Operating Manual

UMTS/GSM Mobile Phone Tests

R&S® UPV-K9   R&S® UPV-K91

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ROHDE & SCHWARZ

Test and Measurement

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.

⚠ **DANGER** indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE indicates 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 ±10 % shall apply to the nominal voltage and ±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	Adver-tencia: 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**	PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.
⚠ **ADVERTENCIA**	ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.
⚠ **ATENCIÓN**	ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.
AVISO	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 ±10 % sobre el voltaje nominal y de ±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_{eff} > 30 V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.

11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.

14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.

15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.

16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.

17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.

18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.

2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".

3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.

4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.

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

6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.

7. 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 (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.

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

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

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ROHDE & SCHWARZ

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 8:00 AM – 8:00 PM	(except US public holidays) Eastern Standard Time (EST)
	Tel. from USA From outside USA Fax	888-test-rsa (888-837-8772) (opt 2) +1 410 910 7800 (opt 2) +1 410 910 7801
	E-mail	CustomerSupport@rohde-schwarz.com
East Asia	Monday to Friday 8:30 AM – 6:00 PM	(except Singaporean public holidays) Singapore Time (SGT)
	Tel. Fax	+65 6 513 0488 +65 6 846 1090
	E-mail	CustomerSupport@rohde-schwarz.com
Rest of the World	Monday to Friday 08:00 – 17:00	(except German public holidays) Central European Time (CET)
	Tel. Fax	+49 89 4129 13774 +49 (0) 89 41 29 637 78
	E-mail	CustomerSupport@rohde-schwarz.com

ROHDE & SCHWARZ

Address List

Headquarters, Plants and Subsidiaries

Headquarters

ROHDE&SCHWARZ GmbH & Co. KG
Mühldorfstraße 15 · D-81671 München
P.O.Box 80 14 69 · D-81614 München

Phone +49 (89) 41 29-0
Fax +49 (89) 41 29-121 64
info.rs@rohde-schwarz.com

Plants

ROHDE&SCHWARZ Messgerätebau GmbH
Riedbachstraße 58 · D-87700 Memmingen
P.O.Box 16 52 · D-87686 Memmingen

Phone +49 (83 31) 1 08-0
+49 (83 31) 1 08-1124
info.rsmb@rohde-schwarz.com

ROHDE&SCHWARZ GmbH & Co. KG
Werk Teisnach
Kaikenrieder Straße 27 · D-94244 Teisnach
P.O.Box 11 49 · D-94240 Teisnach

Phone +49 (99 23) 8 50-0
Fax +49 (99 23) 8 50-174
info.rsdts@rohde-schwarz.com

ROHDE&SCHWARZ závod
Vimperk, s.r.o.
Location Spidrova 49
CZ-38501 Vimperk

Phone +420 (388) 45 21 09
Fax +420 (388) 45 21 13

ROHDE&SCHWARZ GmbH & Co. KG
Dienstleistungszentrum Köln
Graf-Zeppelin-Straße 18 · D-51147 Köln
P.O.Box 98 02 60 · D-51130 Köln

Phone +49 (22 03) 49-0
Fax +49 (22 03) 49 51-229
info.rsdc@rohde-schwarz.com
service.rsdc@rohde-schwarz.com

Subsidiaries

R&S BICK Mobilfunk GmbH
Fritz-Hahne-Str. 7 · D-31848 Bad Münder
P.O.Box 20 02 · D-31844 Bad Münder

Phone +49 (50 42) 9 98-0
Fax +49 (50 42) 9 98-105
info.bick@rohde-schwarz.com

ROHDE&SCHWARZ FTK GmbH
Wendenschloßstraße 168, Haus 28
D-12557 Berlin

Phone +49 (30) 658 91-122
Fax +49 (30) 655 50-221
info.ftk@rohde-schwarz.com

ROHDE&SCHWARZ SIT GmbH
Am Studio 3
D-12489 Berlin

Phone +49 (30) 658 84-0
Fax +49 (30) 658 84-183
info.sit@rohde-schwarz.com

R&S Systems GmbH
Graf-Zeppelin-Straße 18
D-51147 Köln

Phone +49 (22 03) 49-5 23 25
Fax +49 (22 03) 49-5 23 36
info.rssys@rohde-schwarz.com

GEDIS GmbH
Sophienblatt 100
D-24114 Kiel

Phone +49 (431) 600 51-0
Fax +49 (431) 600 51-11
sales@gedis-online.de

HAMEG Instruments GmbH
Industriestraße 6
D-63533 Mainhausen

Phone +49 (61 82) 800-0
Fax +49 (61 82) 800-100
info@hameg.de

Locations Worldwide

Please refer to our homepage: www.rohde-schwarz.com
◆ Sales Locations
◆ Service Locations
◆ National Websites

1 Overview

The acoustic transmission and reproduction quality of a mobile phone is its most important characteristic in everyday use. Even the most visually appealing design and wonderfully sophisticated operating concept are not much use, when the user cannot or can hardly understand what is being said at the other end.

Instruments and methods for measuring acoustic characteristics are therefore essential tools for assessing the quality and suitability of a mobile phone.

Since a digital audio interface is no longer required even for conformance tests on 3rd generation mobile phones, it was necessary to develop new test methods that allowed measurements to be performed via the air interface and the normal speech coder and decoder. The test signals have to simulate human voice in the frequency and time domain to be able to test the mobile phone in the normal operating mode with DSP assessment such as voice activity detector (VAD), noise suppression, echo cancellation, etc switched on.

These tests are based on standards for 3GPP mobile phones. The test methods are stipulated in 3GPP TS 26.132 and the values to be attained in 3GPP TS 26.131.

As of release 4 of the GSM 51.010 standard (successor to GSM 11.10), even GSM mobile phones may be tested to 3GPP TS 26.132.

The R&S UPV-K9 and R&S UPV-K91 options (UMTS/GSM Mobile Phone Tests) of the Audio Analyzer R&S UPV, called herein below "UPV", are now available for measuring the acoustic characteristics of UMTS and GSM mobile phones. The measurements are in line with 3GPP TS 26.131, TS 26.132 and TS 51.010 and have been validated by an independent test house for conformance testing on UMTS and GSM mobile phones.

2   Preparation and Start of the Application Software

Required Measuring Instruments and Accessories

The Audio Analyzer R&S UPV with the following options is required for the measurements:

- Base Software for Mobile Phone Tests R&S UPV-K9

- UMTS/GSM Mobile Phone Tests R&S UPV-K91

Note: The UPV firmware version must be 2.4.0.452 or higher.

The GSM mobile phone under test is connected via the RF interface using the Universal Digital Radio Communication Tester R&S CMU200, called herein below CMU 200. This tester simulates a base station for the mobile phone so that a call can be set up. For GSM, the CMU200 must be equipped with the options CMU-B21 (signalling unit), CMU-B52 (speech coder/decoder) and the appropriate software options for the GSM band used. For WCDMA (UMTS), the option CMU-B69 is required. Wideband-AMR tests require option CMU-K46 for both GSM and/or WCDMA (UMTS).

Note: The firmware level in the CMU200 must be 4.52 or higher.

Acoustic devices such as an artificial mouth, artificial ear and other accessories are required for the measurements. The following equipment from Brüel & Kjær or G.R.A.S. is normally used:

Table 1   Equipment for mobile phone tests

Device	Description	Type (examples)
Telephone test head	Device for fixing the DUT in the prescribed position	B&K 4602B
Wideband ear simulator	IEC 711 type occluded ear simulator with adapters for connection to the ear piece of the DUT	B&K 4195 (type 3.2)
Artificial mouth	Special loudspeaker for simulation of the mouth	B&K 4227 or G.R.A.S. 44AB or 44AA (with power amplifier)
Head and torso simulator	Head and torso simulator with artificial ear (type 3.3) and artificial mouth, may be used alternatively to the abovementioned devices	B&K 4128 D
Handset fixture for Head and Torso simulator	Required to position the handset on the artificial head, and to apply a defined force with the earpiece against the pinna	B&K 4606
Measurement microphone	½" or ¼" measurement microphone for measurement of artificial mouth output during calibration. This microphone can use the preamplifier of the artificial ear.	B&K4191 (free field, may be used for hands free tests), B&K 4192 (pressure field, may be used with type 1 art. ear)
Acoustic calibrator	Sound level calibrator for calibrating the measuring microphone	B&K 4231
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.*

A cable with a BNC connector and special small or angled banana plugs is required for connecting the artificial mouth, as the space between the mouth connectors and the LRGP test head (B&K 4602B) is too small for common banana plugs.

The transformer supplied with option R&S UPV-K9 must be connected between generator output 1 of Audio Analyzer R&S UPV and the connector of the artificial mouth. The transformer matches the impedance of the loudspeaker in the artificial mouth to that of the generator output of the R&S UPV. Without this transformer, the available power is too low for driving the artificial mouth.

Alternatively, a power amplifier, preferably with a voltage gain of approx. 0 dB, can be connected between generator output and mouth instead of the transformer. In this case, the gain set must be kept absolutely stable after calibration.

A cable with male (analyzer) and female (generator) XLR connector is supplied for connection to the "Speech" connector of the Digital Radio Communication Tester CMU.

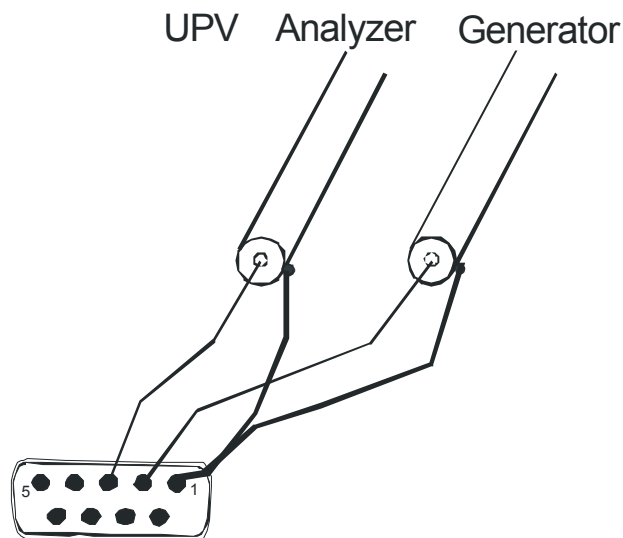Fig. 1   Assignment of 9-contact speech connector on CMU front panel

This cable is configured for connection to link handler #1 in the CMU. Depending on the CMU hardware, link handler #2 in the CMU can also be used for GSM; in this case, the supplied adapter must be inserted between the cable and the speech connector on the CMU.

Note: *If the CODEC calibration fails, the adapter has most likely to be inserted.*

Note: *The CMU connects pin 1 of the R&S UPV generator output to the equipment grounding conductor of the mains. If an external power amplifier is used, care must be taken that the external power amplifier does not connect R&S UPV generator output pin 2 to the equipment grounding conductor of the mains. If available, a balanced connection to the power amplifier should be preferred.*

Attention: *An external power amplifier should be switched on after the R&S UPV-K9x program has been started, and switched off before the program is ended. This prevents the artificial mouth from undue power loading by setups which are loaded external to the application.*

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

Caution: *R&S UPV-K9x does not support the use of headphones. Do not connect headphones to the R&S UPV during mobile phone tests. High level signals may be present at the headphone connector.*

The program required and the associated files are in the folder "UPV-K9x Software" on the installation CD supplied with the R&S UPV-K91 option. The audio analyzer must meet the following firmware requirements:

- R&S UPV firmware version 2.4.0.452 or higher

- Option R&S UPV-K9 installed

- Option R&S UPV-K91 installed.

Installing the Software

The application program requires option keys K9 and K91 to be installed. The keys are installed in the factory in case a new R&S UPV is ordered together with these options. If the options are ordered separately, the keys as well as the installation manual are part of the delivery.

It is recommended to copy the files UPV-K9x.msi, Config.ini, dotnetfx.exe, Setup.exe and Settings.ini from the folder "UPV-K9x 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-K9x\Version x.y". Run the file "Setup.exe" to start the installation. Follow the instructions of the installer on the screen.

To have full control over minimized windows, it is recommended to set the windows taskbar to "Auto-hide", on top of other windows. Right-click on the Windows Start button and click "properties".
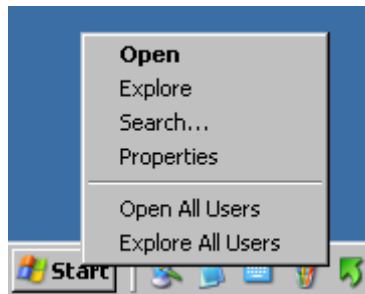

Fig. 2   Context menu for taskbar

In the properties window, click tab "Taskbar" and activate "Auto-hide the taskbar" and "Keep the taskbar on top of other windows". Click "Apply" and close the window.
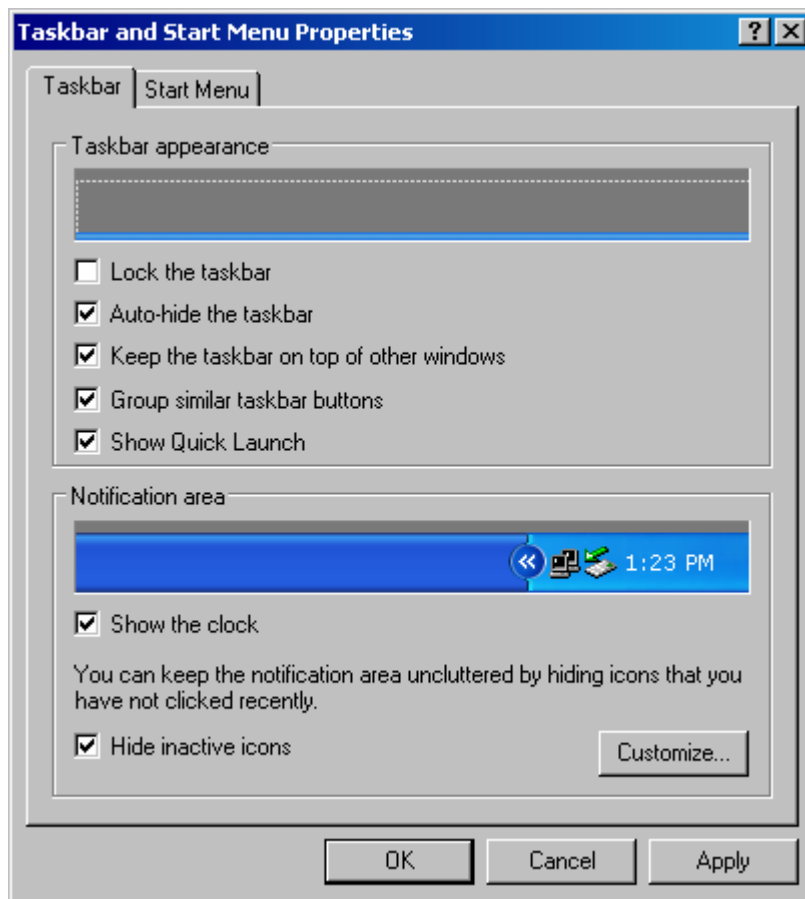

Fig. 3   Properties window for taskbar

Test Setup
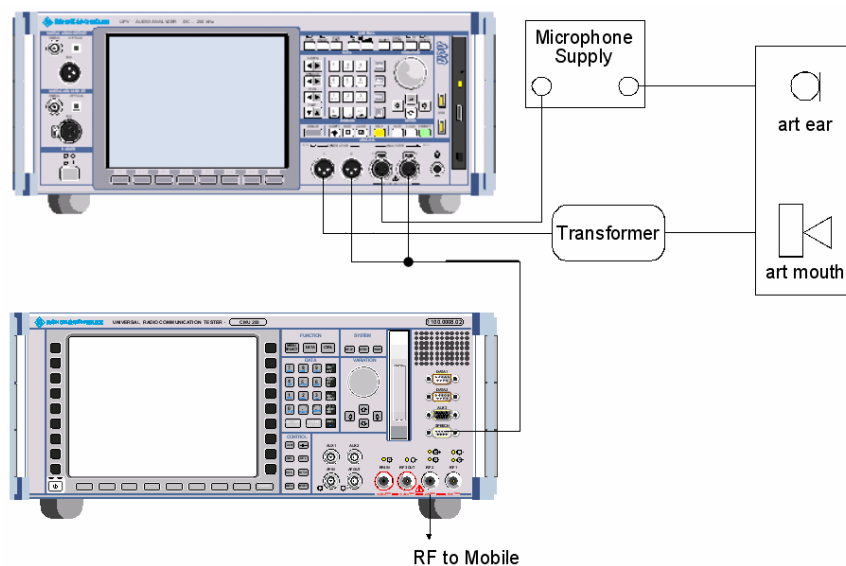
Fig. 4   Test setup and connection of external components

3GPP TS 26.132 specifies binaural measurement for the test of Handsfree (speakerphone) devices using a head-and torso simulator (HATS). From Release 8, binaural measurement is also foreseen for binaural headsets. The HATS 4128 supplied by Bruel & Kjaer offers an optional left ear simulator 4159C for binaural measurements. The second ear simulator has to be connected to UPV analyzer input 2 for binaural receiving measurements. As this input is also used to connect to the CMU decoder output for sending measurements, R&S 3GPP Mobile Phone Tests UPV-K91 support automatic control of an input switcher UPZ. The connection for automatic input switching is done as shown in Fig. 5.
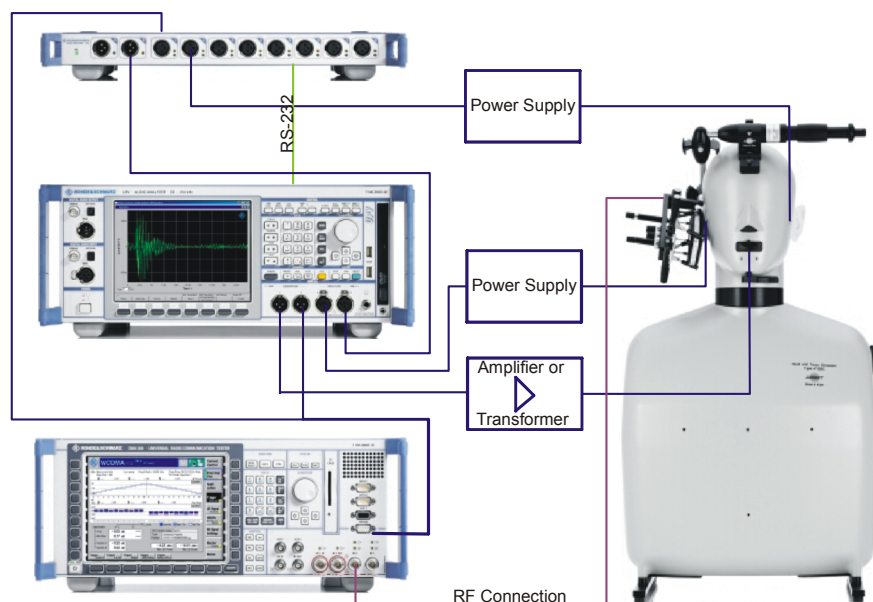
Fig. 5   Test setup and connection of external components for automatic swiching

Starting the Application Software

After installation, the program can be started by double-clicking the Icon "UPV-K9x Mobile Phone Tests" or by clicking "R&S UPV Applications → UPV-K9x Mobile Phone Tests" in the "Programs" menu.

At the fist start of the program, selection windows appear for the standard according to which the measurements should be made, and for the artificial ear and artificial mouth used.

Fig. 6   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. "Non-standard handset" and "non-standard hands free" select handset or hands-free tests, respectively, which can be customized.
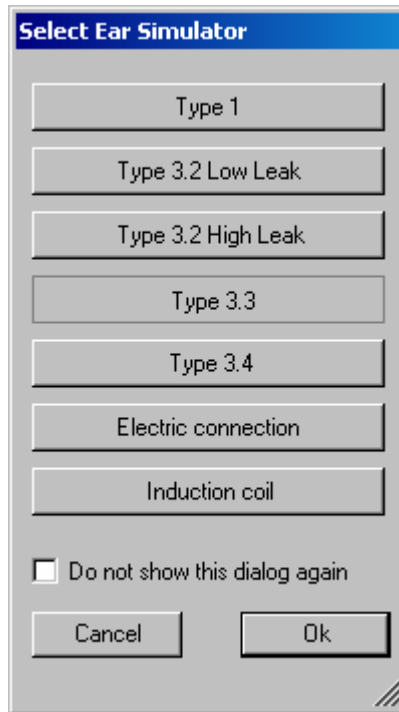
Fig. 7   Query window for selection of artificial ear
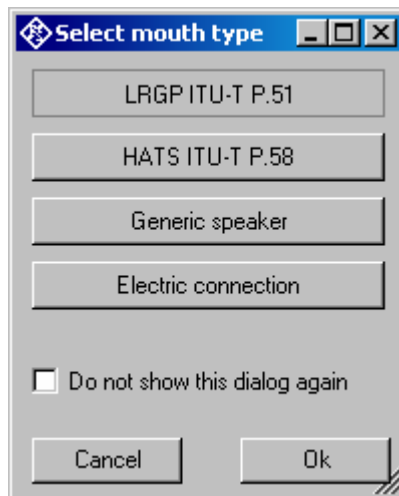
Fig. 8   Query window for selection of artificial mouth

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). After the last of the three selection windows has been closed, the main window of the R&S UPV-K9 opens.
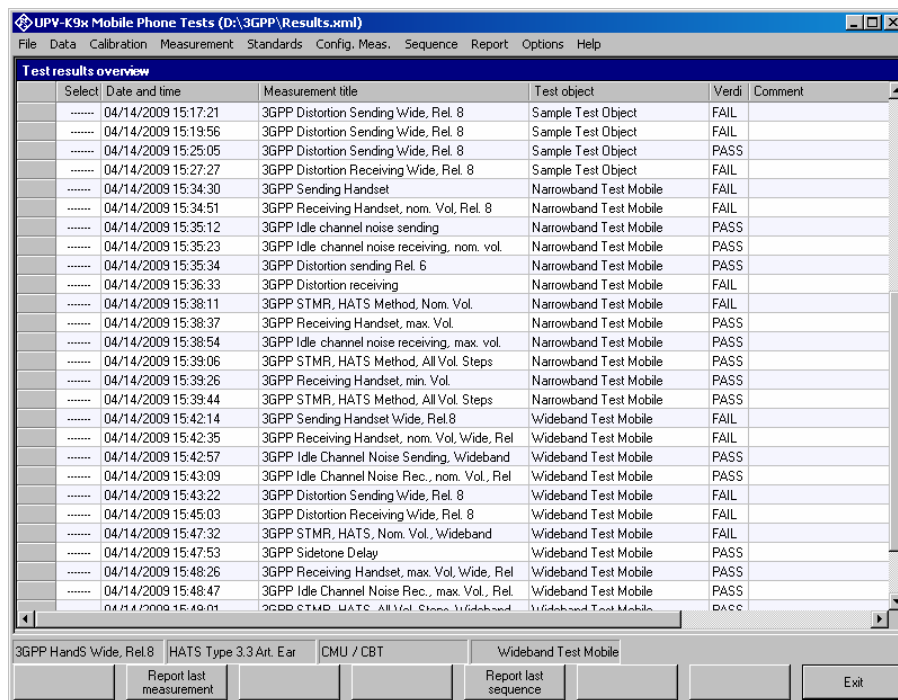
Fig. 9   Main window

Initially the data grid in the center of the screen which shows the result overview is empty. The screenshot in Fig. 9 shows an example after a number of measurements have been made.

By clicking with the right mouse button on the data grid, a context menu opens which allows to create a report of a result marked by a solid triangle in the respective row header, delete the marked result or to export one of the curves in the marked result graph to an ASCII format.
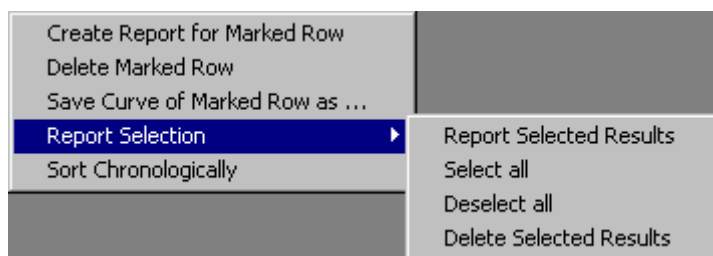
Fig. 10   Context menu of the result data grid
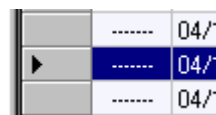
Fig. 11 A triangle in the row header indicates a marked row

The "Report Selection" submenu allows to report on or delete a selection of results which have been marked in the "Select" column of the data grid. To select or unselect a result, click in the "Select" column of the respective

row. Selected rows show "XXXXX", unselected rows show "-------" in this cell.

If the results have been sorted alphabetically according to one of the columns by clicking on the respective column header, the chronological order can be restored using the context menu item "Sort Chronologically".

Operating Concept

R&S 3GPP mobile phone tests consist of the main user interface window which allows general settings, calibration routines, data handling, automatic sequencing and reporting tools, and of test macros for basic measurement types defined in the standards. Each measurement type provides a set of parameters (R&S UPV setup files, limits etc.) which are defined in separated measurement definition files, one for each test case.

Options (General settings)

Fig. 12   Options menu

The "Options" menu in the main window allows to change a set of general settings like ear type and mouth type used which are valid for all or at least a plurality of the tests.

 **"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.

"Artificial mouth" allows to select the type of artificial mouth used. For details on the handling of calibration data see section 4 "Calibration" below.

If **"Select artificial mouth at startup"** is checked, the selection window for the artificial mouth is opened at each start of the program.

"System simulator" allows to select the type of system simulator used. For details on the handling of calibration data see section 4 "Calibration" below.

"Hands free settings" allows to select the acoustic instruments used for hands free testing. It is possible to use an ITU-T P.51 artificial mouth together with a free field microphone, a HATS with one artificial ear or a HATS with two artificial ears. If two artificial ears are used, the decoder has to be disconnected from analyzer input 2 and the second artificial ear has to be connected to it for receiving measurements. Do not forget to re-connect the decoder for any measurement in sending direction.

If "**Show operator instructions"** is checked, instructions to the operator are displayed in a window before the measurement starts. The operator may be prompted to position the mobile in a defined way or to set the volume to a certain setting.

"**Input Switcher**" allows to configure the use of a UPZ input switcher connected to the UPV RS-232 port, to switch analyzer input 2 between sending tests and binaural receiving tests.
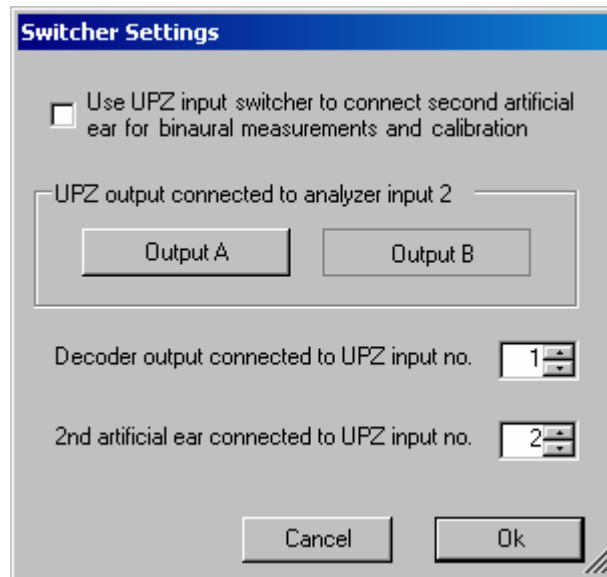
Fig. 13   Switcher window

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

If **"Generate temporary export files"** is checked, some of the measurement macros create "result.exp" with result value and verdict, and, if applicable, "curve.exp" or "abscurve.exp" and "relcurve.exp" files with curve data in ASCII format. This function is provided for compatibility with UPL-B9, and is not supported by all measurement types.

If "**Store results of further measurements"** is checked, curves and calculated values like loudness ratings are also stored for additional

measurements started with the "Add Measurement" key. They will appear in reports of the respective measurements.

Menu item "**Do not change scale for further meas.**" deactivates the automatic Y-axis scaling if the curve of an additional measurement leaves the plot area partially or totally.

If "**Store loaded curve data to results"** is checked, curves loaded from file with the "Load Curve" softkey are stored to the results database and will appear in reports of the respective measurements.

Attention: *Do not attempt to modify files with extensions "set", "sup", "xml", "cal" "seq" or "mdf", using a text editor. Any change with a text editor may make the files unusable and cause malfunction of the software.*

3 Calibration

Calibration Devices

R&S UPV-K9 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.
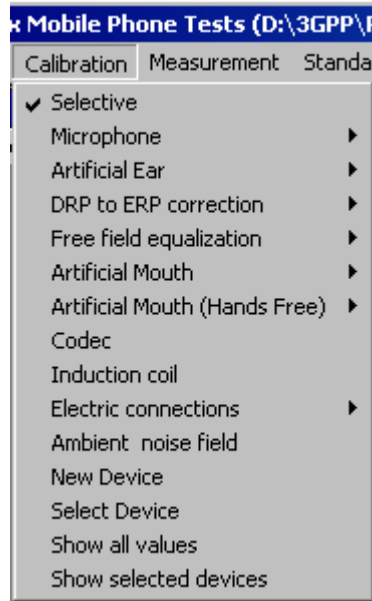
Fig. 14   Calibration menu

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. If the box "Immediately select this device" is checked, the device is selected for immediate use with the "Save, select and close" button.

For ease of use, a "default" device is present and selected for each device type (category) upon first start of the program.

Fig. 15   Input window for information about calibrated device

Before a device can be calibrated or used, it must be selected. This can be done from the "Calibrated Device" input window if the checkbox "Immediately select this device" is checked. Existing devices may 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. 16   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.
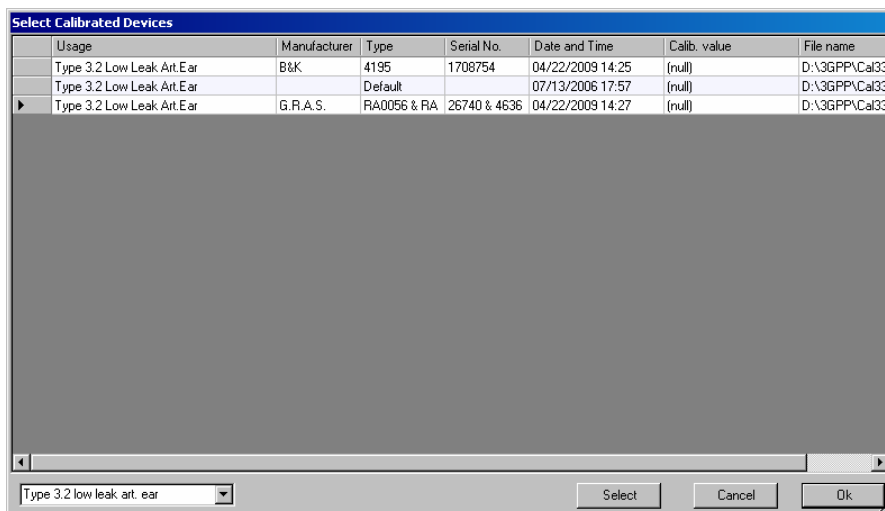
Fig. 17   Selection window for particular device type

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-K91 option are stored independently of other options. Calibration values for 3GPP tests and CDMA2000 tests are handled separately.

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.

An overview of all selected calibration devices together with the calibration values is given under the menu item "Calibration → Show selected devices".

Microphone Calibration

➢ **Insert the measuring microphone fully into the adapter of the sound level calibrator and switch on the calibrator. A ½" adapter or ¼" adapter is required according to the microphone diameter.**

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

➢ **Call the test routine with "Calibration → Microphone → Free field" or "Calibration → Microphone → Diffuse field" from the main menu, depending on the microphone.**
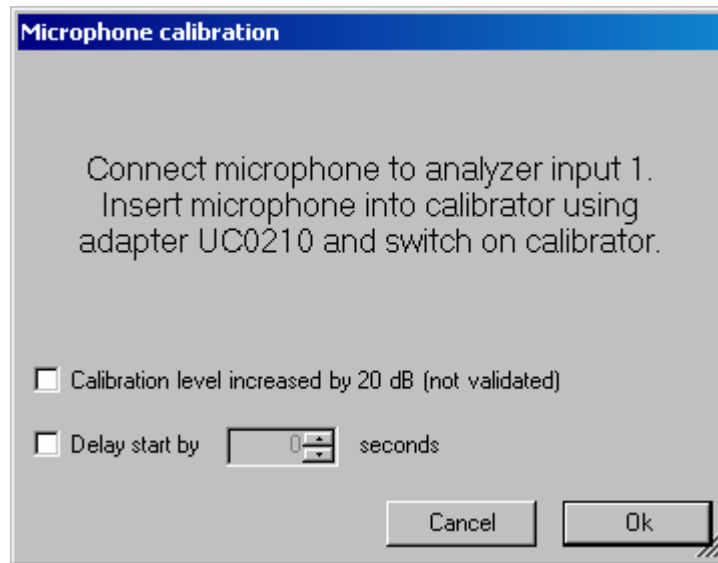
Fig. 18   Initial window of microphone calibration

For calibrators providing a sound pressure level of 114 dB (10 Pa), the checkbox "Calibration level increased by 20 dB" must be checked. In all other cases the checkbox must remain unchecked! If a calibrator with a frequency other than 1000 Hz is used, make sure that the "Selective" item in the Calibration menu is unchecked.

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) . If a conditioning amplifier with 20 dB gain (recommended value) is used, the displayed sensitivity must be about 10 times higher (e.g. 120 mV/Pa). If the voltage measured is below 3 mV, 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 test be repeated. After switching on the microphone power supply, wait approx. 20 s before starting the calibration again.

Calibration of Artificial Ear

Prior to the measurements, the absolute sensitivity of the microphone in the artificial ear must be determined using a sound level calibrator such as the Brüel & Kjær 4231 with a sound pressure level of 94 dBSPL or a sound pressure of 1 Pa at 1 kHz.

Calibration of Ear Type 1

➢ **Switch off the microphone power supply.**

    Attention: The 200 V polarization voltage of the microphone may cause a slight electric shock. The current is harmless, but the microphone preamplifier may be damaged.

➢ **Remove the microphone from the artificial ear.**

➢ **Screw back the microphone capsule and switch on the operating voltage.**

➢ **Insert the 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 compensation.

➢ **Select "Calibration → Artificial ear → Type 1" from the main menu.**

For calibrators providing a sound pressure level of 114 dB (10 Pa), the checkbox "Calibration level increased by 20 dB" must be checked. In all other cases the checkbox must remain unchecked!

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) . If a conditioning amplifier with 20 dB gain (recommended value) is used, the displayed sensitivity must be about 10 times higher (e.g. 120 mV/Pa). If the voltage measured is below 3 mV or fluctuating by more than 0.2 dB, 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 test be repeated. After switching on the microphone power supply, wait approx. 20 s before restarting the calibration.

The reference value measured is stored in a file on the hard disk and used for all subsequent measurements when the same artificial ear type 1 is used as currently selected.

Calibration of Ear Type 3.2 Low Leakage

➢ **Connect the sound level calibrator tightly to the artificial ear using the adapter DP0939 and switch on the calibrator.**

➢ **Select "Calibration → Artificial ear → Type 3.2 Low Leak" from the main menu.**

For calibrators providing a sound pressure level of 114 dB (10 Pa), the checkbox "Calibration level increased by 20 dB" must be checked. In all other cases the checkbox must remain unchecked!

The output voltage of the microphone in the ear is measured and the sensitivity displayed with reference to 1 Pa. If the voltage measured is below 3 mV or fluctuating by more than 0.2 dB, 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 test be repeated. After switching on the microphone power supply, wait approx. 20 s before restarting the calibration.

The measured reference value is stored in a file on the hard disk and used for all subsequent measurements when the same ear type 3.2L is used as currently selected.

Reading the DRP-ERP Correction Data of the Artificial Ear of Type 3.2L:

The frequency response of the artificial ear of type 3.2L is supplied on a floppy together with the artificial ear. The data is used for transforming the measurement values from the drum reference point to the ear reference point.

➢ Connect a USB floppy disk drive with the calibration disk to the R&S UPV, copy the file "OES_LL.ADA" from the manufacturer's calibration disk to a USB stick or a CD-ROM or make this file available on a network drive via LAN**.**

➢ Call the routine "Calibration → DRP to ERP Correction → Type 3.2 Low leak". Browse to the file "OES_LL.ADA" and click "Open".

The calibration file is read. The modified data is stored on the R&S UPV hard disk. This procedure needs only be repeated after a change of the calibration data, e.g. after a recalibration of the ear by the manufacturer, or when the "3GPP" directory has been renamed or removed.

Calibration of Ear Type 3.2 High Leakage

➢ **Connect the sound level calibrator tightly to the artificial ear using the adapter DP0939 and switch on the calibrator.**

➢ **Select "Calibration → Artificial ear → Type 3.2 High Leak" from the main menu.**

For calibrators providing a sound pressure level of 114 dB (10 Pa), the checkbox "Calibration level increased by 20 dB" must be checked. In all other cases the checkbox must remain unchecked!

The output voltage of the microphone in the ear is measured and the sensitivity displayed with reference to 1 Pa. If the voltage measured is below 3 mV or fluctuating by more than 0.2 dB, 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 test be repeated. After switching on the microphone power supply, wait approx. 20 s before restarting the measurement.

The measured reference value is stored in a file on the hard disk and used for all subsequent measurements when the same ear type 3.2H is used as currently selected.

Reading the DRP-ERP Correction Data of the Artificial Ear of Type 3.2H:

The frequency response of the artificial ear of type 3.2H is supplied on a floppy together with the artificial ear. The data is used for transforming the measurement values from the drum reference point to the ear reference point.

➢ Connect a USB floppy disk drive with the calibration disk to the R&S UPV, copy the file "OES_HL.ADA" from the manufacturer's calibration disk to a USB stick or a CD-ROM or make this file available on a network drive via LAN**.**

➢ Call the routine "Calibration → DRP to ERP Correction → Type 3.2 High leak". Browse to the file "OES_HL.ADA" and click "Open".

The calibration file is read. The modified data is stored on the R&S UPV hard disk. This procedure needs only be repeated after a change of the calibration data, e.g. after a recalibration of the ear by the manufacturer, or when the "3GPP" directory has been renamed or removed.

Calibration of Ear Type 3.3

➢ **Remove the pinna from the artificial ear according to the manufacturer's instructions**

➢ **Connect the sound level calibrator tightly to the artificial ear using the adapter UA-1546 and switch the calibrator on.**

➢ **Select "Calibration → Artificial ear → HATS Type 3.3" from the main menu.**

For calibrators providing a sound pressure level of 114 dB (10 Pa), the checkbox "Calibration level increased by 20 dB" must be checked. In all other cases the checkbox must remain unchecked!

The type 3.3 ear calibration requires the calibrator with adapter UA-1546 to be held manually against the ear. If the HATS is installed remote from the UPV, the checkbox "Delay start by … seconds" can be checked and a time interval can be entered by which the start of the calibration measurement is delayed. The countdown is displayed on the UPV screen.
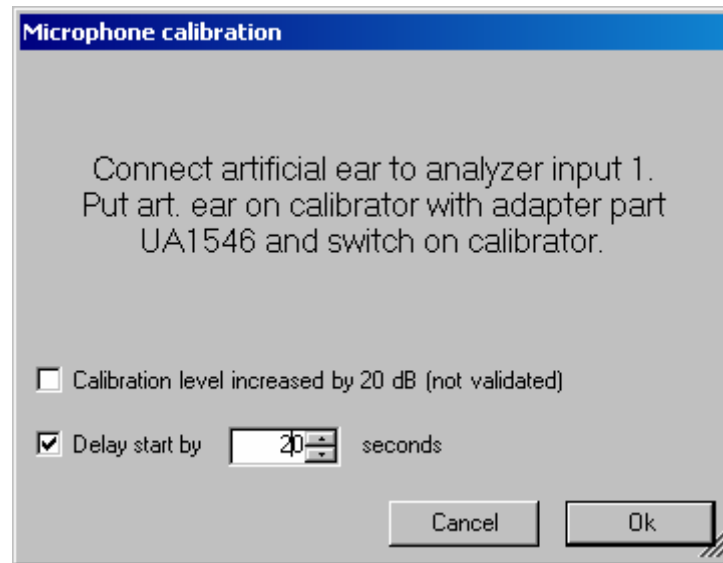
Fig. 19   Ear calibration window with delayed start

The output voltage of the microphone in the ear is measured and the sensitivity displayed with reference to 1 Pa. If the voltage measured is below 3 mV or fluctuating by more than 0.2 dB, 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 test be repeated. After switching on the microphone power supply, wait approx. 20 s before restarting the calibration.

The measured reference value is stored in a file on the hard disk and used for all subsequent measurements when the same ear type 3.3 is used as currently selected.

Reading the DRP-ERP Correction Data of the Artificial Ear of Type 3.3:

Call the routine "Calibration → DRP to ERP Correction → Type 3.3 →From ITU-T P.57 Table 2b". This procedure needs only be repeated when the "3GPP" directory has been renamed or removed.

Alternatively it is also possible to load individual DRP-ERP correction data from a calibration disk. This option is not conformant with the standards.

Calibration of Ear Type 3.4

➢ **Remove the pinna and the ear canal simulator, connect the sound level calibrator tightly to the artificial ear using the short steel adapter and switch the calibrator on.**

➢ **Select "Calibration → Artificial ear → HATS Type 3.4" from the main menu.**

For Head Acoustics HMS II, calibrator B&K 4231 must be used in conjunction with the short steel calibration adapter.

The output voltage of the microphone in the ear is measured and the sensitivity displayed with reference to 1 Pa. If the voltage measured is below 3 mV or fluctuating by more than 0.2 dB, 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 test be repeated. After switching on the microphone power supply, wait approx. 20 s before restarting the calibration.

The measured reference value is stored in a file on the hard disk and used for all subsequent measurements when the same ear type 3.4 is used as currently selected.

Reading the DRP-ERP Correction Data of the Artificial Ear of Type 3.4:

Call the routine "Calibration → DRP to ERP Correction → Type 3.4 → From ITU-T P.57 Table 2b". This procedure needs only be repeated when the "3GPP" directory has been renamed or removed.

Alternatively it is also possible to load individual DRP-ERP correction data from a calibration disk. This option is not conformant with the standards.

Calibration of Artificial Mouth for Handset Tests

Before a mobile phone can be tested, the absolute sensitivity and frequency response of the artificial mouth have to be measured and corrected with the aid of a previously calibrated free-field or diffuse-field (pressure-field) microphone. The measuring microphone removed from artificial ear type 1 can be used for this purpose or an additional microphone capsule is screwed to the microphone preamplifier. The standard microphone is used as a reference for determining the frequency response of the mouth. The frequency response of the microphone can be ignored in the test frequency range (100 Hz to 8 kHz) (see also calibration certificate of microphone capsule).

Since interfering sound falsifies the corrections, the artificial mouth must be calibrated in the anechoic and isolated test chamber. In order to reject any noise present in the test chamber, it is recommended to activate item "Selective" in the calibration menu.

First of all, a calibrated measuring microphone has to be selected.

➢ **Select a reference microphone type with "Calibration → Artificial mouth → Select reference mic".**

For the selected microphone type, a device must be selected and calibrated (see above). This device must be connected to R&S UPV analyzer input 1 via power supply/conditioning amplifier.

For calibration of a P.51 type artificial mouth using a diffuse field type microphone (e.g. B&K 4131 or 4134) or a microphone from a Type1 artificial ear, fit the microphone at right angles to the mouth at the mouth reference point (MRP) using the gauge supplied with the mouth (positioning at right angles is necessary because diffuse field or pressure-calibrated microphones have a flat frequency response to sound from random incident direction and therefore exhibit an emphasis on high frequencies with frontal sound incidence).

For calibration of a P.51 type artificial mouth using a free field microphone, the microphone must be mounted in the axis of the sound outlet of the artificial mouth.

For calibration of the HATS (P.58 type) artificial mouth, a ¼" microphone is clamped in the fixture attached to the HATS.

➢ **Call the calibration routine with "Calibration → Artificial mouth → LRGP ITU-T P.51" or "Calibration → Artificial mouth → HATS ITU-T P.58" from the main menu.**

The sound pressure generated at the MRP is set to exactly -4.7 dBPa 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 artificial mouth. If the sound pressure cannot be adjusted to -4.7 dBPa, an error message is displayed with a request to check the connection of the artificial mouth and to repeat the measurement. A possible error source would be that the transformer supplied is not connected between the generator and the artificial mouth.

The uncorrected frequency response of the artificial mouth 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 in the mouth are measured and taken into account in the final equalization file as fine correction.

To verify the results, the absolute sound pressure versus frequency is measured at a sound pressure of 4.7 dBPa (reference value for most of the measurements). The absolute sound pressure at each frequency must be within a tolerance band of ±0.2 dB. Correct calibration without interfering sound yields an almost straight line in the middle between the two limit lines.

Calibration of CMU Speech Coder

The calibration of the speech coder and decoder is necessary to be able to calculate absolute loudness. Calibration has to be performed only once and must be repeated only if the CMU used is replaced. If the CMU is equipped with model 14 of the Link Handler CMU-B21, GSM as well as WCDMA use the same paths. Calibration of the coder is therefore identical for both operating modes and need not be repeated when switching from GSM to WCDMA or vice versa.

If GSM and WCDMA use different link handlers, separate calibration devices have to be generated for the two link handlers (i.e. with and without the supplied adapter).

Note that encoder and decoder are handled as separate devices but calibrated with one routine.

Auxiliary settings required for calibration can be found in the CMU under Bit Stream (for GSM) and under BS Signal, Dedicated Channel, Voice settings (for WCDMA) (firmware version 4.52 or higher). Call the calibration routines with "Calibration → Codec" from the main menu.

The following information is displayed:
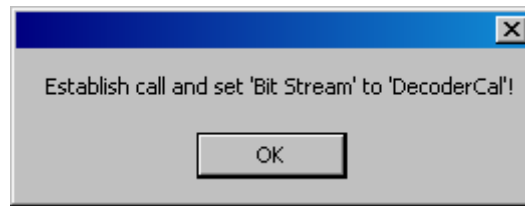
Fig. 20   Message box during decoder calibration

Set up a call to the mobile phone. Set bit stream or voice setting on the CMU to "Decoder Cal" and then click the "OK" button.

The actual voltage at the decoder output of the CMU is now measured for a digital full-scale signal and the required correction value is calculated and saved in the R&S UPV. The following request is then displayed:
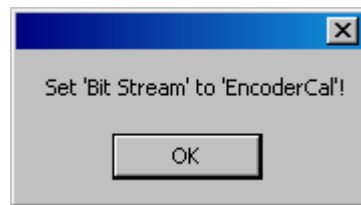
Fig. 21   Message box during encoder calibration

After the "OK" button has been clicked, the input sensitivity of the speech coder is measured and the input voltage required for digital full scale is measured at the speech coder and saved in the R&S UPV.

Calibration of Ambient Noise Field

For the calibration of the noise field for ambient noise rejection tests, all obstacles (test head or HATS, Telephone etc.) have to be removed from the test chamber. For the generation of the noise field, additional equipment is necessary. The noise field should have sufficient homogeneity (sound pressure level independent of place) and diffuseness (randomly incident sound at the place of the microphone). This can either be achieved in a reverberation room with omni-directionally radiating sound source or in an anechoic room with a number of uncorrelated noise sources. Limited homogeneity can be achieved in the centre between two speakers. For good diffuseness a minimum of four speakers distributed in different spatial directions are required.

A diffuse field or pressure field microphone must be positioned at the spot of the mouth reference point of the (removed) test head or HATS.

The menu Item Calibration → Ambient noise field opens the following window:
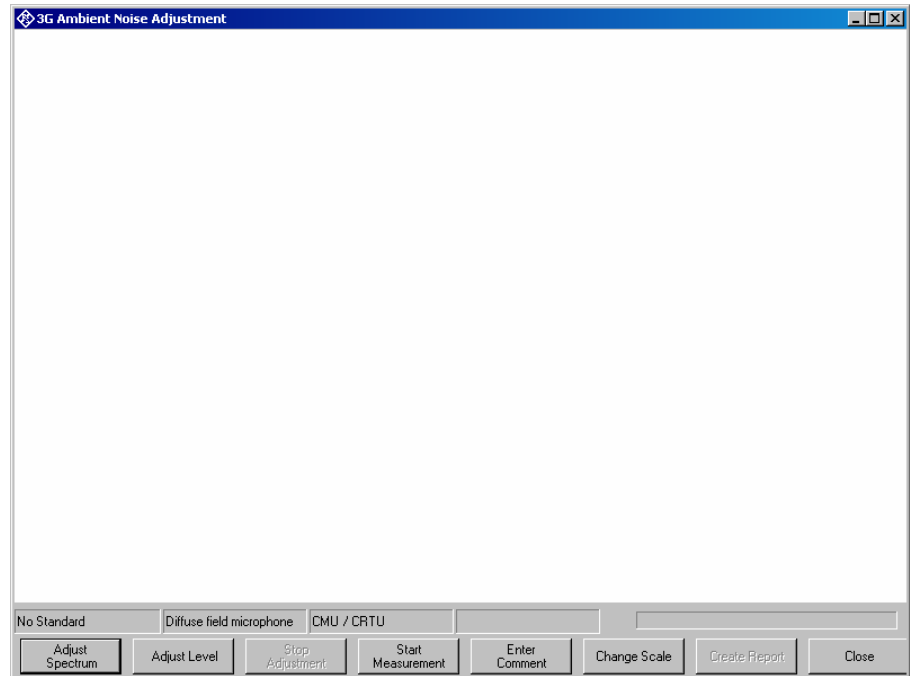
Fig. 22   Measurement window for ambient noise field calibration.

The button "Adjust Spectrum" starts a continuous spectrum measurement which allows to adjust the spectrum of the noise, e.g. using equalizers. The template is centred around the curve irrespective of the absolute level.
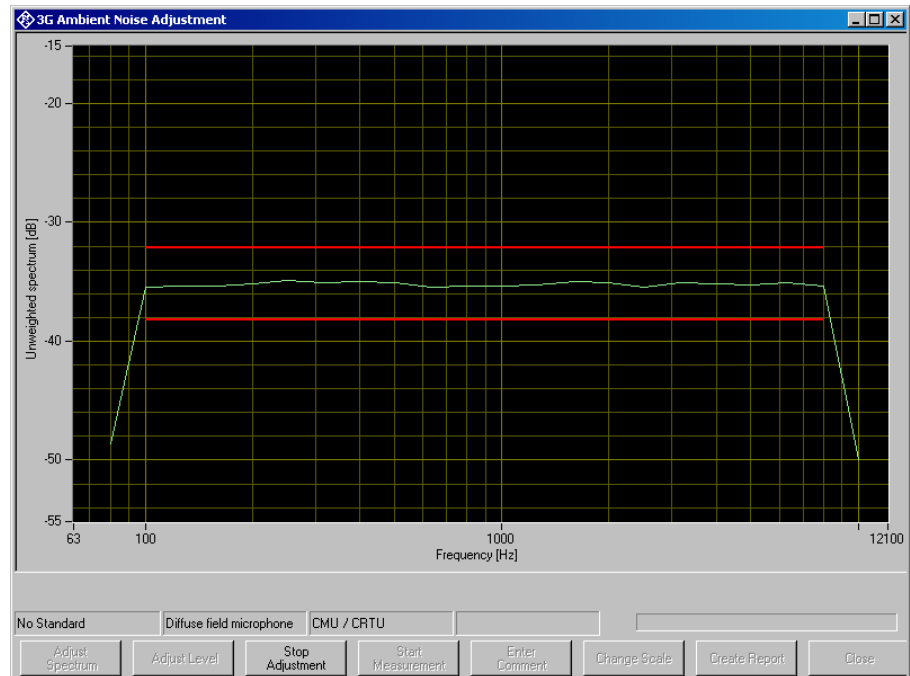
Fig. 23   Measurement window for spectrum adjustment.

The continuous spectrum measurement can be aborted by clicking "Stop Adjustment".

The button "Adjust level" starts a continuous level measurement. If a multitude of sources is used, each source must produce a sound pressure level of -24 dBPa – 3 * LOG n dB, whereby n is the number of noise sources.
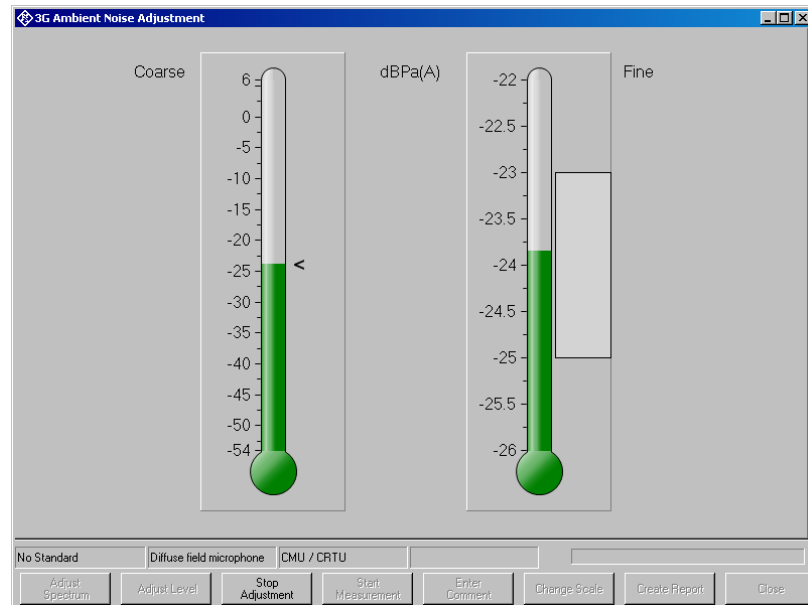
Fig. 24   Measurement window for level adjustment.

The left thermometer column gives a coarse overview. The right column has an enlarged scale for fine adjustment.

The continuous level measurement can be aborted by clicking "Stop Adjustment".

Once the noise field has been adjusted, the result can be documented by pressing "Start Measurement". Although there is no calibration value to be used in the ambient noise rejection measurement, the level is stored and can be included for reference in the measurement report.

Fig. 25   Result of ambient noise calibration.
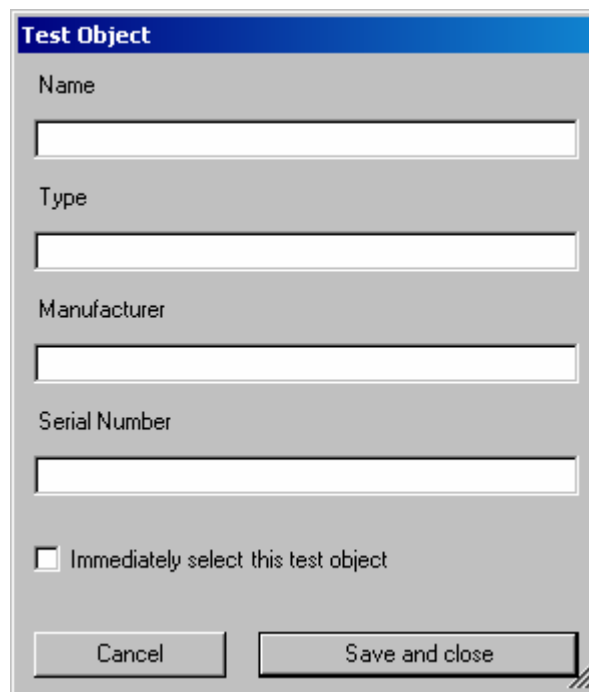
4   Data Entry for Reporting

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.

Fig. 26   Window for input of information about a test object

If the checkbox "Immediately select this test object" is checked, the test object associated with the entered data is automatically selected upon closing the window. 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.

A previously entered test object can be selected with "Data → Test object → Select".

5 Measurements

General

Special problems caused by the coding and decoding algorithms of mobile phones are encountered when measuring acoustic characteristics. Vocoders are used to attain the lowest possible data rate. Mobile phone voice codecs are optimized for transmitting human speech with low data rate. Not the actual voice signals but only the filter and fundamental parameters required for signal reconstruction are transmitted.

Purely sinusoidal tones normally used for audio measurements cannot be transmitted with such a system. Therefore, the coder and decoder had initially been excluded from the measurement, which required a specially prepared test mobile phone with a specific test interface.

In modern mobile phones, this interface is not available anymore. Measurements are generally performed via the air interface with the speech coder and decoder included. As mentioned above, measurements using sinusoidal tones cannot be performed because the static sinusoidal input signal becomes a more or less stochastic output signal as a result of coding, particularly in the medium and high audio frequency ranges.

Signals similar to voice therefore have to be used for the measurement, i.e. either artificial voice according to ITU-T P.50 or a multitone signal according to ITU-T P.501 is possible. At the same time, modulation of the signal in time must largely correspond to voice, since many modern mobile phones use algorithms for interference suppression which use the modulation to distinguish the useful from the interfering signal.

The test routines in the R&S UPV-K91 use an amplitude-modulated multitone signal according to ITU-T P.501 as described in 3GPP TS 26.132.

Starting measurements

Measurements can be started from the "Measurement" menu. This menu contains either all available measurements, or the measurements belonging to the selected standard if the checkbox "Allow only selected measurements" in the "Options → Select standard" window is checked.

The menu "Standards" allows to start any measurement, whereby the measurements are structured into submenus according to the standards to which they belong. This allows a quick and easy access to all available measurements.
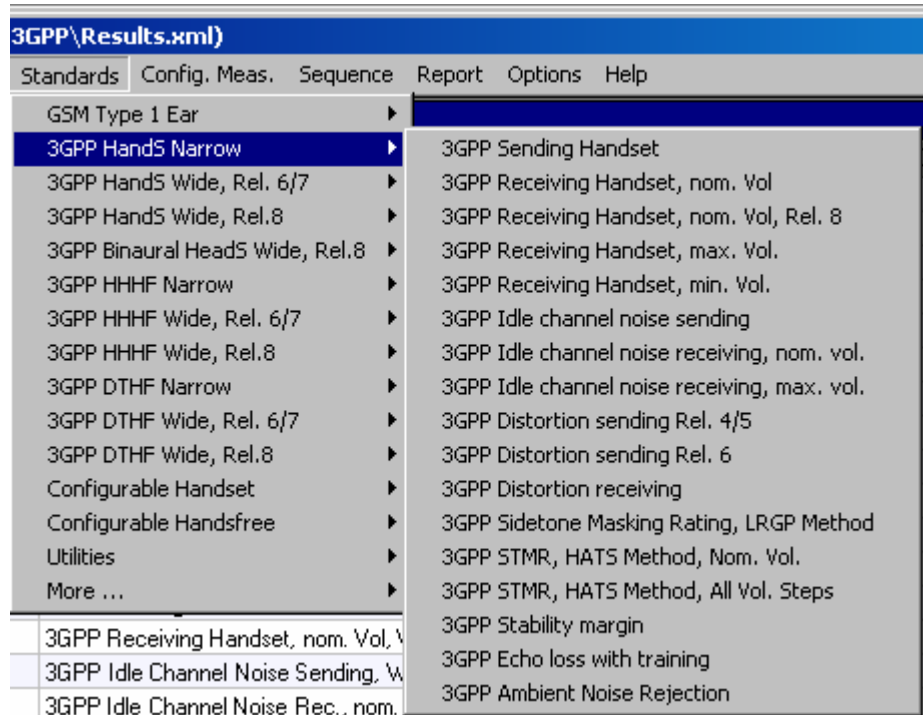
Fig. 27   "Standards" menu with submenu for narrow band handset tests according to 3GPP TS 26.132.

A third possibility to start a single measurement is the button "Run highlighted as single measurement" in the sequence menu (see chapter 7 below).

Functionality and control of the measurement macros
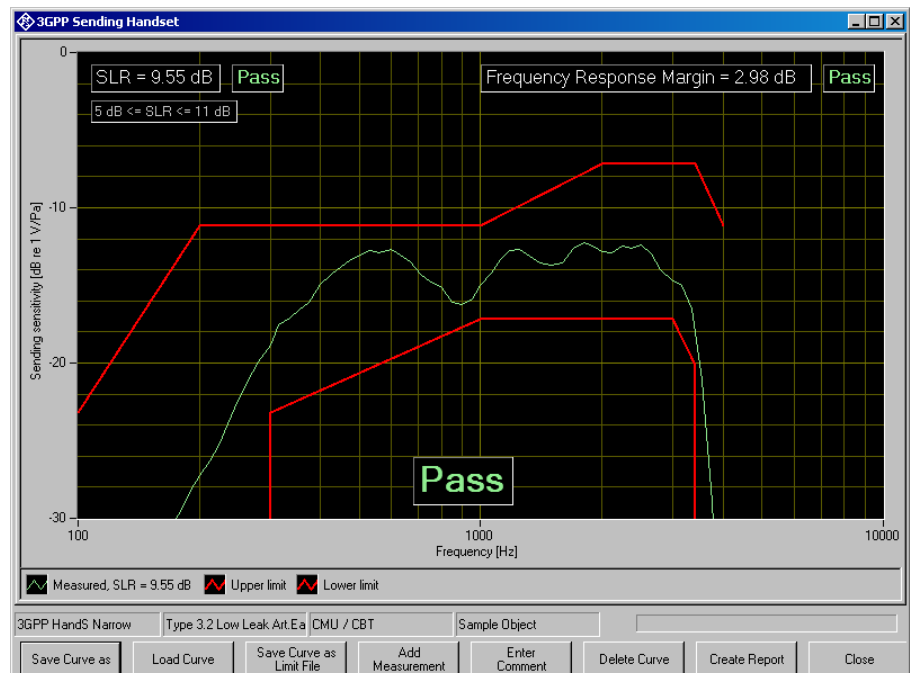
Fig. 28   Example of a measurement window

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:

```
Zoom Out
Unzoom
Show Cursor
Change Scale
Data Point Size
Comment
Save Screenshot as ...
```
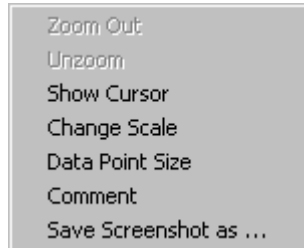
Fig. 29   Context menu of the graph window

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.
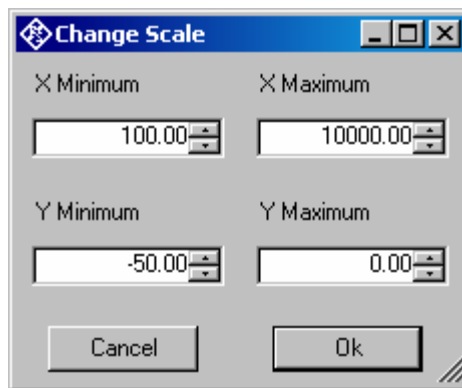
Fig. 30   Window for changing the scale of the graph

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.

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.

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.

Storing a Hardcopy of the Graph

With the menu item "Save Screenshot as …" in the graph context menu, a hardcopy of the current graph window with all numeric displays, legend etc. can be stored as image. The current view of the graph including additional curves, current scaling and size is copied. However, colours are inverted to a printer-friendly colour set.
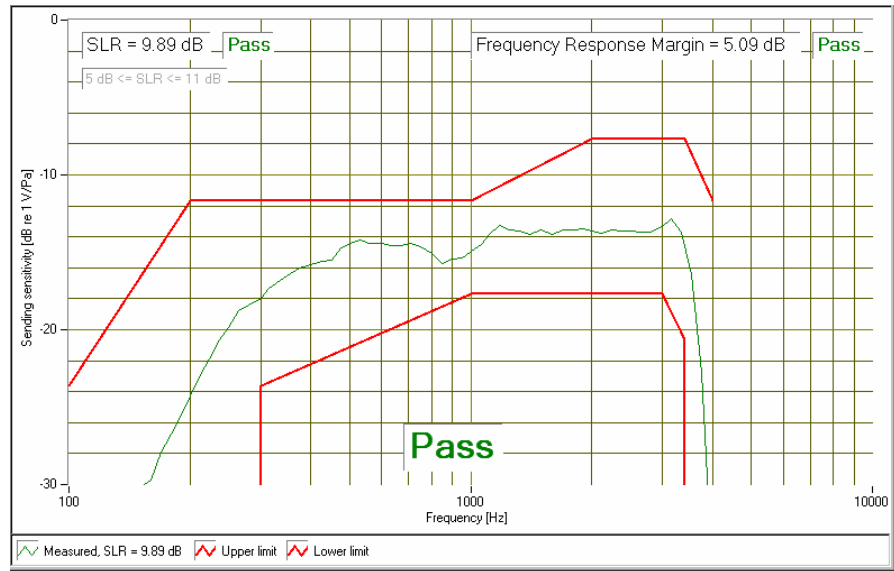
Fig. 31   Hardcopy of measurement graph

Making Additional Measurements

The softkey "Add Measurement" triggers another measurement according to the specification of the test. Loudness ratings and other result values like total noise level are calculated and displayed in the legend. The additional curves and results will appear in the report if item "Store results of further measurements" had been activated before the measurement was started. However, limits are not checked for additional measurements.

This function can e.g. be used to find the correct volume setting to pass nominal RLR. It can further be used for adjustments in the device under test.

Storing and Loading Curves

All curves in the graph can be stored to an ASCII file (*.tra), and such curves can be loaded back into the graph. For easy import to Excel the csv format is also offered. The softkey "Store Curve" opens a window in which a combo box offers choice between the legends of all curves in the graph. The curve associated in which the selected entry is stored to the file with the specified format at the specified location.

If the "Options" menu item "Store loaded curves to results database" is checked, loaded curves are stored together with the measurement results and will appear in reports about the measurement.

Frequency response curves may also be stored as (relative!) UPL-compatible trace files.

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.

Deleting Additional Curves in the Measurement Graph

By pressing or clicking "Delete Curve", an additional curve in the measurement graph can be removed. A window pops up with a combo box in which the curve to be deleted can be selected. Note that it is not possible to delete the curve of the first measurement, as this is the measurement for which the verdict is given. The selected curve disappears from the graph on the screen and is removed from the database such that it does not appear in reports anymore.

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.

Closing the Measurement Window

The softkey "Close" closes the measurement window. The control is returned to the R&S UPV-K9 main window. All relevant data associated with the measurement is imported to the results data. A new entry appears for the measurement as new row on the bottom of the overview data grid in the main window.

Notes on Handset Measurements

Applicability of Measurements and Equipment Depending on the Release

The 3GPP standard is constantly updated according to technical advances etc. Therefore different versions of the specifications exist in parallel, the so-called releases. Depending on the release selected for audio testing, the following rules apply for artificial ears and for the measurements/standards offered in this version of the UPV-K9x software:

Table 2 Compatibility of equipment and measurements with the releases of 3GPP TS 26.132.

Release	4	5	6	7	8	9
Artificial Ears						
Ear Type 1	GSM only	-	-	-	-	-
Ear Type 3.2 LL & HL	X	X	X	X	NB only	-
Ear Type 3.3 & 3.4	X	X	X	X	X	X
Standards						
GSM Type 1 Ear	GSM only	-	-	-	-	-
3GPP HandS Wide, Rel. 6/7	-	-	X	X	-	-
3GPP HandS Wide, Rel. 8	-	-	-	-	X	X
3GPP Binaural HeadS Wide, Rel. 8	-	-	-	-	X	X
3GPP HandS Wide, Rel. 6/7	-	-	X	X	-	-
3GPP HandS Wide, Rel. 8	-	-	-	-	X	X
3GPP HandS Wide, Rel. 6/7	-	-	X	X	-	-
3GPP HandS Wide, Rel. 8	-	-	-	-	X	X
Measurements						
3GPP Receiving Handset, nom. Vol.	X	X	X	X	-	-
3GPP Receiving Handset, nom. Vol., Rel. 8	-	-	-	-	X	X
3GPP Distortion Sending, Rel. 4/5	X	X	-	-	-	-
3GPP Distortion Sending, Rel. 6	-	-	X	X	X	X
3GPP Sidetone Masking Rating, LRGP Method	X	X	X	X	X	-
3GPP STMR, HATS Method	-	-	-	from 7.1	*	*
3GPP STMR, HATS Method, Rel. 8.2+9	-	-	-	-	**	**
3GPP Ambient Noise Rejection	X	X	X	X	X	X
3GPP ANR, w. 3 dB Uncertainty Allowance	-	from 5.1	X	X	X	X
3GPP Ambient Noise Rejection, Wideband	-	-	X	X	X	X
3GPP ANR, Wideb., Rel. 8, w. 3 dB Uncert. Allow.	-	-	-	-	X	X

* Applicable for tests according to release 8 as long as version 8.2 of TS 26.131 and TS 26.132 is not available. Applicable for tests according to release 9 as long as version 9.2 of TS 26.131 and version 9.1 of TS 26.132 are not available.

** Has to be used for all tests according to release 8 as soon as version 8.2 of TS 26.131 and TS 26.132 is available. Has to be used for all tests according release 9 as soon as version 9.2 of TS 26.131 and version 9.1 of TS 26.132 are available.

Sending Frequency Response and Loudness Rating

("3GPP Sending Handset", "3GPP Sending Handset Wideband, Rel. 6/7", "3GPP Sending Handset Wide, Rel.8")

Sending Frequency Response

The sending frequency response is specified as the transmission ratio in dB of the voltage at the decoder output to the input noise pressure at the artificial mouth.

The mobile phone under test is installed in the LRGP (loudness rating guard-ring position) according to ITU-T P.76, and the receiver is sealed to the artificial ear.

Tones with a sound pressure of -4.7 dBPa are created with the artificial mouth at the MRP (mouth reference point), and the corresponding output voltage is measured at the CMU speech decoder output and evaluated.

The sending frequency response must be within the limit lines specified according to table 1 of 3GPP TS 26.131. The absolute sensitivity is not yet taken into account.

Table 3 Sending frequency response limit lines for narrowband according to table 1 of 3GPP TS 26.131

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	-12	
200	0	
300	0	-12
1000	0	-6
2000	4	-6
3000	4	-6
3400	4	-9
4000	0	

Table 4 Sending frequency response limit lines for wideband AMR according to table 9 of 3GPP TS 26.131, release 6 and 7

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	-12	
200	0	
300	0	-12
1000	0	-6
2000	4	-6
5000	4	-6
6300	4	-9
8000	0	

Table 5 Sending frequency response limit lines for wideband AMR according to table 9 of 3GPP TS 26.131, release 8

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	-6	
200	2	
300	2	-12
1000	2	-6
2000	4	-6
5000	4	-6
6300	4	-9
8000	0	

The offset of the measured frequency response to the upper or lower limit line is calculated and then the whole limit template is shifted to be centered with respect to the measured curve. Then another limit check is performed. If the shifted curve is now within the limit lines, PASS is output, otherwise FAIL is displayed. The limit check is performed at each measured frequency. If the measured value and the end point of a limit line are not at the same frequency, it may happen that the trace slightly crosses a corner of the limit line although there are no limit violations. The remaining margin is displayed. A negative margin shows the amount of limit violation.

Sending Loudness Rating

The sending loudness rating (SLR) takes into account the absolute loudness in the transmit direction and weights the tones in compliance with the average speech spectrum and the normal sensitivity of the average human ear.

To this end, the frequencies (Hz) of bands 4 to 17 (narrowband) or bands 1 to 20 (wideband), resp., are evaluated according to table 1 of ITU-T P.79.

Table 6 Frequencies (Hz) of bands 1 to 20 acc. to table 3 of ITU-T P.79

Band	1	2	3	4	5	6	7
f (Hz)	100	125	160	200	250	315	400

Band	8	9	10	11	12	13	14
f (Hz)	500	630	800	1000	1250	1600	2000

Band	15	16	17	18	19	20
f (Hz)	2500	3150	4000	5000	6300	8000

The sensitivity in dBV/Pa at each frequency is defined as the difference between the level at the network interface (digital level measured at the analog CMU speech output) and the sound pressure level at the mouth reference point (MRP), and the sending loudness rating is calculated according to formula 5-1 of ITU-T P.79. The weighting factors are taken from ITU-T P.79, table A2 for narrowband and for wideband according to release 8, and from ITU-T P-79, table G1 for wideband according to release 6 and 7. Note that loudness rating values are loss values, i.e. a high loudness rating values indicates a low gain and a low loudness rating value indicates a high gain.

Due to the input sensitivity tolerance of the CMU speech coder, the individual sensitivity of the CMU used has to be taken into account in order to calculate the sending loudness rating (see calibration routines). According to 3GPP TS 26.131, the sending loudness rating should be between 5 dB and 11 dB, with lower dB values corresponding to greater loudness (5 dB = maximum loudness, 11 dB = minimum loudness). The measured SLR is indicated in a window in the frequency response display and checked for compliance with these limits. In addition to the numeric value, either PASS or FAIL is displayed.

The general PASS or FAIL information is obtained from the limit check of the frequency response curve and the loudness rating. PASS is output only if both the curve and the loudness value are within tolerances.

Fig. 32   Sending frequency response with SLR value displayed

Receiving Frequency Response and Loudness Rating

("3GPP Receiving Handset, nom. Vol.", "3GPP Receiving Handset, nom. Vol., Rel.8", "3GPP Receiving Handset, max. Vol.", "3GPP Receiving Handset, min. Vol.", "3GPP Receiving Handset, nom.Vol., Wide, Rel. 6/7", "3GPP Receiving Handset, max.Vol., Wide, Rel. 6/7" ,"3GPP Receiving Handset, min.Vol., Wideband", "3GPP Receiving Handset, nom.Vol., Wide, Rel. 8", "3GPP Receiving Handset, max.Vol., Wide, Rel. 8", "3GPP Rec. Bin Headset, Nom. Vol., Wideband, Mon. meas.", "3GPP Rec. Bin Headset, Nom. Vol., Wideband, Bin. meas.", "3GPP Rec. Bin Headset, Max. Vol., Wideband, Mon. meas.", "3GPP Rec. Bin Headset, Max. Vol., Wideband, Bin. meas.", "3GPP Rec. Bin Headset, Min. Vol., Wideband, Mon. meas.", "3GPP Rec. Bin Headset, Min. Vol., Wideband, Bin. meas.")

The following three measurement definitions are available, as the permissible limit values of the loudness rating depend on the volume set in the mobile phone under test: "3GPP Receiving Handset, nom. Vol" checks loudness rating limits for nominal loudness setting and at the same time compliance with the frequency response limit template. "3GPP Receiving Handset, max. Vol." checks the receiving loudness rating at the highest volume setting against a minimum. "3GPP Receiving Handset, min. Vol." checks the receiving loudness rating at the lowest volume setting against a maximum. *(Note: As the loudness rating is a loss value, a high RLR is associated with a soft speech signal and a low RLR is associated with a loud speech signal).*

Receiving Frequency Response

The receiving frequency response is specified as the transmission ratio in dB of the sound pressure in the artificial ear to the rms value at the network interface, applied as input voltage at the speech coder input of the CMU. The measured sound pressure is referenced to the ear reference point (ERP). For ear type 1, the measuring microphone is directly applied to the ERP and no further correction is required. For ear types 3.x, the measuring microphone is applied to the drum reference point (DRP), which is the reason why any measured value has to be converted to the ERP by means of calibration factors. For special purpose there are separate measurements supplied with R&S UPV-K91 which measure the sound pressure referenced to the DRP.

The mobile phone under test is installed in the LRGP (ITU-T P.76) or on the HATS. In case of ear type 1, the receiver is sealed to knife edge of the artificial ear. In case of ear type 3.2, the receiver is sealed to the rubber gasket of the artificial ear. If the low leak version of this ear type is used, care must be taken that the defined leak opening at the circumference of the artificial ear is not accidentally covered.

The speech coder is driven such that tones with a system reference level of -16 dBm0 are obtained. The sound pressure in the artificial ear is measured and evaluated.

Ear type 1 will no longer be used for measurements on 3GPP mobile phones. Therefore, 3GPP TS 26.131 defines limit values only for ear types 3.x, whereas the limit values specified in 3GPP TS 51.010 (previously GSM 11.10) are still valid for ear type 1.

Table 7   Limit lines according to table 30.2 of 3GPP TS 51.010 (ear type 1)

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	-10	
200	0	
300	2	-7
500	*	-5
1000	0	-5
3000	2	-5
3400	2	-10
4000	2	

* Intermediate values are obtained by drawing a straight line between the specified values and using a logarithmic frequency scale and a linear dB scale.

Use tests "3GPP GSM Rel. 4 Receiving Handset, nom. Vol", "3GPP GSM Rel. 4 Receiving Handset, max. Vol", "3GPP GSM Rel. 4 Receiving Handset, min. Vol" for receiving tests with type 1 artificial ear.

When ear type 1 is used, the receiving frequency response must be within the limit lines specified in table 30.2 of 3GPP TS 51.010. When ear type 3.x is used, it must be within the limit lines specified in table 2 of 3GPP TS 26.131. In the frequency response curve, the limit template is shifted to be centred with respect to the displayed absolute sensitivity.

Table 8   Limit lines for narrowband receiving frequency response according to table 2 of 3GPP TS 26.131, up to release 7 (ear type 3.x)

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
70	-10	
200	2	
300	*	-9
500	*	*
1000	*	-7
3000	*	*
3400	*	-12
4000	2	

* Intermediate values are obtained by drawing a straight line between the specified values and using a logarithmic frequency scale and a linear dB scale.

Table 9   Provisional limit lines for narrowband receiving frequency response according to table 2 of 3GPP TS 26.131, from release 8 (ear type 3.x), for further study

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
100	6	-
200	6	-
300	6	-6
1000	6	-6
2000	8	-6
3400	8	-6
4000	8	-

* Intermediate values are obtained by drawing a straight line between the specified values and using a logarithmic frequency scale and a linear dB scale.

Table 10   Limit lines for wideband receiving frequency response according to table 10 of 3GPP TS 26.131, release 6 and 7 (ear type 3.x)

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
70	-10	
200	2	
300	*	-9
500	*	*
1000	*	-7
3000	*	*
3400	*	*
6300	*	-14
8000	2	

Table 11   Limit lines for wideband receiving frequency response according to table 10 of 3GPP TS 26.131, release 8 (ear type 3.x)

Frequency (Hz)	Upper limit (dB)	Lower limit (dB)
70	6	
200	6	-10
300	6	-6
1000	6	-6
2000	8	-6
5000	8	-6
6300	8	-12
8000	8	

The margins of the measured frequency response to the upper and lower limit lines are calculated separately, and then the whole template is shifted such that the resulting margins to upper and lower limit are equal. Then another limit check is performed. If the shifted curve is now within the limit lines, PASS is output, otherwise FAIL is displayed. The limit check is performed at each measured frequency. If the measured value and the end point of a limit line are not at the same frequency, it may happen that the trace slightly crosses a corner of the limit line although there are no limit violations. The remaining margin is displayed. A negative margin shows the amount of limit violation.

Receiving Loudness Rating

The receiving loudness rating (RLR) takes into account the absolute loudness in the receive direction and weights the tones in compliance with the difference between an average speech spectrum and the normal threshold of hearing in quiet of the average human ear.

To this end, the frequencies (Hz) of bands 4 to 17 (narrowband) or bands 1 to 20 (wideband), resp., are evaluated according to table 1 of ITU-T P.79 (see table 4)

The sensitivity at each frequency is specified as the ratio dBPa/V, calculated from the level difference between the level at the network interface (measured at the analog CMU speech decoder output) and the sound pressure level at the artificial ear, referenced to the ERP, and the receiving loudness rating is calculated according to formula 5-1 of ITU-T P.79. The weighting factors are taken from ITU-T P-79, table A2 for narrowband and for wideband according to release 8, and from ITU-T P-79, table G1 for wideband according to release 6 and 7.

Due to the output gain tolerance of the CMU speech decoder, the individual sensitivity of the CMU used has to be taken into account in order to calculate the receiving loudness rating (see section "Calibration" above).

The receiving loudness rating depends on the volume setting on the mobile phone under test and, according to 3GPP TS 26.131, should be between -1 dB and +5 dB for narrowband and for wideband according to release 8, and between 2 dB and 8 dB for wideband according to release 6 and 7, obtained at a rated ("nominal") loudness setting, with lower dB values corresponding to a higher loudness.

The RLR must not fall below -13 dB (-10 dB for wideband in release 6 and 7) when maximum loudness is set on the mobile phone. To prevent damage to the human ear, the maximum receiving loudness must not exceed a certain value.

The measured RLR is indicated in a window in the frequency response display and checked for compliance with these limits. In addition to the numeric value, either PASS or FAIL is displayed.

With "3GPP Receiving Handset, nom. Vol", the general PASS or FAIL information is obtained from the limit check of the frequency response curve and the loudness rating. PASS is output only if both the curve and the loudness value are within tolerances.

"3GPP Receiving Handset, max. Vol" checks only the RLR against a minimum of -13 dB. The frequency response curve is shown for information only.

"3GPP Receiving Handset, min. Vol" checks the RLR against a maximum of +18 dB.

Fig. 33   Receiving frequency response with RLR value displayed

Sidetone Masking Rating (STMR)

("GSM Rel. 4 Sidetone Masking Rating", "3GPP STMR, LRGP Method", "3GPP STMR, HATS Method, Nom. Vol.", "3GPP STMR, HATS Method, all Vol. Steps", "3GPP Sidetone Masking Rating, LRGP, Wideband", "3GPP STMR, HATS, Nom. Vol., Wideband", "3GPP STMR, HATS, All Vol. Steps, Wideband", "3GPP Bin. Headset, Nom. Vol., Wideband, Rel. 8", "3GPP STMR, HATS Method, Nom. Vol., Rel. 8.2+9", "3GPP STMR, HATS Method, all Vol. Steps, Rel. 8.2+9", "3GPP Sidetone Masking Rating, LRGP, Wide, Rel. 8.2+9", "3GPP STMR, HATS, Nom. Vol., Wide, Rel. 8.2+9", "3GPP STMR, HATS, All Vol. Steps, Wide, Rel. 8.2+9", "3GPP Bin. Headset, Nom. Vol., Wide, Rel. 8.2+9")

The sidetone path is the deliberate output of a part of the signal picked up by the microphone to the phone's receiver. This is to create a natural hearing impression for the person speaking on the phone as is encountered under normal conditions involving an acoustic path between mouth and ear.

Up to release 7.0 the STMR can only be measured according to standard using ear type 3.2 (low leakage) ("3GPP STMR, LRGP Method"). Up to release 4, ear type 1 may alternatively be used for 3GPP TS 51.010 only ("3GPP GSM Rel. 4 Sidetone Masking Rating"). For these tests the mobile phone under test is installed in the LRGP (ITU-T P.76), and the receiver is sealed to the artificial ear.

From release 7.1 it is also possible to use ear type 3.3 or 3.4 for this test. "3GPP STMR, HATS Method, Nom. Vol" has to be passed in the nominal setting of the user volume control. "3GPP STMR, HATS Method, All Vol. Steps" has to be passed in all (other) settings of the volume control.

The artificial mouth generates tones with a sound pressure of -4.7 dBPa at the MRP (mouth reference point), and the sound pressure is measured in the artificial ear.

The attenuation of the sidetone path is determined at each frequency according to table 1 of ITU-T P.79, and the sidetone masking rating (STMR) is calculated according to formula 5-1 of ITU-T P.79 with the weighting factors of table 3 of ITU-T P.79 taken into account. In addition, the gain of the sidetone path is displayed as a curve.

When the phone is set to nominal receiving loudness, the STMR should be within 13 dB and 23 dB according to 3GPP TS 26.131 when the LRGP method is applied. With the HATS method, the target STMR is between 12 dB and 20 dB at nominal volume setting. At all other volume settings, the STMR must not be below 8 dB with the HATS method.

From version 8.2 and 9.2 of TS 26.131 the target STMR range for the HATS method has been changed to within 13 and 23 dB. From Version 8.2. and 9.1 of TS 26.132 the weighting factors for unsealed condition of ITU-T P.79 Table B2 have to be used for the STMR calculation. These changes are taken into account with the test cases according to "Rel. 8.2+9".

Fig. 34   Typical measurement of sidetone masking rating

Sidetone Delay

("3GPP Sidetone Delay", "3GPP Sidetone Delay, Binaural")

The sidetone delay measurement is only specified from release 8 of the 3GPP specifications, and only for wideband AMR. Digital signal processing in the sidetone path can cause a delay of the sidetone, which would result in an annoying local echo in the handset or headset.

The test produces a short click in the artificial mouth and analyzes the amplitude-over-time response at the artificial ear, starting from the time when the click was produced at the artificial mouth. The first occurring maximum after approx. 1 ms is associated with the acoustic propagation from the HATS mouth to the HATS ear. There may be more maxima during the first milliseconds due to different propagation paths around the head. The time difference between the last occurring maximum exceeding a pre-defined level difference to the noise floor in the observed period, and the

first peak, is defined as sidetone delay. This value must not exceed 10 ms. If no significant maximum is found before 8 ms from the start of the click at the artificial mouth, the sidetone delay is defined to be smaller than 8 ms. In the measurement window, "< 8ms" is displayed as result whereas in the report the value will be simply displayed as "0 ms".
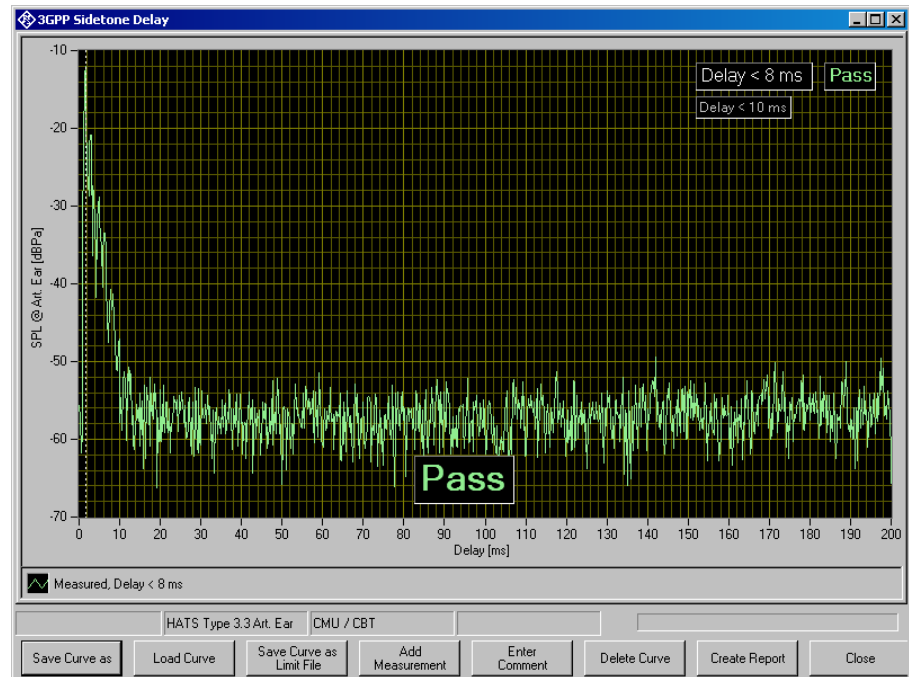

Fig. 35   Typical sidetone delay result

Echo Loss (TCLw)

("3GPP Echo loss with training", "3GPP Echo loss without training",)

The echo loss is the attenuation between the speech coder input and the speech decoder output (gain of speech coder + decoder = 1). Normally the echo is caused by internal acoustic coupling between the telephone receiver and the microphone. Since the echo considerably reduces the sound transmission quality, it must not exceed a certain level.

The mobile phone under test is suspended in free air in the anechoic test chamber (previous specifications used the LRGP).

A modulated multitone signal according to ITU-T P.501 is generated as a test signal and applied to the speech coder. First, the spectral energy distribution of the generated signal is measured in the third-octave bands from 200 Hz to 4 kHz. Then, the spectral distribution in the output signal of the speech decoder is measured. The echo loss is calculated from the differences of the bands according to ITU-T G.122. According to 3GPP TS26.132, the mobile phone under test has to be fed for approx. 10 s with the male and female version of artificial voice according to ITU-T P.50 prior to this measurement. This training sequence is to facilitate optimization for potential echo cancellers. A quicker test without training sequence is available as "3GPP Echo loss without training".

The actual gain of the speech coder and decoder must also be considered in the result. These values are obtained during codec calibration.

In addition, the attenuation of the echo path is displayed as a curve.

3GPP TS 26.131 specifies an echo loss of at least 46 dB; mobile phones with good echo cancellers can meet this requirement. Since the microphone of the mobile phone under test also picks up any side noise and treats it like an echo, it is essential that the test chamber is well shielded against external noise.
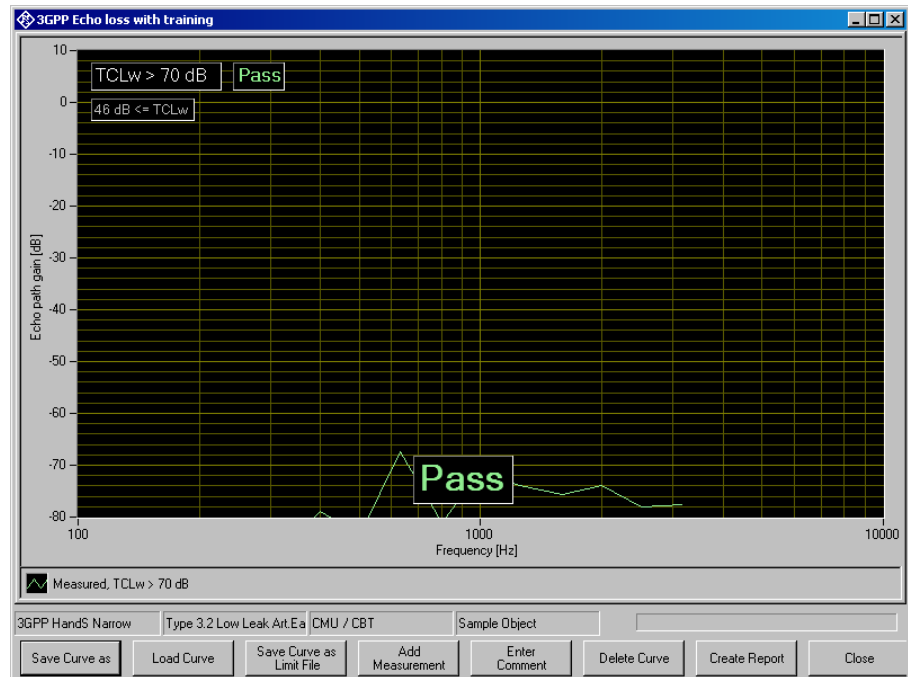

Fig. 36   Typical result of echo loss measurement

Stability Margin

("3GPP Stability margin")

The stability margin is measured to test the susceptibility of the phone to acoustic feedback and instability.

For the test, the telephone is placed on an even, hard board with the receiver and microphone pointing downwards.

A loop is closed in the R&S UPV between the receiving and the voice channel, and an overall gain of 6 dB is set. The gain of the coder is automatically taken into account (see also Echo Loss).

To activate the loop, a noise signal of -10 dBm0 in line with ITU-T O.131 is applied for 1 s and then switched off, with the loop remaining closed.
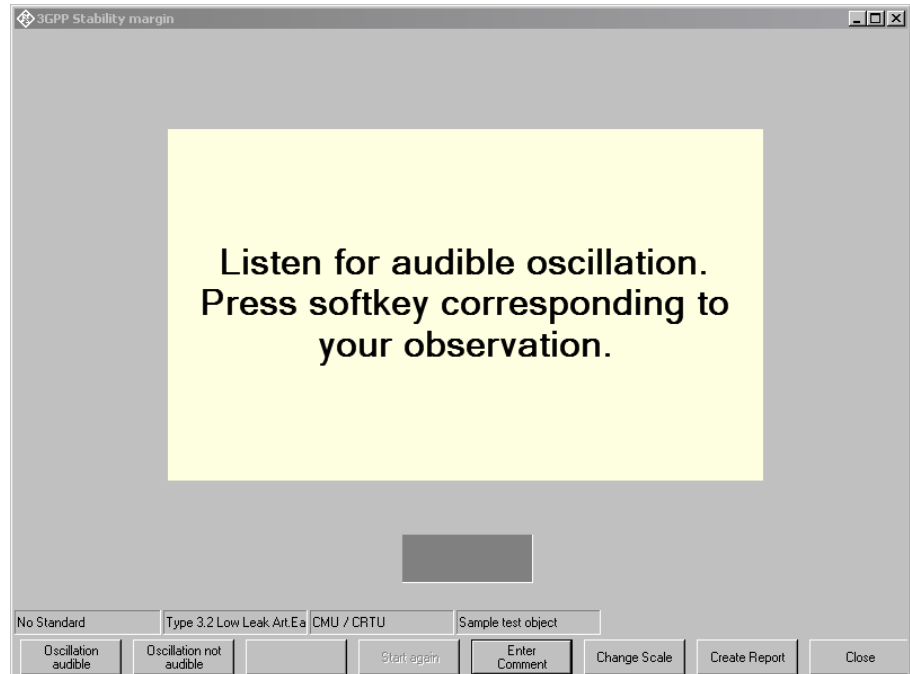
Fig. 37   Window during stability margin test

The test person has to listen to determine whether any resonances or oscillations are produced. If there are no oscillations, the minimum requirements according to 3GPP TS 26.131 for a stability margin of 6 dB are met.

Sending Distortion

("3GPP Distortion sending, Rel. 4/5", "3GPP Distortion sending, Rel. 6", "3GPP Distortion Sending Wideband, Rel. 6/7", "3GPP Distortion Sending Wide, Rel. 8")

The SINAD ratio in the transmit path is measured as a function of the sound level.

A pulsed sinusoidal tone of 1015 Hz with a pulse length of approx. 340 ms is used for the measurement. At this frequency, coding yields a sufficiently stable output signal. Voice activity detection continues to be active in the mobile phone under test due to this pulsating signal.

The mobile phone under test is installed in the LRGP or on the HATS.

The test signal is generated with the artificial mouth at the MRP (mouth reference point) and the SINAD value of the received signal is measured at the CMU decoder output.

The acoustic reference level (ARL) is defined as the sound pressure which creates a signal level of -10 dBm0 in the transmit channel. An automatic routine varies the sound pressure at the artificial mouth until the desired level is attained. This value is then used as a reference for determining the SINAD value versus level.

The SINAD value is measured at sound pressures between -35 dB and +10 dB relative to the acoustic reference level (ARL) and compared with the limits specified in table 7 of 26.131 of 3GPP.

Signal processing of a modern mobile phone comprises a voice activity detector which determines whether a voice signal is present or whether the sending signal just comprises background noise. With such mobile phones the sending distortion test according to 3GPP TS 26.132 before release 6.0.0 may be failed at low levels because the 1 kHz sinewave test signal is classified as background noise and suppressed. For this reason the sending distortion measurement according to release 6.0.0 and onwards omits levels below -25 dB and starts at high test tone levels gradually reducing the level. For this release, use "3GPP Distortion sending, Rel. 6", for earlier releases use "3GPP Distortion sending, Rel. 4/5".

Table 12   Limit lines specified in table 7 of 3GPP TS 26.131

dB relative to ARL	Level ratio
-25 dB	26.6 dB
-20 dB	30.7 dB
-10 dB	33.3 dB
0 dB	33.7 dB
7 dB	31.7 dB
10 dB	25.5 dB

The measurement is performed up to a maximum sound pressure of 10 dBPa at the artificial mouth if the value 10 dB relative to ARL with 10 dBPa cannot be attained. The actual trace may therefore end at a lower pressure. This occurs for mobile phones under test which have a low sensitivity in the transmit direction.

If the measured trace is above the limit line, PASS is output, otherwise FAIL is displayed.

Fig. 38   Sending distortion measurement

For tests in WB-AMR mode starting from release 8 of 3GPP TS 26.131 and TS 26.132, additional measurements are performed at the frequencies of 315 Hz, 408 Hz, 510 Hz and 816 Hz with a SPL of -4.7 dBPa at the MRP.

Other than in the previous version of the test, the levels are not defined relative to ARL, but as absolute SPL at the MRP. An activation signal is issued before each measurement to activate the VAD (voice activity detector) of the mobile under test. To avoid an impact of the activation signal on the result due to the processing delay in the transmission chain, the test routine comprises a delay measurement. The start of the analysis is delayed against the start of the test signal by the measured delay time.

Table 13 Limits specified in table 15 of 3GPP TS 26.131, release 8.

Frequency	Sending level (dBPa at the MRP)	Sending Ratio (dB)
315 Hz	-4,7	[28]
408 Hz	-4,7	[32]
510 Hz	-4,7	[32]
816 Hz	-4,7	[32]
1020 Hz	-20	[27]
	-15	[30]
	-10	[33]
	-4,7	[35]
	0	[35]
	+5	[30]
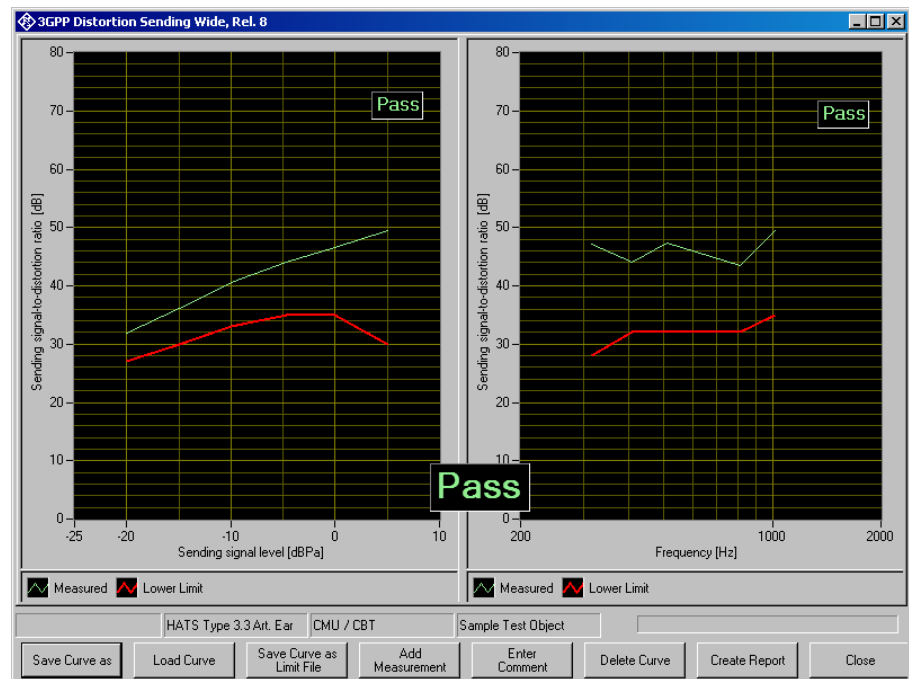
Fig. 39 Sending distortion measurement for wideband according to rel. 8

Receiving Distortion

("3GPP Distortion receiving", "3GPP Distortion Receiving Wide, Rel.8", "3GPP Dist. Rec. Wide, Binaural, Rel. 8")

The SINAD ratio in the receiving path is measured as a function of the acoustic signal level.

A pulsed sinusoidal tone of 1015 Hz is used for the measurement. At this frequency, coding yields a sufficiently stable output signal.
Voice activity detection continues to be active in the mobile phone under test due to this pulsating signal.

The mobile phone under test is installed in the LRGP (ITU-T P.76) with the receiver is sealed to the artificial ear, or on the HATS.

The test signal is applied to the input of the CMU speech coder, and the SINAD value of the sound pressure in the artificial ear is measured with psophometric weighting according to ITU-T G.714.

The SINAD value of the sound pressure is measured at levels between -45 dBm0 and 0 dBm0 and compared with the limits given in table 8 of 3GPP TS 26.131.

Table 14   Limit lines specified in table 8 of 3GPP TS 26.131

Level	Level ratio
-45 dBm0	17.5 dB
-40 dBm0	22.5 dB
-30 dBm0	30.5 dB
-20 dBm0	33.0 dB
-10 dBm0	33.5 dB
-3 dBm0	31.2 dB
0 dBm0	25.5 dB

The measurement is performed up to a maximum sound pressure of 10 dBPa in the artificial ear; the actual trace may end at an earlier point.

If the operator desires to see the receiving distortion value at the point exceeding 10 dBPa, this can be achieved by pressing the "add measurement" button. This causes the measurement to be repeated at all specified levels. The second measurement is not taken into account for reporting and Pass/Fail decision.

If the measured trace is above the limit line, PASS is output, otherwise FAIL is displayed.
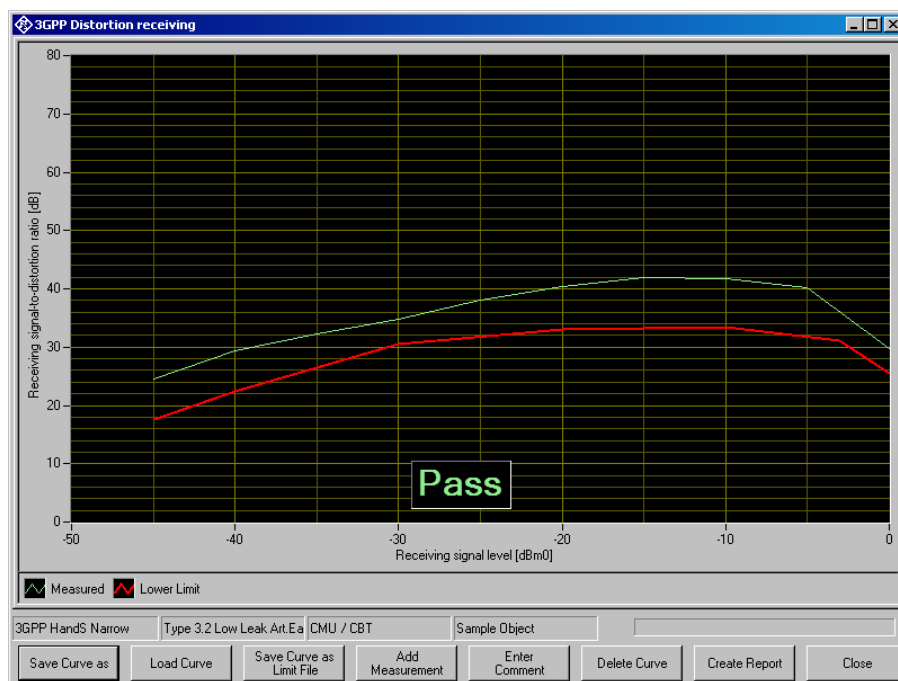
Fig. 40   Typical result of receiving distortion measurement

Table 15   Limits specified in table 16 of 3GPP TS 26.131, rel. 8

Frequency	Receiving level at the digital interface (dBm0)	Receiving ratio at nominal volume setting (dB)
315 Hz	-16	[20]
408 Hz	-16	[28]
510 Hz	-16	[28]
816 Hz	-16	[28]
1020 Hz	-45	[17,5]
	-40	[22,5]
	-30	[30,5]
	-20	[33,0]
	-16	[33,5]
	-10	33,5
	-3	31,5
	0	25,5

For tests in WB-AMR mode starting from release 8 of 3GPP TS 26.131 and TS 26.132, additional measurements are performed at the frequencies of 315 Hz, 408 Hz, 510 Hz and 816 Hz with a digital level of -16 dBm0 at the network interface (encoder input). An activation signal precedes the test signal. To avoid an impact of the activation signal on the result due to the processing delay in the transmission chain, the test routine comprises a delay measurement. The start of the analysis is delayed against the start of the test signal by the measured delay time.
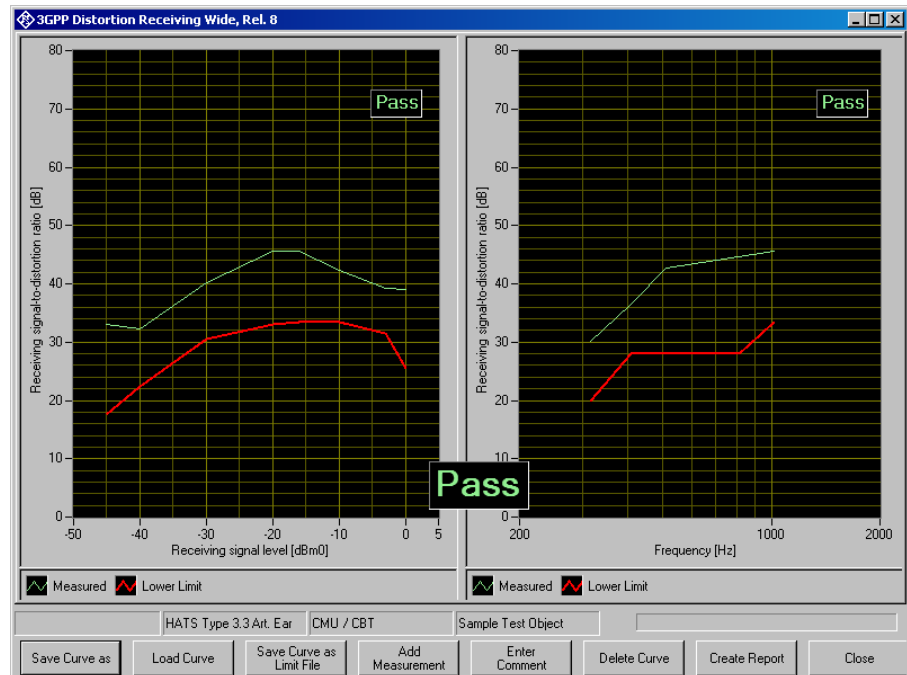
Fig. 41 Typical result of receiving distortion measurement in wideband according to release 8.

Idle Channel Noise Sending

("3GPP Idle channel noise sending", "3GPP Idle Channel Noise Sending, Wideband")

The noise voltage at the speech decoder output is measured with the phone set up in a quiet environment (<30 dB(A)).

The mobile phone under test is installed in the LRGP (ITU-T P.76) or on the HATS.

The decoder output voltage is measured, weighted and recalculated for the internal level in dBm0p.

For the narrow band test, the weighting is done psophometrically according to ITU-T G.223. For the wideband version of the test, A weighting according to IEC 60651 is applied.

To keep the mobile phone under test in the normal operating mode, a pulsed signal is applied. The noise level is measured during the signal pauses. The voice activity decoder (VAD) is activated and the mobile phone remains in the active normal sending mode.

The idle noise level should not exceed -64 dBm0p. The measured noise voltage is also displayed as a spectrum, making it easier to find causes if the limit value is exceeded.
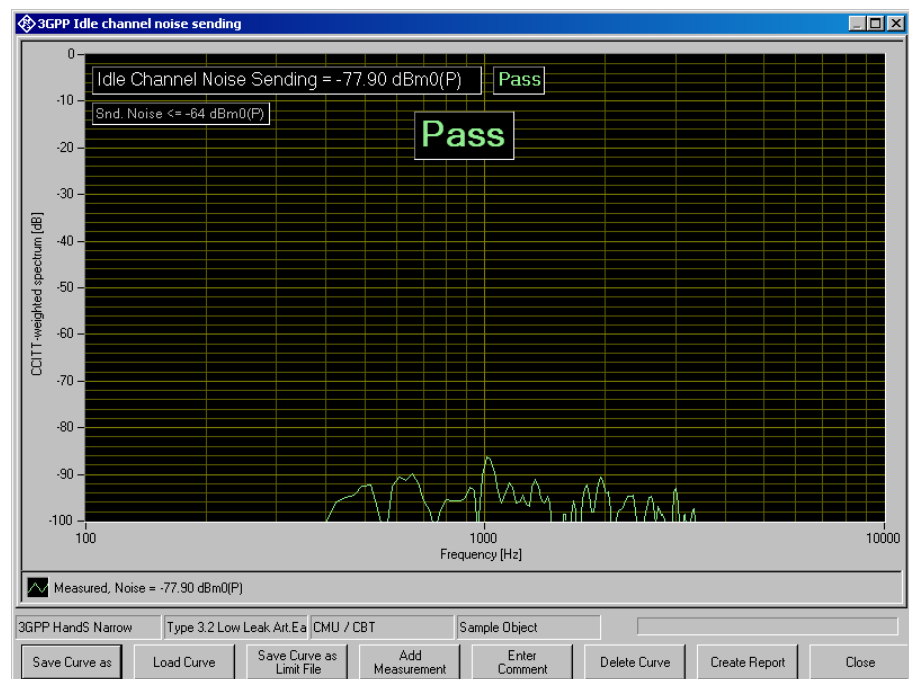
Fig. 42   Typical result of sending noise measurement

Idle Channel Noise Receiving

("3GPP Idle channel noise receiving, nom. Vol", "3GPP Idle channel noise receiving, max. Vol", "3GPP Idle Channel Noise Rec., Nom. Vol., Rel. 8", "3GPP Idle Channel Noise Rec., Max. Vol., Rel. 8", "3GPP Idle ch. noise rec.,binaural, nom. vol., Rel. 8", "3GPP Idle ch. noise rec., binaural, max. vol., Rel. 8")

The sound pressure in the artificial ear is measured with the phone set up in a quiet environment.

The mobile phone under test is installed in the LRGP (ITU-T P.76) with the receiver sealed to the artificial ear, or mounted on the HATS.

The sound pressure in the artificial ear is measured with A-weighting on.

To keep the mobile phone under test in the normal operating mode, a pulsed signal is applied to the speech coder input. The noise level is

measured during the signal pauses. The voice activity decoder is activated and the mobile phone remains in the active normal receiving mode.

With rated loudness set on the mobile phone, the sound pressure should not exceed -57 dBPa(A). In this case use test "3GPP Idle channel noise receiving, nom. Vol".

At maximum receiving loudness, the sound pressure should not exceed -54 dBPa(A). In this case use test "3GPP Idle channel noise receiving, max. Vol".

The measured noise voltage is also displayed as a spectrum, making it easier to find causes if the limit value is exceeded.
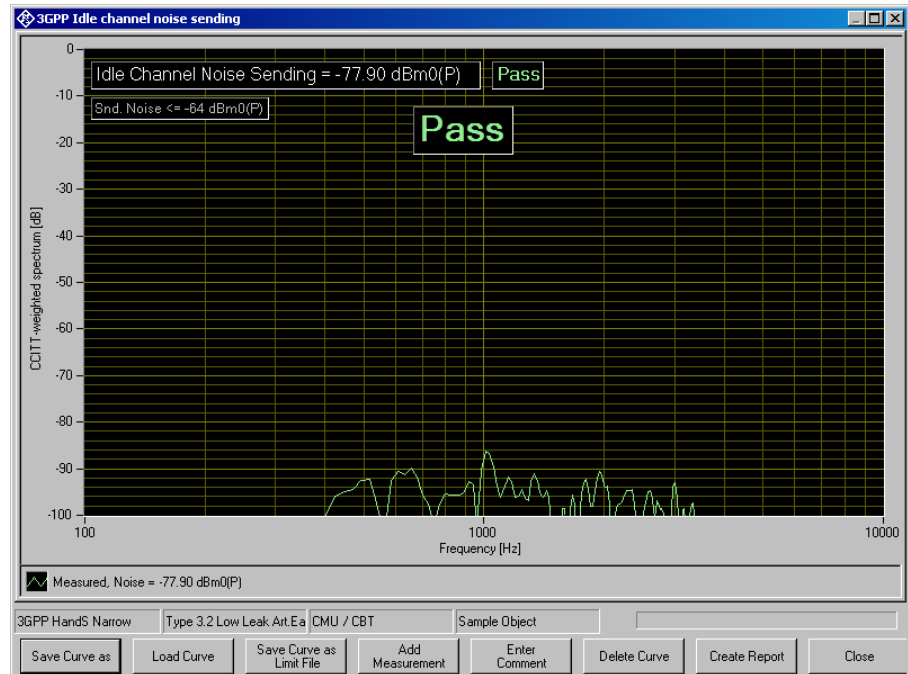
Fig. 43   Typical result of receiving noise measurement

This measurement makes high demands on the sound insulation of the test chamber and the S/N ratio of the measuring microphone including preamplifier in the artificial ear. A comparison measurement with the test mobile phone switched off or without a DUT shows the measurement reserves of the test equipment. Due to the inherent noise of the Audio Analyzer R&S UPV, measurements can be made to about -80 dBPa(A) at 0 dB microphone gain, and even to lower values when a higher microphone gain is set.

Ambient Noise Rejection

("3GPP Ambient Noise Rejection", "3GPP ANR, w. 3dB uncert. allow.", "3GPP Ambient Noise Rejection, Wide, Rel. 6/7", "3GPP Ambient Noise Rejection, Wide, Rel. 8", "3GPP ANR, Wide, Rel. 8, w. 3dB uncert. allow.")

Ambient noise rejection describes the weighted ratio of voice signal transmission to transmission of ambient noise. An ANR value >0 dB means that voice as the useful signal is transmitted more loudly than any ambient noise. The minimum requirement according to 3GPP TS 26.131 is ANR > 0 dB. A value >= 3 dB is recommended. From version 5.1 (with the

exception of wideband measurement according to release 6 and 7), an additional allowance of 3 dB should take measurement tolerances into account, such that the effective minimum value is -3 dB.

To perform this measurement, a homogeneous noise field for simulating the noise in the environment has to be generated. This sound field must be generated by additional loudspeakers and noise generators. To obtain a sufficiently homogeneous sound field, several uncorrelated generators and loudspeakers are required. The use of 2 to 8 generators and loudspeakers is common practice. The noise sources have to generate pink noise (spectral power density ~ 1/f). The permissible error in the relevant third-octave bands must be smaller than ±3 dB with the frequency response of the loudspeakers used also being taken into account.

This adjustment and testing of the sound field is done as a calibration process (see section 4 above). With sufficient long-term stability of the noise generators and loudspeakers it can be used for a number of subsequent tests. Alignment of the noise field has to be repeated if anything in the setup of the noise sources (loudspeaker position, amplifier gain etc.) is changed. Furthermore it is recommended to check the noise field in regular intervals.

 After the noise field calibration, the artificial mouth and the artificial ear must be installed again for the actual measurement of ANR. The MRP must be installed at the same position as the reference microphone had during the calibration of the noise field.

The mobile phone under test is installed in the LRGP (ITU-T P.76) or on the HATS (ITU-T P.58). If installed on the LRGP, the receiver is sealed to the artificial ear.

Set up a call to the CMU and set the bit stream to "Handset Low" (GSM) or the dedicated channel voice to "Speechcodec Low" (WCDMA).

At first the noise spectrum picked up by the phone and sent on the uplink is measured. After completion of the measurement, the request to switch off the noise field will be displayed on the screen. If this is confirmed, the speech sending sensitivity will be measured automatically and the ANR value will be calculated afterwards.

The minimum value in the tests named "…, w. 3 dB uncert. allow." is -3 dB. In all other ANR tests the minimum requirement is 0 dB.

Fig. 44   Typical result of ambient noise rejection measurement

The graph displays the difference of the room noise sensitivity and the speech sending sensitivity (DELSM) for information.

Notes on Hands-Free Measurements

General Remarks

The standards 3GPP TS 26.131 and TS 26.132 define requirements and test specifications for the tests of the acoustic behaviour of the mobile phone in this mode, but not all details are specified yet.
UPV-K91 3GPP Mobile Phone tests provide test cases for handheld hands-free and desktop hands-free mode with narrow band and wideband speech. Test specifications and limits for hands free car kits are the same as for desk top hands-free terminals.

Hands-free tests with UPV-K91 support the use of either artificial mouth according to ITU-T P.51 together with a free field measurement microphone or alternatively the use of a HATS with type 3.3 or 3.4 artificial ear and artificial mouth according to ITU-T P.58.

Test Setup

All tests must be performed in an anechoic room. Background noise must be less than 24 dBSPL(A). Furthermore the room should be big enough and its walls should have sufficient absorption to provide nearly free-field conditions at the hands-free reference point. Not all test boxes which are appropriate for handset tests can be used for hands free measurements.

If a free-field microphone with a discrete P. 51 mouth is used, it should be configured to the Handheld hands-free UE as per Figure 12 for receiving measurements and Figure 13 for sending measurements. The measurement instrument should be located at a distance d_{HF} from the

centre of the visual display of the mobile station. The distance d_{HF} is specified by the manufacturer.
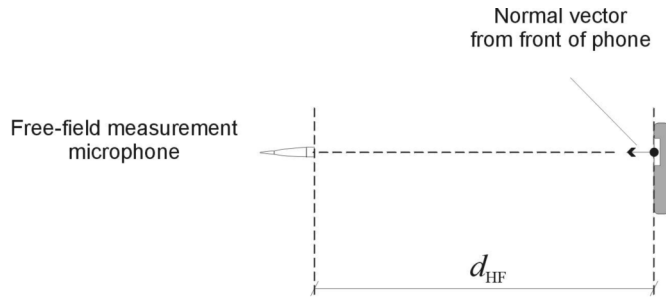
Fig. 45   Configuration of handheld hands-free UE, free-field microphone for receiving measurements
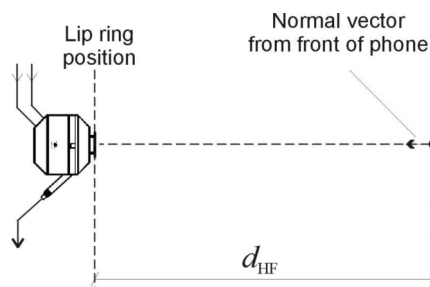
Fig. 46 Configuration of handheld hands-free UE, free-field microphone for receiving measurements

If a HATS is used, the measurement can either be performed binaurally (with two artificial ears and correction of the RLR by 6 dB) or monaural.

The selection of acoustic accessories used for the hands free tests can be entered in menu item "Options → Hands free settings".
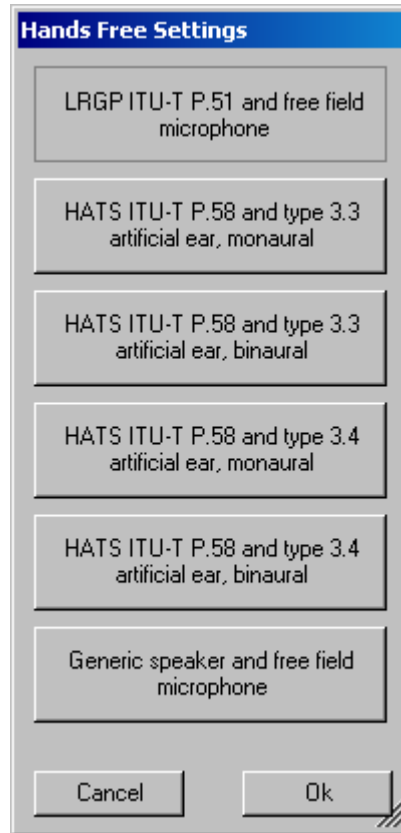
Fig. 47   Hands free settings
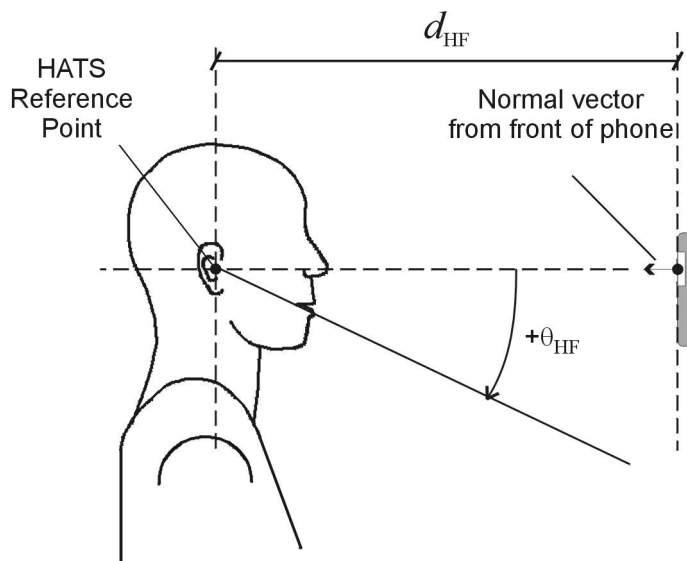
Fig. 48   Configuration of handheld hands-free UE with HATS

For desk top hands-free it is referred to ITU-T P. 340 (http://www.itu.int) for the use of free field microphone and discrete P.51 mouth. The hands free terminal should be placed on a table of approximately 1 m^2 with the centre of its front edge 400 mm perpendicularly from the centre of the front edge of the table. The surface area should not be less than 0.96 m^2 and its width should not be less than 0.8 m. The front centre of the measuring

microphone or centre of the lip ring, respectively, should be placed 300 mm above the centre of the front edge of the table with the axis of the microphone or artificial mouth inclined towards the centre of the front edge of the hands-free terminal.

For the use of a HATS with both types of hands-free terminals it is referred to ITU-T P.581. For handheld hands free the setup of ITU-T P.581 corresponding to "portable hands-free" should be used. For desk top hands-free, the centre of the lip ring is positioned as described above, but the axis of the artificial mouth should be horizontal.

Acoustic Calibration for Hands Free Tests

The calibration for the free field microphone or type 3.3 or type 3.4 HATS ear, respectively, is done as described in chapter 4 above.

For binaural measurements, the second artificial ear has to be calibrated accordingly, using the sub-item "Second Type 3.3 ear" or "Second type 3.4 ear", respectively, in "Calibration → Artificial Ear". Note that the second artificial ear must be connected to Analyzer input 2 instead of the CMU connection.

According to 3GPP TS 26.132, free field equalization has to be taken into account. Free field data can either be imported as an average table from the standard or from an individual calibration disk, using the menu item "Calibration → Free field equalization".

The calibration of the artificial mouth for hands free tests comprises two additional steps. After the level has been adjusted and the frequency response has been equalized at the MRP, the reference microphone has to be repositioned at the so-called Hands-Free Reference Point (HFRP or HATSHFRP).

For the mouth according to ITU-T P.51 the HFRP is in 50 cm distance from the lip ring on the axis of the mouth. The calibration has to be performed at this point independent of the measuring distance currently used.

The HATS HFRP is stipulated in ITU-T P.581. It is one of the points 11 to 17 defined in table 6a of ITU-T P.58. It should be on the axis which is closest to the actual axis from the lip ring to the microphone under test. The distance is always 50 cm from the lip ring. The axis may be azimuthally centric (i.e. 0° horizontally) with an elevation (vertical) angle of 0°, ±15° or ±30°. Points 16 and 17 are located on an axis with 0° elevation and an azimuth angle of 15° or 30°.

The level at this point is adjusted to -28.7 dBPa. For the last step, the reference microphone is returned to the MRP, and the level and spectrum at the MRP are measured as reference for the transfer function calculation.

The mouth calibration for hands-free tests is started with the menu item "Calibration → Artificial Mouth (Hands Free)". This procedure comprises the mouth calibration for handset tests and has also effect on subsequent handset tests with the same individual artificial mouth.

"Utilites" Measurements

This item of the "Standards" menu contains useful measurements which are either from other standards or for checking test conditions.

Sidetone Distortion

A sidetone distortion test is specified in 3GPP TS 51.010 30.8 for measurements using the DAI. As the downlink conveys only silence during this test, it is, however, more or less independent of the kind of transmission between system simulator and mobile. The sidetone distortion test determines 3rd order harmonic distortion at a given set of frequencies (in the case of TS 51.010 at 315, 500 and 1000 Hz) with a level of -4.7 dBPa at the MRP. The third order harmonic distortion is required to be less than 10 % (-20 dB) at all frequencies.
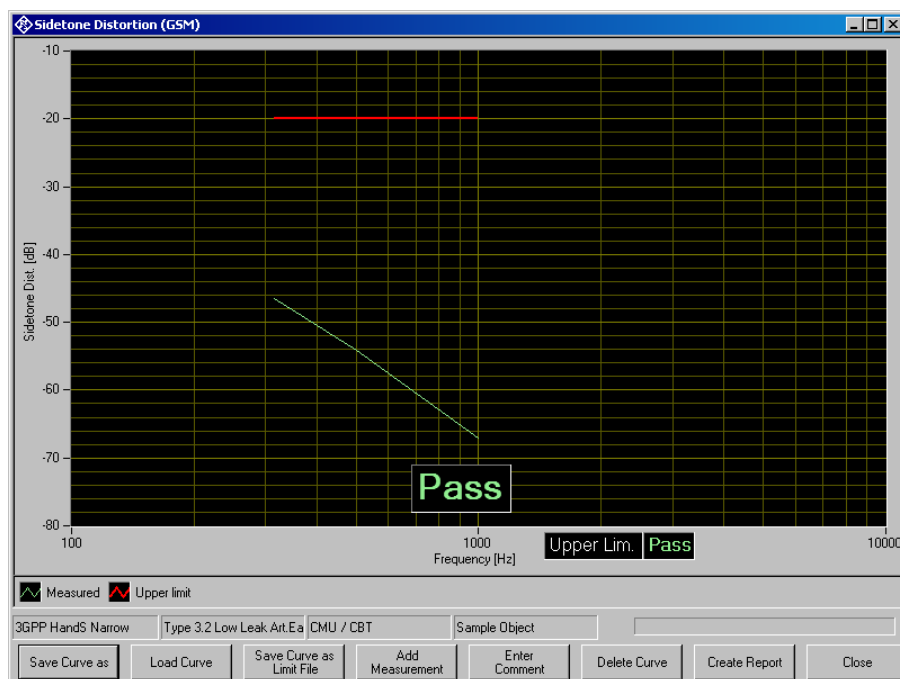
Fig. 49   Sidetone distortion test

Gain Variation Tests

Gain variation tests in sending and receiving direction are specified in 3GPP TS 43.050 Annex C.5. The limits given in TS 43.050, sections 3.9.1 and 3.9.2 are meant for measurement over DAI and cannot be fulfilled when a Codec is in the transmission chain. The configurable versions of the gain variation tests allow to define specific limit curves.
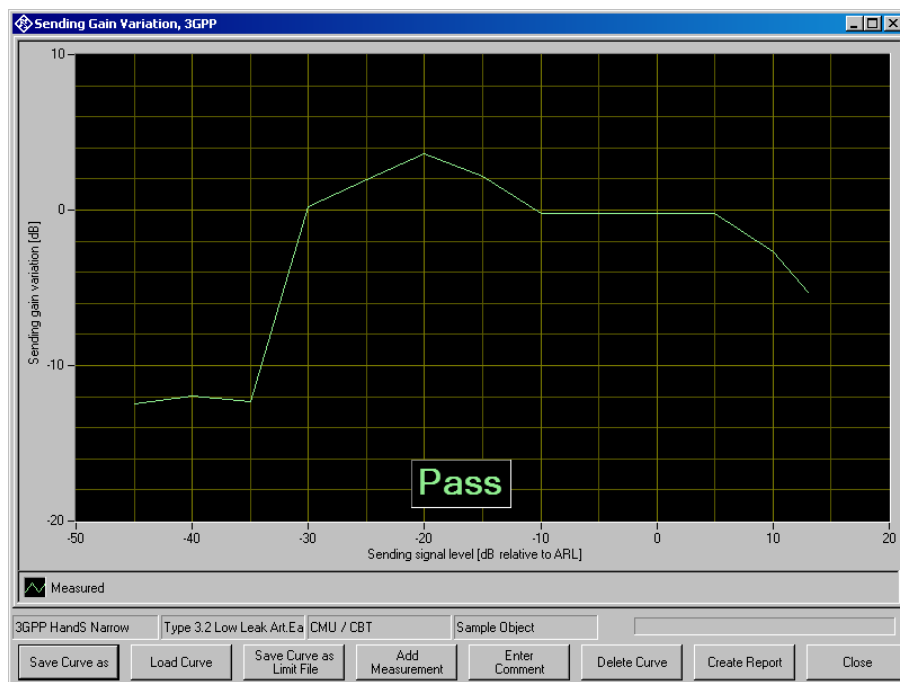
Fig. 50   Sending gain variation test

Delay Measurements

Sending and receiving delay can only be measured end-to-end, i.e. from the acoustic origin of the artificial mouth to the decoder output of the system simulator or from the encoder input of the system simulator to the DRP. The measurements offered with R&S UPV-K91 allow to subtract the estimated delay of the CMU from the total measured value. As the data is interleaved on the air interface, no exact time instance can be determined when the audio data are transmitted between mobile phone and system simulator. The values used in the present measurements are estimations with an uncertainty of about 10 ms. The delay measurement is performed for a given set of frequencies, and an average is calculated over all frequencies.
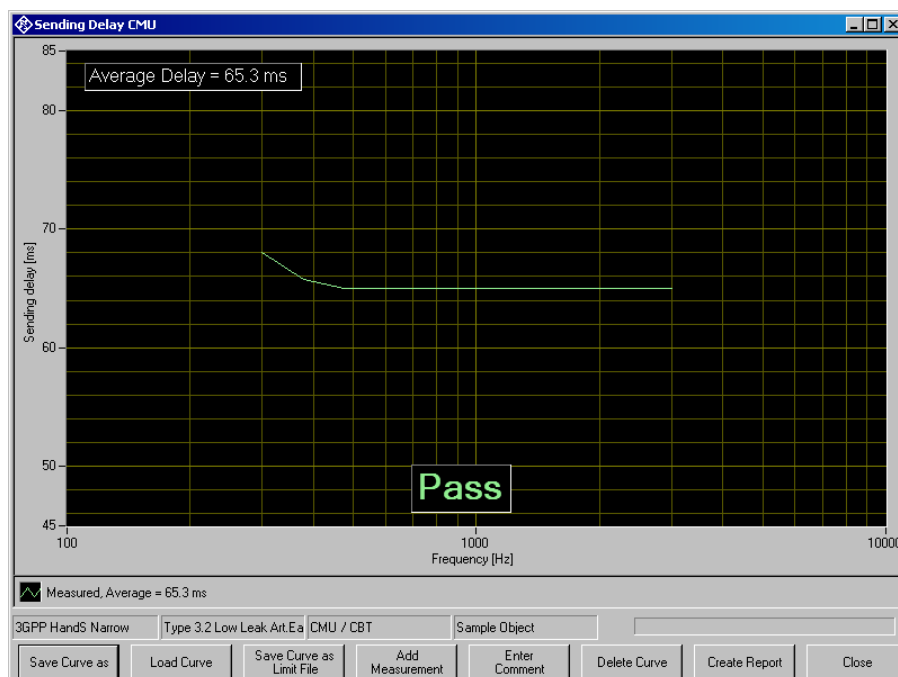
Fig. 51   Sending delay measurement

Background Noise Measurements

3GPP TS 26.132 demands the background noise in the test room to be below -64 dBPa(A) for idle channel noise measurements and below -30 dBPa(A) for all other handset measurements. For hands free measurements the background noise needs to be below -70 dBPa. The background noise measurements offered in R&S UPV-K91 check the overall noise level against these limits and display the spectrum of the noise. A lower limit assures that the test is not erroneously passed if no microphone is connected or the microphone supply is switched off. The test requires a diffuse field (pressure field) microphone to be connected to analyzer input 1 and to be placed in the test room, preferably at the place of the MRP.
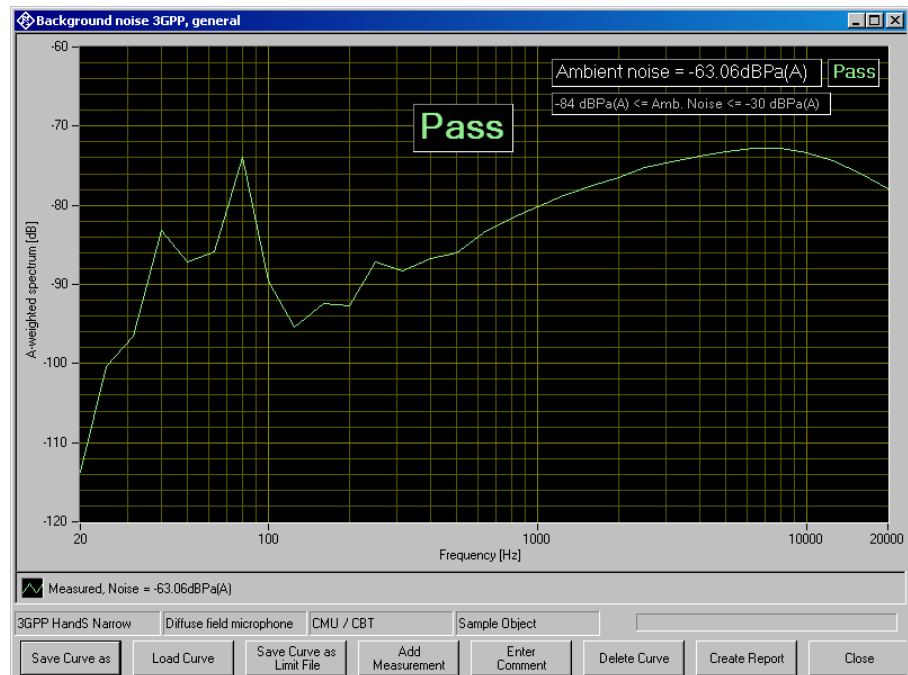
Fig. 52   Background noise measurement

If the noise in the test room does not fulfil the requirements it may first be attempted to remove noise sources in the vicinity of the test chamber. If no further reduction is possible, the sound isolation of the chamber should be improved. This can be achieved e.g. by heavier walls. Low frequency noise may possibly be conducted as structure borne sound, which may be reduced by an isolating support of the chamber. High frequency noise can be caused by a leakage e.g. at the door and may be reduced by an improved gasket.

6 Customizing Measurements

Measurements which implement a test case of a standard are locked and cannot be edited. However, for each measurement type there is also a configurable measurement provided, in which the limits can be customized. The parameters of the measurements are accessible through the menu item "Config. Meas."
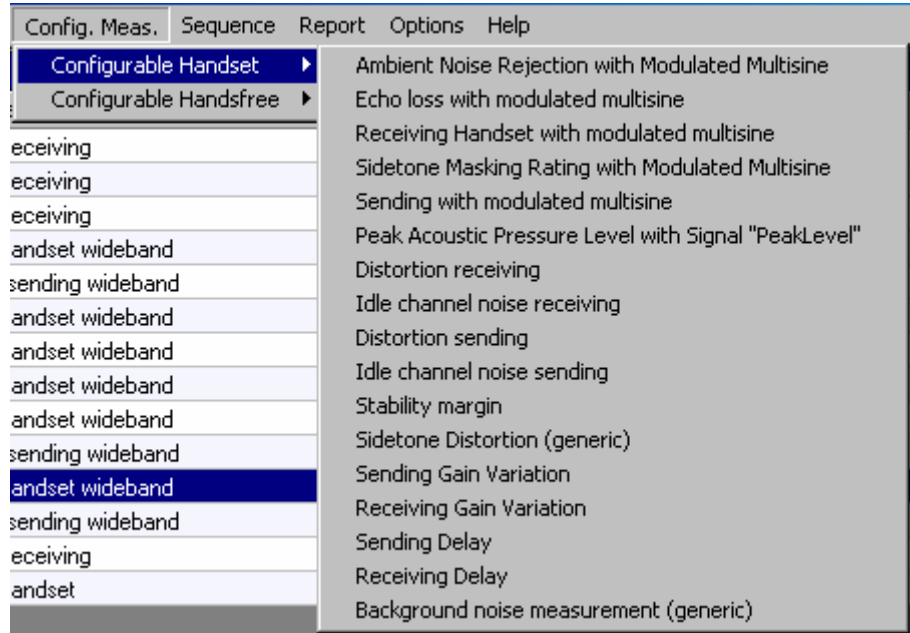
Fig. 53   Measurement configuration menu

Clicking on one of the entries opens a window in which all parameters can be viewed and most of them can be customized:
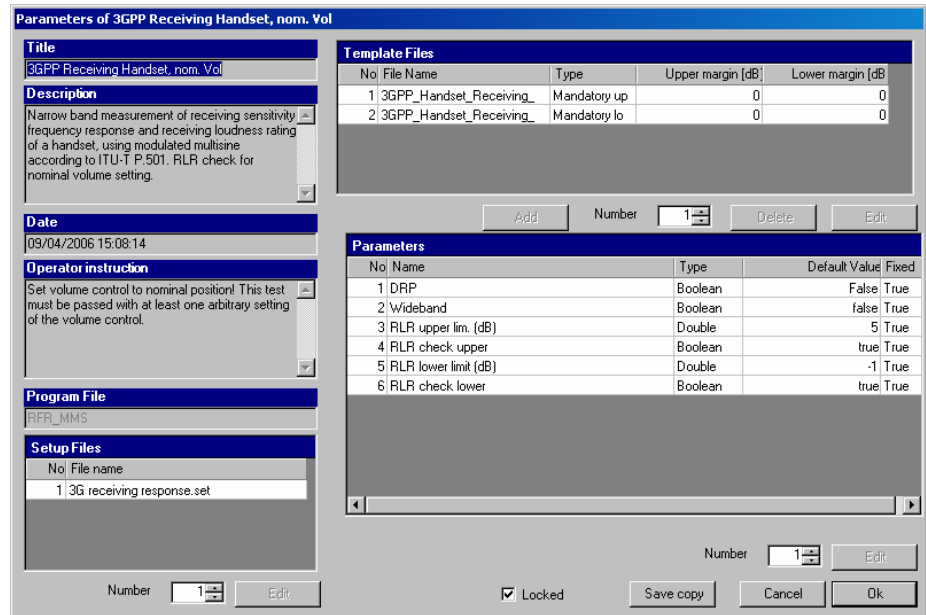
Fig. 54   Measurement parameters window

As Sequences create copies of the parameter files, each instance of a measurement in a sequence can have different settings which remain independent of the setting of this measurement in the main window and in other sequences. It is for example possible to compile a sequence with a number of stability margin tests having different loop gain.

The titles of the tests and the messages displayed to the operator before start of the measurement can also be edited in the "Parameters" window.
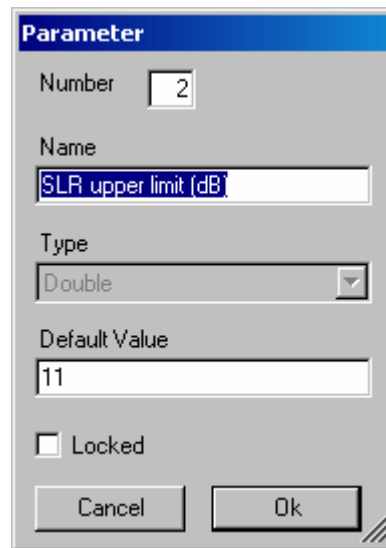
To facilitate copies of test definitions with small adaptations, it is possible to store a copy of the current parameter set under a different file name (button "Save copy"). Each measurement definition must have a unique title to be distinguished from other definitions like for example the original from which the copy was made.

For the purpose of making adapted copies it is possible to unlock a standard test definition (uncheck the "Locked" checkbox). In this case the "ok" button is disabled to avoid unintentional changes in standard tests.

All newly created test definitions appear in the last sub-menu of the "Standards" menu" ("More…").

Editing Parameters

Parameters can be edited by entering their number in the "number" field below the data grid and clicking "Edit".

Fig. 55   Entry window for parameters

Note that the type conformity of the entered value is checked, but not the value itself against any range limits.

Editing Limit Curves

Clicking "Add" or "Edit" below the data grid for the limit curves opens the window for selecting limit files.

Note that currently "Desired" limit curves are not supported in all test routines. Most of the measurement allow to specify either lower limits or upper limits or both. An exception is formed by the sending response and

receiving response measurements. As the limit template is centered around the measured curve with these measurements, upper and lower mandatory limits have to be specified pair-wise.

An existing limit file can be selected using the "browse" button. New limit files can be created by copying an existing limit file and editing the copy with a text editor ("Send to → Notepad" in the context menu of the file in the windows explorer). The number of data points on the curve must be specified in the "Datacount" line.
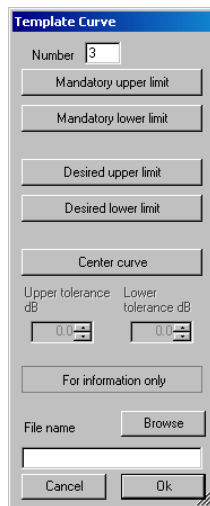
Fig. 56   Entry window for selecting limit curves

7   Measurements with electric connections

Introduction

Usually the mobile under test is connected via RF connection to the CMU and via acoustic interfaces (artificial mouth and ear) to the R&S UPV. Therefore no intrusion in the mobile device is required.

There may, however, be cases during the design process of a mobile phone where the usual interfaces are not available:

-   if a mechanic mockup is to be measured just with the acoustic components but without the rest of the circuitry

-   if a circuit of a mobile phone is to be measured without acoustic components

-   if a hands free kit or headset is to be measured without mobile phone

-   if the hands free or headset connection of a mobile phone is to be measured without hands free kit or headset, respectively.

In these cases either coder and decoder or artificial ear and artificial mouth may be replaced by direct electrical connections to the R&S UPV. To use electric connections, select "Electric connection" in the respective item of the "Options" menu.

Calibration values for electric connections

Electrical connections cannot be calibrated. Instead a virtual sensitivity has to be entered for each type of electrical connection under "Calibration → Electric connections → …".

Electric connection replacing artificial ear

R&S UPV Analyzer input 1 is directly connected to the earpiece amplifier output.

A nominal sensitivity of the receiver (earpiece speaker) for which the circuit is intended has to be entered in dB re 1 Pa/V.

Electric connection replacing artificial mouth

R&S UPV generator output 1 is directly connected to the microphone input of the mobile phone circuit.

A nominal sensitivity of the microphone for which the circuit is intended has to be entered in dB re 1 V/Pa.

Electric connection replacing encoder

R&S UPV generator output 2 is directly connected to a earpiece or headset speaker or to the speech input of a hands free kit.

A nominal full scale output voltage (output voltage corresponding to digital full scale) of the circuit intended to drive the speaker or car kit has to be entered.

Electric connection replacing decoder

R&S UPV analyzer input 2 is directly connected to a microphone or to the speech output of a hands free kit.

A nominal full scale input voltage (input voltage corresponding to digital full scale) of the respective microphone or speech input has to be entered.

Performing the measurements

After applying the settings in the "Options" menu and after entering appropriate calibration values for the electric connections in use, the measurements may be started as usual.

Some parts of the standard require the use of particular artificial ears for particular measurements. Therefore the checkbox "Allow only selected measurements" should be unchecked in "Options → Standard".

For sending tests, the output voltage range in the R&S UPV is set to a large value in order to be able to drive the speaker of the artificial mouth. In rare cases sending distortion and/or sending noise results may be degraded with electric connections if a low microphone sensitivity is entered. In this case please contact R&S support.

8 Automatic Test Sequences
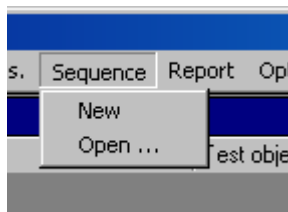
Fig. 57   Sequence menu

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.
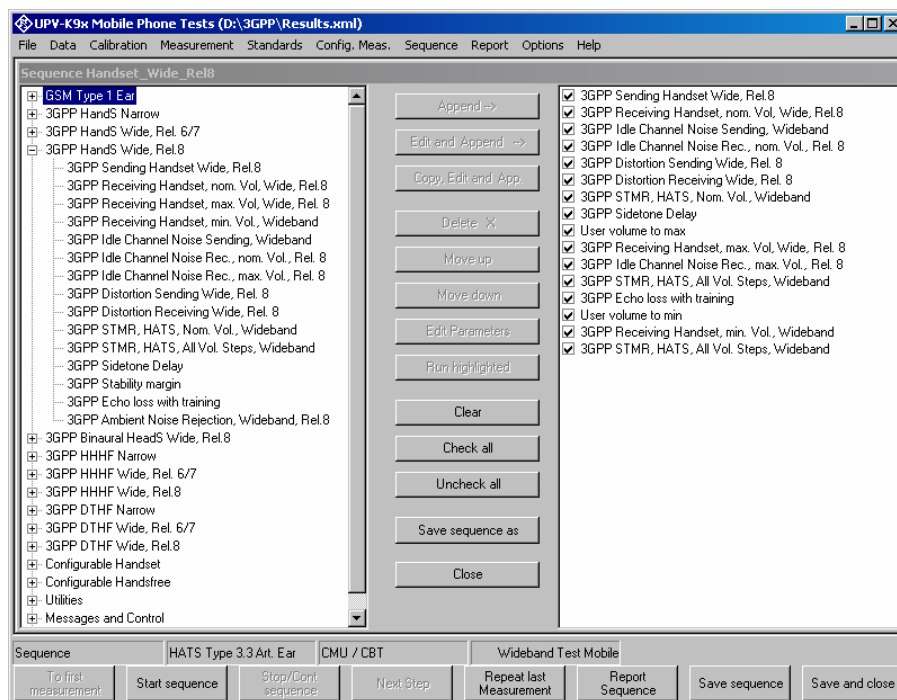
Fig. 58   Sequence window

Initially the right checked list box is empty. The tree view box on the left side displays all available measurement definitions structured according to the standards, similar to their order 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. For non-standard measurements which allow to change parameters like limit curves, it is possible to edit the parameters 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 contains stability margin tests with different loop gains.

A sequence should be run with option "Show operator instructions" disabled. This avoids interruption of the execution. If a message to the operator is to be inserted into the sequence on purpose, e.g. "Set user volume control to maximum!", the items provided in the tree view under "Messages and Control" may be used. Such a message will stop the execution of the sequence until it is closed by acknowledgement of the operator.

Opening an Existing Sequence

The menu item "Sequence → Open …" opens a file selector for specifying the sequence to be loaded. The sequence file is usually found in a subfolder of D:\3GPP with the same name as the sequence. The sequence window opens with the specified sequence loaded. The sequence can then be edited and/or run.

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.

A running sequence may be interrupted with one of the buttons in the measurement control window which is visible while a measurement is running. "Cancel and continue sequence" cancels the currently running measurement and resumes execution of the sequence with the next measurement. "Cancel and stop sequence" aborts both running measurement and sequence. "Stop sequence after this measurement" completes the running measurement and stops the sequence afterwards.
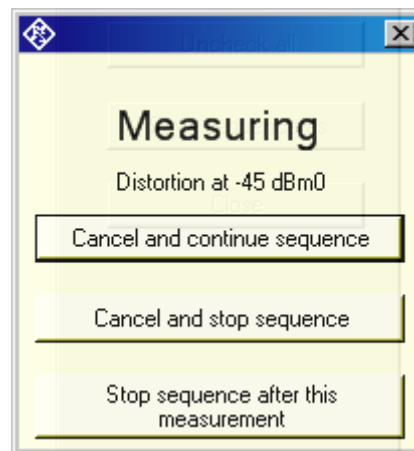
Fig. 59   Measurement control window

Running a Single Measurement out of a Sequence

A single measurement of a sequence may be started by highlighting the measurement in the right checked list box and clicking the button "Run Highlighted".

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.

9   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.
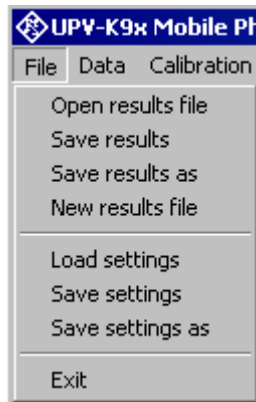
Fig. 60   File menu

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 → Store 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.

The size of diagrams in the report can be scaled between 100% (approx. page width) and 50%.

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 (see Fig. 11), right-clicking into the data grid and selecting "Generate report" from the 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.

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. 10). 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.

Preview Window
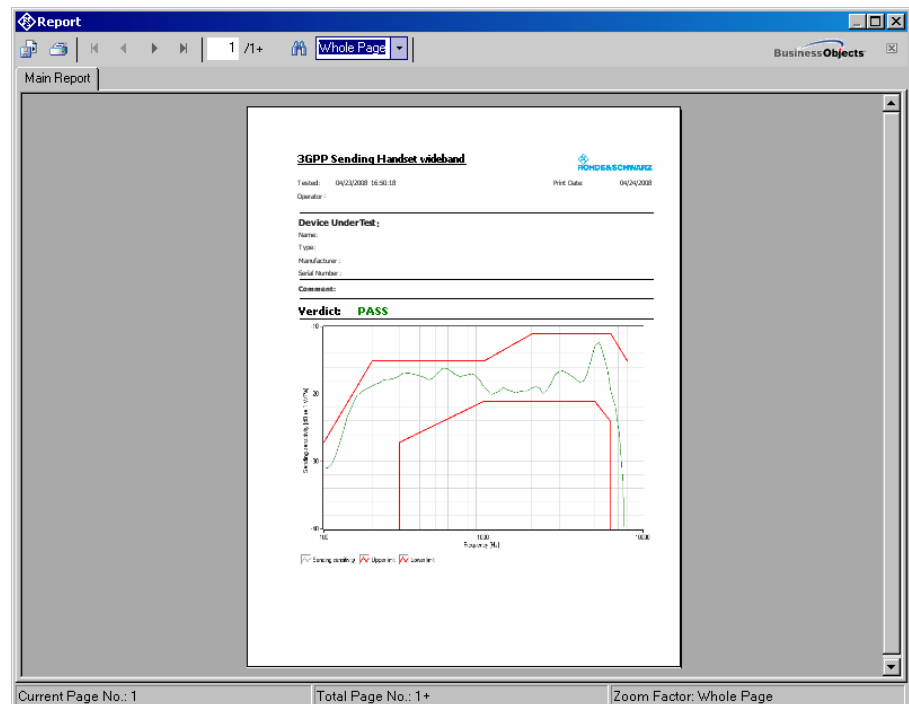
Fig. 61   Report preview window

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
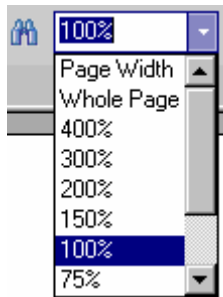
Fig. 62   Scale menu of the preview window

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-K9/K91 window. This allows e.g. to derive tolerance schemes from "golden devices". The measured curve can be arbitrarily shifted before being stored.
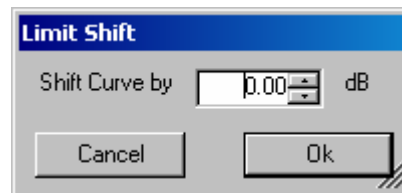
Fig. 63   Input window for defining a shift of a measured curve for storage as limit curve

Furthermore curves can be exported from the main results window by marking the result in the data grid, right-clicking on it and choosing the item "Save curve of selected row as …" in the context menu.

ASCII Result Files

When the item "Generate temporary export files" in the "Options" menu is checked, the standard tests generate "curve.exp" or "abscurve.exp" and

"relcurve.exp" and "result.exp" files similar to those generated by UPL-B9. These files are always deleted and overwritten by subsequent tests.

This feature is provided only for compatibility reason. It is not available in all measurement types.

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 a missing call to the mobile, 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.

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".

10   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.

Appendix A Settings on the Radio Communication Tester CMU200

Firmware 4.52

Settings for GSM:

Selection of the GSM band:
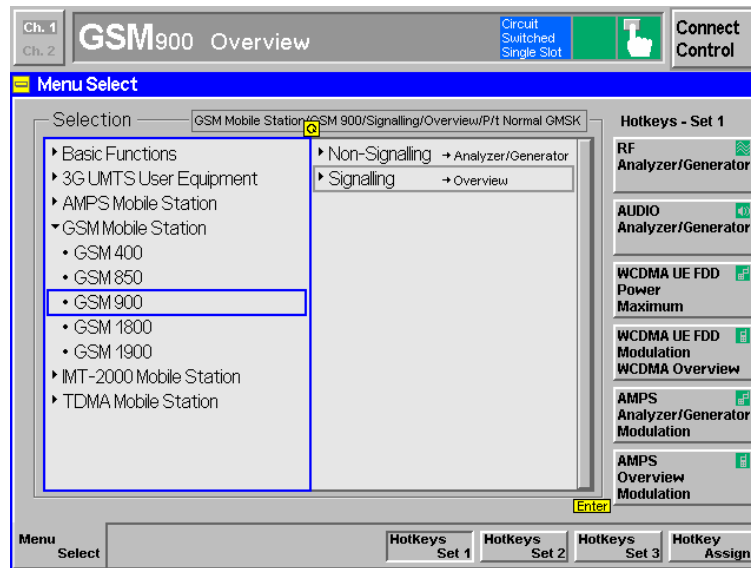
Taking a coupling loss of the antenna coupler into account:
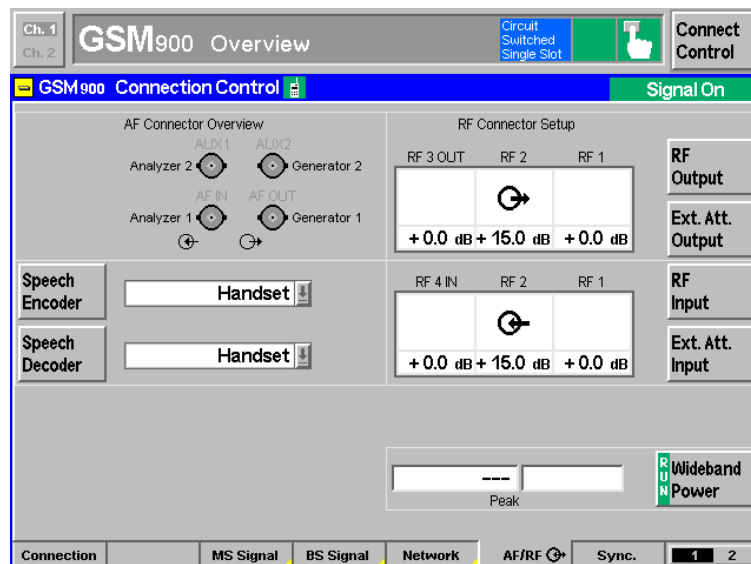
Select EFR (full rate version 2), HR (half rate version 1), AMR full rate or AMR half rate speech coder:
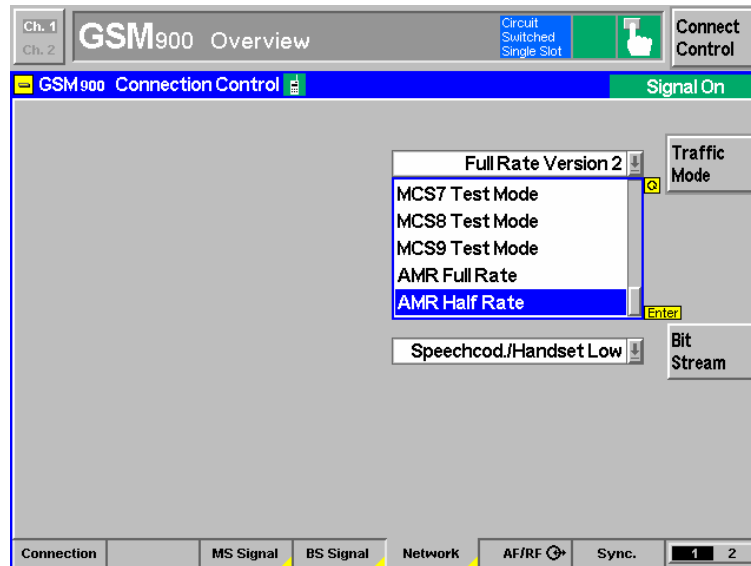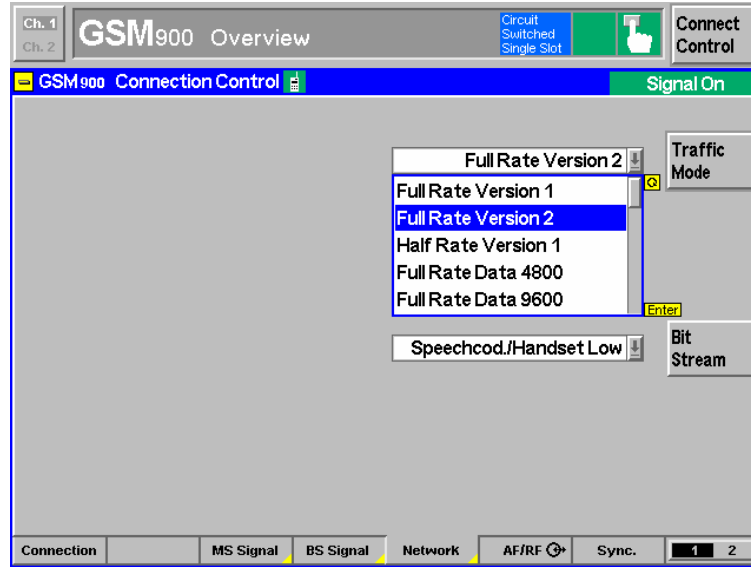
Selection of the Bit Stream Handset Low setting for the measurements or Decoder Cal and Encoder Cal for the calibration:
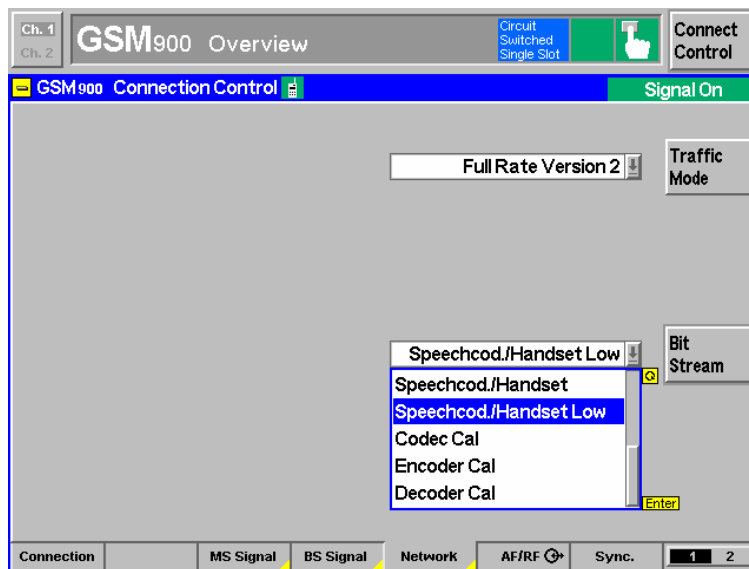
Setting of the desired TCH and BCCH levels:
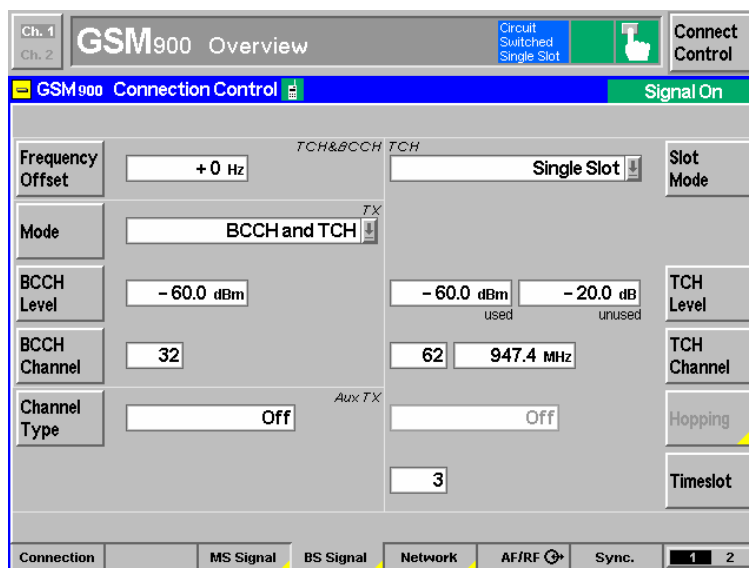
Typical setting with EFR speech coder (corresponds to AMR 12.2) for measurements in the call established status:
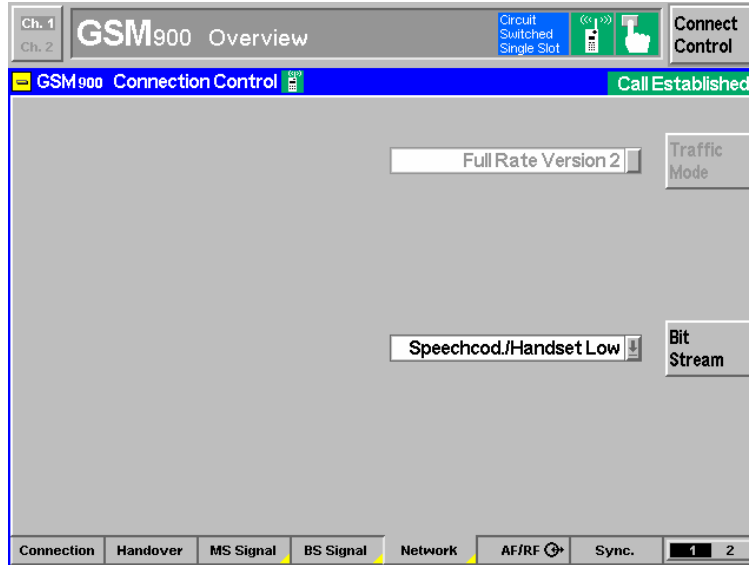
Settings for WB-AMR:
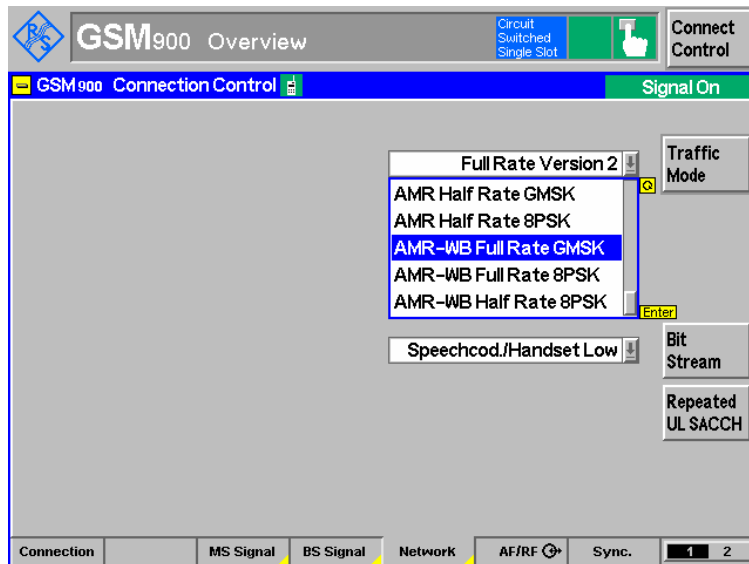
Settings for UMTS WCDMA FDD:

Selection of mode:
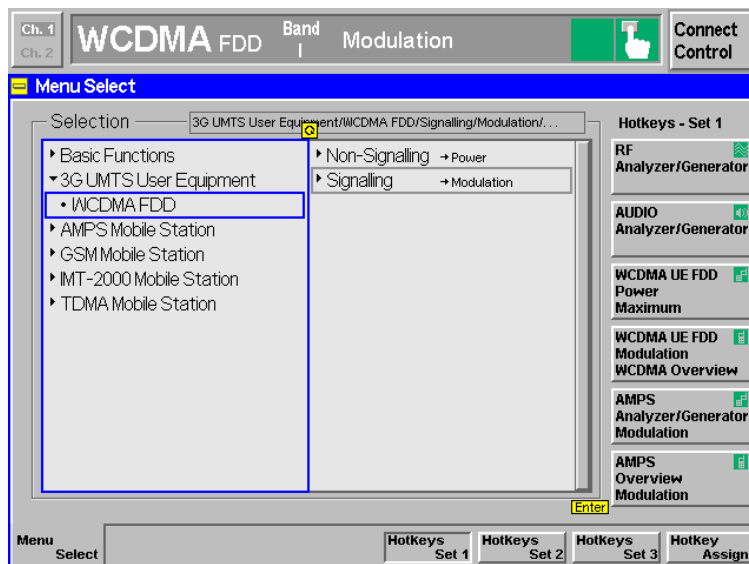
Setting dedicated channel to voice:
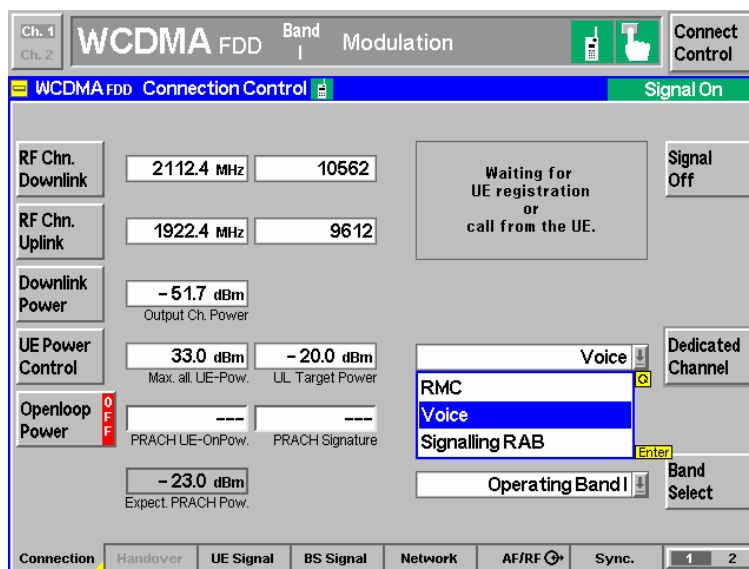
Selection of the Narrowband AMR Speechcodec Low setting and AMR Bit Rate for the measurements or Decoder Cal and Encoder Cal for the calibration (selection is possible only if call is deactivated):
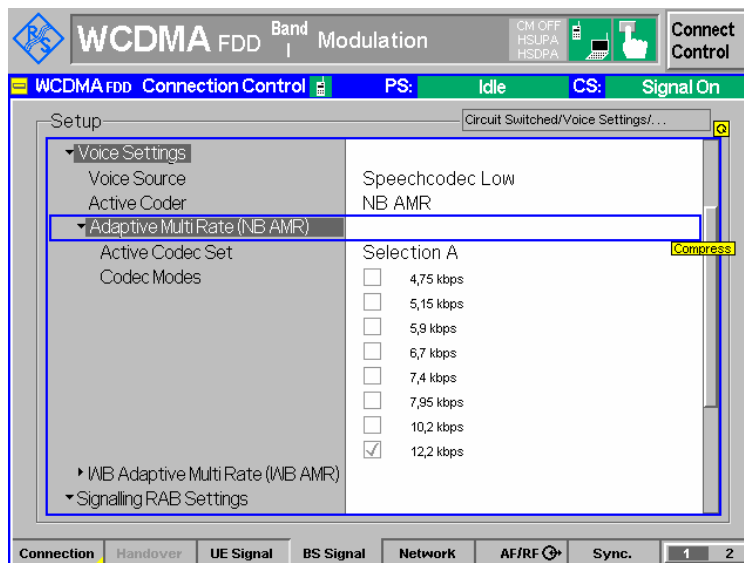
3GPP Ts 26.132 specifies 12.2 kbps bit rate for audio testing with the NB AMR codec.

Selection of the Wideband AMR Speechcodec Low setting and AMR Bit Rate for the measurements or Decoder Cal and Encoder Cal for the calibration (selection is possible only if call is deactivated). 3GPP TS 26.132 specifies 19.85 kbps for audio with the WB AMR codec:
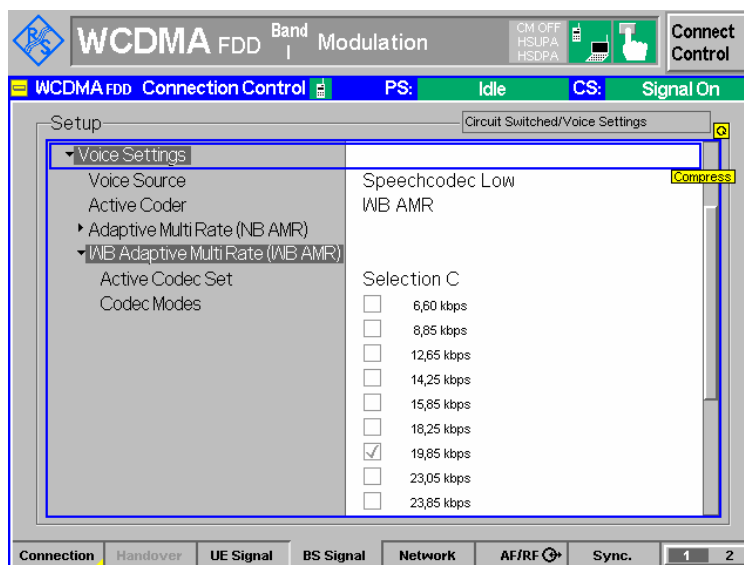
Mobile phone registered status, codec settings possible:

Call active (connected) status for the measurements:

Appendix B Troubleshooting

Damaged setup file is reported

If the program is unable to load the latest setup file, it will automatically offer to restore a backup of the damaged file. Only if there is no backup available, or loading of the backup fails again, the following procedure can be applied:

Copy "Settings.sup" from C:\Program Files\Rohde&Schwarz\UPV-K9x Mobile Phone Tests" to "D:\3GPP", overwriting the damaged file of the same name. Alternatively, "D:\3GPP\settings.sup" may just be deleted. Subsequently all settings in the "Options" menu have to re-done and for all used calibration types calibrated devices have to be selected again.

Damaged results file is reported

There are backup files available of the file containing the test results, with appendix ~1 and ~2 to the file name of the results file (usually "D:\3GPP\Results.xml"). If the results file cannot be opened for some reason, the program automatically offers to restore the latest backup file.

If this does not work, a backup file can be renamed by removing the respective ~1 or ~2 extension, and opened subsequently. It is recommended to store the damaged results file under a different name.

A test is not starting properly

Re-select devices for the calibration types required for the respective test, using menu item Calibration → Select device. If this does not solve the problem, copy all files from "C:\Program Files\Rohde&Schwarz\UPV-K9x mobile phone tests\3GPP files\Overwrite" to "D:\3GPP", overwriting the existing files therein.

A calibration value is missing or no device is selected for a required calibration type

If re-selecting the calibration device and re-calibrating it does not help, create a new device with "Calibration → New device". Tick the "Immediately select this device" box before clicking the "Ok" button and do the calibration for this device. All selected devices and their calibration values can be checked with "Calibration → Show selected devices".

The receiving noise test produces an overrange error

Reduce the gain of the conditioning amplifer in the signal path of the artificial ear, re-calibrate the artificial ear and re-try the test.

ARL for the sending distortion test cannot be adjusted

First, try a sending test to see if the connection to the mobile is existing. If the RLR value is too high, the sending sensitivity of the mobile under test may be too low to adjust the ARL. If there is no signal in the sending test (SLR > 60 dB) check the connection between CMU and mobile. If no signal from the artificial mouth is audible during the sending test, check the signal path between R&S UPV and artificial mouth. Re-calibrate the artificial mouth.

Other problems of unknown reason

If the problem cannot be solved with the information given above, the folder "D:\3GPP" can be renamed or deleted. At the next start of the application, this folder is created anew with all files in default state.

Attention: *Store a backup copy of the results file in a different folder before deleting "D:\3GPP".*

Note: *Subsequently all settings in the Options menu and all data entries have to be re-done, all calibrated devices have to be created and calibrated again.*