



ROHDE & SCHWARZ

Test and Measurement
Division

Operating Manual

Hearing Aid Test System

UPL-B7

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Contents

1 Use..... 1.1

2 Putting into Operation..... 1.1

2.1 Test Setup 1.1

2.2 Firmware Installation..... 1.3

2.3 Measurements 1.4

2.4 Performing a Measurement 1.5

2.5 Calibration 1.8

2.6 Generation of tests..... 1.9

2.7 Generation of limit curves 1.10

 Fig. 1-1 Connection of test box using coupler with built-in electret microphone 1.2

 Fig. 1-2 Connection of test box using coupler with 1/4" measurement microphone ... 1.2

 Fig. 1-3 Result display 1.6

 Fig. 1-4 Printout of test report..... 1.7



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



Safety Instructions

Rohde & Schwarz makes every effort to keep the safety standard of its products up to date and to offer its customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance with the relevant safety standards. Compliance with these standards is continuously monitored by our quality assurance system. This product has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, Rohde & Schwarz will be happy to answer them.

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

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

Symbols and safety labels

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

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

Safety Instructions

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before putting the product into operation. It is also absolutely essential to observe the additional safety instructions on personal safety that appear in other parts of the documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by Rohde & Schwarz, including instruments, systems and all accessories.

Tags and their meaning

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

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

Basic safety instructions

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

Safety Instructions

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

Safety Instructions

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



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



Informaciones de seguridad

Es el principio de Rohde & Schwarz de tener a sus productos siempre al día con los estándares de seguridad y de ofrecer a sus clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. Este producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, deberá el usuario atenerse a todas las informaciones, informaciones de seguridad y notas de alerta. Rohde&Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto solamente fue elaborado para ser utilizado en la industria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del maluso del producto.

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

Símbolos y definiciones de seguridad

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

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

Informaciones de seguridad

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

Palabras de señal y su significado

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

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

Informaciones de seguridad elementales

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

Informaciones de seguridad

- seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).
3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se produjeran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.
 4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.
 5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberán ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.
 6. Ciertos productos, como por ejemplo las instalaciones de radiación HF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario está comprometido a valorar y señalar áreas de trabajo en las que se corra un riesgo de exposición a radiaciones aumentadas de riesgo aumentado para evitar riesgos.
 7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.
 8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del producto.
 9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.
 10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto ya que puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro, que es controlado su estado técnico de seguridad.
 11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (medida del cable de distribución aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en construcciones o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

Informaciones de seguridad

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

Informaciones de seguridad

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

1 Use

Audio Analyzer UPL with option UPL-B7 and test program HEARPRO.BAS forms a complete test system for use in production, quality assurance and development of hearing aids.

The installation diskette also generates the program Heartst.bas which is intended for use in the development of hearing aids. The program is described in the Application Note 1GA 34-1. The application note can be requested from the local Rohde & Schwarz sales office.

There are several national and international standards defining measurements on hearing aids and the representation of results. The most important ones at present are the European standard IEC 118, parts 0 to 12, Hearing Aids, and the American National Standard ANSI S3.22, Specification of Hearing Aid Characteristics.

Program HEARPRO measures either in line with the latest IEC 118 -7-1993 or ANSI S3.22-1996 standard. All standard measurement can be performed:

- SSPL curves
- Setting to reference gain
- OSPL curves
- Equivalent input noise
- Distortion
- Current drain from battery
- Output sound pressure versus input sound pressure
- Attack and release time of AGC units
- Frequency response characteristics with selectable input sound pressure level or induction field strength
- Setup for telephone coil measurements on hearing aid
- OSPL curve with telephone coil
- Distortion with telephone coil

The sequence of measurements and associated parameters may be configured in any way and are stored as individual test sequences.

2 Putting into Operation

2.1 Test Setup

Option UPL-B7 includes an acoustic test box, a complete cable set, a 2 cm³ coupler with built-in microphone and calibration adapter as well as a set of battery adapters for all common battery sizes. The connecting pieces of the coupler are exchangeable to suit behind-the-ear, in-the-ear and detached hearing aids.

An adapter piece is also supplied, allowing the use of commercial ¼ inch test microphones together with the 2 cm³ coupler. Thus a fully calibrated precision test system is made available to the user.

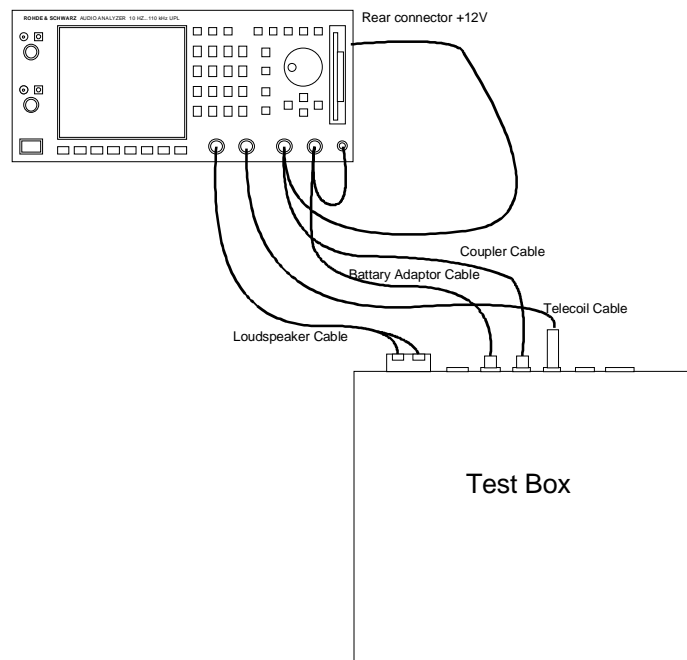


Fig.: 1-1 Connection of test box using coupler with built-in electret microphone

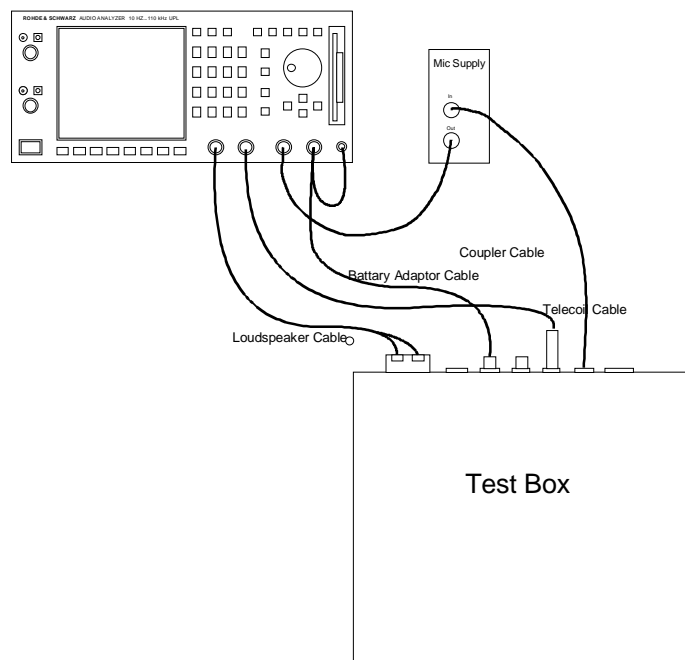


Fig. 1-2 Connection of test box using coupler with 1/4 inch test microphone

If option UPL-B7 is ordered together with Audio Analyzer UPL and Audio Monitor UPL-B5, two modifications are automatically incorporated in the UPL:

The output impedance of the audio monitor option is changed to 0 Ω so that the monitor can be used as a feeder for the hearing aid, and an additional BNC connector is provided at the rear of UPL where a filtered 12 V operating voltage is available for the microphone in the test coupler. Since the output impedance is 220 Ω , this source is only intended for low operating currents. The cable set of UPL-B7 can be used for this configuration.

With option UPL-B5, a programmable precision DC source of low noise is available. The two outputs of cable set UPL-B7 are connected in parallel via 1 Ω so that a source with an impedance of 0.5 Ω and a current of more than 100 mA (typ. 150 mA) is obtained. As the output impedance of the battery adapters is typically 1.7 Ω , the total impedance together with that of the cables is approx. 2.5 Ω . With the 2 Ω current measurement resistor in the cable, a total impedance of approx. 5 Ω is obtained which corresponds to the typical impedance of a battery.

An external keyboard is required for the installation and operation of the test program.

2.2 Firmware Installation

The test program Hearpro.bas and the program Heartst.bas with all setups is supplied on a floppy disk. To carry out the installation, terminate the UPL program (system key), change to drive A: and call up the program named Install. The directory C:\HEARING is created in the UPL. All program routines are copied into this directory. In addition, the directories C:\HEARING\TST and C:\HEARING\RESULTS are created in which the generated test routines or results are stored.

To use the monitor option as a DC voltage source, Audio Analyzer UPL must be started with a call-up parameter -tdcl, which can be entered either in the AUTOEXEC.BAT or the USERKEYB.BAT file. To enable this the UPL call in the AUTOEXEC.BAT file has to be changed to UPL -tdcl or line

```
Set uplcfg = -tdcl
```

has to be written into the C:\UPL directory of the USERKEYB.BAT file. The file USERKEYB.BAT is called up automatically on the start-up of the UPL. Drivers for country-specific keyboards can therefore be installed and defined with the variables UPLCFG startup switches. This file must be named USERKEYB.BAT and located in the directory C:\UPL. This method has the advantage that the switch is maintained after a firmware update. The DOS editor EDIT should be used for the above change or the creation of file USERKEYB.BAT in the directory C:\UPL.

(Call-up parameter -tdcl connects the monitoring output to a DC voltage source with a setting range of ± 2 V. With call-up parameter -tdch a setting range of ± 6 V is obtained but in this case the noise is increased by a factor of 3 from typically 50 to 150 μ V).

2.3 Measurements

The test program HEARPRO.BAS permits customized test sequences to be defined including the measurement using an inductive coil and the measurement of attack and release times of hearing aids with AGC. The order of the test routines and the measurement parameters can be user-defined and stored as a complete test sequence including a tolerance check. Tolerance curves can be obtained automatically from measured curves and used for series tests.

The following can be measured or performed:

- Output noise pressure level at maximum gain either at an input sound pressure level of 50, 60 and 90 dB or 90 dB only; on request with a tolerance check of the frequency response at 90 dB.
- Routine for setting the reference gain of the hearing aid with the aid of a bargraph.
- Output sound pressure level at reference gain at an input sound pressure level of 50 dB, 60 dB or 50+60+90 dB, on request with a tolerance check of the frequency response at 50 or 60 dB.
- Equivalent input noise referred to 60 dB sound pressure level or to 50 dB sound pressure level if a 50 dB curve is selected for the OSPL measurement.
- Distortion at 70 dB input sound pressure level at 3 selectable frequencies.
- Current drain in the idle state at a sound pressure level of 60 or 65 dB (requires the battery adapter and monitor option UPL-B5 to be used)
- Output sound pressure level versus input sound pressure level (transfer function) in the range 50 to 90 dB at any selectable frequency.
- Attack and release times of AGC with selectable parameters and automatic matching of tolerances for the settling test to IEC or ANSI.
- Frequency response characteristics, eg to display the setting ranges of frequency response adjusting elements at an input sound pressure selectable between 40 and 100 dB or field strength of 1mA/m to 100 mA/m, also combined.
- Routine for setting the hearing aid to induction coil measurement
- Frequency response of output sound pressure with selectable induction field strength
- Distortion with selectable induction field strength using a setting routine for matching the output sound pressure to the acoustically measured value at 70 dB.
- Waiting routine for interrupting the test run.

Since all measurement parameters are stored together with the test routine, eg the associated test procedure for each type of hearing aid can be stored under an appropriate name. The tests generated in this way are stored in directory C:\HEARING\TST and, if required, the path can be modified in the program.

2.4 Performing a Measurement

To load the HEARPRO.BAS program set the UPL to the programming mode using key <F3>. The program is loaded with command LOAD"HEARPRO <RETURN> and started with RUN <RETURN>. With the aid of the utility program UPLSET an automatic sequence control program can be loaded and started in the UPL (see also UPL manual).

Prior to the first measurement the complete test setup has to be calibrated with the aid of a sound level calibrator and a reference microphone (neither supplied), see section 2.5 on calibration. The calibration values are stored in a file and used for all measurements. A recalibration is required if the environment conditions (temperature) significantly change or a calibration interval is stipulated for any other reasons. The error limits of the UPL are extremely low so the calibration interval is solely determined by the stability of the test microphone. The measured values of each calibration are appended to a file. If the calibration has not been taken on the current day, the following message appears after the start of the program:

Last Calibration <Date>

Broadly speaking measurements with all types of test couplers are possible. Supplied are a 2 cm³ coupler with built-in electret microphone and an adapter for ¼ inch microphone which in place of the coupler is used with the built-in microphone. This setup offers the advantage that the test microphone can be undone from the coupler and thus it can be used to calibrate the test box (no reference microphone is required) or it can be calibrated the same as any test microphone (the frequency response of the built-in microphone cannot be calibrated this way but is only subjected to a small design-specific spread). The adapters for the various hearing aids are usable with both setups.

Measurements with the ear simulator are also possible. The only thing to make sure is that all components find room in the test box.

When using a test microphone with the adapter or ear simulator the preamplifier and the voltage supply of the test microphone will also be required. The output signal from the preamplifier is taken to channel 1 of the UPL in place of the coupler cable.

The hearing aid to be measured is connected to the test adapter and inserted in the test box such that its microphone is about in the center of the (blue) reference area. For measurements via the telephone coil, remove the blue foam rubber and place the adapter in the recess thus obtained. The hearing aid then hangs on the silicone tubing (of a unit behind the ear) and is in a similar position as it would be when carried by the user. Since the telephone coil is fitted below the foam-rubber insert of the test box, the effective field strength depends on the position of the receive coil as the hearing aid is not at the same level as the coil. With an excitation current of 3.33 mA a field strength of 10 mA/m is obtained approx. 20 mm above the rubber insert. The hearing aid should be positioned such that the built-in hearing coil is approx. 20 mm above the rubber insert. To obtain this height a suitable (non-metallic) support may be used.

When the <LOAD> key is pressed upon program start all stored tests are listed. The desired test name has to be entered and confirmed with <RETURN>. The measurement itself is started with the <START> softkey. Manual manipulation, eg setting the reference gain of the hearing aid, will be requested on the screen.

Upon completion of the measurements defined in the test, all results are displayed on the screen. Typical measurements look like the following:

Fast Hearing Aid Test with Rohde & Schwarz Audio Analyzer UPL

According to IEC 118

	Setting max Gain:	Setting ref Gain:	Setting Telecoil:
Max OSPL90/OSPL90:	124.2 dB	122.3 dB	99.5 dB
OSPL90/OSPL90 REF:	109.7 dB	107.3 dB	90.2 dB
Gain @ 60 dB @ REF:	46.1 dB	33.9 dB	
Gain @ 50 dB @ REF:	54.9 dB	33.9 dB	
Equiv. Inp. Noise @ 60 dB:		26.6 dB	
THD 500 Hz @ 70 dB/ 100 mA/m:		2.2 %	4.0 %
THD 800 Hz @ 70 dB/ 100 mA/m:		1.1 %	1.0 %
THD 1600 Hz @ 70 dB/ 100 mA/m:		0.8 %	0.6 %
Battery Current idle/sound:		1.70 mA / 1.63 mA	
Attack Time:		27.5 ms	
Release Time:		68 ms	

Fig. 1-1 Result display

With the tolerance check switched on, all numerical values (see Fig. 1-1) outside permissible tolerances are marked with an asterisk (*). In addition, FAIL is displayed in red on the screen (on UPL with colour display or external monitor). If tolerances have not been exceeded, PASS is displayed in green. FAIL is also displayed if one of the frequency response curves exceeds the associated limit curve.

The measured numerical values and all measured curves can be stored. The first eight digits of the entered series number are used as a default file name but any other name may of course be chosen, observing the DOS conventions for file names, eg no spaces are allowed in the file name.

By means of the <REPORT> key a test report is output to a Laserjet printer or compatibles (up to 6 graphs for each report) depending on the definition in the test parameters. (If no graphs are output other types of printers may be used. For graphics output the printer is switched to HPGL using an escape sequence, and this is only possible with a Laserjet printer). To be able to print all graphs in the HPGL mode, the printer must have a sufficient memory size. A memory of at least 2 Mbyte is recommended and the printer must be configured for whole pages printing (otherwise an error message may be output on the printer and printout will be incomplete). Error messages from the printer such as no paper generate an error message after printing the report. The printout can be continued with space after troubleshooting or aborted with Q.

Hearing Aid Test with Rohde & Schwarz Audio Analyzer UPL

Test: **iecl.tst** Standard: **EN 60118-7 - 1993**
 Device under Test: Tested by: **Mustermann** Date: **07-08-97**
 Manufacturer: **Audio Systems** Model: **Audimax5** Time: **13:45**
 Serial No: **001** Circ/Rev: **Spec.1/1.0**

Measuring Results:	Setting	Setting	Setting
REF @ 1600 Hz	max Gain:	ref Gain:	Telecoil:
Max OSPL90/OSPL90:	123.8 dB @ 993 Hz	122.6 dB @ 993 Hz	105.6 dB @ 993 Hz
OSPL90/OSPL90 @ REF:	109.2 dB	107.6 dB	96.2 dB
Max. Gain @ 60 dB:	60.4 dB @ 993 Hz	45.2 dB @ 993 Hz	
Gain @ 60 dB @ REF:	46.8 dB	34.3 dB	66.2 dB @ 1mA/m
Max. Gain @ 50 dB:	60.3 dB @ 993 Hz	45.1 dB @ 993 Hz	
Gain @ 50 dB @ REF:	49.3 dB	34.3 dB	
Equiv. Inp. Noise:		31.2 dB	
THD 500 Hz @ 70 dB/ 100 mA/m:		2.2 %	3.5 %
THD 800 Hz @ 70 dB/ 100 mA/m:		1.1 %	1.2 %
THD 1600 Hz @ 70 dB/ 100 mA/m:		0.7 %	1.8 %
Battery Current idle/sound:		0.98 mA / 1.02 mA	
Attack Time:		24.5 ms	
Release Time:		75 ms	

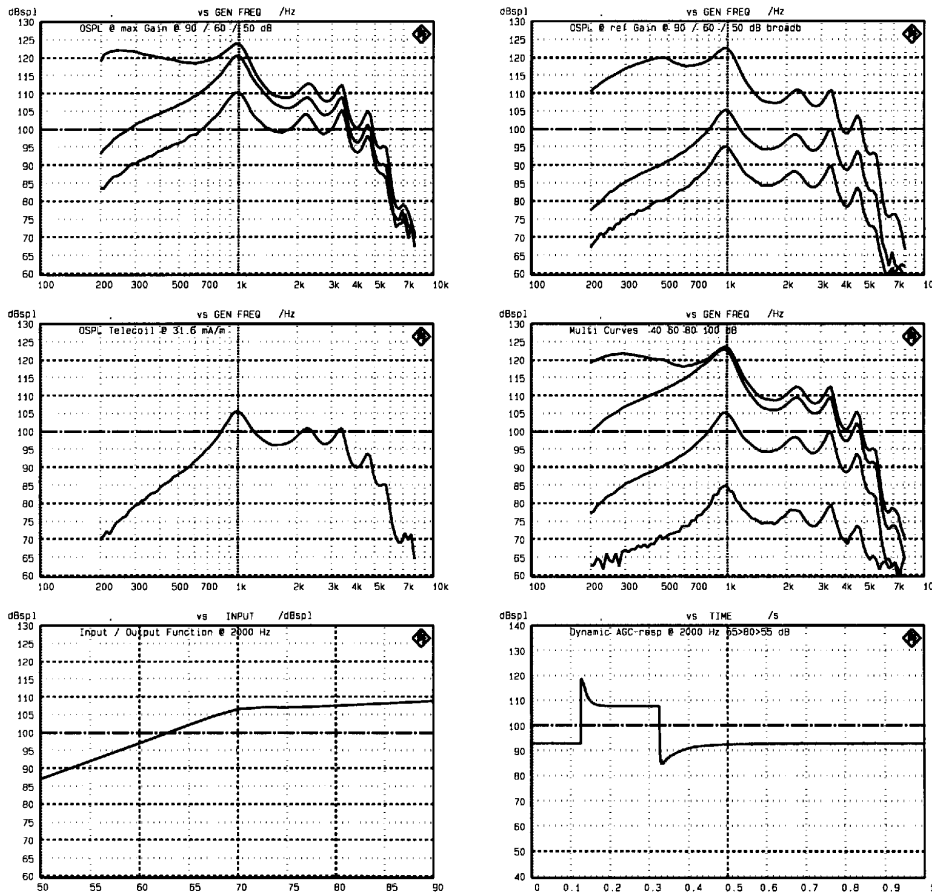


Fig. 1-4 Printout of test report

Another measurement is started with <NEXT> or <REPEAT>. If NEXT is used, the serial number is automatically incremented when this has been selected in the test definition. With REPEAT the measurement is repeated without incrementing the serial number.

With the aid of the <BACK> key the next higher menu level is selected. If this key is pressed in the start menu, the user will be asked whether he wishes to terminate the program. The ESC key is for interrupting a current measurement and results in the start menu displayed on the screen.

2.5 Calibration

Before the test system is put into operation for the first time, the microphones or ear simulators used and the test box must be calibrated with the aid of a sound pressure calibrator, eg Bruel & Kjaer 4231, and a test microphone for the calibration of the test box. A suitable microphone is for example type 40 BF with amplifier 26 AC + feed unit of Messrs. G.R.A.S. Denmark. This microphone which has a total length of approx. 55 m is especially suitable for the calibration. The microphone sensitivity and the frequency response of the test box are to be measured and are entered in a file as calibration value for the following measurements. The frequency response of the test box is referenced to the frequency response of the test microphone whose tolerance must therefore be known for the measurement to be traceable. The absolute sensitivity of the used microphone is measured for each calibration with the sound level calibrator. Traceability is thus referenced to the tolerance of the used sound level calibrator.

After the <CALIB> key has been pressed the user is asked whether one or two microphones will be used.

If one microphone is selected, the microphone of the test coupler is used for calibrating the frequency response of the test box. In this case it is necessary that the microphone is completely disconnected from the coupler. This is the case when the adapter for the ¼ inch microphone is used in the 2 cm³ coupler. The adapter is to be removed from microphone for calibration. If two microphones are used, microphone 2 is only used for calibration and has to be connected to channel 2 of Audio Analyzers UPL during calibration (instead of the current test cable for the battery adapter).

Calibration is performed in 5 steps:

- Absolute calibration of microphone 1 or ear simulator
- Absolute calibration of microphone 2, if used
- Calibration of test box
- Entry of required current in mA for a field strength of 10 mA/m of the induction coil in the test box.
- Entry of shunt used with the current measuring device

For absolute calibration, the actual sound pressure level of the calibrator has to be specified, if required by taking into consideration the correction values eg for calibrating the ear simulator. For calibrating the 2 cm³ coupler with the built-in microphone supplied with UPL-B7 and the associated adapter, a correction value has to be considered.

Depending on the sound level calibrator employed the effect of the volume of the calibration adapter is different.

When calibrating with a pistonphone such as Bruel & Kjaer 4228 the sound pressure given off is reduced by 0.6 dB so that instead of the nominal of 124 dB a calibration value of 123.4 dB (plus correction for the atmospheric pressure) has to be entered.

When calibrating with the calibrator 4230 from Bruel & Kjaer the correction factor is + 2 dB, thus a calibration sound pressure of 96 dB is to be entered.

When calibrating with the calibrator 4231 the correction factor is +1.8 dB and a calibration sound pressure of 95.8 dB is to be entered.

With a setup based on a ¼ inch test microphone for the 2 cm³ coupler, the microphone for the calibration is to be disconnected from the coupler and connected as usual directly to the sound level calibrator for calibration at the sound pressure level given for the calibrator.

After absolute calibration, the reference microphone (microphone 1 if only one microphone is used, otherwise microphone 2) is placed at the focus of the test box (center of blue foam rubber insert). If required, test coupler and DUT should also be placed in the box for calibrating the sound field with the DUT. When the <RUN> key is pressed, the absolute sensitivity and the frequency response of the box are measured and automatically stored in the form of an equalization file.

In the subsequent query the user is requested to enter the current in mA which produces a field strength of 10 mA/m in the box. For Test Box UPL-B7, 3.33 mA should be entered (for 10 mA/m at 20 mm above the foam rubber insert).

The last query concerns the value of the shunt used for the current measurement of the hearing aid. The cable supplied with the UPL-B7 for measuring the current is fitted with a 2 Ω ±1% resistor. If this value is changed or if another cable is used, the value of the new resistor is to be entered.

After calibration has been completed, all values are stored and reused for all subsequent measurements. When the HEARPRO.BAS program is loaded and started, all calibration data are read in and the calibration date is checked. A reference to the last calibration is displayed when the calibration date does not correspond to the current date.

2.6 Generation of tests

Normally, predefined tests are used in production for testing a specific type of hearing aid. These tests should not be modified by the user. A coded sequence of keys has therefore been integrated to access the test definition menu. The expert mode is called up by pressing twice the key combination <ALT>+<E>. The <DEFINE> key for opening the test generation menu is then displayed in the start menu next to the <LOAD> key. The expert mode is switched off with the O key (character O).

In the define menu predefined tests can be loaded, eg for generating another test through modification.

After pressing the <DEF TST> key the test sequence is displayed and can be confirmed with <OK> or newly defined with <CHANGE>. Enter the number of the desired test step and terminate with <RETURN>. At the right-hand side of the screen the test step is displayed in plain text. The first measurement is always an acoustic (with max. gain also an SSPL) measurement. This may be sufficient for performing a minimum test. The definition of the test sequence is terminated with <RETURN> without specifying numerals.

In the next steps the test conditions for all the measurements can be defined. Values are called up with the respective key and confirmed with <OK> or modified with <CHANGE>. Remember that values in the entry fields **must be confirmed with <RETURN>**. **Cursor keys will cause a malfunction and must therefore not be used.**

In addition to the usual information, other selection items are offered under the menu item <GENERAL>:

Frequency range It can be selected whether the frequency response measurement should be performed in 100 steps in the range 200 Hz to 8 kHz or in 150 steps in the range 100 Hz to 10 kHz. Calibration is always performed in the range 100 Hz to 10 kHz to ensure that calibration values are available any time. The measurement speed is somewhat reduced in the wider frequency range because of the greater number of test steps.

Rumble filter If Y is specified, a 100 Hz highpass filter is used for all measurements. The settling time of the filter slightly slows down the measurement.

Adaptive measurement	All measured values are subjected to an additional settling test. The measurement speed is reduced depending on the settling speed of the DUT. This option is useful if the hearing aid is provided, eg with a relatively slow AGC, which would impair measurement results at the maximum measurement speed.
Selective measurement	A third-octave filter is switched on for selective measurements. Irrespective of this selection, SSPL measurement is always a broadband measurement

The maximum measurement speed is attained with broadband measurement without the rumble filter and adaptive measurement in the frequency range 200 Hz to 8 kHz.

Numeric measurement results and frequency response curves may be subjected to a tolerance check. The frequency response check is defined for SSPL or OSPL, a check of numeric values in the <GENERAL> menu. Limit curves for SSPL and OSPL must be given different names when the two limit curves are to be used in the same test, since the files cannot be distinguished by their extensions. A file for testing the tolerance of numeric values has always the extension .tol so that it may have the same name as a limit file for a frequency response measurement or the test. When generating a tolerance mask for checking numeric values, individual tests may be disabled by entering 0 (zero) as the upper limit value or -100 dB as gain value. In this case the respective value is not checked.

2.7 Generation of limit curves

It is assumed that a "golden device" is used in this case, which corresponds to the mean value for the tolerance of the DUT.

Menu item <LIM CURV> may be called up for defining limit curves, the UPL is then set, all calibration values are considered and the manual control mode is selected. The desired generator level (dBr directly corresponds to dBspl) must be set, eg for a 90 dB curve. Pressing the <SINGLE> key triggers an accurate frequency measurement (averaging of 20 values). After completion of the measurement, which may be repeated any time with <SINGLE>, return to the test program with <F3> or <BACKSP>. A query is displayed as to the number of tolerance segments to be contained in the measured curve. Three segments for instance permit higher tolerances at low frequencies, narrower tolerances at medium frequencies and higher tolerances again at high frequencies. First the desired frequencies are entered, then the permissible tolerances in dB (without sign). The values may be corrected again. After confirmation with <Y> the limit files are calculated and stored under the specified name. The upper limit file is given the extension .LUP, the lower one the extension .LLW.

Cursor keys should not be used here for entering values.

With the definition completed, the whole test should be stored under a meaningful name for ease of recall later on.

Special features

During the test run it may be useful to briefly interrupt the measurement, eg for a closer examination of a test curve. Pressing the <W> key triggers a stop at the end of a frequency sweep and the measurement is continued when any key is pressed. During attack and release measurements, pressing W causes the graph of a settling characteristic to be displayed. Again the measurement is continued by pressing any key. The measurement is interrupted by pressing the ESC key and the start menu is displayed.

Format of stored measurements

Measured values are stored sequentially in ASCII format in a file under the selected name with the extension .VAL. The order of the values is predefined. The file can be edited with any editor and

evaluated by other programs. In the HEARPRO.BAS program the path for storing results is entered in line 150. This path is normally C:\HEARING\RESULTS. The user may enter another path and store the program under the same or a new name. The entered path and the directory must both exist. The path for storing and calling up tests can be entered in the same way in the next line. Thus programs, tests and results can be stored separately.

Order of entries in the result file:

Filename
 Date
 Time
 Company
 Serial No.
 Circuit
 Revision
 Name of tester
 Auto increment
 Sspl90max
 Frequency @ Sspl90 max
 Ospl90max
 Osplmax mit telecoil
 Frequency @ Ospl90max
 Sspl90 @ ref
 Ospl90 @ ref
 Ospl telecoil @ ref
 Gainmax @ 60 dB
 Gainref @ 60 dB
 Gainmax @ 50 dB
 Gainref @ 50 dB
 Noise
 Distortion 1, frequency 1
 Distortion 1 telecoil
 Distortion 2, frequency 2
 Distortion 2 telecoil
 Distortion 3, frequency 3
 Distortion 3 telecoil
 Current sound
 Current idle
 Attack time
 Release time
 Maxgain @ 60 dB @ Maxgain
 Frequency @ Maxgain @ 60 dB
 Maxgain @ 50 dB @ Maxgain
 Frequency @ Maxgain @ 50 dB
 Maxgain @ 60 dB @ ref. Gain
 Frequency @ Maxgain @ 60 dB ref.
 Maxgain @ 50 dB @ ref. Gain
 Frequency @ Maxgain @ 50 dB ref.

In addition, all curves are stored in files under same name as the result file but with the following extensions:

- .ssp for SSPL curves
- .osp for OSPL curves
- .trn for transfer curves
- .agc for attack and release curves
- .mul for multiple curves
- .ost for OSPL curves with telephone coil