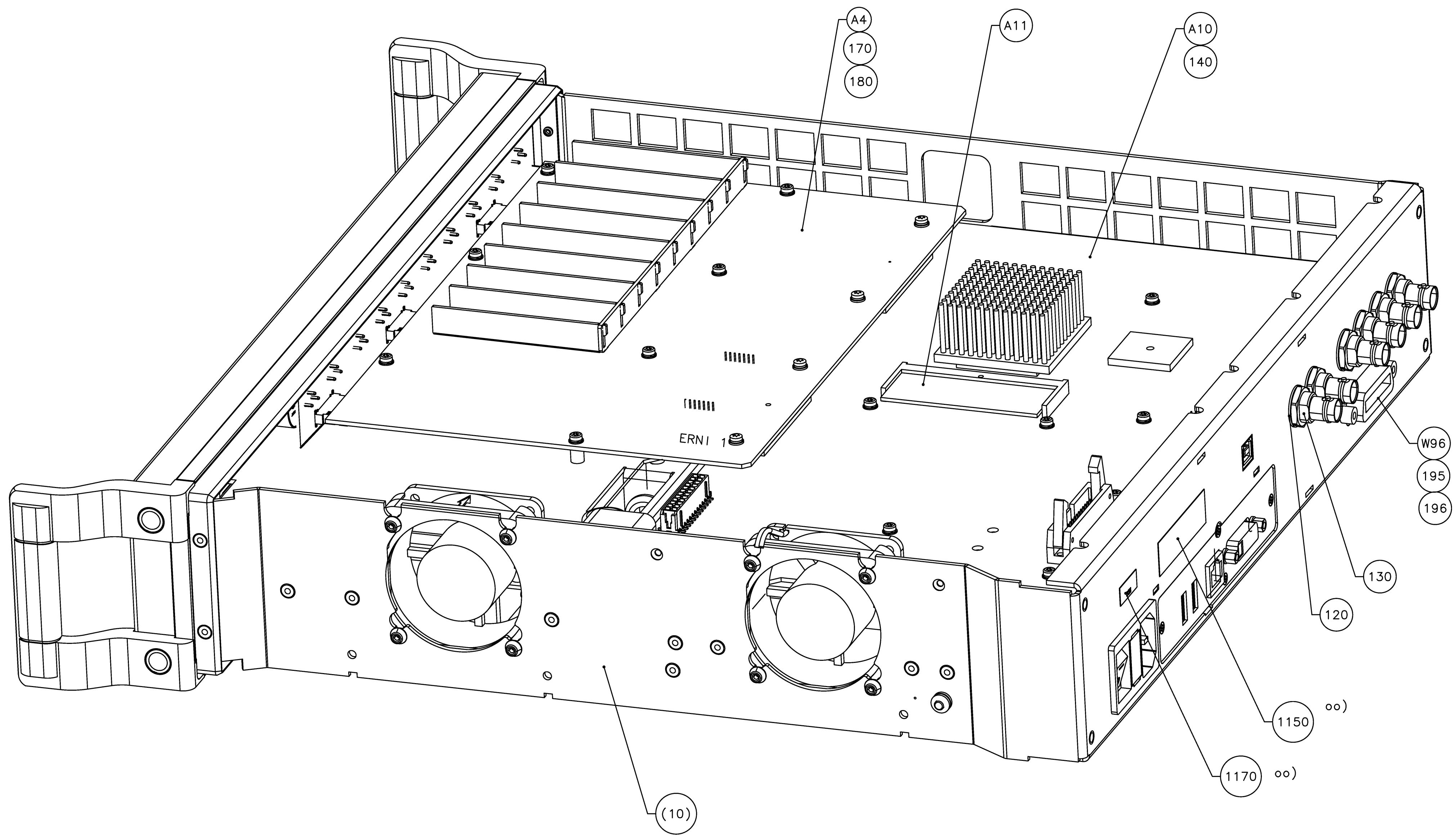
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Projektions-
methode
Projection
Method

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Projektions-
methode
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Method

dargestellt: VAR 08



oo) geklebt n. HVL700

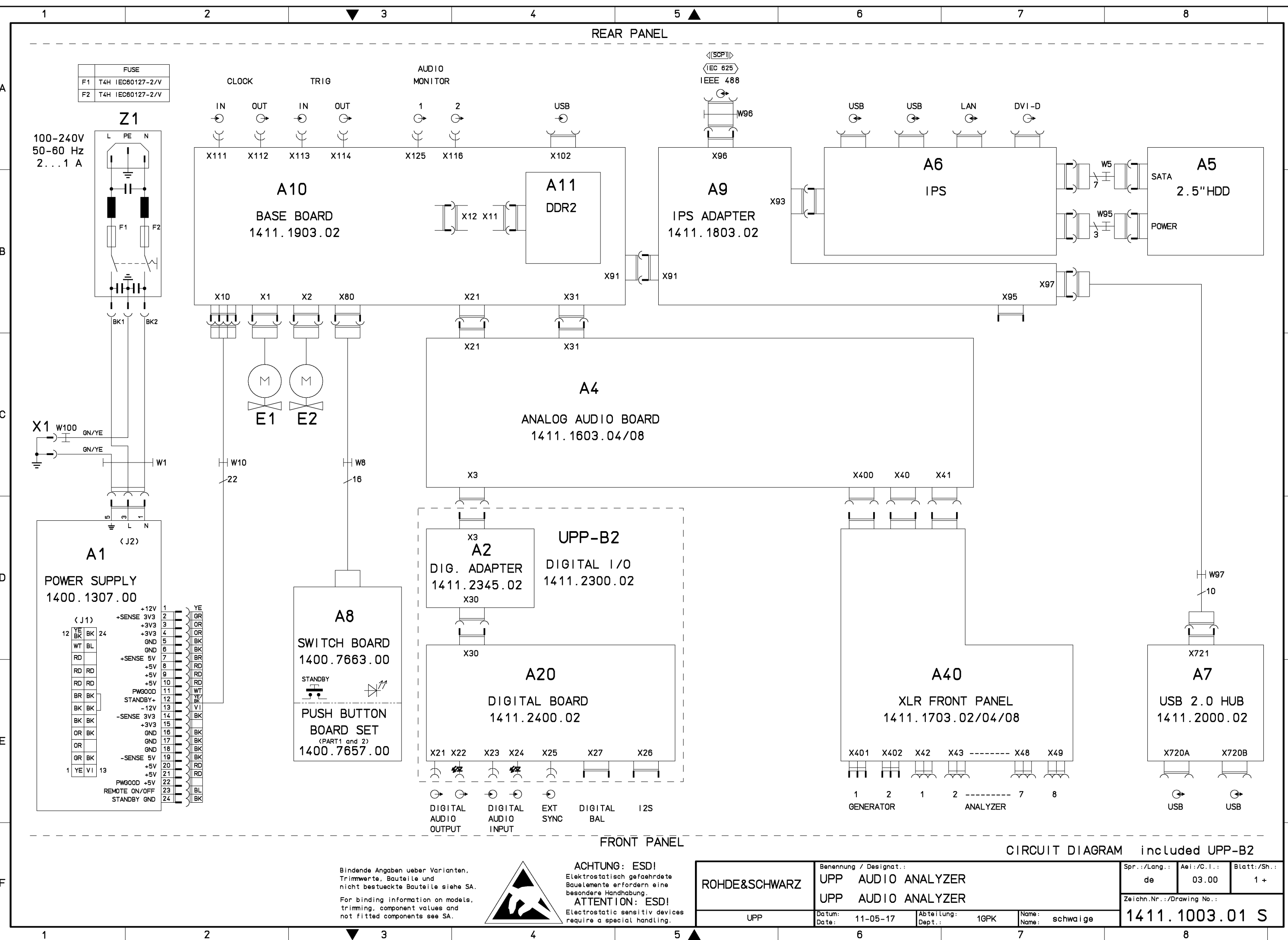
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UPP	Datum Date	2012-08-23	Abteilung Dept.	MTEK	Name Name
				hm	1411.1003.01
					D

Block Diagrams

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E

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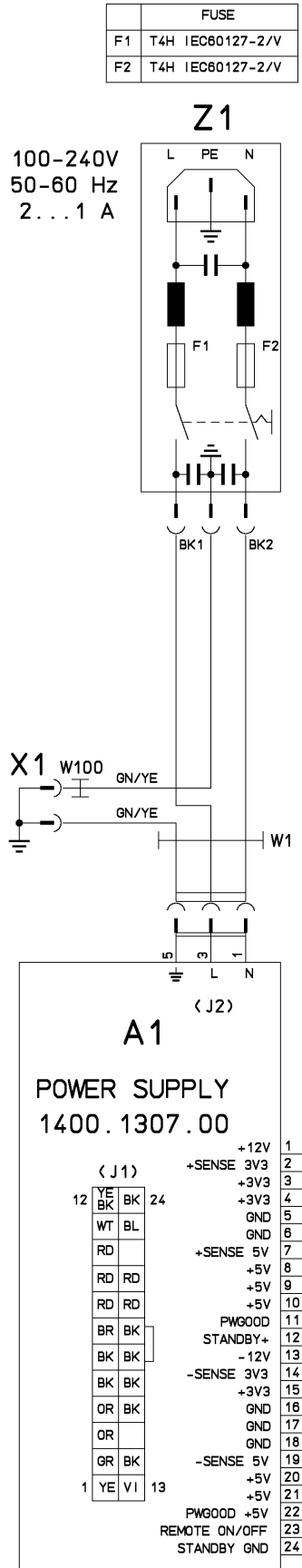
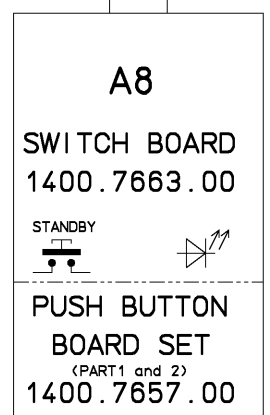
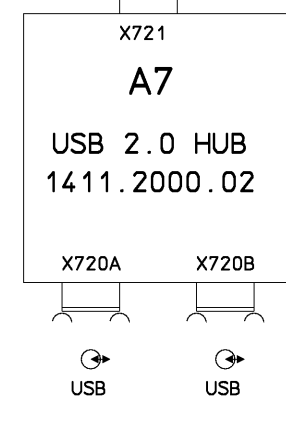
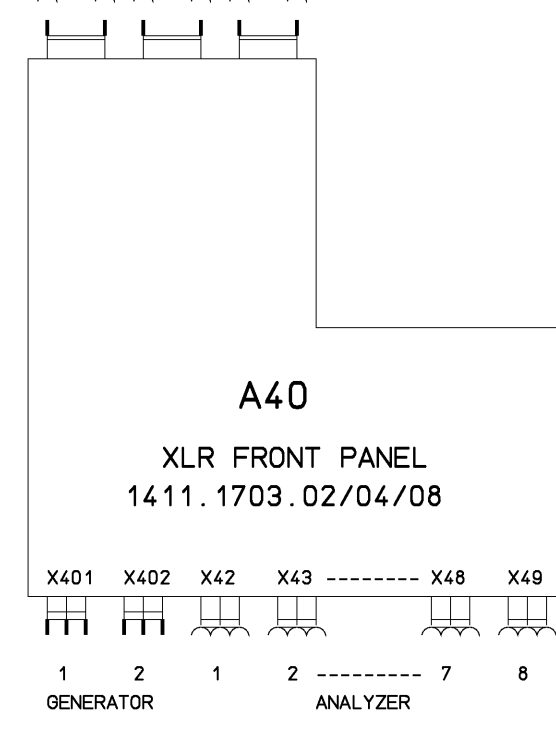
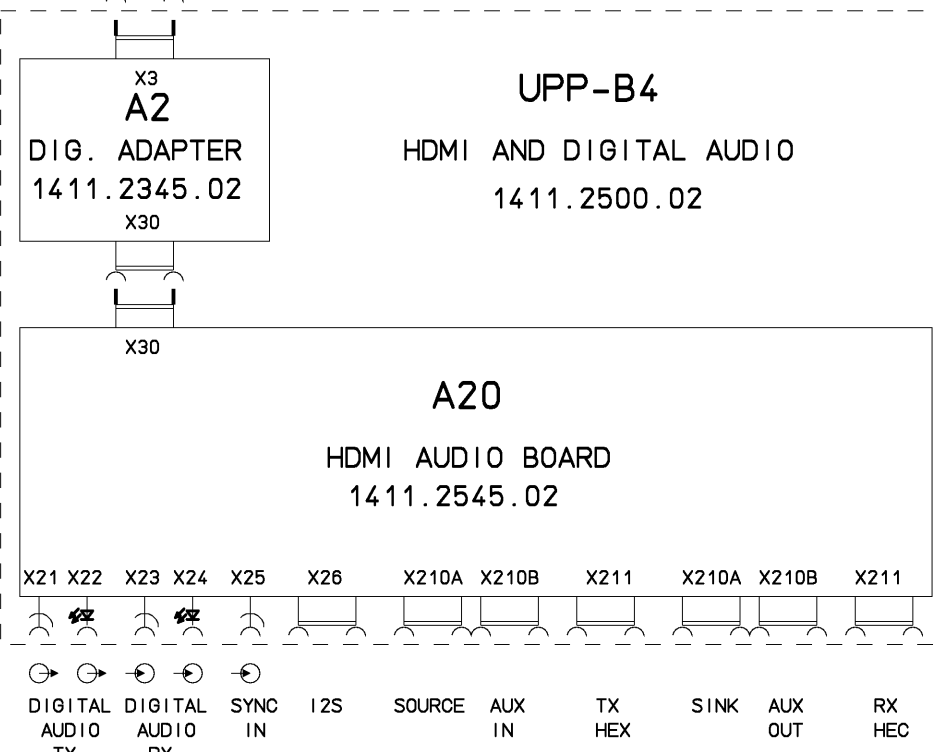
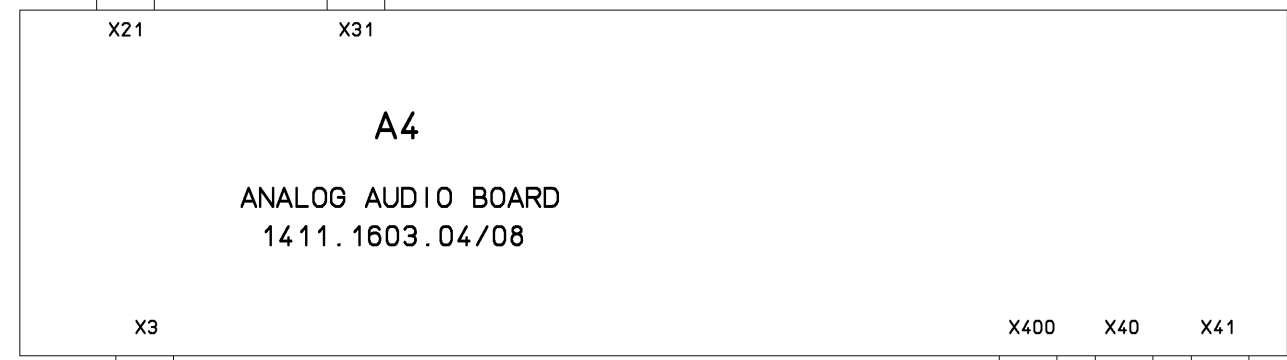
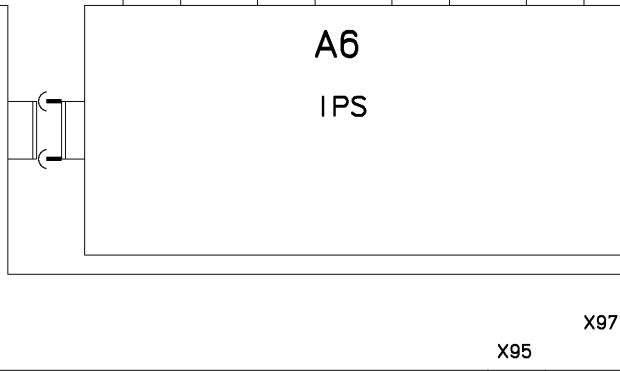
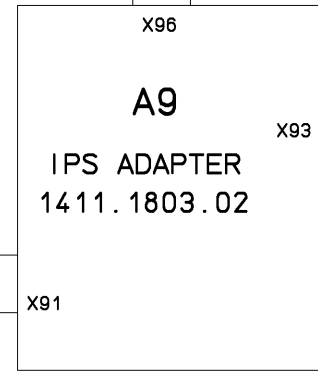
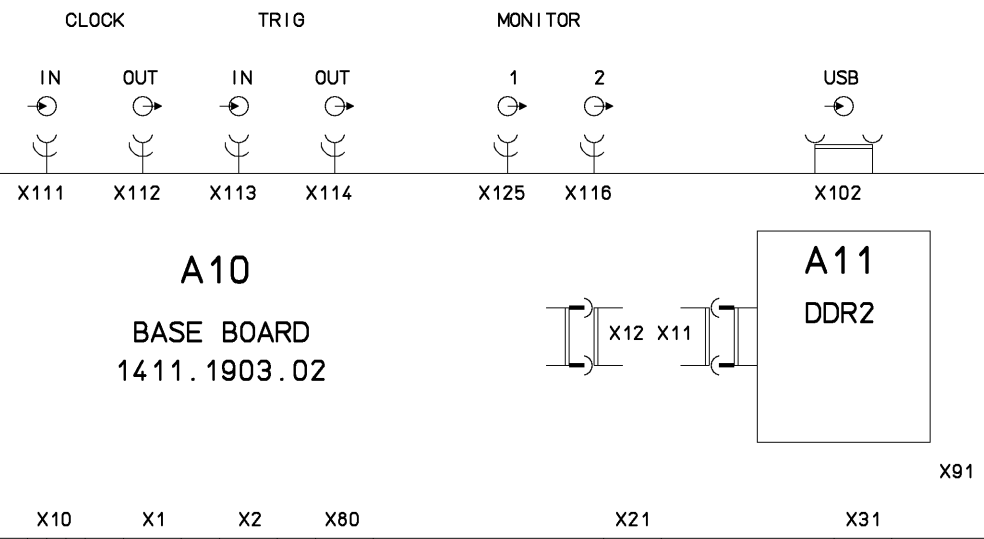
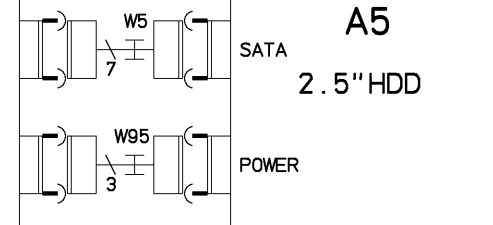
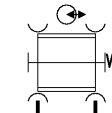
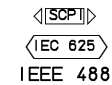
Bindende Angaben ueber Varianten,
Trimmwerte, Bauteile und
nicht bestueckte Bauteile siehe SA.
For binding information on models,
trimming, component values and
not fitted components see SA.



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

ROHDE&SCHWARZ	Benennung / Designat.:			Spr.:/Lang.:	Aei:/C.I.:	Blatt:/Sh.:
	UPP AUDIO ANALYZER			de	03.00	1 +
	UPP AUDIO ANALYZER			Zeichn.Nr.:/Drawing No.:		
UPP	Datum: Date:	11-05-17	Abteilung: Dept.:	10PK	1411.1003.01 S	
	Name: Name:			schwaige		

REAR PANEL



FRONT PANEL

Blindende 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.

ROHDE&SCHWARZ

UPF

Benennung / Designat.:	UPP AUDIO ANALYZER
	UPP AUDIO ANALYZER

Datum:	2011-05-17
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Abteilung:	1GPK
Dept.:	

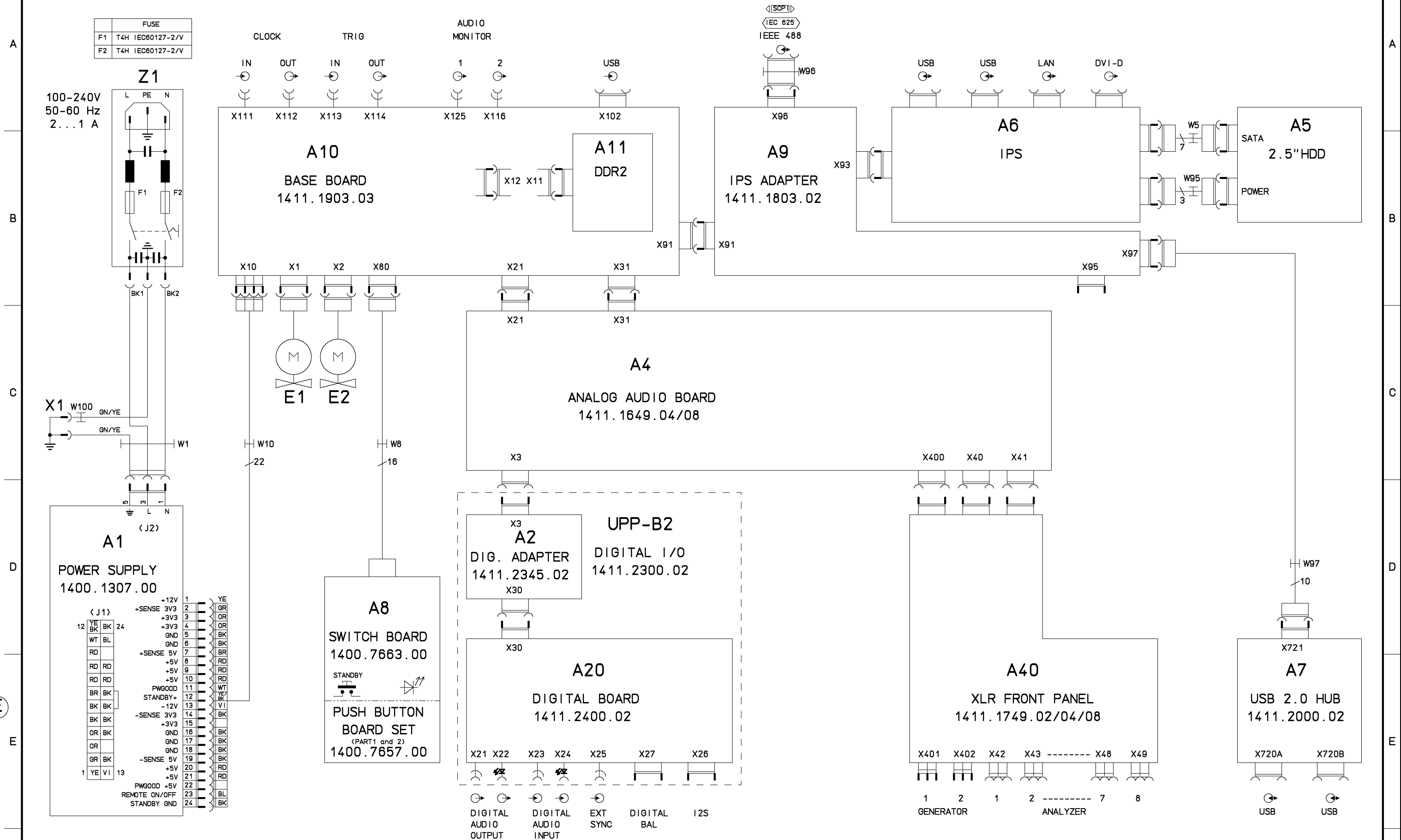
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1411.1003.01 S

REAR PANEL



FRONT PANEL

CIRCUIT DIAGRAM included UPP-B2

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.

ROHDE&SCHWARZ

UPP

Benennung / Designat.:	
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UPP AUDIO ANALYZER

UPP AUDIO ANALYZER

Datum:	
Date:	

11-07-20

Abteilung:	
Dept.:	

Name :	schwa i ge
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Spr.:/Lang.:	Aei:/C.l.:	Blatt:/Sh.:
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Zeichn.Nr.:/Drawing No.:	
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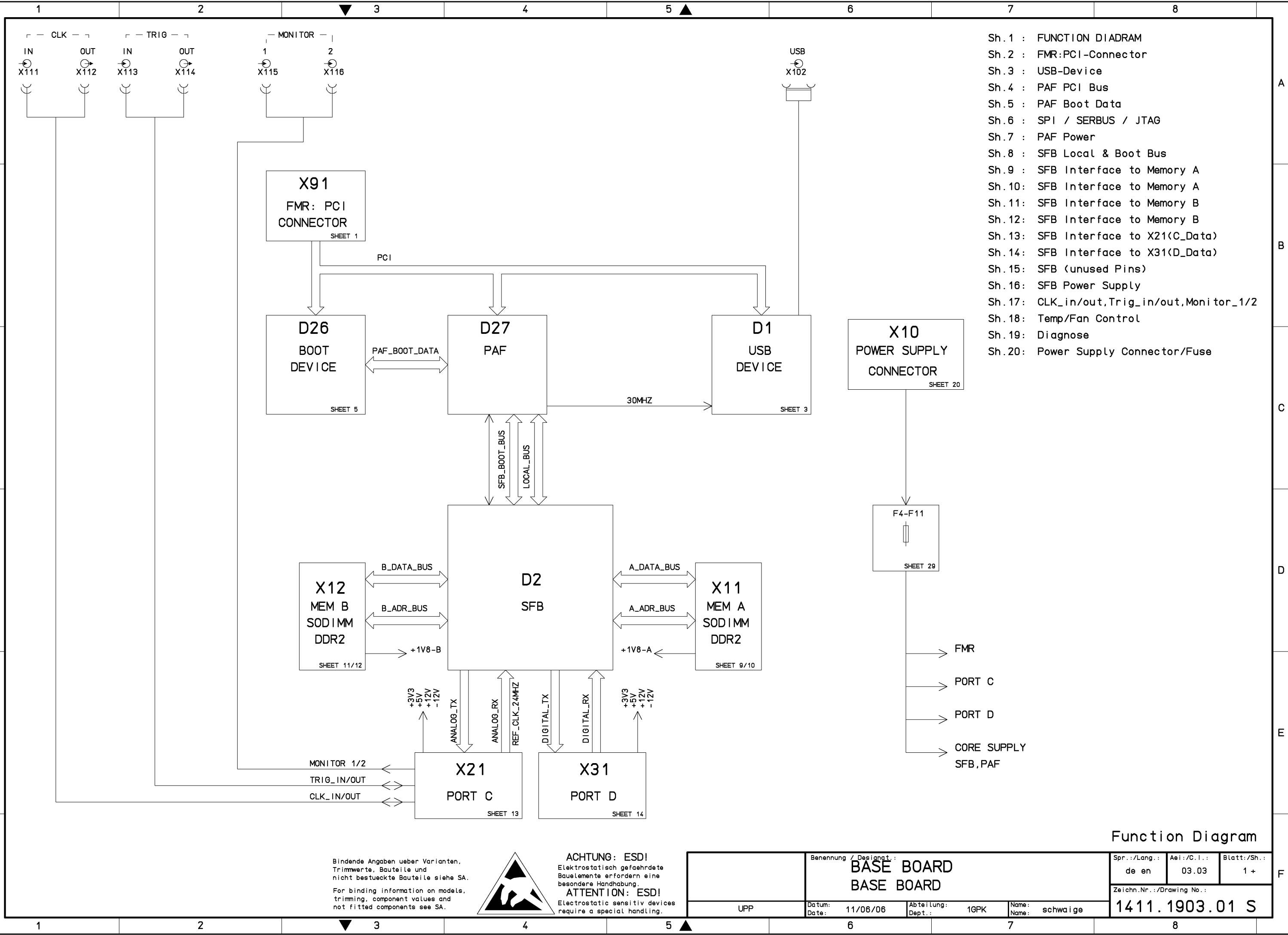
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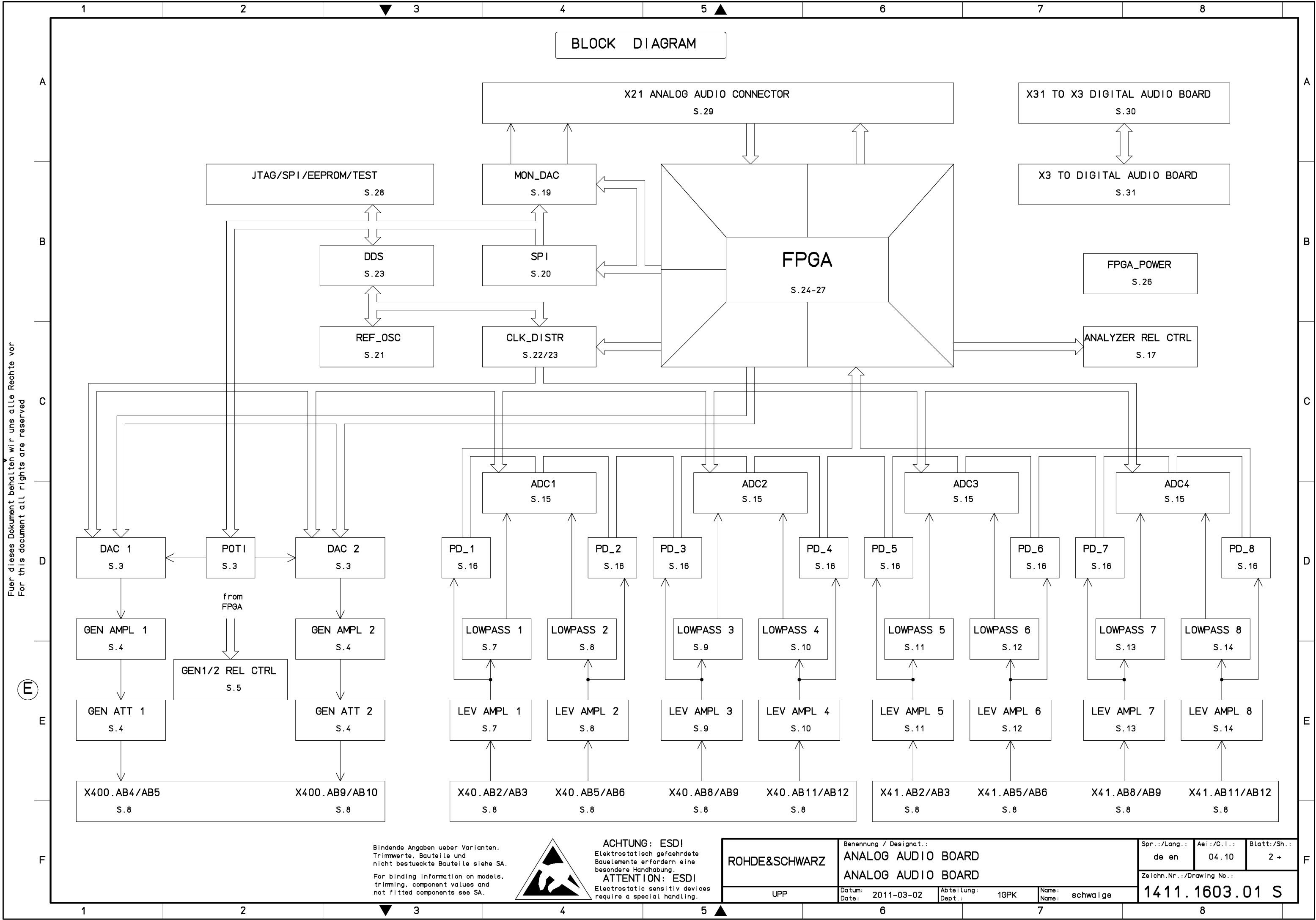
Function Diagram

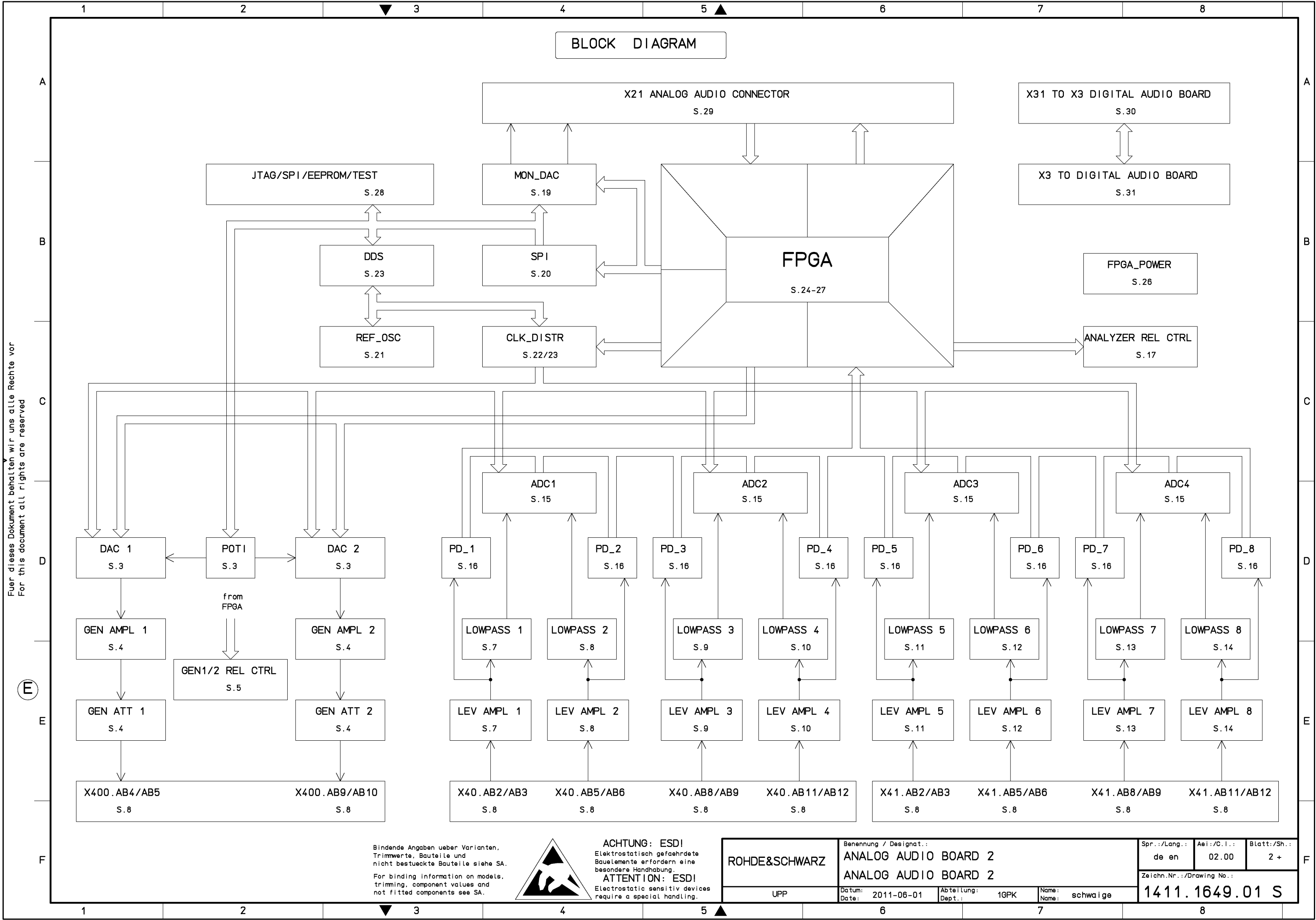
Bindende Angaben ueber Varianten,
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nicht bestueckte Bauteile siehe SA.
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trimming, component values and
not fitted components see SA.

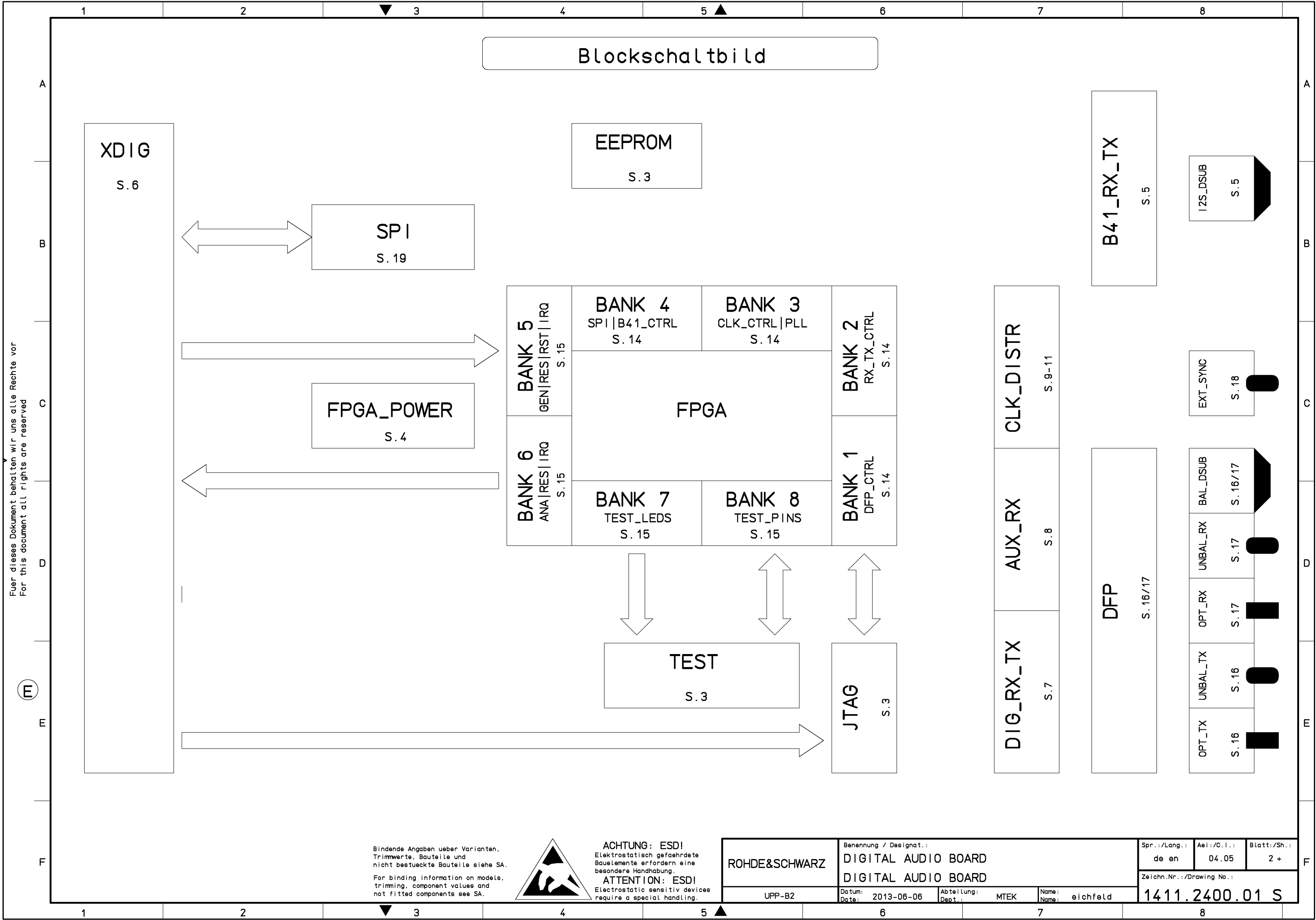


ACHTUNG: ESD!
Elektrostatisch gefaehrdete
Bauelemente erfordern eine
besondere Handhabung.
ATTENTION: ESD!
Electrostatic sensitiv devices
require a special handling.

	Benennung / Designat.:				Spr.:/Lang.:		Aei./C.I.:		Blatt:/Sh.:		
	BASE BOARD BASE BOARD				de en		03.03		1 +		
					Zeichn.Nr.:/Drawing No.:						
UPP	Datum: Date:		11/06/06		Abteilung: Dept.:		10PK		Name: Name:		
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not fitted components see SA.



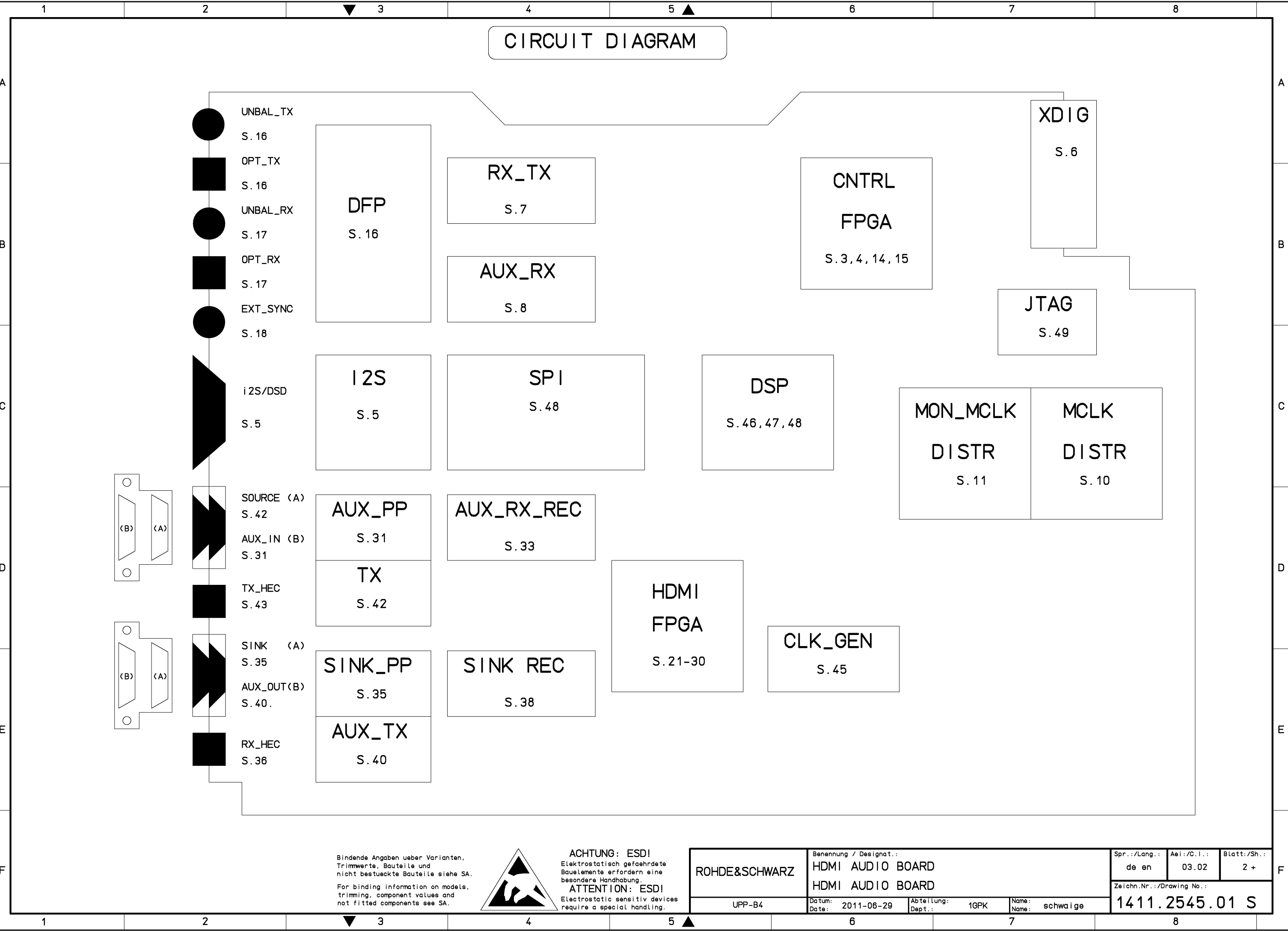
ACHTUNG: ESD!
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besondere Handhabung.
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	UPP-B2	Datum: Date: 2013-06-06	Abteilung: Dept.: MTEK	Name: Name: eichfeld	Zeichn.Nr.:/Drawing No.: 1411.2400.01 S	

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not fitted components see SA.



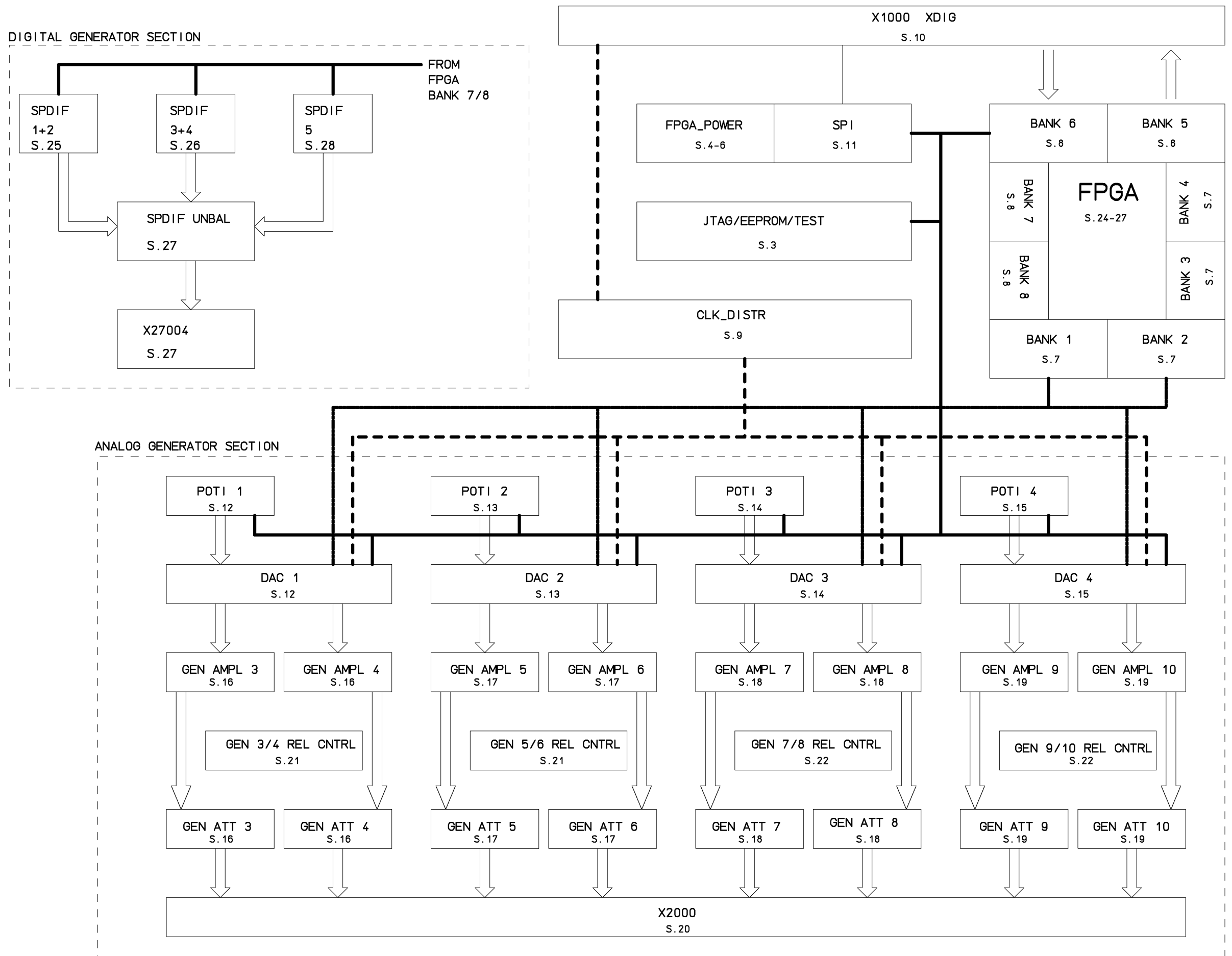
ACHTUNG: ESD!
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Bauelemente erfordern eine
besondere Handhabung.
ATTENTION: ESD!
Electrostatic sensitiv devices
require a special handling.

ROHDE&SCHWARZ	Benennung / Designat.: HDMI AUDIO BOARD HDMI AUDIO BOARD			Spr.:/Lang.: de en	Aei:/C.I.: 03.02	Blatt:/Sh.: 2 +
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trimming, component values and
not fitted components see SA.



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ROHDE&SCHWARZ

UPP-B8

Benennung / Designat.:

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GENERATOR 8CH BOARD

Datum:
Date: 2013-07-22

Abteilung:
Dept.: 1GP6

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Name: dorner

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Zeichn.Nr.:/Drawing No.:

1411.2745.01 S

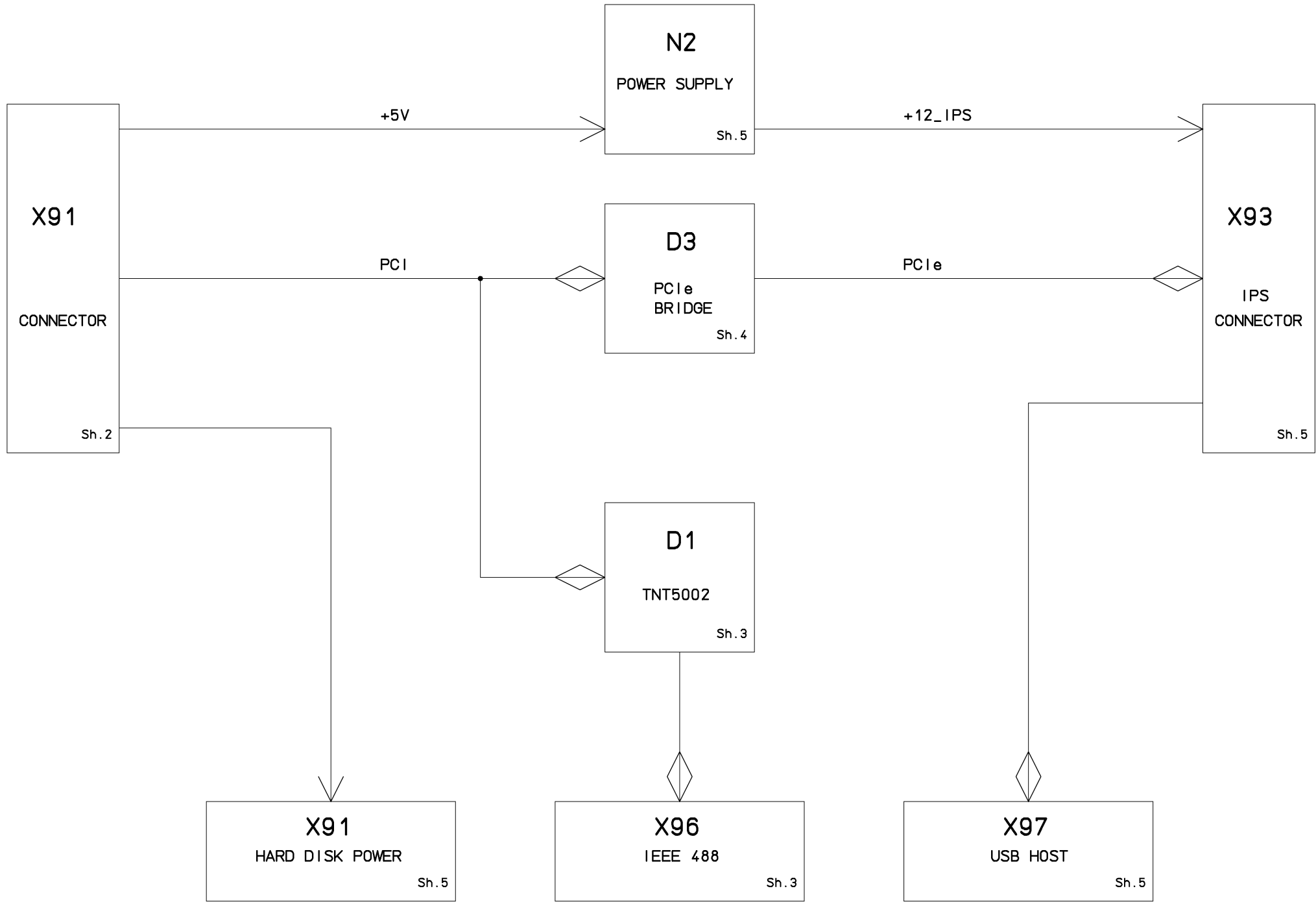
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BLOCK DIAGRAM



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nicht bestueckte Bauteile siehe ST.
For binding information on models,
trimming and components values and
nonfitted components see parts list.



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	UPP	Datum: Date: 10-04-27	Abteilung: Dept.: 10PK	Name: Name: schwaige	Zeichn.Nr.:/Drawing No.: 1411.1803.01 S	