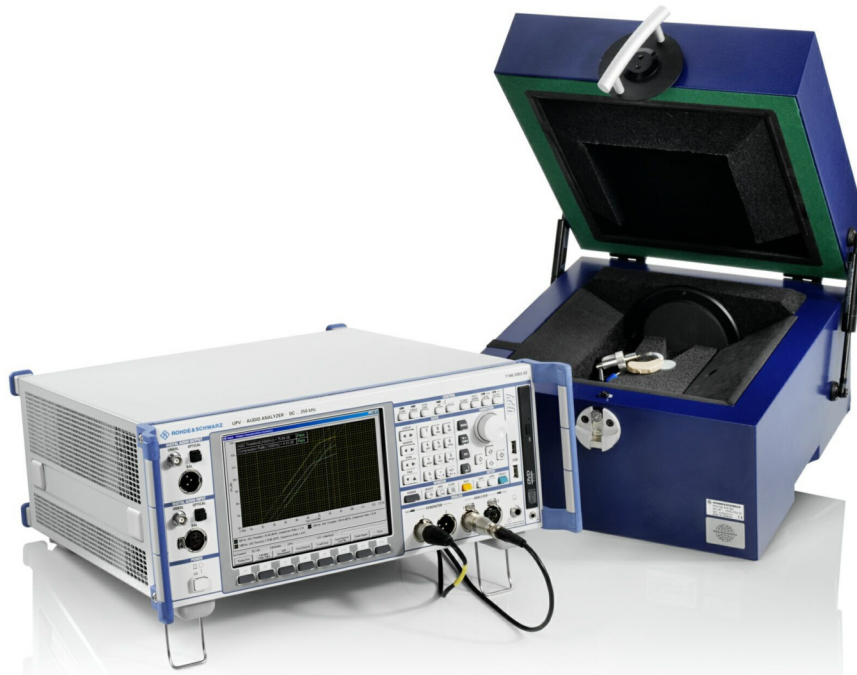


# Operating Manual



## Software for Hearing Aids Tests

**R&S<sup>®</sup> UPV-K7**

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**Dear Customer,**

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# 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 attached 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 intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and 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.

## Symbols and safety labels

							
Notice, general danger location Observe product documentation	Caution when handling heavy equipment	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Be careful when handling electrostatic sensitive devices

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

## Tags 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 the possibility of incorrect operation which can result in damage to the product.

In the product documentation, the word ATTENTION is used synonymously.

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

## Operating states and operating positions

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

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, 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.
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 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 death.

## Electrical safety

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

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.
3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 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, a disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
6. The product may be operated only from TN/TT supply networks fused 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. 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, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

### Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", 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. 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).



### **Repair and service**

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE 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. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.
5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
6. 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.
7. 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.
8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

### **Transport**

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.

2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

### **Waste disposal**

1. 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.
2. 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.

## Informaciones elementales de seguridad

### **Es imprescindible leer y observar 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 adjunto 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.

### Símbolos y definiciones de seguridad

							
Aviso: punto de peligro general  Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Advertencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)

					
Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

## Palabras de señal y su significado

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



PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.



ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.



ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.



AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.  
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, grado de suciedad 2, categoría de sobrecarga eléctrica 2, 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.
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, pueden causarse lesiones o incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

## Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en 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.
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", punto 1.

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y 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. 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).

### **Reparación y mantenimiento**

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

### **Baterías y acumuladores o celdas**

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

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

6. 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.
7. 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).
8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

### **Transporte**

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

### **Eliminación**

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (povos 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.
2. 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.



# Qualitätszertifikat

## Certificate of quality

## Certificat de qualité

Certified Quality System  
**ISO 9001**

Certified Environmental System  
**ISO 14001**

### **Sehr geehrter Kunde,**

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

### **Der Umwelt verpflichtet**

- ▮ Energie-effiziente, RoHS-konforme Produkte
- ▮ Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ▮ ISO 14001-zertifiziertes Umweltmanagementsystem

### **Dear Customer,**

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

### **Environmental commitment**

- ▮ Energy-efficient products
- ▮ Continuous improvement in environmental sustainability
- ▮ ISO 14001-certified environmental management system

### **Cher client,**

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.

### **Engagement écologique**

- ▮ Produits à efficience énergétique
- ▮ Amélioration continue de la durabilité environnementale
- ▮ Système de gestion de l'environnement certifié selon ISO 14001

# Customer Support

## Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

## Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish. We will take care that you will get the right information.

### USA & Canada

Monday to Friday (except US public holidays)  
8:00 AM – 8:00 PM Eastern Standard Time (EST)

Tel. from USA 888-test-rsa (888-837-8772) (opt 2)  
From outside USA +1 410 910 7800 (opt 2)  
Fax +1 410 910 7801

E-mail [CustomerSupport@rohde-schwarz.com](mailto:CustomerSupport@rohde-schwarz.com)

### East Asia

Monday to Friday (except Singaporean public holidays)  
8:30 AM – 6:00 PM Singapore Time (SGT)

Tel. +65 6 513 0488  
Fax +65 6 846 1090

E-mail [CustomerSupport@rohde-schwarz.com](mailto:CustomerSupport@rohde-schwarz.com)

### Rest of the World

Monday to Friday (except German public holidays)  
08:00 – 17:00 Central European Time (CET)

Tel. +49 89 4129 13774  
Fax +49 (0) 89 41 29 637 78

E-mail [CustomerSupport@rohde-schwarz.com](mailto:CustomerSupport@rohde-schwarz.com)



## 1 Overview

Tests of basic properties of hearing aids are specified in standards IEC 60118 and ANSI S3.22. They comprise measurement of output sound pressure level, frequency responses, output SPL over input SPL, harmonic distortion, battery current drain and AGC settling.

Audio Analyzer R&S UPV with option R&S UPV-K7 provides a test system which, together with the necessary acoustic accessories, allows measurements according to IEC60118-0:1983, IEC60118-1:1995, IEC60118-2:1983, IEC60118-7:2005 and ANSI S3.22-2003.

In addition to standard measurements it is possible to create own tests by customizing the available parameters.

Automatic test sequences can be compiled from the available tests, and results are compiled for subsequent creation of test reports.

## 2 Preparation and Start of the Application Software

### Required Measuring Instruments and Accessories

The Audio Analyzer R&S UPV with option R&S UPV-K7 is required for the measurements.

Acoustic devices such as measurement couplers, a calibrator and other accessories are required for the measurements. The following equipment from Brüel & Kjær or G.R.A.S. may be used:

Device	Description	Type (examples)
Hearing aid test box	Anechoic box with built-in sound source and induction loop, feed-throughs for the most important connection lines	R&S UPL-B7 or Interacoustics TBS25 or B&K 4232
Measurement microphone	¼" measurement microphone for measurement of artificial mouth output during calibration, to be inserted into IEC 126 2cc coupler, and for comparison measurement	B&K 4938 with B&K 2670 or G.R.A.S. 40BP with G.R.A.S. 26AC
IEC 126 coupler	Acoustic coupler according to IEC 126	Part of R&S UPL-B7 (with internal microphone or with ¼" microphone with preamplifier)
IEC 711 ear simulator (optional)	IEC 711 type occluded ear simulator with adapters for calibration and connection to the output of the DUT, with 1/2" - preamplifier	B&K 4157 & 2669
Acoustic calibrator	Sound level calibrator or pistonphone for calibrating the measuring microphones	B&K 4231 or G.R.A.S. 42AB
Microphone power supply	Power supply and preamplifier for the measuring microphone	B&K 2829, 5935L or 2690A0S2 or G.R.A.S. 12AD or 12AA

**Note:** *With the amplifier set to 0 dB, the microphone power supply B&K 2690A0S2 produces too much noise for measuring idle noise and distortion. It is therefore advisable to set a gain of 20 dB.*

*Theoretically the reference microphone for sound source calibration and comparison measurement should be a free field type and the IEC 126 coupler should be used with a pressure field type. However with a ¼" microphone the frequency response difference is negligible up to at least 10 kHz.*

*An external USB keyboard and a mouse must be connected to the R&S UPV.*

**Caution:** R&S UPV-K7 does not support the use of headphones. Do not connect headphones to the R&S UPV during hearing aid tests. High level signals may be present at the headphone connector.

The audio analyzer must meet the following firmware requirements:

- R&S UPV firmware version 2.5.0 or higher
- License key R&S UPV-K7 installed

### Installing the Software

The application program requires key K7 to be installed. The application program and the key are installed in the factory in case a new R&S UPV is ordered together with this option. If the option is ordered separately, the key as well as the installation manual is part of the delivery.

The program required and the associated files are in the folder “UPV-K7 Software” on the installation CD supplied with the R&S UPV-K7 option. It is recommended to copy the files UPV-K7\_1109.msi, Config.ini, dotnetfx.exe, Setup.Exe and Settings.Ini from the folder “UPV-K7 Software” on the installation CD to drive D: on the R&S UPV hard disk drive, e.g. to a folder named “D:\R&S Software\UPV-K7\Version 1.1.0”. Run the file “Setup.Exe” to start the installation. Follow the instructions of the installer on the screen.

### Verification of Installation

After the installation has terminated, a folder C:\Program Files\Rohde&Schwarz\UPV-K7 Hearing Aid tests must have been created. It must contain 27 files plus a folder “Data” which in turn must contain 88 files, and a folder “Sequences” with sub-folders “ANSI\_S3\_22”, “IEC60118-0,-1,-2” and “IEC60118-7”.

Upon first startup, the application program creates the folder D:\Hearing. After the program has been exited without any further action, this folder must contain 90 files.

If the software reports a missing key code at the first start, delete folder “D:\Hearing” (if existing) and install the missing key code before starting the software again.

### Test Setup

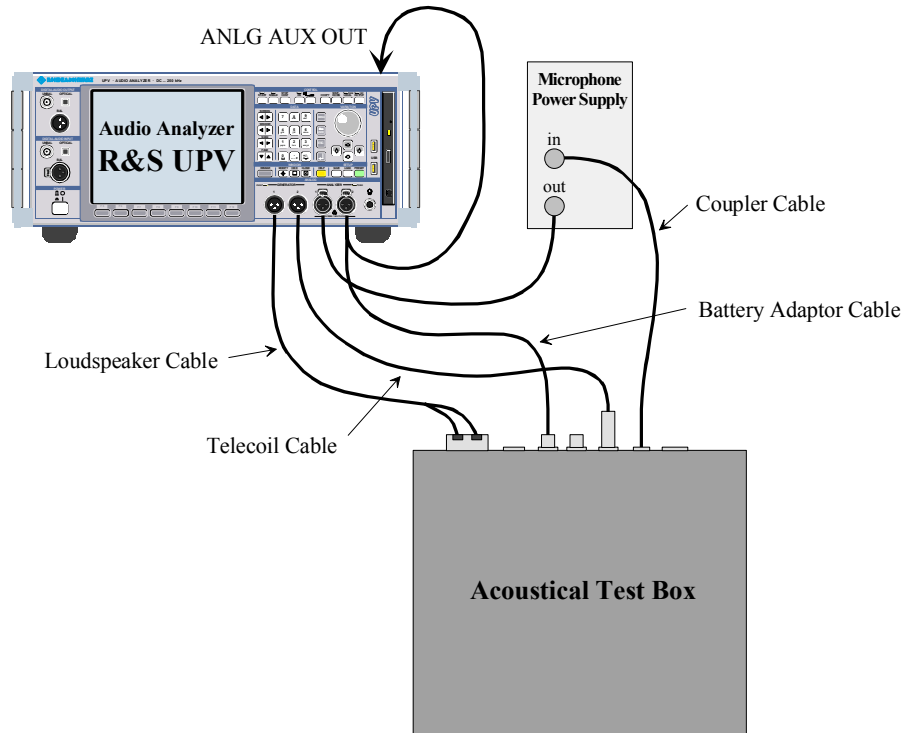


Fig. 1 Test setup and connection of external components

The following cables are required to connect speaker, induction loop and battery voltage supply of the test box delivered with R&S UPL-B7 to the R&S UPV. The microphone signal from the microphone power supply may be connected to the analyzer input with a BNC cable and a R&S UPL-Z1 adapter. If a custom made BNC to XLR cable is used, it should be made following the schematics of the R&S UPL-Z1 adapter (see R&S UPV manual, chapter "Configuring the Analog Analyzer").

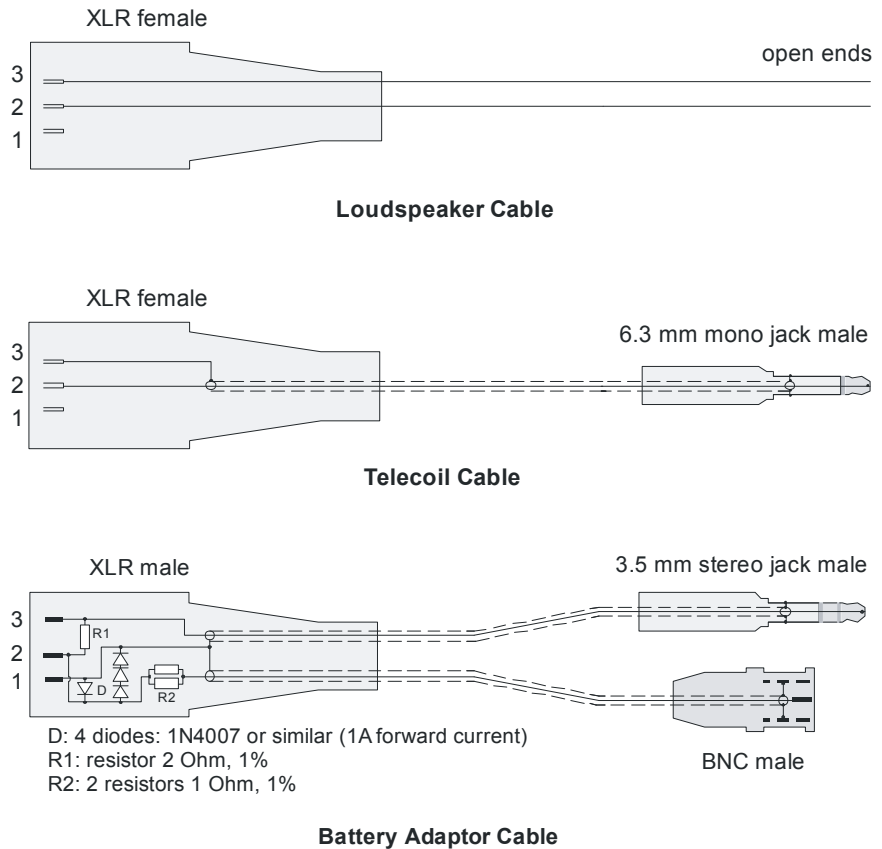


Fig. 2 Connection cables for R&S UPL-B7 (Interacoustics TBS 25) test box

The cables shown in Fig. 2 can be ordered as Accessory UPV-Z7.

The cables of R&S UPL-B7 can be re-used for R&S UPV-K7. As the supply voltage is now provided by the "ANLG AUX OUT" on the rear panel of the R&S UPV, the following adapter is required in addition.



Fig. 3 Adapter cable to connect the R&S UPL-B7 battery supply cable to the "ANLG AUX OUT" of the R&S UPV

### Starting the Application Software

After installation, the program can be started by double-clicking the Icon “UPV-K7 Hearing Aid Tests” or by clicking “R&S UPV Applications → UPV-K7 Hearing Aid Tests” in the “Programs” menu.

At the first start of the program, selection windows appear for the standard according to which the measurements should be made, and for the measurement coupler used.

The entered selections are stored with the settings and automatically loaded at the next start of the program.

At each start of the program, the ambient conditions temperature, relative humidity and atmospheric pressure are queried for protocol purpose. The entered values are not stored in the settings, because the ambient conditions are supposed to change with time. The query can be deselected and values can be changed any time in the “Options” menu.

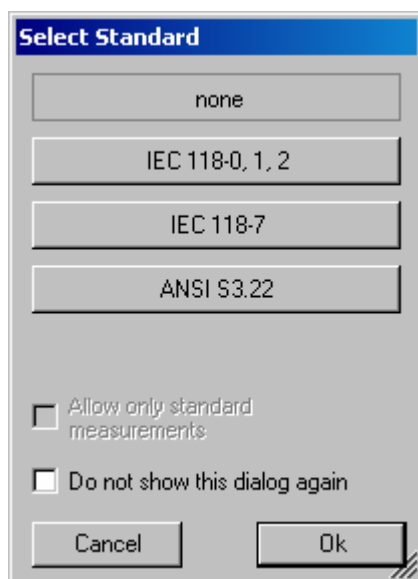


Fig. 4 Query window for selection of applied standard

If “none” is selected in the standard selection window, all measurements appear in the “Measurement” menu. If a standard is selected, all measurements appear in the “Measurement” menu, but compliant measurements are checked in the menu. If “Allow only standard measurements” is checked, non-compliant measurements are suppressed in the Measurement menu.



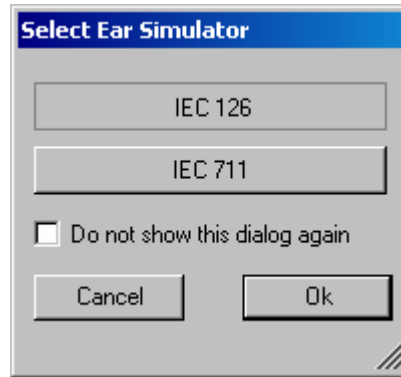


Fig. 5 Query window for selection of ear simulator

When the checkbox “Do not show this dialog again” is checked, the corresponding selection window will not appear at the program start in future. However, the selection is still available in the “Options” menu (see below).

The next window to open is the input window for the ambient conditions temperature, relative humidity and atmospheric pressure.

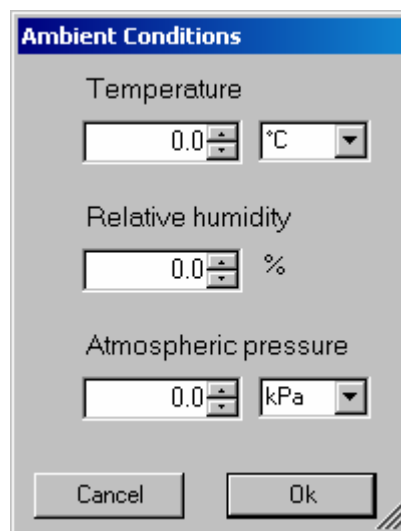


Fig. 6 Query window for input of ambient conditions

The units can be switched between °C and °F and between kPa and mmHg, respectively. After the last of the three selection windows has been closed, the main window of the R&S UPV-K7 opens.

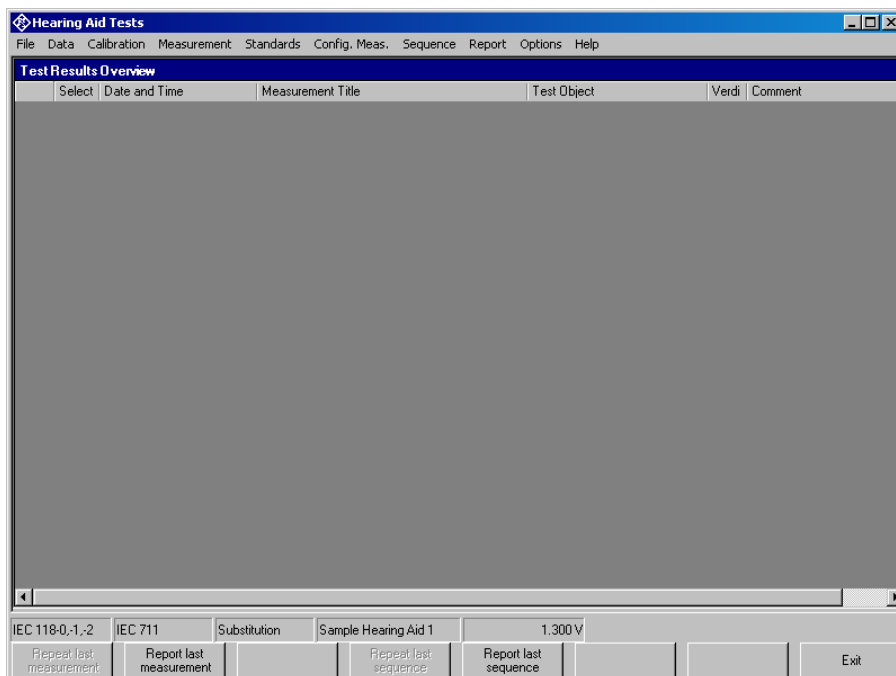


Fig. 7 Main window after first start of the program

Initially the data grid in the centre of the screen which shows the result overview is empty. The screenshot below shows an example after a number of measurements have been made.

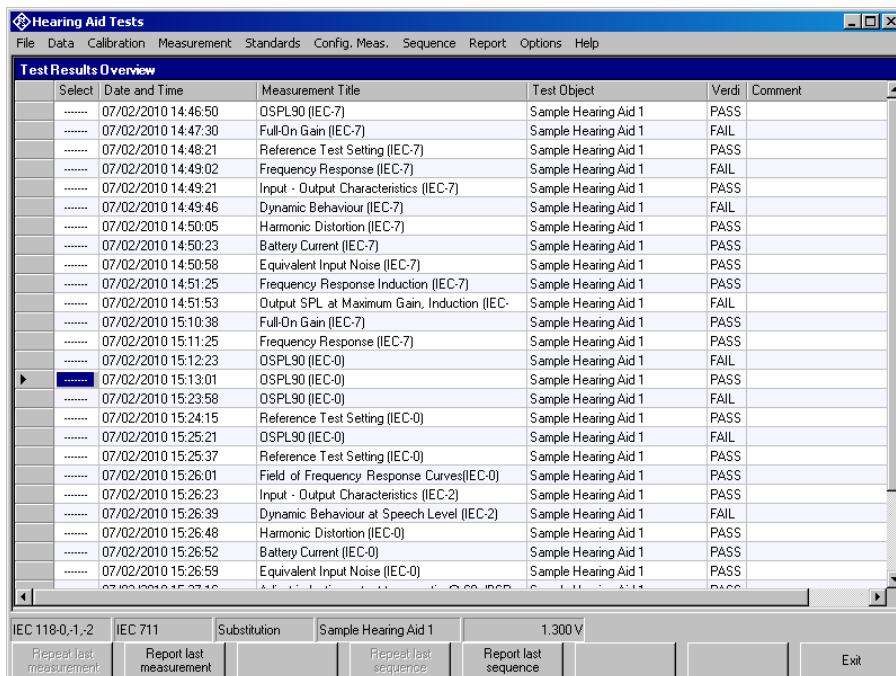


Fig. 8 Main window with results

### 3 Operating Concept

#### Options (General settings)

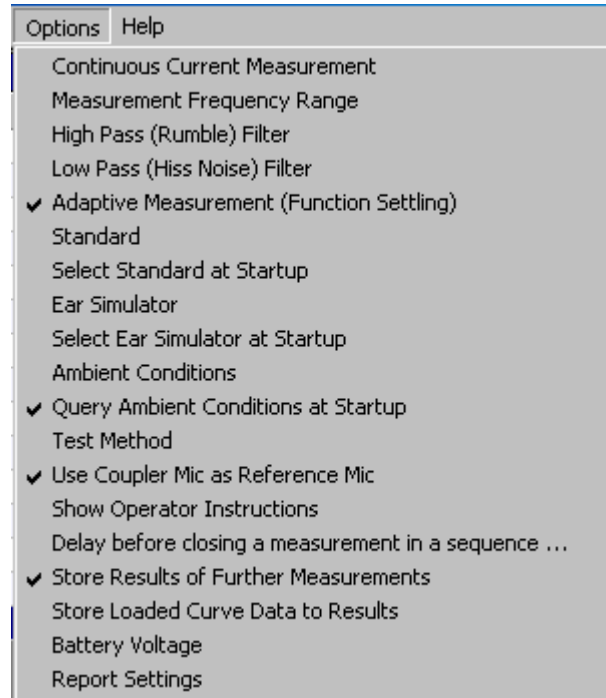


Fig. 9 Options menu

The “Options” menu in the main window allows to change a set of general settings like ear simulator, test method and battery voltage, which are valid for all or at least a plurality of the tests.

“**Continuous current measurement**” allows to measure the supply current at analyzer input 2. This option can only be selected with the substitution method. The value of the shunt resistor for the current measurement can be entered in the calibration menu. By default it is set to 2  $\Omega$ .

“**Measurement frequency range**” allows to enter the frequency range in which the sound source is calibrated. In general this will be 100 Hz to 10 kHz which is the default. “Number of points” specifies the number of (logarithmically spaced) frequencies measured for the sound source equalization.

“**High pass (rumble) filter**” allows to set a high pass filter which is active in most measurements except distortion measurements, battery current measurements and noise measurements. The edge frequency of the high pass filter can be set, and the filter can be activated and deactivated. The high pass filter is not applied to battery current measurements.

If “File defined” is deactivated, the edge frequency can be set in the “Limit frequency” field. The UPV firmware then calculates the filter coefficients and the delay to account for the filter settling. If “File defined” is activated, a file with filter coefficients can be loaded using the “Browse” button. A measurement delay for the filter settling time can be set manually if the “Def. delay” checkbox is activated.

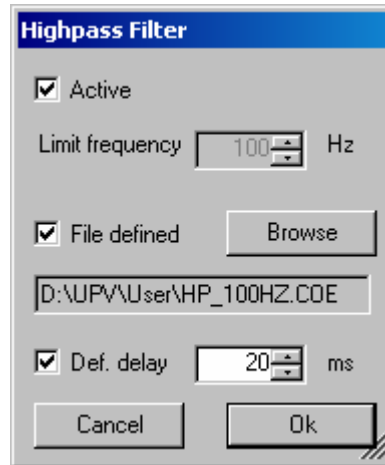


Fig. 10 Input window for filter settings

“**Low pass (hiss noise) filter**” allows to set a low pass filter which is active in most measurements except battery current measurements and noise measurements. The edge frequency of the high pass filter can be set, and the filter can be activated and deactivated. The low pass filter is not applied to battery current and distortion measurements.

The settings in the “Lowpass Filter” window are according to those for the highpass filter.

With noise measurements, the filters from the “Options” menu are only applied to the gain measurement. The noise measurement has own parameters for the band limits of the noise level measurement.

**Note: Filters slow down the measurement. Therefore they should only be used if necessary. In particular a combination of selective measurement with high pass and / or low pass filter is not recommended.**

“**Adaptive measurement (function settling)**” causes gain and level measurements to be repeated until the result has settled within a specified tolerance. This is helpful to assure that an AGC which is present in the signal path has adapted to the applied input signal of the hearing aid.

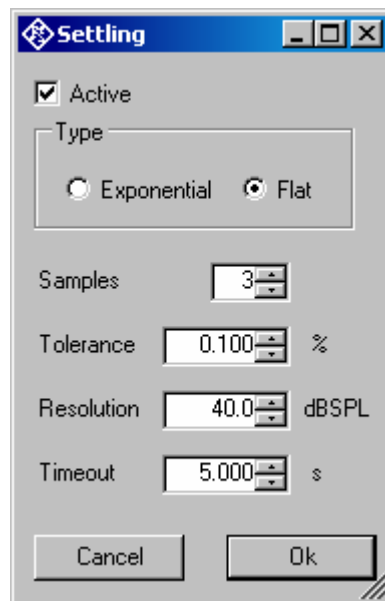


Fig. 11 Input window for adaptive measurement

With the “Flat” type, measurements are repeated until the last “Samples” number of results are within the given “Tolerance” or the difference between two subsequent measurement results is below the “Resolution” value. The “Resolution” can be used to take into account the idle channel noise of hearing aid and measurement equipment.

**Note: The resolution value must be set high enough to take idle channel noise into account. If it is set too low, especially measurements with high gain at low input levels may be aborted due to invalid result values.**

**Note: If the use of filters leads to slow measurements, the timeout value may have to be increased.**

With the “exponential” type of settling, differences between the earlier results may be higher than specified, but the results must converge exponentially into the specified values.

If the settling time of the hearing aid is known, measurement may be faster with settling turned off. In this case the known settling time has to be entered as pre-delay in the measurement parameters of each measurement.

Function settling is generally not applied to battery current measurements. For harmonic distortion measurements the resolution is set fix to 0.01 % THD.

“**Standard**” allows to select one of the available standards. Measurements belonging to this standard will be checked in the measurement menu. If “Allow only standard measurements” is checked, it is not possible to start single measurements which do not belong to the standard.

If “**Select standard at startup**” is checked, the selection window for the standard is opened at each start of the program.

“**Ear simulator**” allows to select the type of ear simulator used. For details on the handling of calibration data see section 4 (“Calibration”) below.

If “**Select ear simulator at startup**” is checked, the selection window for the ear simulator is opened at each start of the program.

“**Ambient conditions**” allows to change the temperature, relative humidity and atmospheric pressure values for the protocol.

“**Query ambient conditions at startup**” causes the input window for the ambient condition to be opened at each start of the program.

“**Test method**” allows to select the test method for transfer measurements. With “Substitution”, the nominally set SPL at the input of the hearing aid is assumed to be correct, due to the calibration of the sound source. With “Comparison”, the input SPL is measured simultaneously with the output SPL by the reference microphone in a two channel measurement, and results are corrected for the deviation of the input SPL from the nominal value. “Comparison” can not be selected when the continuous current measurement is active or when the coupler microphone is used as reference microphone (see below).

“**Use coupler mic as reference mic**” allows to use the microphone of the IEC 126 coupler for sound source calibration. In this case the program applies the calibration value of the coupler microphone for the sound source calibration, and the reference microphone has to be connected to analyzer input 1 instead of analyzer input 2.

If **“Show operator instructions”** is checked, instructions to the operator are displayed in a message box before the measurement starts. The operator may be prompted to position the hearing aid in a defined way or to set the volume to a certain setting.

In Menu item **“Delay before closing a measurement in a sequence”** a time period can be defined for which the result of a completed measurement is shown during execution of a sequence, before the measurement window is closed and the next measurement in the sequence is started.

**“Store results of further measurements”** allows to include results obtained with the “Add measurement” softkey to the result database. All curves obtained this way will be reported in the same graph. This allows e.g. to measure responses depending on settings of the hearing aid, and to report them in a field of curves.

**“Store Loaded Curve Data to results”** includes curve data which is loaded with the button “Load Curve” to the result database such that the loaded curves will appear in the diagram of the respective report.

**“Battery voltage”** allows to specify the supply voltage for the hearing aid. If a supply voltage is specified in the parameters of a measurement, the general setting is overridden. This allows to measure response curves for different supply voltages within one sequence.

**“Report settings”** allows to define the type of information which should appear in the reports. For details on reporting, see section 8 below.

## 4 Calibration

### Calibration Devices

R&S UPV-K7 allows to simultaneously store calibration values for multiple individuals of the same type. This allows to switch devices without the requirement for re-calibration. However, regular re-calibration is recommended in order to assure the correct function of the used devices.

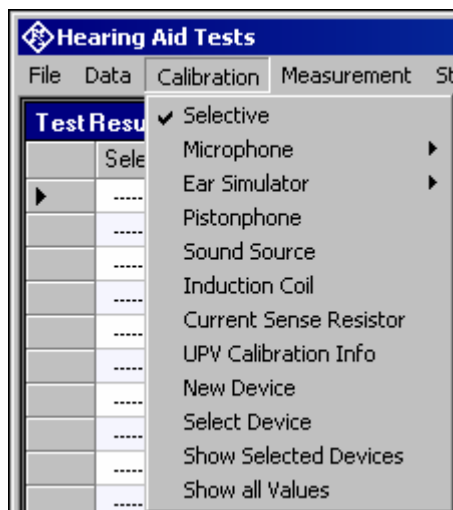


Fig. 12 Calibration menu

For every device to be calibrated, an entry must be created using “Calibration → New device” in the main menu. This menu item opens an entry window to specify the calibrated device. A category of device must be chosen from the combo box on top. Type, manufacturer and serial number are entered into the text boxes below. The entries are confirmed by clicking on the “Save and close” button.

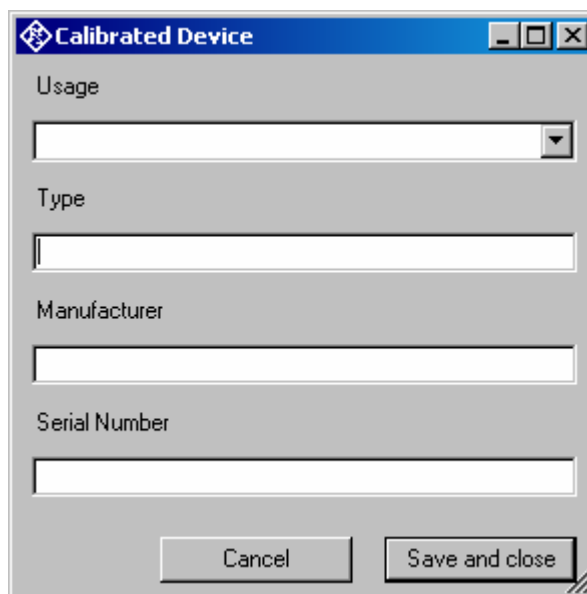


Fig. 13 Input window for information about calibrated device

Before a device can be calibrated or used, it must be selected with “Calibration → Select device” in the main menu. Clicking on this item opens a window with a table of all entered devices.



Fig. 14 Window for selection of calibrated devices

In the combo box lower left, a category of devices must be selected. Subsequently the table is reduced to available devices in this category. At first startup, there is only a “Default” device for each category, but when more devices have been created with the “New device” function, a choice will be available in this view. In this state a row in the table can be marked with a mouse click on its left end. A mouse click on the button “Select” selects this device for the associated usage.

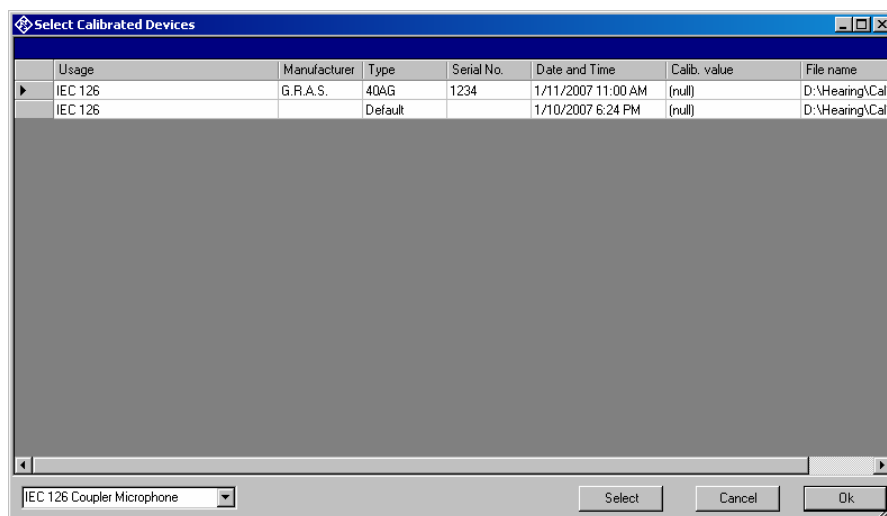


Fig. 15 Selection window for particular device type (here IEC 126 coupler)

Subsequently this procedure may be repeated for other categories. Finally all selections are confirmed by clicking the “Ok” button.

All calibration data are stored on the R&S UPV hard disk and are therefore automatically available again after every restart. The calibration values for the R&S UPV-K7 option are stored independently of other options.

All calibration routines below require as pre-requisite that a device for the respective usage has been generated and selected.



To simplify the procedure for the case that it is not intended to use multiple devices of the same category nor to include information about the used devices into a report, there is a “Default” device selected for each device type or category after the first start of the program.

### Microphone Calibration

- **Insert the measuring microphone fully into the adapter of the sound level calibrator and switch on the calibrator.**

**Note:** After inserting the microphone, wait about 10 s to allow for static pressure equalization.

- **Call the test routine with “Calibration → Microphone → Coupler” or “Calibration → Microphone → Reference” from the main menu, depending on the microphone.**

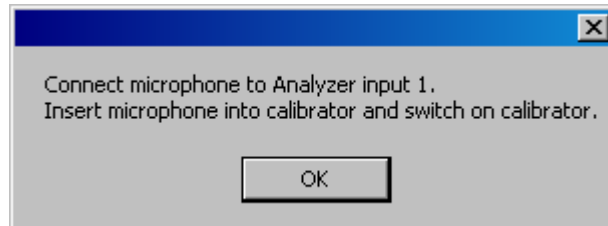


Fig. 16 Initial window of microphone calibration

Next, the nominal SPL of the calibrator has to be entered:

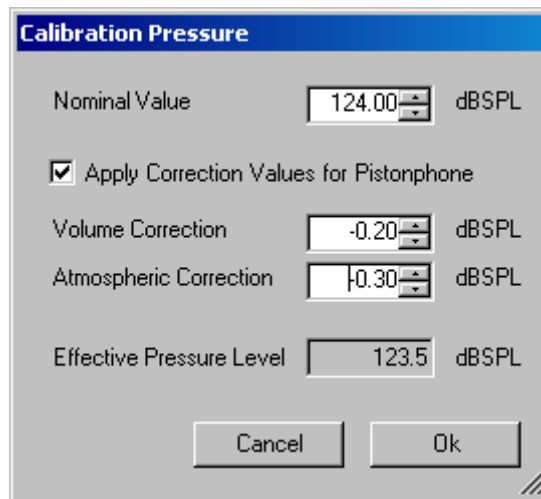


Fig. 17 Input window for calibration SPL

Checkbox “Apply Correction Values for Pistonphone” allows to specify volume correction and atmospheric correction values which are added to the nominal calibration value to calculate the effective pressure level at the microphone during calibration. If this checkbox is checked, the default for the nominal calibration value is 124 dBPL. If the calibration values are deactivated, the default is 93.98 dB SPL.

If selective calibration is activated in the calibration menu, the frequency of the calibration signal has to be entered:

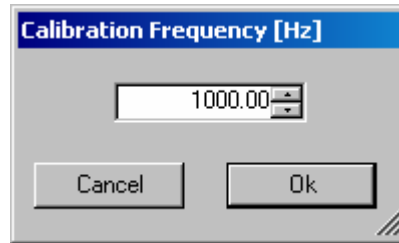


Fig. 18 Input window for calibration frequency

If correction values for pistonphone are used, the default for the calibration frequency is 250 Hz. Otherwise the default calibration frequency is 1000 Hz.

Subsequently, the output voltage of the microphone is measured and the sensitivity displayed with reference to 1 Pa. If a mere power supply without gain is used, the displayed sensitivity must approximately match the value in the calibration certificate of the microphone capsule (typical value for microphone capsule 4134 of artificial ear 4185 is approx. 12 mV/Pa, display = 120 mV/Pa). If a conditioning amplifier with 20 dB gain (recommended value) is used, the displayed sensitivity must be about 10 times higher. If the voltage measured is below 3 mV or instable, an error message is displayed. Possible error sources are, for example, a switched-off microphone power supply or a disabled calibrator. In this case, the program requests that the calibration is repeated. After switching on the microphone power supply, wait approx. 20 s before starting the calibration again.

### Calibration of Ear Simulator IEC 711

For calibration of the IEC 711 ear simulator, an adaptor part must be screwed onto the simulator which allows it to be inserted into the calibrator like a ½" microphone. The calibration routine is started with "Calibration → Ear Simulator → IEC 711" and follows the course described above.

### Entering correction values for Pistonphones

With the menu Item "Pistonphone" in the "Calibration" menu, volume and atmospheric correction values can be viewed and edited. In addition the default nominal level and calibration frequency for pistonphone use can be modified.

Volume correction values are specific to the different microphone or coupler types and can therefore be entered separately. The atmospheric correction value is common to all microphones and ear simulators.

Section	Parameter	Value	Unit
Default Values	Nominal Level	124.0	dB
	Frequency	250.0	Hz
Volume Correction	IEC711 Coupler	-0.20	dB
	Coupler Microphone	-0.25	dB
	Reference Microphone	-0.40	dB
Atmospheric Correction	All Microphones	-0.30	dB

Fig. 19 Input window pistonphone correction values

## Calibration of Sound Source

Before a hearing aid can be tested, the absolute sensitivity and frequency response of the sound source have to be measured and corrected with the aid of a previously calibrated reference microphone. If "Use coupler mic as reference mic" is activated in the "Options" menu, the microphone of the IEC 126 coupler can be used for this purpose. The frequency response of the microphone can be ignored in the test frequency range (100 Hz to 10 kHz) (see also calibration certificate of microphone capsule). If a separate reference microphone is used, this has to be calibrated beforehand with "Calibration → Microphone → Reference".

After starting the sound source calibration with "Calibration → Sound Source", the calibration level can be defined. This allows to adapt the calibration to specific measurement levels. It is also possible to store calibrations for different levels using multiple calibration devices (see above).

The sound pressure generated at the point of the reference microphone is set to exactly the specified level in an automatic measurement routine at 1 kHz. The generator voltage required is stored in a file on the hard disk and used as a reference for all subsequent settings with the same sound source. If the sound pressure cannot be adjusted to the specified value, an error message is displayed with a request to check the connection to the sound source and to repeat the measurement.

The uncorrected frequency response of the sound source is measured and displayed. Next, the frequency response is measured with the inverse frequency response correction automatically selected in the generator (equalization). Residual errors caused by nonlinearities of the speaker are measured and taken into account in the final equalization file as fine correction.

## ***Acoustic Measurements on Hearing Aids***

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To verify the results, the absolute sound pressure versus frequency is measured at the specified sound pressure level. Correct calibration without interfering sound yields an almost straight line.

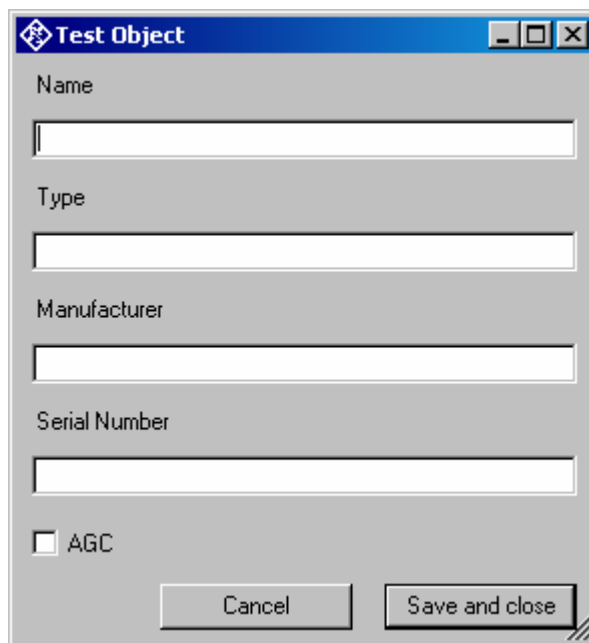
## 5 Data Entry for Reporting

### Operator

Under “Data→Operator” an operator’s name can be entered which is stored in association with all calibration and measurement results. If “Operator” is activated in the report settings, the name will appear in all reports about these measurements.

### Test object

Under “Data → Test object → New” a description of the device under test can be entered.



The image shows a software dialog box titled "Test Object". It features a blue title bar with a diamond icon on the left and standard window control buttons (minimize, maximize, close) on the right. The main area is light gray and contains four text input fields stacked vertically, labeled "Name", "Type", "Manufacturer", and "Serial Number". Below the "Serial Number" field is a checkbox labeled "AGC". At the bottom of the dialog are two buttons: "Cancel" on the left and "Save and close" on the right.

Fig. 20 Window for input of information about a test object

With “Data → Test object → Select” one of the entered test objects can be selected. The data of this selected test object will be stored in association with all measurements and appear on the associated reports if “DUT information” is activated in the report settings.

## 6 Measurements

### Functionality and control of the measurement macros

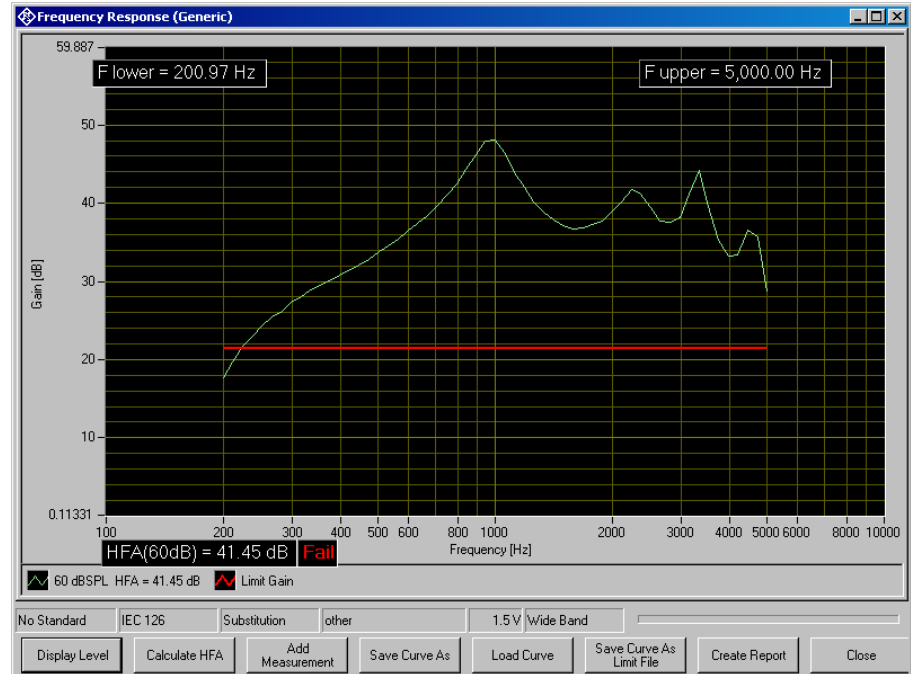


Fig. 21 Example of a measurement window

When a measurement macro is started, e.g. from the “Measurement” menu, the standardized measurement is immediately executed. With a single measurement, the window of the measurement macro stays open after the measurement is terminated. At that time, the following functionality is available:

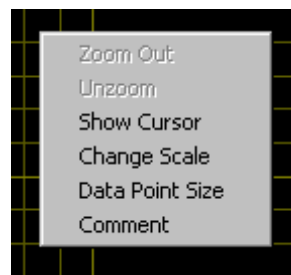


Fig. 22 Context menu of the graph window

#### Zooming

When the “Shift” key on the keyboard is pressed, the mouse cursor changes to the zoom cursor. When the left mouse button is pressed, a rectangle can be marked in the graph. As soon as the left mouse button is released, the graph is zoomed into the area of the marked rectangle

“Zoom Out” in the graph context menu reverses the last zooming step. “Unzoom” zooms completely out to the original scaling.

### Changing the Scale of the Graph

“Change Scale” in the context menu opens a window in which the upper and lower bounds of both axes can be entered by numbers.

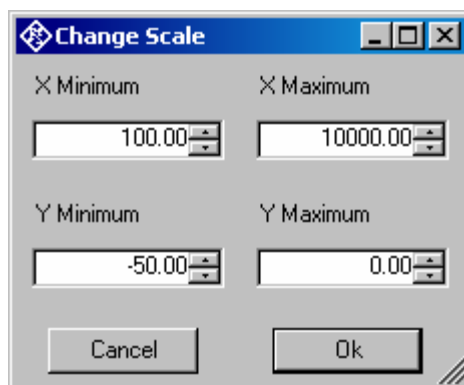


Fig. 23 Window for changing the scale of the graph

### Cursor

When the item “Show Cursor” is marked in the graph context menu, a cursor is displayed which can be dragged along the graph with the mouse. X and Y values of the data points below the cursor are displayed.

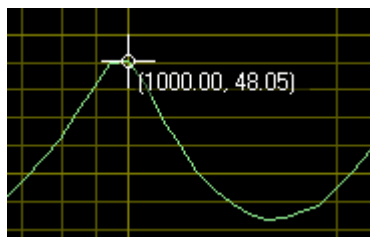


Fig. 24 Cursor with data display

### Data Point Size

“Data Point Size” in the graph context menu opens a window in which the size of marks at the measured data points can be specified. Moving the mouse cursor over one of the marks causes the associated X and Y values to be displayed.

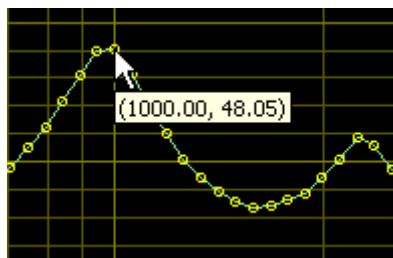


Fig. 25 Data points with data display

### Making Additional Measurements

The softkey “Add Measurement” triggers another measurement according to the specification of the test. Loudness ratings and noise values are

calculated and displayed in the legend. However, limits are not checked. This function can e.g. be used to compare different settings in a device under test.

If the item “Store results of further measurements” is activated in the “Options” menu, graphs and result values obtained with this functionality are added to the results database and will appear later in reports on this measurement. All curves obtained within the same measurement will appear in the report in the same graph.

### **Storing and Loading Curves**

All measured curves in the graph can be stored to an ASCII file, and stored curves can be loaded back into the graph. The softkey “Store Curve” opens a window in which a combo box offers choice between the legends of all measured curves in the graph. The curve associated in which the selected entry is stored to the file at the specified location.

### **Storing Curves as Limit Curves**

With “Store As Limit Curve” a curve can be selected and stored into a R&S UPV format limit file with a specified shift in Y axis direction. This functionality can be used to generate limit curves from “golden” devices for evaluation purpose. Regarding the use of such limit curves see section “Customizing Measurements” below.

### **Entering a Comment**

With the softkey “Enter Comment” or the item “Comment” in the graph context menu, a comment can be entered and edited which will appear in the report about the respective measurement.

### **Creating a Report**

The softkey “Create Report” causes a report to be prepared. The report preview window (see below) opens and shows the preview of the report. Buttons in the preview window allow to print the report or to export it to PDF, WORD, EXCEL or Rich Text format. For details see section “Preview Window” below.

### **Generating a Landscape Report**

Landscape reports are only available for frequency response graphs. They show the result graph together with the measurement title and information about the tested hearing aid and about the operator. The layout and scale is fixed and cannot be configured.

A landscape report can be generated from the measurement window by right-clicking into the result graph of a frequency response measurement and selecting “Create Landscape Report” from the context menu.

### **Closing the Measurement Window**

The softkey “Close” closes the measurement window. The control is returned to the R&S UPV-K7 main window. All relevant data associated with the measurement is imported to the results database. A new entry appears for the measurement as new row on the bottom of the overview data grid in the main window.



## Customizing Measurements

The first item in the “Measurement” menu which is called “Settings” opens a sub-menu with all available measurements in it. Clicking on a measurement in this sub-menu opens a window which allows to change parameters of the selected measurement.

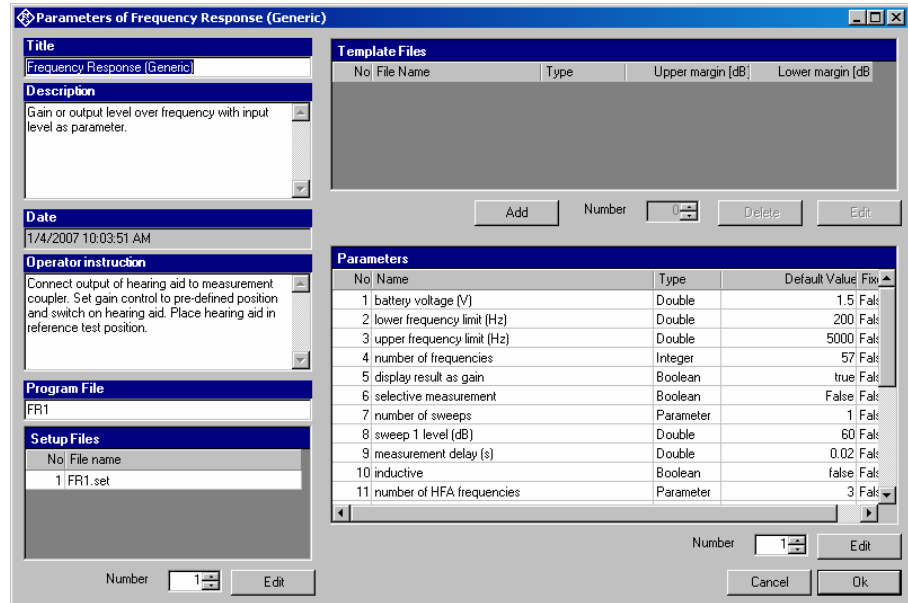


Fig. 26 Measurement setup window

The “Title” appears in the measurement menu and forms the heading of the report.

The “Description” can be chosen to be included into the report.

“Date” shows the date of the last change to this measurement definition.

“Operator instruction” is the text displayed before the start of each measurement, provided that the item “Show operator instructions” is activated in the “Options” menu.

The entry in the field “Program File” designates the measurement type and must not be changed.

The field “Setup Files” specifies the R&S UPV setups used by the measurement. The specified file can be replaced by a user defined file but the number of setups is defined by the measurement type. The customized setup file must be stored in folder D:\Hearing. It is recommended to generate customized setups by copying existing ones. Note that changes in the setup like changing the analysis function or generator signal may cause malfunction of the measurement. Some parameters of the setup might be overwritten by the macro during the measurement run.

The field “Template files” specifies limit template curves for the response curve. The buttons “Add” or “Edit” produce the following input window:

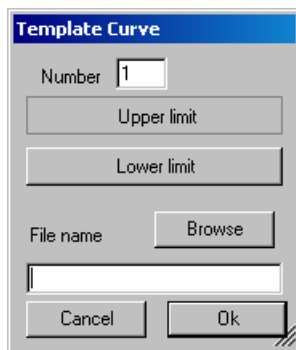


Fig. 27 Input window for limit template curve

The radio buttons allow to determine whether the given curve should be used as upper limit, lower limit or for information only (no limit check). The field "File name" must contain the path name of the file. To generate a new limit curve file, use the softkey "Save as limit curve" of the respective measurement window or copy and edit an existing limit file using a text editor.

All other available parameters of a measurement definition are shown in the "Parameters" data grid. The rightmost column with the headline "Fixed" displays whether the respective parameter can be changed by the operator or not. In "generic" measurements all parameters may be changed. In measurements which follow standards, only parameters which are not determined by the standard may be changed by the operator. The "Edit" button opens an input window for the parameter in the line specified in "Number":

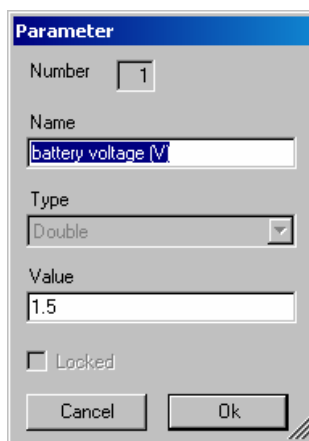


Fig. 28 Input window for parameter value

Alternatively this input window can be opened by double-clicking on the row header of the parameter to be edited.

"Name" appears in the report and explains the meaning of the parameter. "Type" is determined by the measurement routine and cannot be changed. In the field "Value" a value must be entered which conforms with the syntax rules of the selected data type. The syntax is checked automatically when the text box is left. However there is no check for the allowable range of the value. Entering inadequate values (e.g. too high levels, negative frequencies) may cause malfunction of the measurement.

## Notes on Individual Measurements

### Frequency Response Measurement

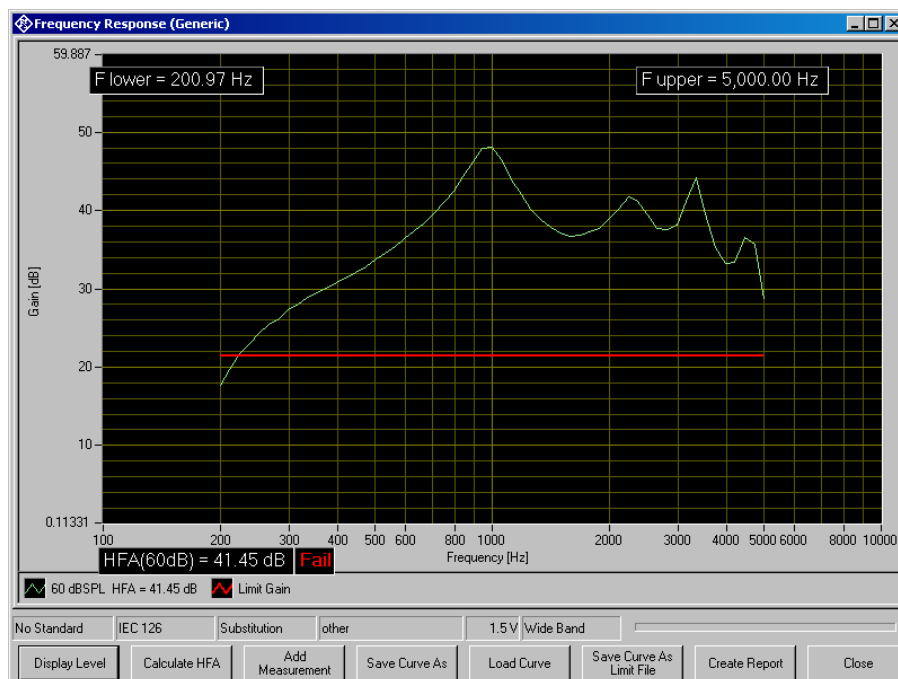


Fig. 29 Display window of frequency response measurement

The softkey “Display Level” or “Display Gain”, respectively, allows to toggle between gain and level in the Y axis of the graph. The button “Calculate HFA” allows to calculate a high frequency average or special frequency average from one of the displayed curves:

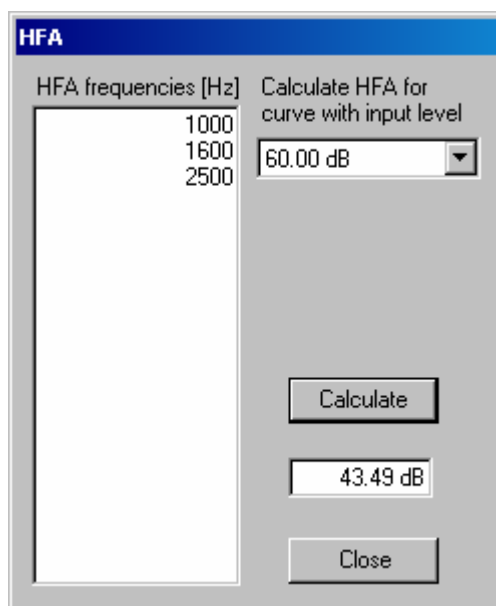


Fig. 30 Input window for HFA calculation

In the text box on the left side the HFA frequencies are entered in separate lines. In the combo box top right, one of the existing curves is chosen.

## Acoustic Measurements on Hearing Aids

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When the button “Calculate” is clicked, the text box below shows the associated HFA value.

The following table lists all available parameters in the generic frequency response measurement:

Name	Type	Value	Explanation
battery voltage (V)	Double	0	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. “0 V ” means “use voltage from general setting”.
lower frequency limit (Hz)	Double	200	Start frequency of sweep
upper frequency limit (Hz)	Double	5000	Stop frequency of sweep
number of frequencies	Integer	57	Number of sweep points
display result as gain	Boolean	True	„True“: Gain on Y axis, „False“: SPL on Y axis
selective measurement	Boolean	false	„True“: Selective measurement with fast 3rd octave filter
number of sweeps	Parameter count	1	Number of sweeps with level as parameter
sweep 1 level (dB)	Double	60	Sweep level for each sweep (dB SPL or dB re 1 mA/m)
measurement delay (s)	Double	0.02	Pre-delay between sweep Step and measurement trigger, allows for settling of the DUT (e.g. AGC)
inductive	Boolean	false	“False“: Acoustic input, “True“: Inductive input
number of HFA frequencies	Parameter count	3	Number of frequencies averaged in the high frequency average
HFA frequency 1 (Hz)	Double	1000	
HFA frequency (Hz)	Double	1600	
HFA frequency (Hz)	Double	2500	
HFA upper limit (dB)	Double	30	Upper limit for limit check
HFA lower limit (dB)	Double	10	Lower limit for limit check
check limit for sweep no.	Byte	1	“0” means: “don’t check”
calc. freq. range for swp. no	Byte	1	“0” means: “don’t calculate”
level difference (dB)	Double	20	Level difference between HFA level and frequency response limit points
check frequency range limits	Boolean	True	Determines whether the frequency range is checked against the limits given below
max. lower frequency (Hz)	Double	500	
min. upper frequency (Hz)	Double	3500	
display curve maximum	Boolean	True	Stipulates whether the absolute curve maximum should be determined
lower limit of max. (dB)	Double	0	
upper limit of max. (dB)	Double	40	
check max limits for swp. no	Byte	1	“0” means: “don’t check”

Table 1 Available parameters for frequency response measurements

If for example only an upper limit should be checked but not the corresponding lower one, select the lower limit low enough to be always passed.

The following standard conformal tests are based on the frequency response measurement routine:

- Frequency Response @ 60 dB SPL (IEC-0)
- Frequency Response (ANSI)
- Field of Frequency Response Curves (IEC-0)
- Frequency Response (IEC-7)
- Frequency Response Induction (ANSI)
- Frequency Response Induction (IEC-1)
- Full-On Gain 50 dB (IEC-0)
- Full-On Gain 60 dB (IEC-0)
- Full-On Gain (IEC-7)
- Response Curve at Maximum Gain (IEC-1)
- Full-On Gain (ANSI)
- Output SPL at Maximum Gain, Induction (IEC-1)
- OSPL90 (ANSI)
- OSPL90 (IEC-7)
- OSPL 90 (IEC-0)

### Multi-Curve Measurement

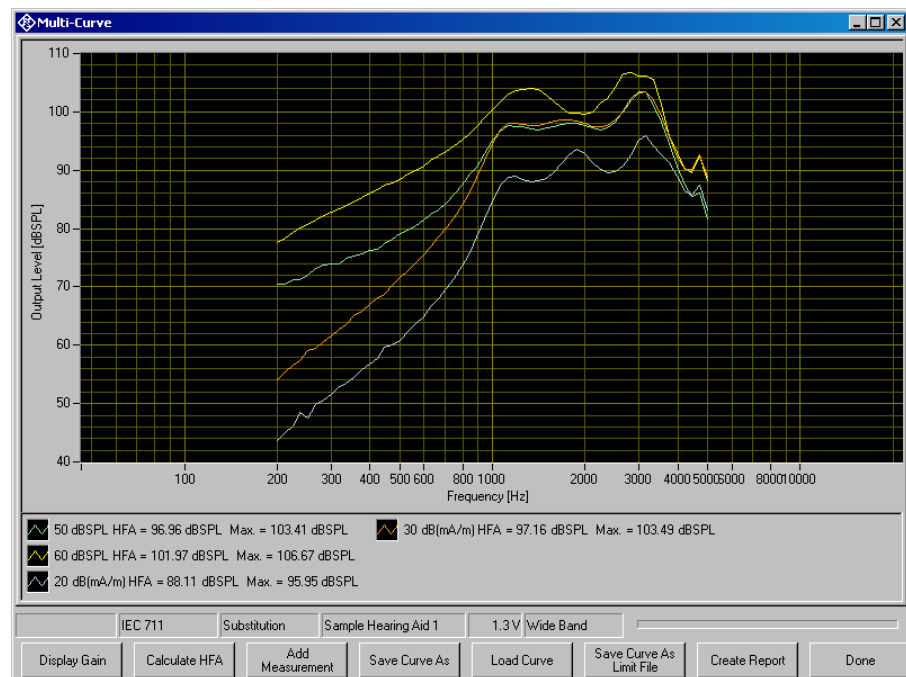


Fig. 31 Display window of multi-curve measurement

The multi-curve measurement is found in "Standards → Utilities". It is similar to frequency response measurements and allows measurement and display of acoustic and inductive frequency responses in one window. Unlike other measurements, the multi-curve measurement does not automatically start a sweep when it opens. All sweeps are started by the user using the "Add Measurement" button, even within sequences. Therefore this window does not close automatically within a sequence but has to be closed using the "Done" button.

## **Acoustic Measurements on Hearing Aids**

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The following table lists all available parameters available for configuration of the multi-curve measurement:

<b>Name</b>	<b>Type</b>	<b>Value</b>	<b>Explanation</b>
battery voltage (V)	Double	0	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. "0 V" means "use voltage from general setting".
lower frequency limit (Hz)	Double	200	Start frequency of sweep
upper frequency limit (Hz)	Double	5000	Stop frequency of sweep
number of frequencies	Integer	57	Number of sweep points
display result as gain	Boolean	false	„True“: Gain on Y axis, „False“: SPL on Y axis
selective measurement	Boolean	false	„True“: Selective measurement with fast 3rd octave filter
measurement predelay (s)	Double	0.02	Pre-delay between sweep Step and measurement trigger, allows for settling of the DUT (e.g. AGC)
number of HFA frequencies	Parameter count	3	Number of frequencies averaged in the high frequency average
HFA frequency 1 (Hz)	Double	1000	
HFA frequency (Hz)	Double	1600	
HFA frequency (Hz)	Double	2500	
HFA upper limit (dB)	Double	30	Upper limit for limit check
HFA lower limit (dB)	Double	10	Lower limit for limit check
Determine maximum gain	Boolean	True	Stipulates whether the absolute curve maximum should be determined
Show operator instruction	Boolean	True	Determines whether the operator should be prompted to switch the hearing aid between microphone and telecoil mode
Selective acoustic measurement	Boolean	False	Activates selective measurement for acoustic input only
Selective induction measurement	Boolean	True	Activates selective measurement for inductione input only

Table 2 Available parameters for multi-curve measurements

When the “Add Measurement” button is clicked, an entry window for the level of the next sweep opens.

The input to the hearing aid can be switched between acoustic and inductive signal. For acoustic input the level is set in dB SPL. For inductive input the level can be entered in mA/m or dB(mA/m). If there are already sweeps present in the graph, the input window always opens with the settings done for the last sweep. In addition buttons are provided for increasing or decreasing the level from the previous sweep by 1, 5 or 10 dB.

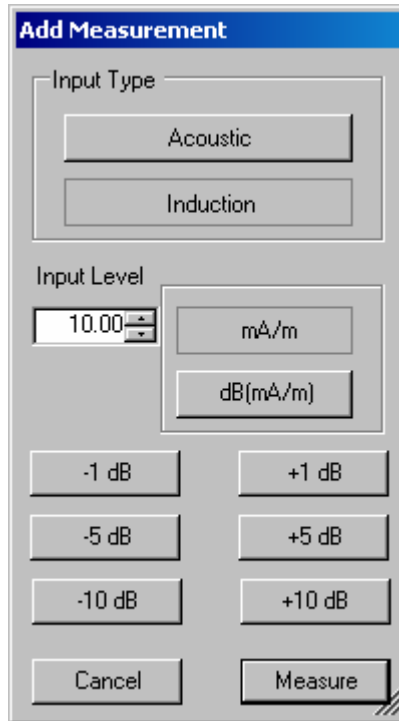


Fig. 32 Entry window for sweep level in Multi-curve measurements

### Saturation Sound Pressure Level Measurement



Fig. 33 Display window of saturation sound pressure level measurement

The saturation sound pressure level measurement performs the specified number of level sweeps and records the maximum level obtained in each sweep.

## Acoustic Measurements on Hearing Aids

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The following table lists all available parameters in the generic saturation sound pressure level measurement:

<b>Name</b>	<b>Type</b>	<b>Value</b>	<b>Explanation</b>
battery voltage (V)	Double	1.5	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. "0 V" means "use voltage from general setting".
lower frequency limit (Hz)	Double	200	Start frequency of sweep
upper frequency limit (Hz)	Double	8000	Stop frequency of sweep
number of frequencies	Integer	65	Number of sweep points
lowest input level (dB)	Double	60	Start level of sweep (dBSPL or dB re 1 mA/m)
highest input level (dB)	Double	90	Stop level of sweep (dBSPL or dB re 1 mA/m)
number of levels	Integer	31	Number of level steps in sweep
selective measurement	Boolean	false	„True“: Selective measurement with fast 3rd octave filter
measurement delay (s)	Double	0.02	Pre-delay between sweep Step and measurement trigger, allows for settling of the DUT (e.g. AGC)
inductive	Boolean	false	“False“: Acoustic input, “True“: Inductive input
display curve maximum	Boolean	True	Stipulates whether the absolute curve maximum should be determined
lower limit of max. (dB)	Double	130	
upper limit of max. (dB)	Double	150	
check max limits	Boolean	true	Stipulates whether pass / fail check takes place

Table 3 Available parameters for saturation SPL measurements

The only standard conformal test based on the saturation SPL measurement routine is Saturation SPL (IEC-0).



## Harmonic Distortion Measurement



Fig. 34 Curve display of harmonic distortion measurement

The softkey “Display dB” or “Display %”, respectively, allows to toggle between both Y axis units. The softkey “Show Discrete Values” or “Show Curves”, respectively, allows to toggle between curve display and result data table provided that discrete values or curves, respectively, have been measured.



Fig. 35 Data table display of harmonic distortion measurement

## Acoustic Measurements on Hearing Aids

The following table lists all available parameters in the generic frequency response measurement:

Name	Type	Value	Explanation
battery voltage [V]	Double	0	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. "0 V " means "use voltage from general setting".
lower frequency limit [Hz]	Double	200	Start frequency of sweep
upper frequency limit [Hz]	Double	5000	Stop frequency of sweep
number of frequencies	Integer	57	Number of sweep points
display result in dB	Boolean	false	"False": Y axis and values in %, "True": Y axis and values in dB
number of sweeps	Parameter count	3	Number of sweeps with level as parameter
sweep 1 level [dB]	Double	60	(dB SPL or dB re 1 mA/m)
sweep 2 level [dB]	Double	80	(dB SPL or dB re 1 mA/m)
sweep 3 level [dB]	Double	100	(dB SPL or dB re 1 mA/m)
measurement delay [s]	Double	0.01	Pre-delay between sweep Step and measurement trigger, allows for settling of the DUT (e.g. AGC)
induction	Boolean	false	"False": Acoustic input, "True": Inductive input
show thd	Boolean	true	Stipulates whether the thd curve is displayed
show 2nd	Boolean	true	Stipulates whether curve of 2 <sup>nd</sup> harmonic is displayed
show 3rd	Boolean	true	Stipulates whether curve of 3 <sup>rd</sup> harmonic is displayed
show 4th	Boolean	false	Etc.
show 5th	Boolean	false	
show 6th	Boolean	false	
show 7th	Boolean	false	
show 8th	Boolean	false	
show 9th	Boolean	false	
check limit for sweep no.	Byte	0	Stipulates whether limit curve is checked. "0" means no limit check
number of discrete points	Parameter count	3	Number of discrete measured values
point 1 [Hz], [dB], limit	String	500, 70, 1	Value triples specifying measurements and upper limits
point 2 [Hz], [dB], limit	String	800, 70, 0.5	
point 3 [Hz], [dB], limit	String	1600, 65, 0.5	
check limits	Boolean	true	Stipulates whether limits are checked in discrete measurements

Table 4 Available parameters for harmonic distortion measurements

The following standard conformal tests are based on the harmonic distortion measurement routine:

Harmonic Distortion (ANSI)  
Harmonic Distortion (IEC-7)  
Harmonic Distortion (IEC-0)

### Measurement of Dynamic Behaviour (AGC Settling)

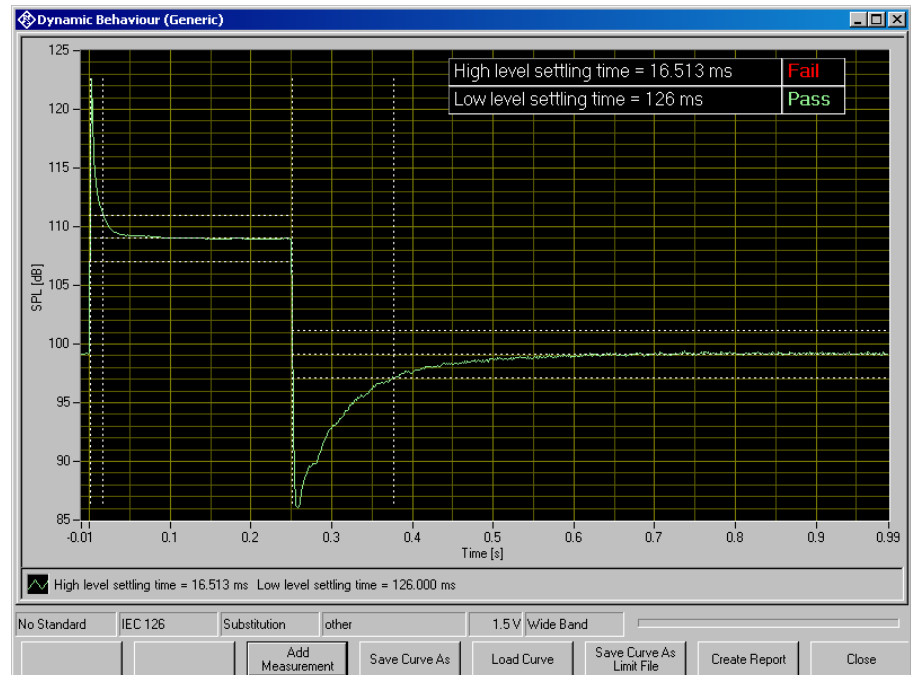


Fig. 36 Measurement window for dynamic behaviour

The dynamic behaviour measurement inputs a step-up and step-down burst of a sinewave signal to the hearing aid. The output sound pressure level of the hearing aid is plotted over time. The settling time is the time elapsing from the level step until the level settles within a defined tolerance band around the final output level. The tolerance bands and the settling periods are indicated in the graph with dotted lines.

The following standard conformal tests are based on the dynamic behaviour measurement routine:

Dynamic Behaviour (ANSI)  
Dynamic Behaviour at High Level (IEC-2)  
Dynamic Behaviour at Speech Level (IEC-2)  
Dynamic Behaviour (IEC-7)

The following table lists all available parameters in the generic dynamic behaviour measurement:

## Acoustic Measurements on Hearing Aids

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<b>Name</b>	<b>Type</b>	<b>Value</b>	<b>Explanation</b>
battery voltage (V)	Double	0	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. "0 V " means "use voltage from general setting".
test frequency (Hz)	Double	2000	Frequency of sine burst tone
high level (dB)	Double	80	High level of sine burst (dBSPL or dB re 1 mA/m)
low level (dB)	Double	55	Low level of sine burst (dBSPL or dB re 1 mA/m)
on time (s)	Double	0.25	Duration of high level
interval (s)	Double	1	Period duration of sine burst
selective measurement	Boolean	False	"True": Signal filtered with one octave width around test tone frequency
induction	Boolean	false	"False": Acoustic input, "True": Inductive input
store diagram	Boolean	true	"False": Only values are stored in the database (saves disk space), "True" compressed curve is stored in the database
display dB	Boolean	true	"False": Sound pressure on Y axis, "True": SPL on Y axis
attack tolerance (dB)	Double	2	Settling time is determined as the time after which the curve approaches the steady value closer than this difference
attack time lower limit (ms)	Double	20	Lower limit of high settling time for limit check
attack time upper limit (ms)	Double	150	Upper limit of high settling time for limit check
release tolerance (dB)	Double	2	Settling time is determined as the time after which the curve approaches the steady value closer than this difference
release time lower limit (ms)	Double	50	Lower limit of low settling time for limit check
release time upper limit (ms)	Double	300	Upper limit of low settling time for limit check
check limits	Boolean	true	Stipulates whether limits of settling times are checked

Table 5 Available parameters for dynamic behaviour measurements

## Measurement of Input-Output Characteristics

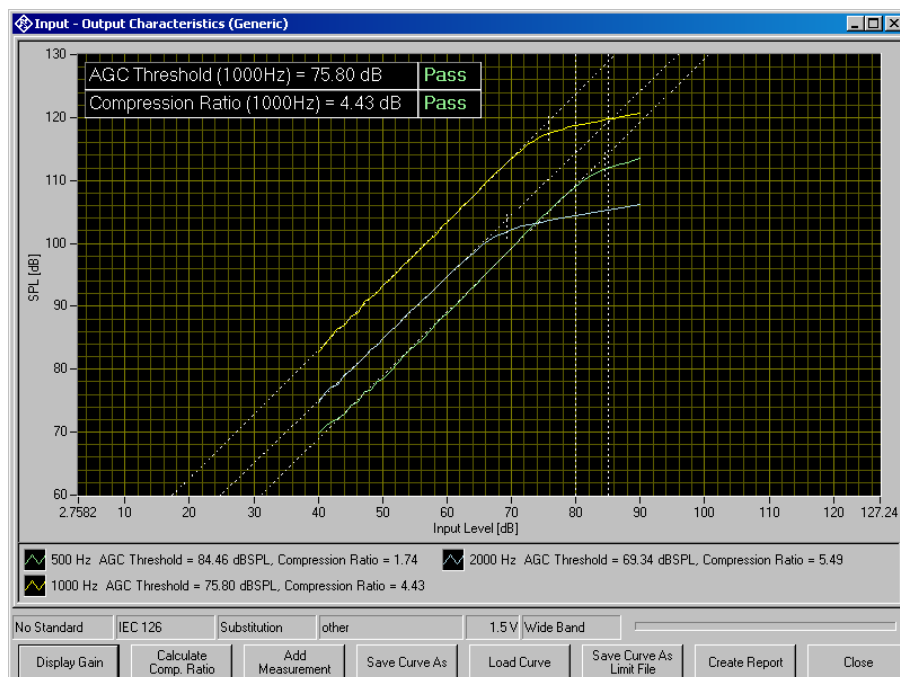


Fig. 37 Measurement window for input-output characteristics

The softkey “Display Gain” or “Display Level”, respectively, toggles the Y axis data between gain and sound pressure level. With the softkey “Calculate Comp. Ratio” a compression ratio may be calculated for any of the measured curves.

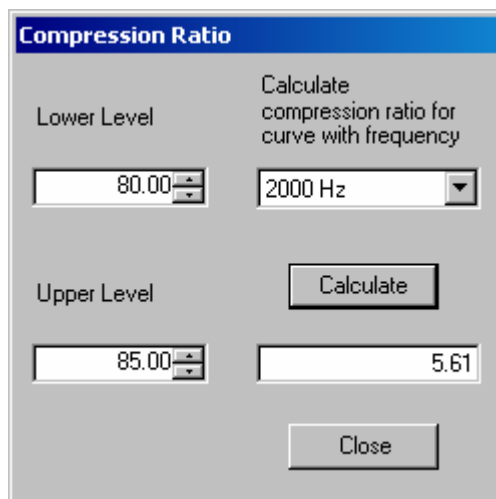


Fig. 38 Window for calculation of compression ratio

With “Lower Level” and “Upper Level” the input levels for the compression ratio calculation are determined. The combo box top right selects one of the measured curves. When the button “Calculate” is clicked, the compression ratio is calculated and displayed in the text box below.

The following table lists all available parameters in the generic input-output measurement:

## Acoustic Measurements on Hearing Aids

Name	Type	Value	Explanation
battery voltage (V)	Double	0	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. "0 V " means "use voltage from general setting".
lowest input level (dB)	Double	40	Start level of sweep (dBSPL or dB re 1 mA/m)
highest input level (dB)	Double	90	Stop level of sweep (dBSPL or dB re 1 mA/m)
number of level steps	Integer	50	Number of level steps in sweep
display result as gain	Boolean	false	"False": Level on the Y axis, "True": Gain on the Y axis
selective measurement	Boolean	False	"True": selective measurement with fast 3 <sup>rd</sup> octave filter
number of sweeps	Parameter count	3	Number of sweeps with frequency as parameter
sweep 1 frequency (Hz)	Double	500	
sweep 2 frequency (Hz)	Double	1000	
sweep 3 frequency (Hz)	Double	2000	
measurement delay (s)	Double	0.05	Pre-delay between sweep Step and measurement trigger, allows for settling of the DUT (e.g. AGC)
induction	Boolean	false	"False": Acoustic input, "True": Inductive input
calculate values	Boolean	true	"True": AGC threshold and compression ratio are determined for each curve
AGC threshold upper limit (dB)	Double	80	Upper limit for limit check of AGC threshold
AGC threshold lower limit (dB)	Double	60	Lower limit for limit check of AGC threshold
compression input level 1 (dB)	Double	80	Lower input level for compression ratio calculation (dBSPL or dB re 1 mA/m)
compression input level 2 (dB)	Double	85	Higher input level for compression ratio calculation (dBSPL or dB re 1 mA/m)
compression ratio upper limit	Double	8	Upper limit for limit check of compression ratio
compression ratio lower limit	Double	4	Lower limit for limit check of compression ratio
check limit for curve no.	Byte	2	"0" means "don't check"

Table 6 Available parameters for input-output measurements

The following standard conformal tests are based on the measurement routine for input-output characteristics:

Input-Output characteristics (ANSI)  
 Input-Output characteristics (IEC-2)  
 Input-Output characteristics (IEC-7)

Measurement of Equivalent Input Noise

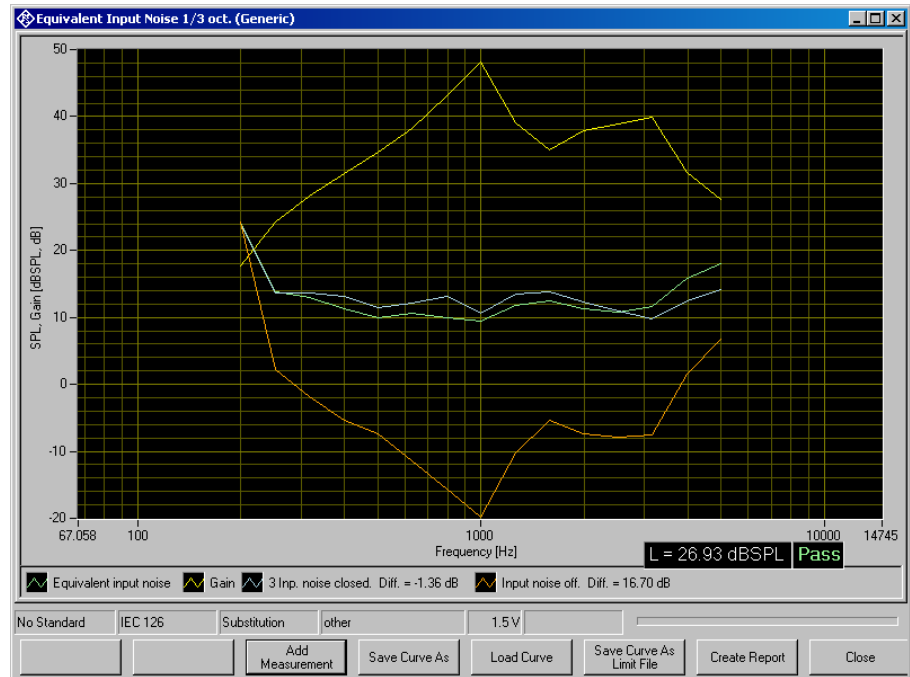


Fig. 39 Measurement window for equivalent input noise

The test routine for equivalent input noise determines the gain at an average of pre-defined frequencies. The output noise is measured, and the equivalent input noise is determined by subtracting the gain from the output noise level. In addition to the wideband input noise, it is optionally possible to measure the 3<sup>rd</sup> octave spectrum of the equivalent input noise.

Additional measurements can be performed with sealed input and with hearing aid switched off. The equivalent input noise with sealed input should not differ significantly from that measured with open input because otherwise the noise must be assumed to be picked up from the acoustic environment. The noise measured with hearing aid switched off should be significantly lower than the measured equivalent input noise, because otherwise the noise must be assumed to be at least partly generated by the coupler microphone.

The following table lists all available parameters in the generic measurement of equivalent input noise:

## Acoustic Measurements on Hearing Aids

Name	Type	Value	Explanation
battery voltage (V)	Double	0	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. "0 V" means "use voltage from general setting".
lower cutoff freq. (Hz)	Double	175	Lower band limit for wideband noise measurement
upper cutoff frequency (Hz)	Double	5650	Upper band limit for wideband noise measurement
gain test input level (dB)	Double	60	Level for measurement of gain (dBSPL or dB re 1 mA/m)
integration time (s)	Double	1	Integration time for noise measurement
predelay (s)	Double	0	Pre-delay between sweep Step and measurement trigger, allows for settling of the DUT (e.g. AGC)
induction	Boolean	False	"False": Acoustic input, "True": Inductive input
number of HFA frequencies	Parameter count	1	Number of frequencies averaged for gain measurement
HFA frequency 1 (Hz)	Double	1600	
check closed input	Boolean	True	"True": Repeat noise measurement with sealed input and check level difference
max level difference (dB)	Double	1	Maximum acceptable noise level difference between input open and input sealed
check off	Boolean	True	"True": Repeat noise measurement with hearing aid switched off
min. level difference (dB)	Double	10	Minimum acceptable noise difference between hearing aid switched of and hearing aid switched on with input open
maximum noise level (dBSPL)	Double	40	Maximum noise level for pass/fail check
check limits	Boolean	True	Stipulates whether limit should be checked
display spectrum	Boolean	True	"True": Noise spectrum is measured with a sweep of a fast 3 <sup>rd</sup> octave filter
lower frequency (Hz)	Double	200	Lowest 3 <sup>rd</sup> octave center frequency
upper frequency (Hz)	Double	5000	Highest 3 <sup>rd</sup> octave center frequency
number of frequencies	Double	15	Number of 3 <sup>rd</sup> octaves measured, must match the number of 3 <sup>rd</sup> octaves including the lowest and highest one

Table 7 Available parameters for equivalent input noise measurements

The following standard conformal tests are based on the measurement routine for equivalent input noise:

Equivalent Input Noise (ANSI)  
 Equivalent Input Noise 1/3 oct. (IEC-0)  
 Equivalent Input Noise (IEC-7)



## Battery Current Measurement

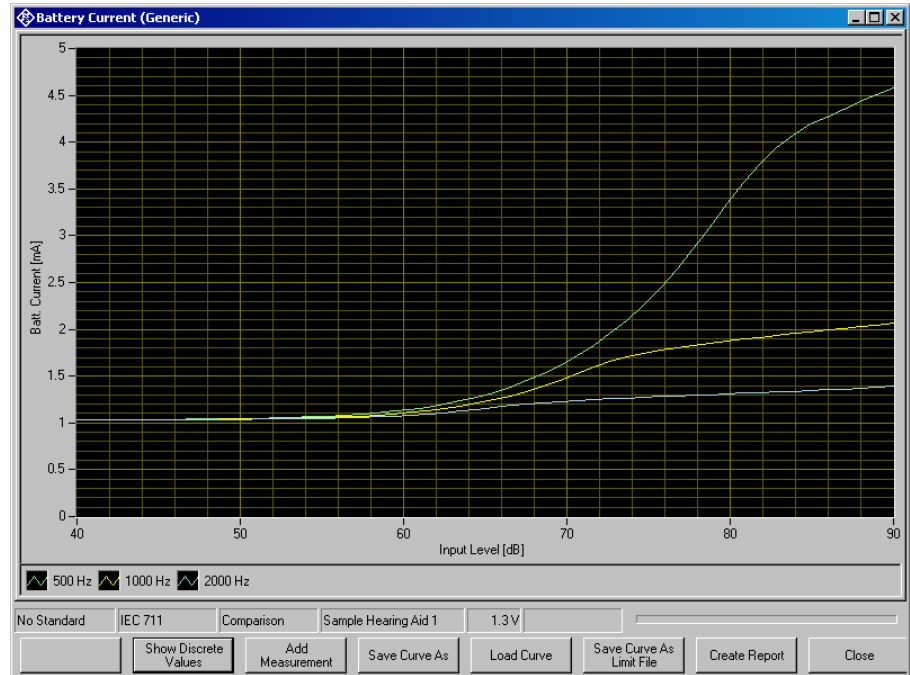


Fig. 40 Graphic display of battery current measurement

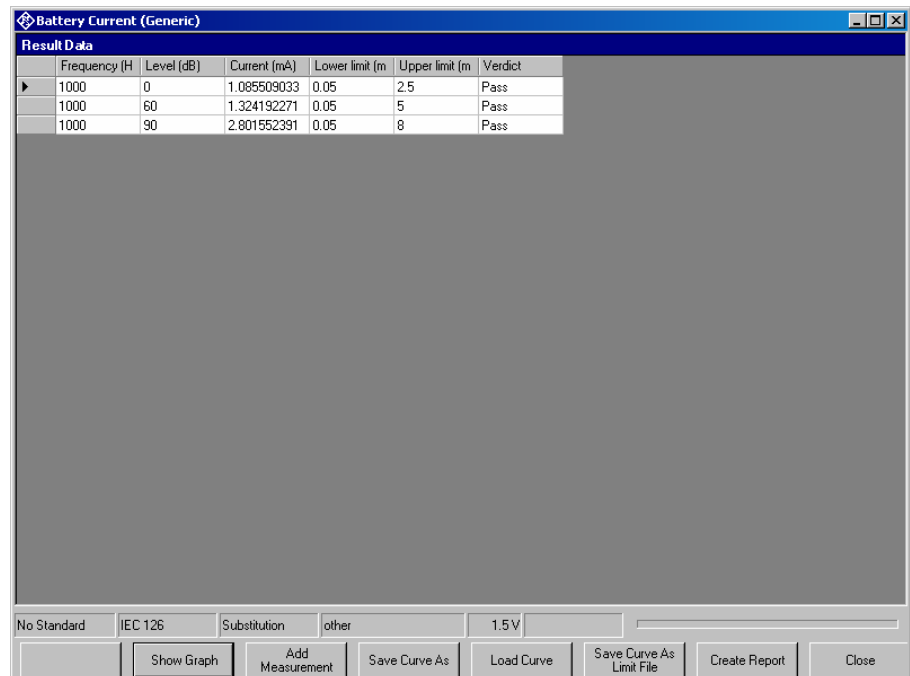


Fig. 41 Value table display of battery current measurement

The softkey “Show Discrete Values” or “Show Graph”, respectively, toggles between the graph view and the data table view of the measurement window.

## Acoustic Measurements on Hearing Aids

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The following table lists all available parameters in the generic battery current measurement:

<b>Name</b>	<b>Type</b>	<b>Value</b>	<b>Explanation</b>
battery voltage (V)	Double	0	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. "0 V" means "use voltage from general setting".
lowest input level (dB)	Double	40	Start level of sweep (dBSPL or dB re 1 mA/m)
highest input level (dB)	Double	90	Stop level of sweep (dBSPL or dB re 1 mA/m)
number of level steps	Integer	50	Number of level steps in sweep
number of sweeps	Parameter count	3	Number of sweeps with frequency as parameter
sweep 1 frequency (Hz)	Double	500	
sweep 2 frequency (Hz)	Double	1000	
sweep 3 frequency (Hz)	Double	2000	
measurement delay (s)	Double	0.05	Pre-delay between generator setting and measurement trigger, allows for settling of the DUT (e.g. AGC)
induction	Boolean	false	"False": Acoustic input, "True": Inductive input
check limits for curve no	Byte	2	"0" means "don't check"
number of discrete points	Parameter count	3	Number of discrete measured values
point 1 (Hz), (dB), lower limit, upper limit	String	1000, 0, 0.05, 2.5	Value triples specifying measurements and upper limits
point 2 (Hz), (dB), lower limit, upper limit	String	1000, 60, 0.05, 5	
point 3 (Hz), (dB), lower limit, upper limit	String	1000, 90, 0.05, 8	
check limits	Boolean	true	Stipulates whether limits are checked in discrete measurements

Table 8 Available parameters for battery current measurements

The following standard conformal tests are based on the battery current measurement routine:

- Battery Current (ANSI)
- Battery Current (IEC-0)
- Battery Current (IEC-7)

## Routine for Reference Test Gain Setting

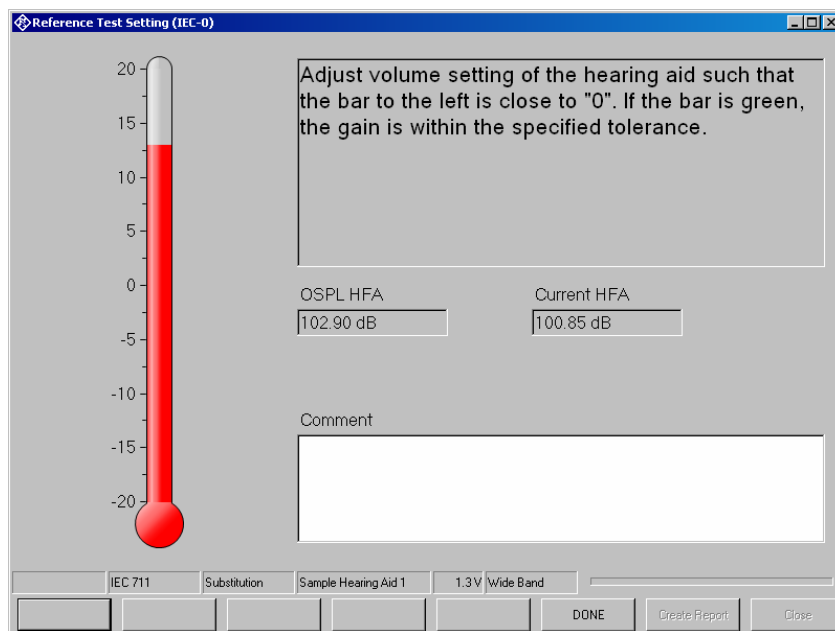


Fig. 42 Initial display of the routine for reference test gain setting

At start of the macro, the full-on gain or output SPL is measured and averaged at the specified HFA frequencies. From this value a target level is calculated.

The gain of the hearing aid at the specified frequencies is repeatedly measured until the "STOP" button is clicked. The thermometer shows the deviation from the target value. If the deviation becomes smaller than 3 dB, the scale is enlarged. The colour of the thermometer is red as long as the deviation is higher than the allowed tolerance and turns green as soon as the deviation is within tolerance.

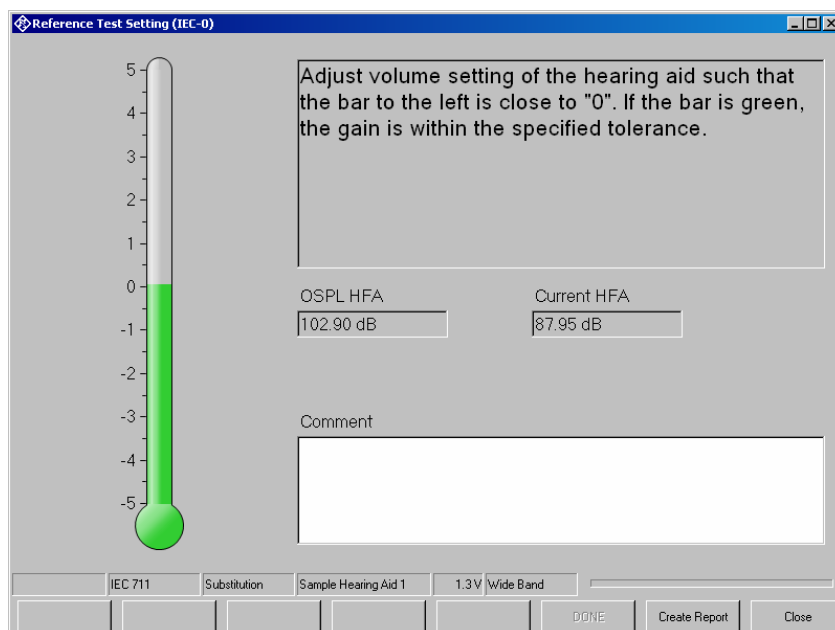


Fig. 43 Display of the routine for reference test gain setting, adjusted

## **Acoustic Measurements on Hearing Aids**

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A comment to be printed with the report (e.g. setting of the gain control) may be entered in the “Comment” field.

The following table lists all available parameters for reference test gain setting:

<b>Name</b>	<b>Type</b>	<b>Value</b>	<b>Explanation</b>
battery voltage (V)	Double	0	Supply voltage provided at ANLG AUX OUT. Overrides the general setting. “0 V ” means “use voltage from general setting”.
selective measurement	Boolean	false	“True”: selective measurement with fast 3 <sup>rd</sup> octave filter
OSPL as gain	Boolean	false	Stipulates whether the full-on value is measured as gain or as level
OSPL (dB)	Double	90	Input level for the full-on measurement
RTS as gain	Boolean	true	Stipulates whether the value during adjustment is measured as gain or as level
RTS level (dB)	Double	60	Input level during adjustment (dBSPL or dB re 1 mA/m)
measurement delay (s)	Double	0	Pre-delay between generator setting and measurement trigger, allows for settling of the DUT (e.g. AGC)
induction	Boolean	false	“False”: Acoustic RTS input, “True”: Inductive RTS input, OSPL measurement is always acoustic
number of HFA frequencies	Parameter count	3	Number of frequencies averaged for gain measurement
HFA frequency 1 (Hz)	Double	1000	
HFA frequency 2 (Hz)	Double	1600	
HFA frequency 3 (Hz)	Double	2500	
level difference (dB)	Double	-77	Difference between target value and full-on value
upper tolerance (dB)	Double	1.5	Maximum allowed difference between value during adjustment and target value
lower tolerance (dB)	Double	-1.5	Minimum allowed between value during adjustment and target value

Table 9 Available parameters for the reference test gain setting

The following standard conformal tests are based on the reference test gain setting routine:

Reference Test Setting (ANSI)  
 Reference Test Setting (IEC-0)  
 Reference Test Setting (IEC-7)

Routine for Alignment of the Hearing Aid in the Magnetic Field

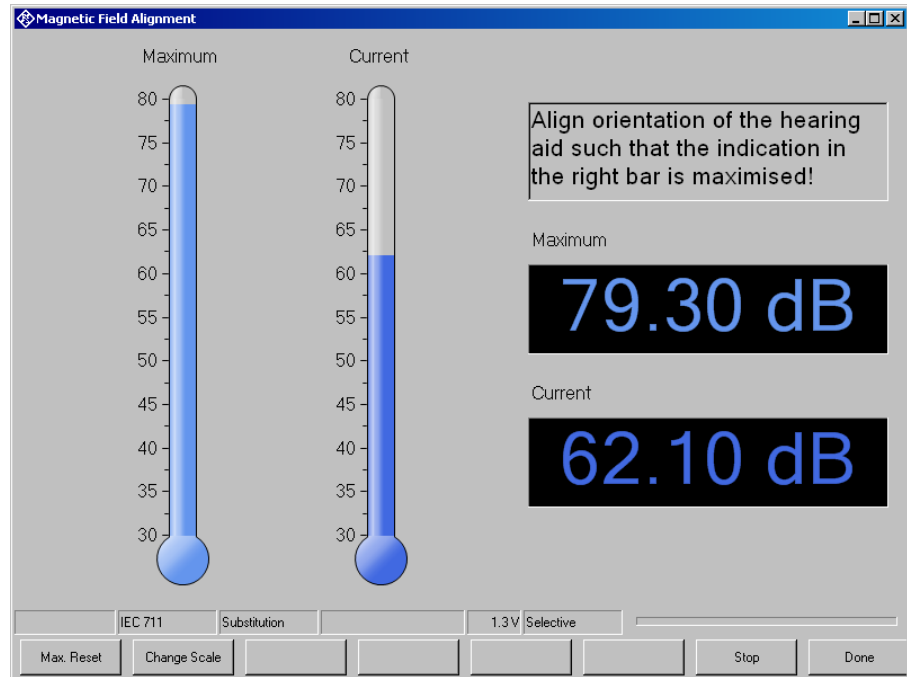


Fig. 44 Display of the routine for magnetic field alignment

This routine shows the output SPL of the hearing aid with a defined magnetic field strength in real time on a graphic thermometer display and on a numeric display. In addition a “maximum hold” display is provided. The maximum reading can be reset by clicking the “Max. Reset” button. The range of the graphic displays can be adapted using the “Change Scale” button.

The “Stop” button stops the continuous measurement and leaves the window open. The “Done” button stops the continuous measurement and closes the window.

The following table lists all available parameters for magnetic field alignment:

Name	Type	Value	Explanation
Selective	Boolean	True	“True”: selective measurement with fast 3 <sup>rd</sup> octave filter
induction	Boolean	True	“False”: Acoustic input, “True”: Inductive input,
number of HFA frequencies	Parameter count	1	Number of frequencies averaged for gain measurement
HFA frequency 1 (Hz)	Double	1600	
Input level (dB re 1 mA/m)	Double	20	Magnetic field strength for inductive input SPL for acoustic input
level scale maximum (dBSPL)	Double	80	Initial upper end of the graphic display
level scale minimum (dBSPL)	Double	30	Initial lower end of the graphic display

Table 10 Available parameters for magnetic field alignment

## 7 Automatic Test Sequences

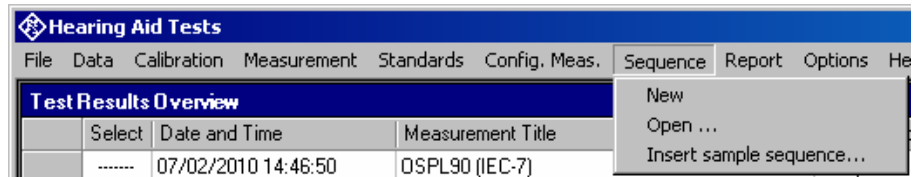


Fig. 45 Sequence menu

### Creating and Editing a Sequence

The menu item “Sequence → New” first produces a window where a name for the new sequence has to be entered. Subsequently the sequence window opens.

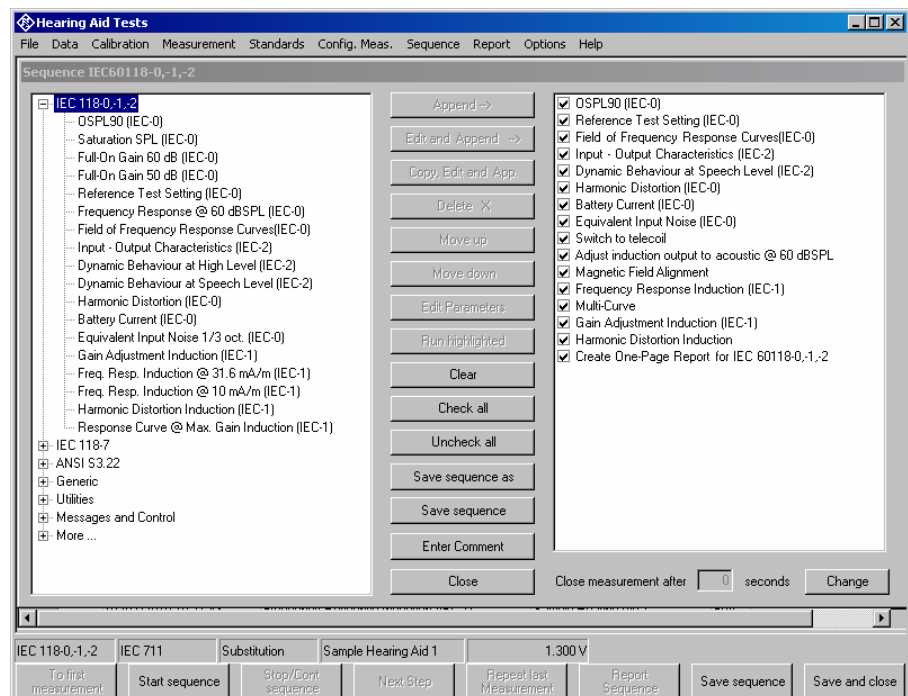


Fig. 46 Sequence window

Initially the right checked list box is empty. The list box on the left side displays all available measurement definitions, sorted by standards like in the “Standards” menu. A measurement is appended to the sequence by highlighting it in the tree view box on the left side and clicking the “Append” button. Subsequently a measurement, which is highlighted in the checked list box on the right side, can be moved within the sequence using the buttons “Move up” and “Move down” and deleted from the sequence with the “Delete X” button. It is possible to edit parameters which are not defined by the standard before appending the measurement to the sequence. This is done by clicking the button “Edit and append”. It is for example possible to assemble a test sequence which repeats a certain test with different battery voltages.

### Opening an Existing Sequence

The menu item “Sequence → Open ...” opens a file selector for specifying the sequence to be loaded. The sequence window opens with the specified sequence loaded. The sequence can then be edited and/or run.

### Using a Sample Sequence

Sample sequences are provided in the folder “C:\Program Files\Rohde&Schwarz\UPV-K7 Hearing Aid Tests”. Before being edited or run, the files should be copied to the current “D:Hearing” directory. This can be done with menu item “Sequence → Insert sample sequence”.

Sample sequences are provided for measurements according to IEC 60118-0,-1,-2, according to IEC 60118-7 and according to ANSI S3.22. They can be used for collecting the data for the one-page reports.

### Running a Sequence

When the softkey “Start sequence” is pressed, all checked measurements in the right list box are executed in sequence. The state of the checkboxes may be altered by marking a measurement and then clicking on the checkbox. Each measurement window may be kept open for a time period defined in “Options → Delay before closing a measurement in a sequence ...”. This value can also be modified on the bottom right corner of the sequence window. In addition, a screenshot of each terminated measurement is copied to a new tab in the sequence results overview:

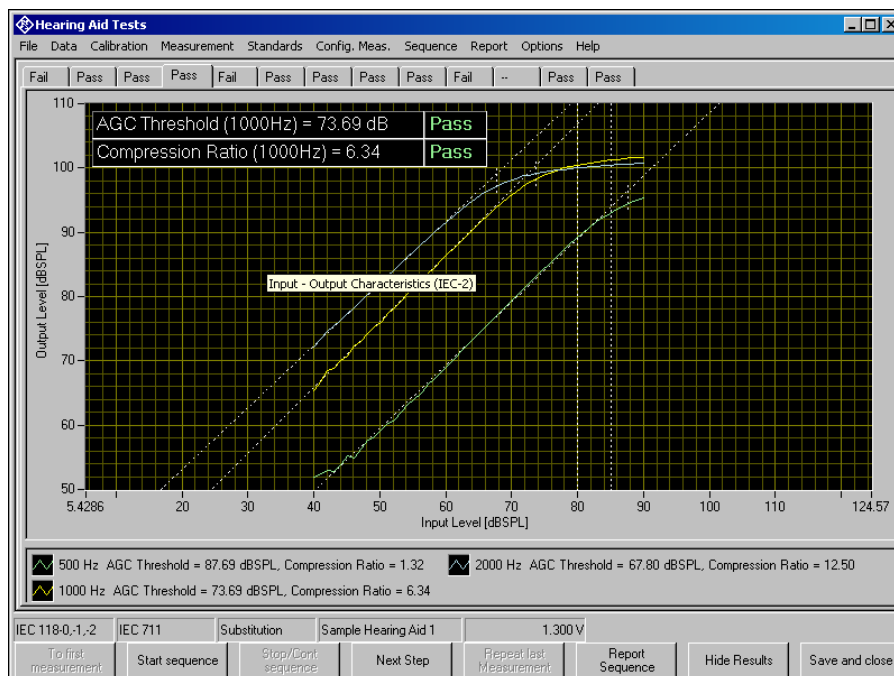


Fig. 47 Sequence results window

The view can be toggled between results and sequence by using the “Hide Results” / “Show Results” bitton, respectively. Each tab indicates the verdict (“Pass” or “Fail”) of the respective result. If the mouse is hovered into the visible screenshot, the tooltip displays the measurement title. Alternatively

the tabs can also be configured in the context menu to show the titles of the measurements.

### **Running a Single Measurement within a Sequence**

When the softkey “Run highlighted” is pressed, the measurement currently selected in the right checked list box is executed regardless of its checked state. Results are added to the result database, however the measurement started this way will not appear in the sequence report. This allows to use sequences as customized sets of measurements which can be stored and opened later again.

### **Reporting on Sequence Results**

A report on all executed measurements of the last run sequence is prepared and displayed after the “Report Sequence” softkey has been pressed. After the sequence window has been closed, a report on the last sequence can be obtained by pressing the “Report last sequence” softkey in the main window.



## 8 Reporting, Storing, Loading and Deleting Results

### Result Files

Measurement results are stored together with all associated data in XML files. Separate files can be used for different projects or operators. They can be archived together with other project data and re-opened later for generating reports.

It is recommended to keep result files small and to generate backups at frequent intervals.

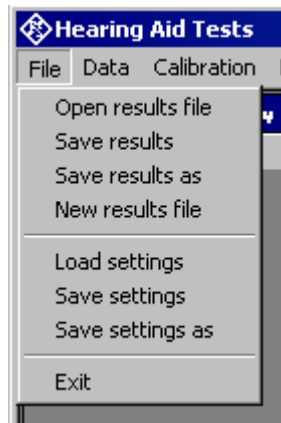


Fig. 48 File menu

A new (empty) result file can be created with “File → New Result File” from the main menu.

An existing result file can be opened with “File → Open Result File” from the main menu.

A currently opened result file can be stored under a new name with “File → Save results as” from the main menu.

### Report Settings

With “Report → Settings” or “Options → Report settings”, a selection can be made of data which should appear in the reports. Thus, information which is the same for a larger number of measurements does not have to be printed with every report again.

### Generating a Single Report

A report on a single measurement result can be generated from the window of a measurement macro by clicking or pressing the softkey “Generate report”.

From the result overview of the main window, a report on a single measurement can be generated by marking the row with the selected result by clicking on the row header to the left, right-clicking into the data grid and selecting “Generate report” from the context menu.

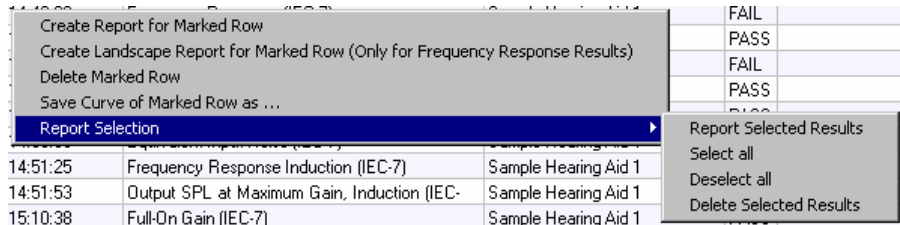


Fig. 49 Results context menu

Subsequently data associated with the selected measurement is assembled, a graph for existing curve data is generated, and the preview window is opened. Depending on the amount of measurement data, this may take a few seconds.

## Generating a Sequence Report

A report on a sequence of measurements can be generated from the sequence window by clicking or pressing the softkey “Report sequence”.

Once the sequence window has been closed, a report on the last executed sequence can be generated by selecting “Report → Last sequence” from the main menu. Reports about previous sequences can be generated as single reports on the measurements of this sequence, as all results appear in the overview data grid in the main window.

## Generating a Landscape Report

Landscape reports are only available for frequency response graphs. They show the result graph together with the measurement title and information about the tested hearing aid and about the operator. The layout and scale is fixed and cannot be configured.

A landscape report can be generated from the measurement window by right-clicking into the result graph of a frequency response measurement and selecting “Create Landscape Report” from the context menu. Furthermore a Landscape report can be created from the results overview data grid in the main window by marking a row in the results overview by clicking into the row header, right-clicking into the results data grid and selecting “Create Landscape Report for Marked Row”). If the result is not from a frequency response measurement, the result generation will abort with a respective message.

## Selection Report

A report on a selection of measurements can be generated from the results overview data grid in the main window by marking the rows with the desired results in the “Select” column and choosing item “Report Selection → Report Selected Results” (see Fig. 49). Rows marked with “XXXXX” in the “Select” column will be added to the report. The selection can be toggled by clicking into the respective “Select” cells. Note that another cell must be clicked before the same cell can be toggled again.

## Configuring the One-Page Report

Menu item “Report → One-Page Report Settings” opens the following input window:

Fig. 50 Data entry window for settings of the one-page report

“**Style**” allows to choose between black-and-white and Color output.

“**HFA Gain vale at 60 dB, Telecoil**” selects whether the output sound pressure level measured at HFA/ref. frequency with 10 mA/m is displayed in column” Setting Telecoil” and row “Gain @ 60 dB @ REF, OSPL(1mA/m, ref.)”, or whether a virtual value at 1 mA/m is displayed, calculated from a measured value of 10 mA/m or 31.6 mA/m by subtracting 20 dB or 30 dB, respectively.

In “**Frequency Response at Ref. Gain**” it can be chosen whether the second diagram shows output sound pressure level values or gain values.

In “**Curve Identification**” it is possible to choose between legends below the respective graph (advantageous with color plots) and labels inside the graphs (compatible with printouts from the UPL-B7 application program “HEARPRO”).

The scaling of each graph can be configured in the “**Axis Scaling**” field. The diagram is chosen with the numeric entry control, and the textbox besides shows the title of the chosen graph. Autoscaling optimizes the size of the curves while preserving the aspect ratio between the axes (10 dB on Y axis equals 10 dB on X axis for input-output curves and 50 dB on Y axis equals 1 logarithmic frequency decade on the x axis for frequency response graphs) like specified in IEC 60118-0 section 8 and in IEC 60263.

Checkboxes “**Edit Comment**”, “**Edit Serial**”, “**Edit Equipment**” cause the respective information to be displayed for editing during generation of

the report. If “**Memorize Serial**” is checked, the serial number is not taken from the information about the selected test object but can be entered during generation of the report. To ease entry of consecutive serial numbers, the last entered number is always memorized and displayed as suggestion for the next instance of the report.

### Generating a One-Page Report

One-page reports are available for standards IEC 60118-0,-1,-2, IEC 60118-7 and ANSI S3.22. They can be generated for the test object selected in “Data → Test object → Select” or for the test object selected in “Report → Select by Object”.

Furthermore a one-page report can be generated from a sequence by inserting a respective control item at the end of the sequence.

To assemble a one-page report, the report generator looks for the latest results for the selected test object, with certain test names as listed below. If the one-page report is generated from a sequence, however, it uses only results obtained during the latest run of this sequence.

	<b>IEC 60118-0,-1,-2</b>	<b>IEC 60118-7</b>	<b>ANSI S3.22</b>
<b>1</b>	OSPL90 (IEC-0)	OSPL90 (IEC-7)	OSPL90 (ANSI)
<b>2</b>	Field of Frequency Response Curves (IEC-0)	Frequency Response (IEC-7)	Frequency Response (ANSI)
<b>3</b>	Frequency Response Induction (IEC-1) <i>or</i> Freq. Resp. Induction @ 10 mA/m (IEC-1) <i>or</i> Freq. Resp. Induction @ 31.6 mA/m (IEC-1)	Frequency Response Induction (IEC-7)	Frequency Response Induction (ANSI)
<b>4</b>	Response Curve @ Max. Gain Induction (IEC-1)	Output SPL at Maximum Gain, Induction (IEC-7)	Output SPL at Maximum Gain, Induction (ANSI)
<b>5</b>	Multi-Curve	Multi-Curve	Multi-Curve
<b>6</b>	Equivalent Input Noise (IEC-0)	Equivalent Input Noise (IEC-7)	Equivalent Input Noise (ANSI)
<b>7</b>	Harmonic Distortion (IEC-0)	Harmonic Distortion (IEC-7)	Harmonic Distortion (ANSI)
<b>8</b>	Harmonic Distortion Induction	Harmonic Distortion Induction	Harmonic Distortion Induction
<b>9</b>	Battery Current (IEC-0)	Battery Current (IEC-7)	Battery Current (ANSI)
<b>10</b>	Dynamic Behaviour at Speech Level (IEC-2)	Dynamic Behaviour (IEC-7)	Dynamic Behaviour (ANSI)
<b>11</b>	Input-Output Characteristics (IEC-2)	Input-Output Characteristics (IEC-7)	Input-Output Characteristics (ANSI)

Table 11 Measurement titles of the data sources for the one-page report

The following figure illustrates which of the above measurements serves as data source for the respective areas of the one-page report:

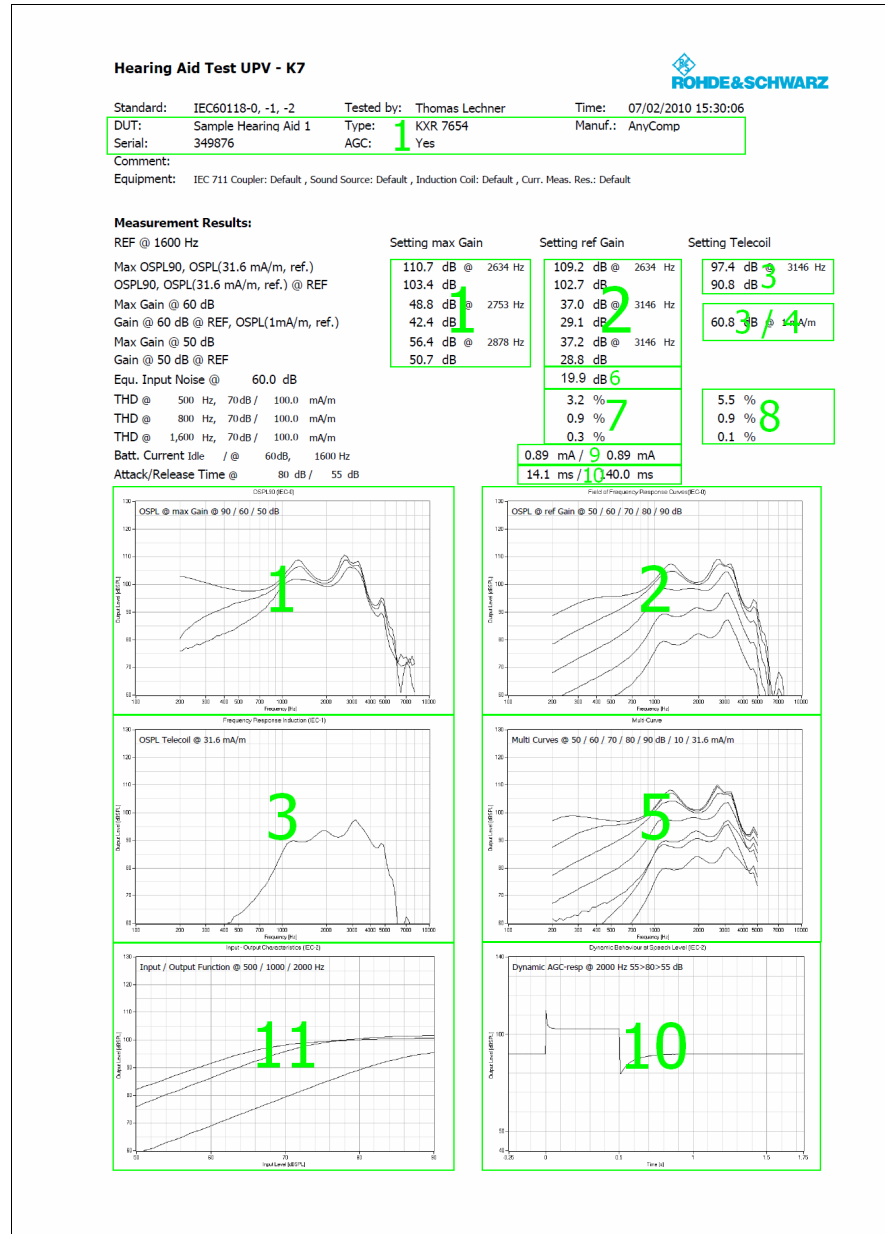


Fig. 51 Data sources for one-page report (refer to table 11)

## Preview Window

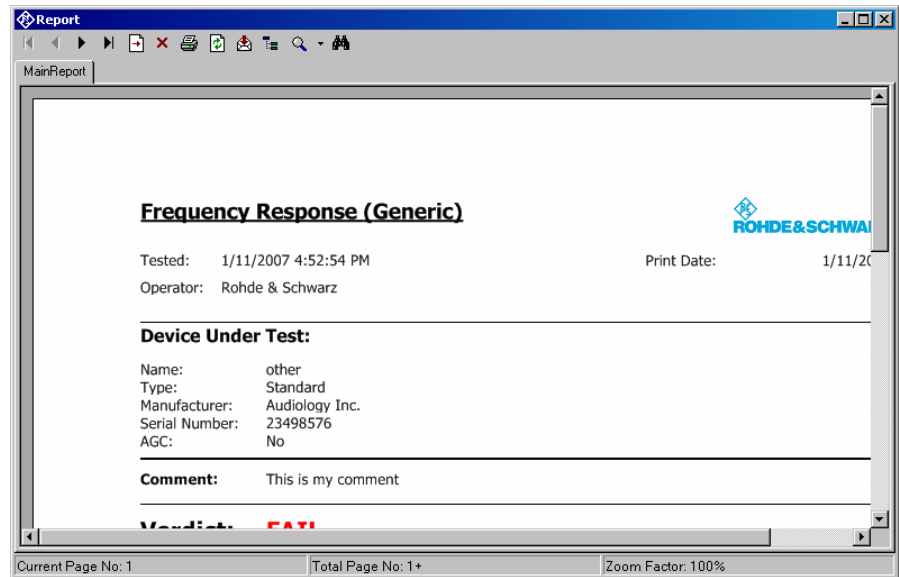


Fig. 52 Report preview window

The main area of the preview window shows a preview of the report as it will be printed or appear in an exported PDF file. If the report comprises more than one page, the pages can be browsed using the buttons



To open the print dialog for installed windows printers click



To open a file selector for export of the report to PDF, WORD, EXCEL or Rich Text format, click



The scale of the document in the preview can be adjusted with

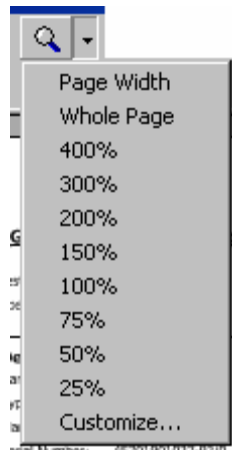


Fig. 53 Scale menu of the preview window

### Storing and Loading Curves

Measured curves can be stored from and loaded into the graph of a measurement macro (see above). This allows easy import into spreadsheets as well as direct comparison of curves measured at different times or places. Measured curves can also be stored in a R&S UPV limit file for use as a limit curve either in a R&S UPV sweep graph or in the graph of a R&S UPV-K7 window. This allows e.g. to derive tolerance schemes from “golden devices”. The measured curve can be arbitrarily shifted before being stored.

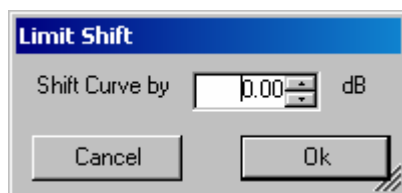


Fig. 54 Input window for defining a shift of a measured curve for storage as limit curve

Measured curves can be stored out of the results overview to an ASCII file by right-clicking into the results overview and selecting “Save Curve of Marked Row as ...”. If the result contains more than one result, the user can select which curve is to be stored, or alternatively choose to store all measured curves into a common file. The file format can be tab separated (“\*.txt”) or comma separated (“\*.csv”). \*.csv files can be directly opened in spreadsheet applications like MS Excel by double-clicking the file. Tab separated text files can also be imported into spreadsheets.

### Deleting Results

It may be desirable to delete results of selected measurements from the result file, e.g. because the measurement was repeated due to the hearing aid being switched off, a wrong setting etc. To delete the result of a particular measurement, mark the row for the selected measurement in the data grid of the main window by clicking on the row header to the left, right-click into the data grid and select “Delete result” from the context menu. After confirmation by the operator, the selected row of the result overview will be deleted from the result file together with all associated data (except data also associated with other measurement results).

A set of results may be selected in the “Select” column of the results data grid and commonly deleted using the context menu item “Report Selection → Delete Selected Results”.

### **Automatic Backup and Restoration of the Results File**

In order to speed up the execution of sequences, the result file is only saved when the program is closed. However, backups of the result file called “\*.xml~1” and “\*.xml~2” are stored alternately after termination of each single measurement and after termination of each sequence (“\*” stands for the name of the results file without extension). If the program is ended without closing it properly, or if the result file is not existing anymore, the R&S UPV-K7 will by the time of its next start offer to restore the result file from the latest backup file:

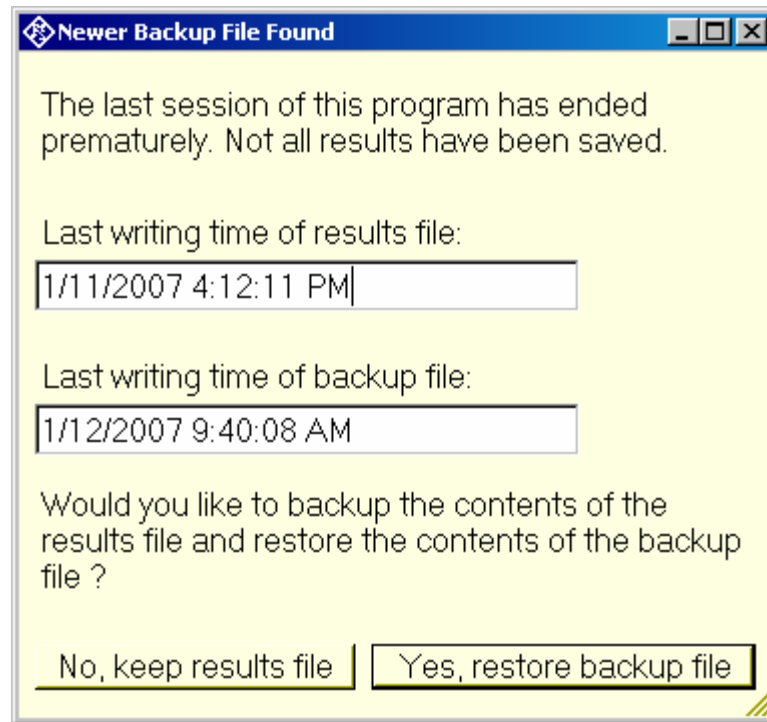


Fig. 55 Restoration of data from backup file

If it is chosen to restore the result file from the backup, the supposedly damaged result file is copied to “\*.xml~3” before the backup file is copied to the original name of the results file.



## **9 Terminating the Application**

The measurement can be terminated from the main window with the “Exit” softkey. This causes the result file to be written to the hard disk.