ROHDE&SCHWARZ

Test and Measurement
Division

Software Manual

PC Software:
WorldSpace Signal Editor
for Signal Generators SMIQ02W/03W

SMIQ-K3

1104.9480.02

Printed in the Federal
Republic of Germany

Tabbed Divider Overview

Contents

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

Safety Instructions

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

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

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

Symbols and safety labels

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

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

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

Tags and their meaning

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

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

Basic safety instructions

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

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

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

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

Informaciones de seguridad

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

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

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

Símbolos y definiciones de seguridad

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

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

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

Palabras de señal y su significado

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

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

Informaciones de seguridad elementales

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

seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).

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

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

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

Table of contents

5 Tutorial

6 Glossary

7 Annex - File Formats

8 Index

Figures

Tables

1 Characteristics

1.1 Uses

SMIQ-K3 is a software option for Rohde&Schwarz Signal Generator SMIQ. This option serves for generating WorldSpace TDM signals as required for the development, testing and quality assurance of WorldSpace receivers and their components.

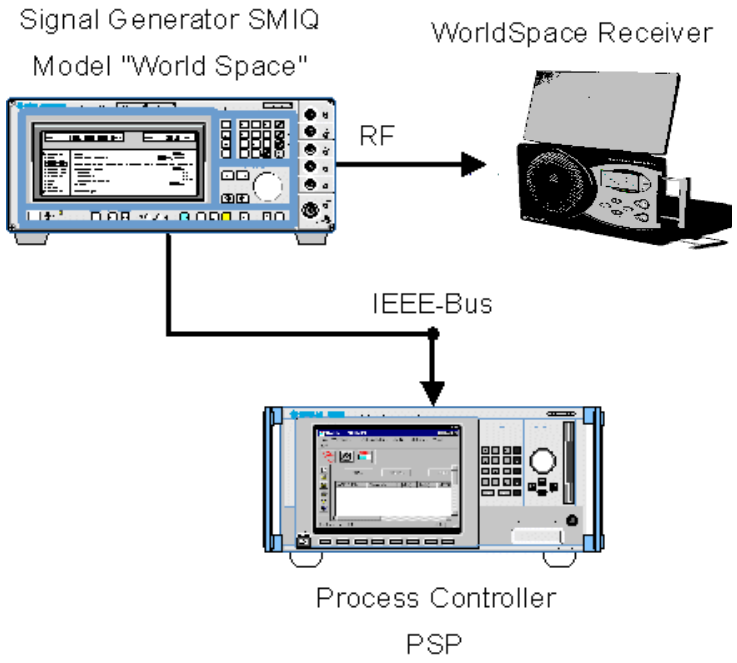


Fig. 1-1 Setup of PC, SMIQ and WorldSpace Receivers

Option SMIQ-K3 allows to perform all the steps required to generate WorldSpace TDM signals starting from the generation of audio test signals to the control of all WorldSpace SMIQ functions.

1.2 Description

The concept of option SMIQ-K3 is as follows:

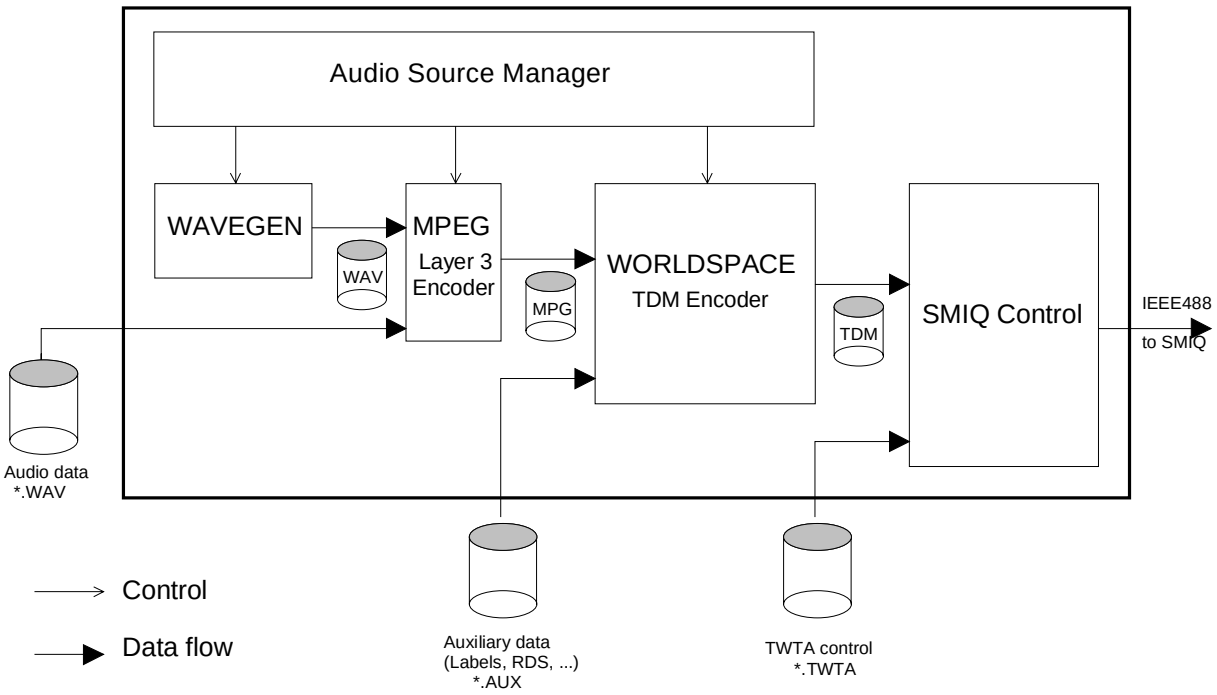


Fig. 1-2 Block diagram

The ***Wavegen*** block generates synthetic test signals. These signals can be compiled by any combination of single tones and frequency sweeps. Moreover, white Gaussian noise can be superimposed onto the resulting signal. *Wavegen* generates the audio test signal in the industrial standard format Wave. For a detailed description of the wave file generator see 4.5.

The ***Audio Source Manager*** is the main window of the application. It manages all audio sources (external audio files and those generated by Wavegen) in the form of lists and controls the conversion of sources into the MPEG format. It also provides the interface to the TDM encoder. For audio source management see 4.3.

The ***MPEG Encoder*** converts audio files from the PCM format into the MPEG bit stream format. The core functionality is in the form of an ACM driver, control is via the audio source manager.

The ***TDM Encoder*** is integrated into option SMIQ-K3 as external EXE file. Communication between these two applications is via a DDE interface.
In this block, TDM can be compiled from existing MPEG bit streams. After setting all parameters, the TDM bit stream is stored in a file (see 4.6) .

SMIQ Control controls Rohde&Schwarz Signal Generator SMIQ. Besides TDM sequence management also faults (TWTA characteristic, AWGN) can be simulated and relevant RF parameter (frequency, level) can be set.
For SMIQ control see 4.7.

2 Getting Started

As far as operation is concerned, Option SMIQ-K3 corresponds to a typical Windows95/NT™ application. Most functions can be used intuitively.

This section is for users who are already familiar with the following: operation of Windows programs, MPEG coding, structure of WorldSpace TDM and capabilities and characteristics of SMIQ from Rohde&Schwarz. The section gives a brief description of the most important aspects of the program.

Section 4 provides a detailed description of all SMIQ-K3 operating and setting facilities. It is meant to be a sort of reference book.

A detailed example is described in Tutorial (section 5). The user is guided step by step through all the menus and dialogs of option SMIQ-K3.

2.1 Preparations

- Install your set of diskettes on a Windows95/NT™ processor.
- Prior to generating a WorldSpace signal, check settings in the option dialog (eg IEC/IEEE-bus address of SMIQ).

2.2 Editing a Pool of Audio Sources

The main window is automatically displayed after the initial mask. It shows the ***Audio Source Manager*** with an empty list. New audio sources are added to the list using ***New..***, marked entries are deleted using ***Delete***.

The output format and the file name are first determined in the upper dialog area of the wave file generator. The test signal can then be compiled based on the individual components.

The marked component (***Single Tone***, ***Sweep*** **or** ***White Gaussian Noise***) is then added to the current list by clicking ***Select***.

The test signal can be generated (use ***Generate***) after having completed the list. The audio file is created under the name entered under **Output File**.
The play function ***Play*** is used for signal checks. The signal is either shown in the time or frequency domain (***Playmode*** = ***Display***) or played via the sound system. (***Playmode*** = ***Speaker***).

If the signal is according to your requirement, the wave file generator can be closed using ***OK***.

A dialog for setting the MPEG format is then displayed and the desired sampling rate/bit rate combination can be selected. A new line in the audio source list will then be displayed comprising the file names and parameters defined beforehand.

When adding an external wave file, a dialog for selecting an already existing wave file will be displayed instead of the wave file generator.

The list thus edited is handled like a document. The list can be loaded, stored or printed by selecting the corresponding menu items in the File menu. The list can also be deleted (use menu item ***File/New***) or previewed (use menu item ***File/Print Preview***).

Prior to using audio sources in the TDM encoder they must first be available in the MPEG format. The ***Make*** function checks the current state and availability of MPEG files and generates them if required.

If this has been done successfully, the message ***INFO: Make complete*** is displayed. All the lines have the entry ***MPEG o.k***. in the last column.

The TDM encoder can now be started with this list.

2.3 TDM Compilation

The TDM encoder offers a similar list management like the audio source manager. While a pool of audio sources is managed by the audio source manager, the TDM encoder allows to assign selected audio sources to the broadcast channels.

The components can be added/deleted as follows:

Table 2-1 TDM compilation

Aim	Procedure	Remark
Adding a broadcast channel	➢ Click ***New Broadcast Channel***	Important fields: - Name (for identification in the encoder) - Service bit rate - BCID (eg continuous)
Deleting a broadcast channel	➢ Mark broadcast channels and then press ***Delete*** key	
Assigning a service component to a broadcast channel	➢ Mark broadcast channel and then click ***New Service Component***	Important fields: - Service file name (selecting an MPEG bit stream from pool) - Frames (number of BC frames, eg 23 for 9.936 seconds)
Deleting a service component	➢ Mark service component and then click ***Delete***	
Adding a new dynamic service	➢ Mark service component and then click ***New Dynamic Service***	Important fields: - Service file name (selecting an MPEG bit stream from pool) - Frames (number of BC frames, eg 23 for 9.936 seconds) - The two arrows allow to cyclically call up and change the parameters of the dynamic service components
Deleting a dynamic service	➢ Click dynamic service component by using right mouse key and select ***Remove Component*** from the local pop-up menu	

The bit stream can be generated as follows after TDM compilation:

➢ Enter a file name and click ***Generate***.

The relevant settings (required for TDM compilation) can be stored.

2.4 Outputting WorldSpace Signal Using SMIQ

A TDM bit stream can be downloaded into the SMIQ (data generator) memory using ***Download***. The selected bit stream is deleted wit ***Delete***, ***Free*** indicates the available memory capacity in bits.

➢ Set a value for the output level that corresponds to the input sensitivity of the used antenna/tuner and start outputting by using the ***Start*** button.

3 Preparations for Use

3.1 Preconditions

Option SMIQ-K3 is a PC software running under operating systems Window95™ and Windows NT™ .

The following hardware requirements have to be met:
- IEC/IEEE-bus card from National Instruments with Windows drivers for operating SMIQ.
- 640*480-pixel resolution (800x600 recommended),
- 16 MB main memory (32 MB recommended).
- Sound card: recommended

Perform a proper installation as described below prior to using the software.

Note: *All figures and descriptions are with reference to an English-language version of the operating system. If another language is used, some dialogs may have a different look.*

3.2 Installation

A set of diskettes comprising three diskettes with the following designations is part of the equipment supplied with option SMIQ-K3:

Rohde&Schwarz SMIQ-K3 MPEG Encoder
Rohde&Schwarz SMIQ-K3 Application 1/2
Rohde&Schwarz SMIQ-K3 Application 2/2

Separate installation steps are required for the MPEG encoder and for application ***SMIQ-K3.EXE***.
In both cases it is possible to select the installation directory and the name of the program file. We recommend to use the corresponding default values.

3.2.1 MPEG Encoder

- Insert diskette labelled with *Rohde&Schwarz SMIQ-K3 MPEG Encoder* into disk drive and start program " L3prod_p " using the explorer or from start menu.
- Follow instructions and use default values as far as possible.

  Program group ***MPEG Layer 3 - Producer*** will be displayed after successful installation.

Note: *Besides the displayed programs and files **MPEG Layer 3** ACM driver is also installed during MPEG encoder installation. In option SMIQ-K3, this driver is required for coding.*

3.2.2 SMIQ-K3

- Insert diskette labelled with *Rohde&Schwarz SMIQ-K3* into disk drive and start program "SETUP" using the explorer or from start menu.
- Follow instructions and use default values as far as possible.

  A program group comprising ***SMIQ-K3.HLP*** in addition to ***SMIQ-K3.EXE*** will be displayed after successful installation.

The following directories have been created:

Note: *<Install Dir> is the directory that was indicated as target directory during installation. It will be used throughout the operating manual and especially in the tutorial.*

Table 3-1 Installation

Directory	**Meaning**	**Files included**
<Install Dir>	Main directory of SMIQ-K3	SMIQK3.exe Smiqk3.hlp SMIQK3.cnt uninst.isu
<Install Dir>\TDM- Encoder	Directory comprising the TDM encoder	encoder.exe Xnmba458.dll Xnmhb458.dll Xnmhn458.dll Xnmte458.dll
<Install Dir>\Sample	Directory comprising example files	Sample.twta Sample.skc simus_mono_1khz_8.wav simus_mono_1khz_8_8kbps.mp3 simus_mono_1khz_8.ssc sweep_mono_1to20_48.wav sweep_mono_1to20_48_64kbps.mp3 sweep_mono_1to20_48.ssc Sample.enc AuxData.txt

3.3 Configuration

Certain settings have to be made after installation to guarantee troublefree operation of option SMIQ-K3. Start options dialog to adapt the IEC/IEEE-bus address and other parameters (see 4.8).

4 Operating Instructions

➢ Start option SMIQ-K3 by double clicking the SMIQK3.exe icon in program group ***Rohde&Schwarz SMIQ-K3*** (Alternatively: double click ***SMIQK3.EXE***" in the explorer) .

To generate a WorldSpace TDM signal the following preconditions have to be met:

1. a list with audio sources has to be created (see 4.3),
2. these audio files have to be converted into MPEG bit streams (see 4.3.2.4),
3. the TDM has to be compiled from broadcast channels and service components (see 4.6.2),
4. a TDM bit stream has to be coded (see 4.6.6) and
5. the bit stream has to be transmitted to SMIQ and played there (see 4.7).

4.1 Conventions

Application: A program that is used for a particular task such as the program of the application described here.

Controls : Parts of the user interface allowing the user to modify values of the application or to trigger actions. This includes buttons, check buttons and radio buttons but also text entry fields.

Window: A rectangular area on the screen displaying related information, and/or providing associated controls.

Dialog: A window that is called up by menu selection or certain operating states. All SMIQ-K3 dialogs are modal, ie the controls outside the dialog cannot be accessed until the dialog is closed by ***OK*** or ***Cancel***.

Button: Buttons that immediately trigger an action. By clicking the OK button, for example, the action selected in a dialog field will be triggered or cancelled by clicking the Cancel button.

Check button: Buttons allowing to switch options on or off. A deactivated option is marked by an empty box ☐, an active option by a box with a cross ☒.

Radio button: Buttons allowing to select the option to be used. Only one option is activated ◉, all other options are switched off ○.

Clicking : The left mouse key is briefly pressed and released. Clicking a button means moving the mouse cursor to this button and pressing it.

Command: Commands are executed after clicking a button or pressing the Enter key (↵). A certain action of the application is activated by a command.

Double clicking: Clicking the mouse key twice in rapid succession.

Field: An area within a window providing information or into which information has to be entered.

Icon: A graphic representation of different elements under Windows™. Icons can replace running applications but can also be used for groups and programs in the program manager. The icons of the tool bar are used to rapidly access commands.

Menu: A list of available elements leading to options or commands that can be executed or cancelled.

Menu bar: Section below the title bar of a window listing available menus.

Marking: A menu or menu item can be marked by the mouse or keyboard.

 First go to menu and then click menu item.

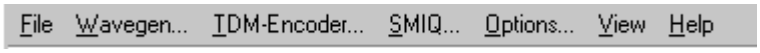
 Click the Alt key to get access to the menu bar.
Use ← or → or ↑ or ↓ to first select the menu and then the menu item.
Press ↵ or ENTER (NL= new line) to open the menu item.

4.2 Program Structure

Option SMIQ-K3 is a Windows95/NT™ application which is structured like most other Windows applications:

- 

Title bar with the name of program/name of current audio source list and buttons (icons to change window size and to close applications)

- 

Menu bar allowing to make special settings and to start subprograms.

- Tool bars to quickly access certain functions.
- Workspace to manage audio sources.
- Status bar providing information about the current command and keyboard status.

4.3 Managing Audio Sources

Audio source management is one of the major tasks of option SMIQ-K3. In contrast to other windows, the audio source manager is always displayed even if it cannot be operated when dialogs are open. All commands of the file menu are with reference to the audio source list that is managed by means of the audio source manager.

4.3.1 Structure of Audio Source List

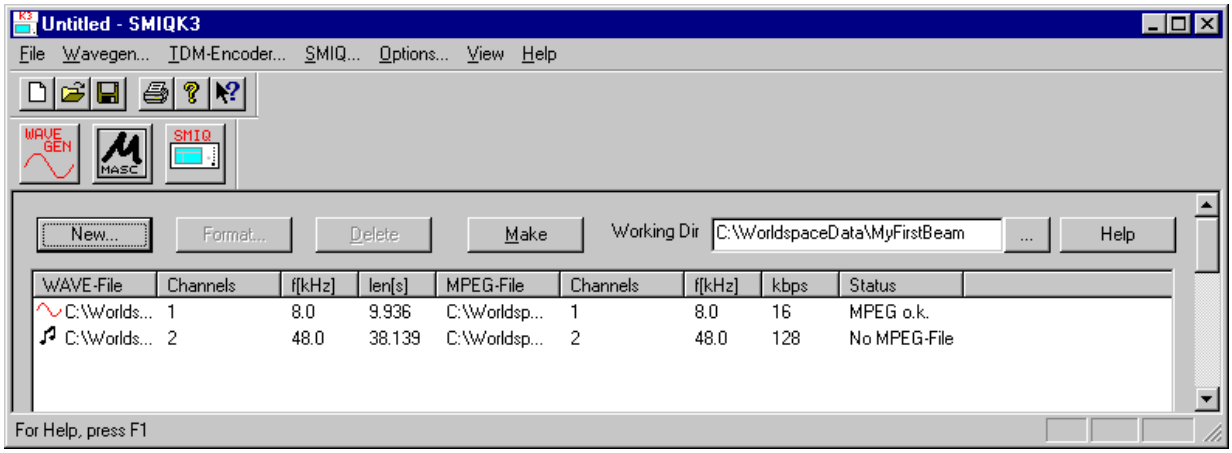


Fig. 4-1-Audio source list

Audio source lists are available in the form of tables. Each line corresponds to a wave file/MPEG file combination with all relevant parameters.

Meaning of the individual columns:

Table 4-1 Structure of audio source list

Name of column	Meaning of column	Change of field contents by
WAVE-File	Symbol of type of wave file and name of wave file	There are two ways to generate wave files: ***Generated by Wavegen*** and ***External (file system)*** (see 4.3.2.1) Wavegen : Entry of name External: Selection in File Open dialog
Channels	Number of channels of wave file (1 = mono, 2 = stereo)	Wavegen : Entry under ***Channels*** External: Read from file
f[kHz]	Sampling rate of wave file in kHz (permissible values: 8, 12, 16, 24, 32, 40, 48)	Wavegen : Entry under ***Sampling Rate*** External: Read from file
len[s]	Length of wave file and of MPEG file in seconds	Wavegen : Entry under ***Length*** External : Length of wave file
MPEG-File	Name of MPEG file	Automatic determination based on name of wave file and bit rate (eg. *sinus_16kbps.MP3* derived from *sinus.wav* and bit rate =16 kbps)
Channels	Number of channels of MPEG file (1 = mono, 2 = stereo)	Setting during conversion (see Fig. 4-4 Setting the MPEG parameters) Mono MPEG files can only be coded from mono wave files, mono and stereo MPEG files can be coded from stereo wave files.
f[kHz]	Sampling rate of MPEG file in kHz (permissible values: 8, 12, 16, 24, 32, 40, 48)	Setting during conversion Sampling rate of MPEG file has to be complete divider of wave file sampling rate.
kbps	Bit rate of MPEG file (permissible values: 8, 16, 24, 32 to 128)	Setting during conversion
Status	Conversion status ("No wave file", "No MPEG-File", "MPEG o.k.")	Selection of files and conversions under ***Make***

The width of list columns can be changed.

- Move cursor over limit line until cursor has following shape: 
- Then move mouse towards left or right with mouse key pressed until desired width is obtained.

The list can be sorted according to the column headlines as follows:

- Click relevant column headline according to which the list is to be sorted.

4.3.2 Functions of Audio Source Manager

The functions of the audio source manager are called up by clicking the button above the audio source list.

4.3.2.1 "New..."

A new audio source is added to the present list.
A select dialog is displayed to indicate the type of audio source:

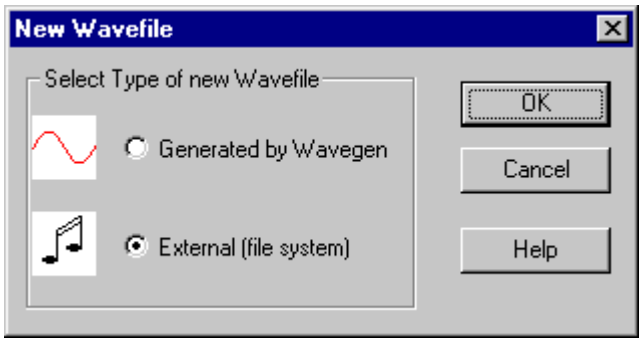


Fig. 4-2 Selecting the type of wave file

- Select ***Generated by Wavegen*** if a new test signal is to be generated with the wave file generator. For detailed information about the wave file generator see 4.5.

- Select ***External (file system)*** to use an available wave file as audio source. A file open dialog is then displayed:

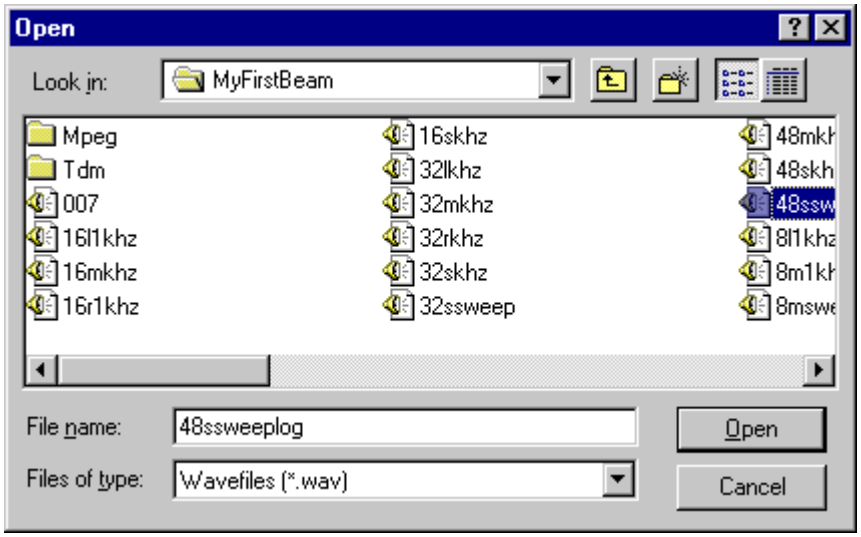


Fig. 4-3 Opening an external wave file

Note: *Only audio files with sampling rates (8 kHz, 12 kHz, to 48 kHz) complying with WorldSpace are suitable. Since most wave files are available with other sampling rates (11 kHz, 22 kHz, 44 kHz) they first have to be converted into a supporting format by means of a suitable program.*

After generating/selecting the wave file a dialog for setting the MPEG parameters will be displayed:

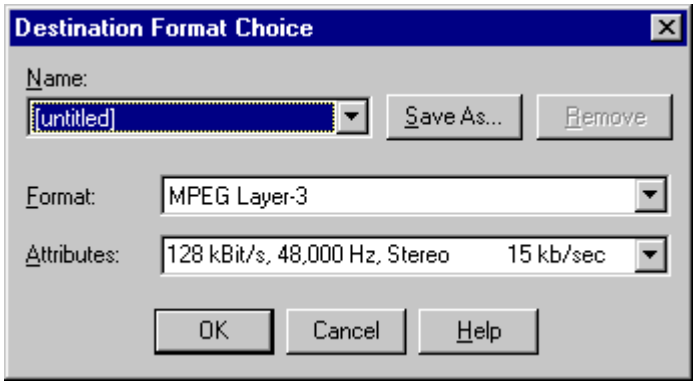


Fig. 4-4 Setting the MPEG parameters

This dialog has the following entry/select fields:

Name	**Function**	**Remark**
Name	List of stored format settings	This list comprises format settings for any ACM drivers as standard. In general, the settings call for a different format than ***MPEG Layer-3*** and thus cannot be used. See Fig. 4-5 Storing an MPEG format
Save As...	Storing a format setting	See Fig. 4-5 Storing an MPEG format
Remove	Deleting the current format setting	
Format	Format list	Option SMIQ-K3 offers format ***MPEG Layer-3***.
Attributes	List of all possible combinations of conversion parameters that are offered by the set format	Each line consists of the following parameters - Bit rate - Sampling rate - Channels (mono or stereo) - Data rate in Kbyte/seconds For all these parameters it is possible to select values as defined in **WST-PMO-DDS-002-000000**. Among all combinations, only those are offered that are useful for the current wave file. The bit rate indicates the quality of the audio signal.(eg 8 kbit/s is only suitable for language, 128 kbit/s are ideal to code music in CD quality) The sampling rate corresponds to the sampling rate of the wave file or divisors of it. If the sampling rate is reduced, the signal is first filtered by means of a lowpass filter. High frequencies are thus lost. Mono signals can only be converted into mono MPEG bit streams, stereo signals to mono or stereo bit streams.
Help	Display of help information	

The selected format setting can be stored under a user-defined name:

- Click ***Save As...*** to store a format setting
  A field to enter the desired name will be displayed.

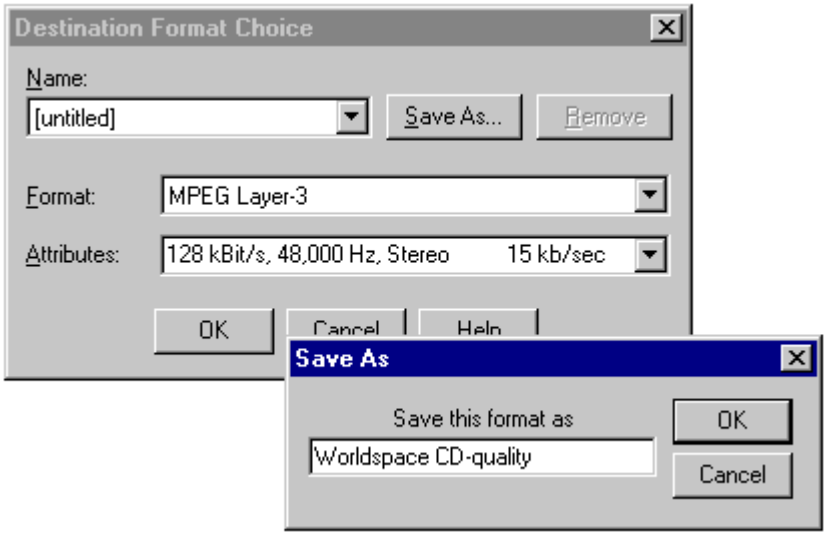


Fig. 4-5 Storing an MPEG format

- Enter desired name and confirm with ***OK***.
- Also click ***OK*** to close the ***Destination Format Choice*** dialog.
  A new entry is created in the audio source list.

Note: *Up to now only the conversion format has been defined. Actual coding is performed only after clicking* ***Make*** *(see 4.3.2.4).*

4.3.2.2 Format...

This dialog allows to change the MPEG format at a later time. For settings see above description.

4.3.2.3 Delete

This button allows to remove an entry from the audio source list. This entry has to be marked beforehand by clicking the name of the wave file (column 1).

4.3.2.4 Make

This function is used to generate all missing MPEG files.
A comparison between the age and format of the wave file and the MPEG file is made for each line. If the MPEG file is missing or is too old or available in the wrong format, conversion will be started and the following window will be displayed:

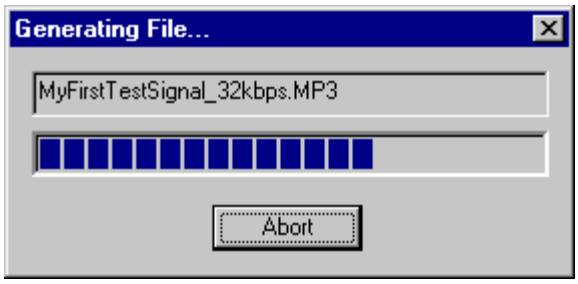


Fig. 4-6 Make

The result of each conversion will be displayed in the ***Status*** column.

A window providing information about a successful conversion is displayed after Make. The following message will be issued after a successful run (all MPEG files are up-to-date):

Fig. 4-7 Successful Make run

The only possible error might be a missing wave file. This may occur if a wave file has been deleted outside option SMIQ-K3.

The following message will then be issued and the Make process will be aborted:

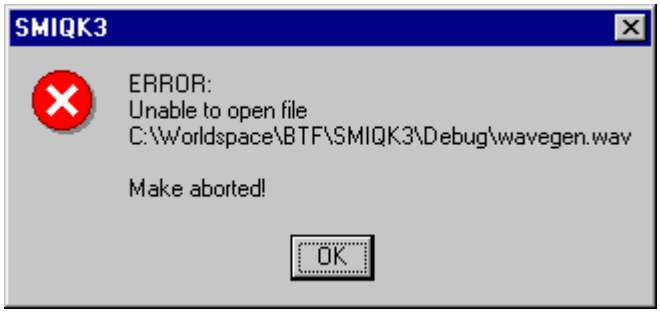


Fig. 4-8 Error message during Make

4.3.2.5 Working Directory

A working directory can be used to get shorter file names under columns ***WAVE-File*** and ***MPEG-File***. If a file is within this directory, the path is not displayed. If not, the whole path will be displayed.

➢ Click the ... button.
A dialog to select the working directories will be displayed:

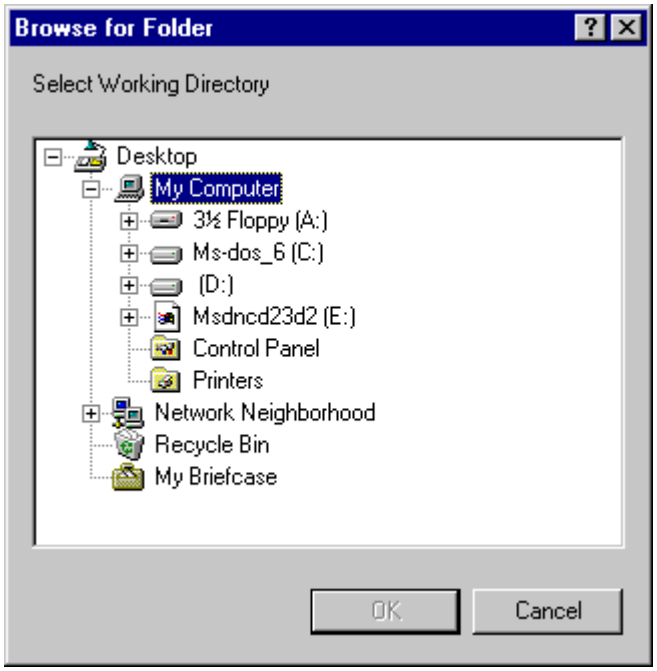


Fig. 4-9 Selecting a working directory

4.3.2.6 Help

This button provides help information for the audio source manager.

4.4 File Menu

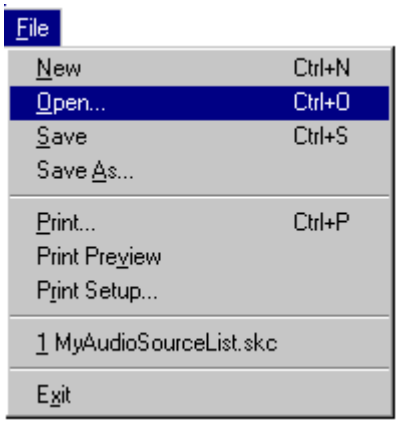


Fig. 4-10 File menu

Note: *In this application, File designates an audio source list.*

The File menu offers the following submenus:

New	Creating a new file.
Save	Storing a current list.
Open	Loading a list.
Save as	Storing the list under a new name.
Print	Printing the list.
Print Preview	Preview to check the page layout prior to printing.
1...	Rapid loading of the audio source list last worked with.
Exit	Leaving the program.

4.5 Wave File Generator

The wave file generator is used to generate test signals. It is started automatically by either adding an entry to the audio source list or manually via the menu (or tool bar):

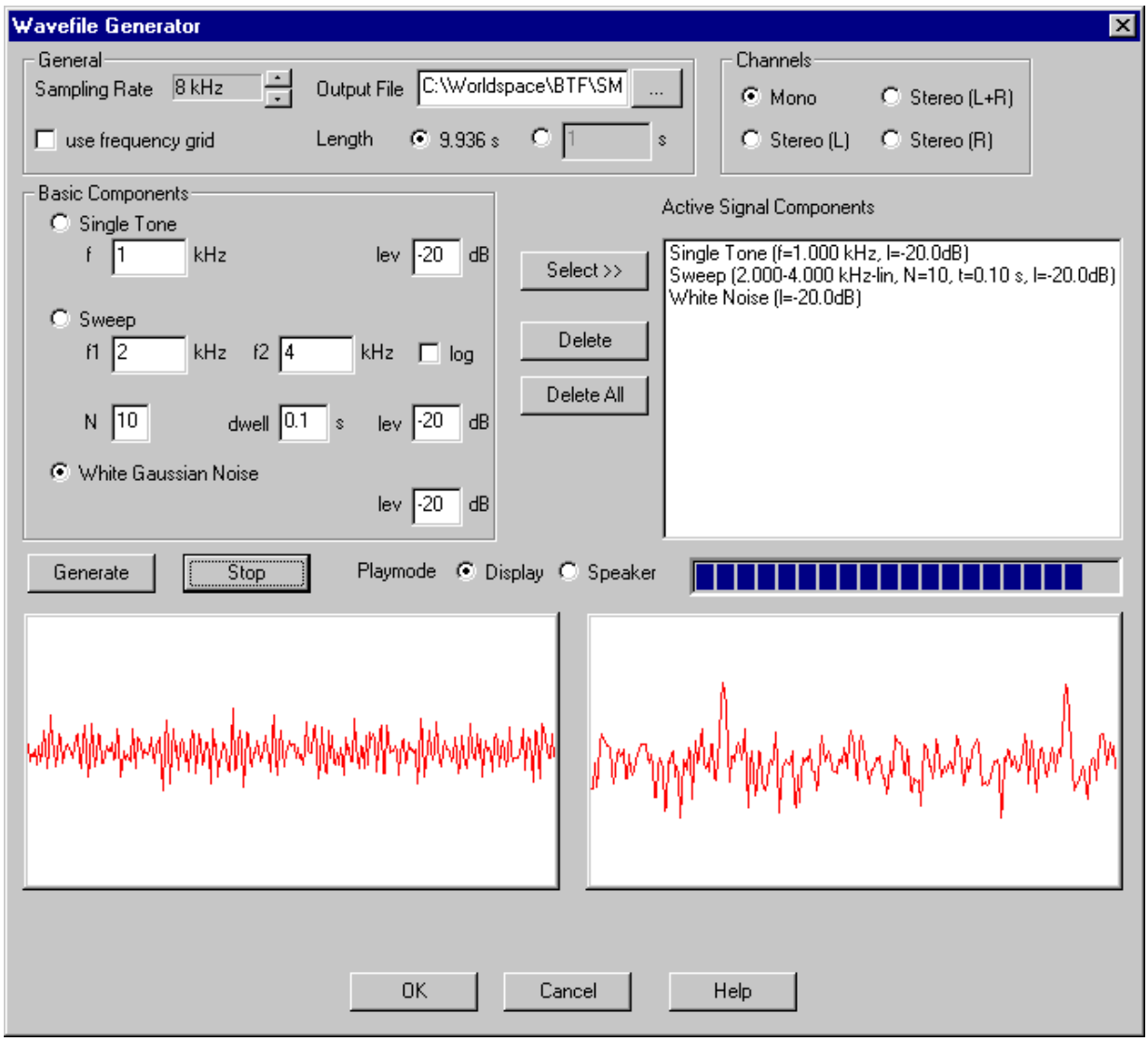


Fig. 4-11 Wave file generator

General settings (sampling rate, file name, frequency grid, length of file and channel configuration) are made in the upper part of the display.

Then come the controls (Basic components/Active Signal Components) for test signal compilation.

The lower part is used to check the generated test signal.

4.5.1 General Settings

The general settings can be changed irrespective of the composition of the test signal. The values are not effective unless they are generated (by clicking the ***Generate*** button). It is thus very easy to generate a defined test signal in different formats (eg sampling rates or channel configuration).

Table 4-2 General settings of WaveGen

Parameter	**Meaning/range of values**	**Remark**
Sampling Rate	Sampling rate of signal (8 kHz, 12 kHz, 16 kHz, 24 kHz, 32 kHz or 48 kHz)	The selected sampling rate has an effect on - available effective bandwidth of test signal - possible bit rates during MPEG coding (to generate a 128 kbps MPEG bit stream, for example, 48 kHz, set stereo)
Output File	File name of generated wave file	The name of the wave file to be generated can be defined with the **...** button to the right of the entry field. The path of the file can also be changed or a new subdirectory can be created using  . (For further details see 4.5.3)
use frequency grid	Using a frequency grids	If this field is marked, a frequency grid (approx. 0.1 Hz) will be applied to all frequencies after activating ***Select***. It is thus guaranteed that the phase of the audio signal is continued without interruption at the end of a 9.936 second superframe.
Length	Length of wave file in seconds	The length is either set to 9.936 seconds (superframe) (press left radio button) or any value (press right radio button)

4.5.2 Test Signal Compilation

The test signal l can be compiled based on any combination of single tones (Single Tone), frequency sweeps (Sweep) and white Gaussian Noise (White Gaussian Noise).
The current component (activated radio button) is added to the list of active signal components by pressing ***Select***. If inconsistent values are entered, warnings will be issued.

List entries can be deleted either individually (mark entry and press ***Delete***) or as a whole (press ***Delete All***).

The Basic Components parameters in detail:

Table 4-3 Parameters of Basic Components

Type	Name	Meaning/range of values	Remarks
Single Tone	f	Effective frequency of tone in kHz	The frequency must be smaller than half the sampling rate.
	lev	Level of tone with reference to full range (-80 dB to 0 dB)	All levels are indicated with reference to the full range (dBFS). The user can define the level of the complete signal. A warning is issued for overranging. (see 4.5.4)
Sweep	f1	Start frequency for sweep in kHz	The frequency must be smaller than half the sampling rate.
	f2	Stop frequency for sweep in kHz	The frequency must be smaller than half the sampling rate.
	log	Activation of logarithmic frequency stepping	If the field is not marked, the frequency steps are defined with constant spacing. If the field is marked, the intermediate frequencies are stepped logarithmically.
	N	Number of frequency steps (2 to 100)	
	dwell	Dwell time on a frequency step in seconds	
	lev	Level of sweep with reference to full range (-80 dB to 0 dB)	All levels are indicated with reference to the full range (dBFS). The user can define the level of the complete signal. A warning is issued for overranging (see 4.5.4)
White Gaussian Noise	lev	Level of noise with reference to full range (-80 dB to 0 dB)	All levels are indicated with reference to the full range (dBFS). The user can define the level of the complete signal. A warning is issued for overranging. (see 4.5.4)

4.5.3 Selection of File Name and Signal Configuration Management

A file comprising the current signal configuration is created automatically during generation. This file has the same name as the wave file but has the extension SSC. An already generated wave file can thus be edited at a later time.

The select dialog for the wave file is started automatically upon activation of WaveGen. If the user selects an already existing file, the following two options are possible:

- The SSC file is found in the same directory:
  The component list can be loaded and the wave file edited.
- No SSC file of the same name is found:
  The wave file cannot be edited but played.

4.5.4 Checking the Generated Test Signal

After defining the setting values (according to 4.5.1) and compiling the signal (according to 4.5.2) the signal can be generated by clicking ***Generate*** and can be written into the wave file.

Note: *Since the wave file is written already after pressing **Generate** and not just after pressing **OK**, it is maintained even if the dialog is aborted with **Cancel**.*

If samples are clipped during generation, the following warning will be issued:

Fig. 4-12 Warning that samples have been clipped

Clipping can be prevented by reducing the levels of the individual components.

Note: *If a signal is to consist of two sinusoidal tones of the same level, for example, the levels of the components have to be set to values ≤-6 dB.*

The file can then be played for checking purposes. With ***Display*** selected in Playmode, the signal on the lefthand side of the display is shown in the time domain and on the righthand side in the spectral range. With ***Speaker*** selected, the wave file is output via the sound system.

The dialog can be closed with ***OK*** or ***Cancel***. With ***OK*** pressed, the generated test signal will be added to the audio source list and all current settings are stored.
With ***Cancel*** selected, all settings are discarded.
The generated wave file will be maintained in both cases.

4.6 TDM Encoder

The TDM encoder is started via the menu or by clicking the 

icon in the tool bar.
The shell command given in the option dialog under ***External programs/TDM-Encoder*** (see 4.8) will be executed.

Note: *The TDM encoder is an independent Windows™ application with its own menu. Data transfer between the TDM encoder and the main part of option SMIQ-K3 is via DDE conversation. An adaptation between the audio source list and the service component properties list is possible any time.*

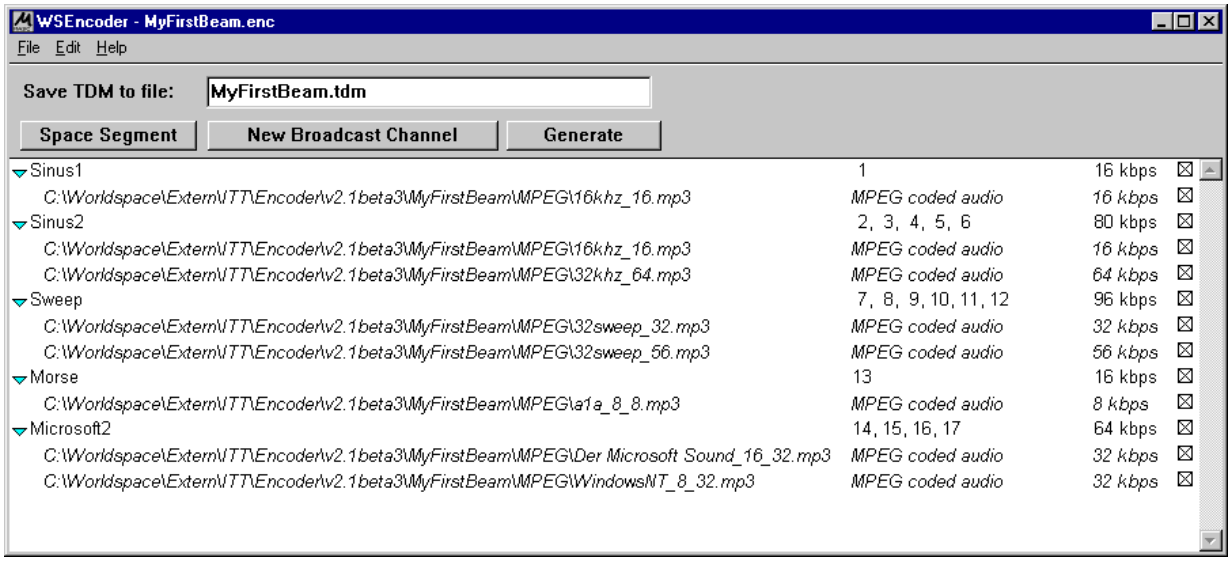


Fig. 4-13 TDM encoder

Besides encoding, the TDM encoder also has an editor to compile the WorldSpace TDM bit stream as well as various dialogs to define parameters.
While the audio source manager provides a pool of MPEG bit streams, these bit streams are, in this case, integrated into the TDM.

Basic knowledge about the Worldspace data format is required to work with the TDM encoder. A detailed description of all Woldspace parameters would be beyond the scope of this manual but a definition of terms can be found in the glossary.
For further information see the following WorldSpace specifications:

WST-PMO-DDS-002-000000	(WorldSpace DAVB System Digital Format Requirements)
WST-WSG-DDS-003-500000	(WorldSpace Encryption System)
WST-WSG-NOT-019-000000	(WorldSpace Guideline for Implementation and Operation of the WorldSpace System)

4.6.1 Menu and other Controls

Since the TDM encoder is an independent Windows™ application, it has its own menu. Further controls are provided above the workspace.

4.6.1.1 Menu

Table 4-4 TDM encoder menu

Menu item	**Action**	**Remark**
File/Open...	Opening an encoder configuration file (*.ENC)	When starting the TDM encoder, an attempt is made to load a configuration file with the same name as the audio source list (eg MyFirstBeam.skc -> MyFirstBeam.enc)
File/Save	Storing the configuration	Perform this prior to closing the TDM encoder in order not to lose any settings.
File/Save As...	Storing the configuration under a new name (*.ENC)	
File/Generate	Generating the TDM (see 4.6.6)	Same action is performed by pressing the ***Generate*** button above the workspace.
File/Space Segment....	Setting the parameter of the space segment (see 4.6.4)	Same action is performed by pressing the ***Space Segment*** button above the workspace
File/Exit	Leaving the TDM encoder	

4.6.1.2 Controls Above Workspace

Table 4-5 Controls above the workspace

Name	**Action**	**Remark**
Save TDM to file:	Entering the TDM file name	If this field is empty when clicking **Generate**, a dialog for selecting/entering the file name will be displayed.
Space Segment	Setting the parameter of the space segment (see 4.6.4)	Same action is performed via menu selection ***File/Space Segment***'
New Broadcast Channel New Service Component New Dynamic Service	Adding the given component to TDM (see 4.6.2.2)	The labelling and meaning of this button depends on the component currently marked in the workspace.
Generate	Generating a TDM (see 4.6.6)	Same action is performed via menu selection ***File/Generate..***.

4.6.2 Compilation of TDM from Broadcast Channels and Service Components

4.6.2.1 Layout of Workspace

A list of broadcast channels (BCs) forming the TDM can be seen in the workspace.
A blue arrow is provided to the left of the BC names. If this arrow is pointing to the right, no service components (SCs) will be displayed. If it is pointing downwards, the corresponding SCs are indicated below the BCs. Switchover between these two displays is via clicking the arrow using the left mouse key.

The following information is contained in the lines:

- Broadcast channel (blue arrow)
  <Name of BC> <occupied Prime Rate Channels> <Bit rate> <Marking whether BC is active>
- Service component, no dynamic service
  <File name of bit stream> <Type of bit stream> <Bit stream> <Marking whether SC is active>
- Service component, dynamic service
  <Name1, Type1, Bit rate1 | ...| NameN, TypeN, Bit rateN> <Marking whether SC is active>

4.6.2.2 Actions to Edit TDM

Table 4-6 TDM compilation

Aim	**Procedure**
Creating a new broadcast channel	➢ If any line is marked, stop marking by clicking the free space below the last line ➢ Click the ***New Broadcast Channel*** button ➢ Work with the Broadcast Channel Properties dialog (see 4.6.3)
Deleting a broadcast channel	➢ Click broadcast channel to be deleted ➢ Click the ***Delete*** key
Changing a broadcast channel	➢ Double click a broadcast channel ➢ Work with the Broadcast Channel Properties dialog (see 4.6.3)
Assigning a new service component to an existing broadcast channel	➢ Click broadcast channel. ➢ Click the ***New Service Component*** button. ➢ Work with the Broadcast Channel Properties dialog (see 4.6.4).
Deleting a service component	➢ If a service component is displayed, click the arrows next to the associated BC. ➢ Mark the service component to be deleted. ➢ Click the ***Delete*** key.
Changing a service component	➢ If a service component is displayed, click the arrows next to the associated BC. ➢ Double click the service component. ➢ Work with the service component dialog (see 4.6.4).
Adding a new dynamic service	➢ If a service component is visible, click the arrows next to the associated BC. ➢ Click the service component. ➢ Click the ***New Dynamic Service*** button. ➢ Work with the service component dialog (see 4.6.4).

Aim	Procedure
Deleting a dynamic service	➢ If a service component is displayed, click the arrows next to the associated BC. ➢ Click the dynamic service component to be deleted using the right mouse key. ➢ Select ***Remove Component*** from the local popup menu.
Changing a dynamic service	➢ If a service component is displayed, click the arrows next to the associated BC. ➢ Double click the service component. ➢ Work with the service component dialog (see 4.6.4)

4.6.3 Defining Broadcast Channel Properties

Broadcast channel properties are entered into the service control header when the TDM is generated (see 4.6.6).

The following dialog is displayed when a new BC (***New Broadcast Channel*** button) is created or an already existing BC is edited (double click):

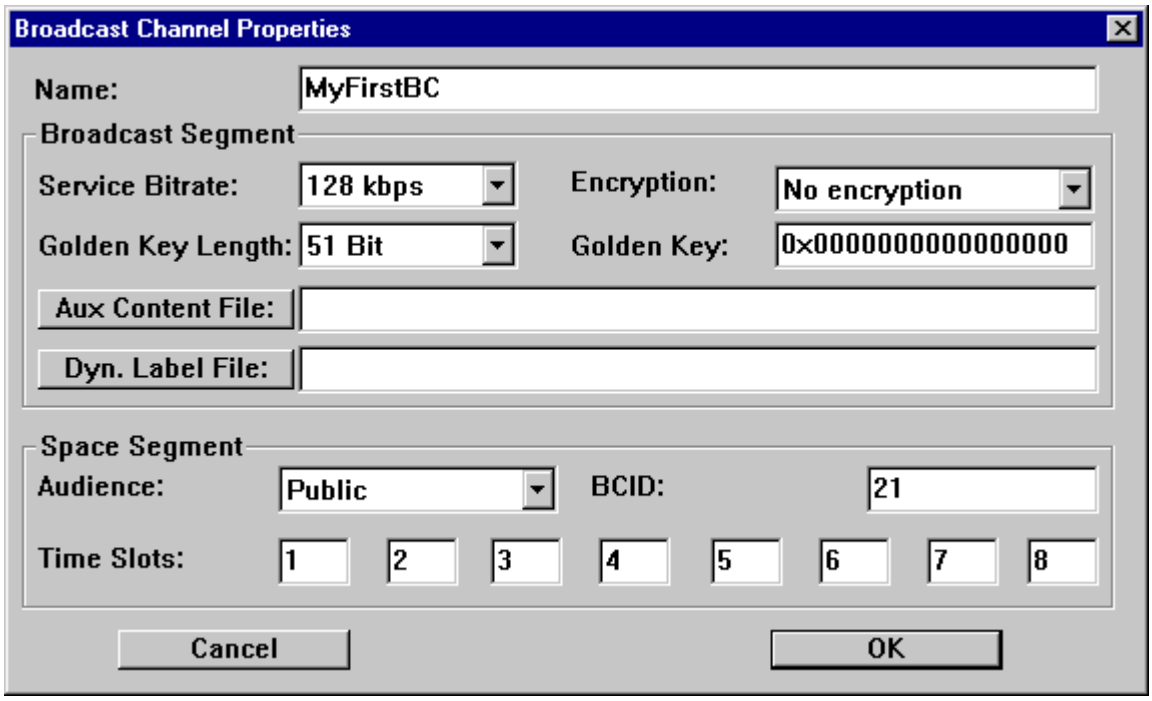


Fig. 4-14 Broadcast channel properties

The following settings are offered by the dialog:

Table 4-7 Broadcast channel properties

Name of parameter	**Meaning/range of values**	**Remark**
Name	Name of BC (any)	The name only serves for identification within the TDM encoder and is not coded into the bit stream.
Service Bitrate	Bit rate of BC (16 kbps to 128 kbps)	The bit rate has to be higher than the sum of SC bit rates
Encryption	Encryption method (no encryption, static key, ES1)	Presetting - an SC is encrypted on the precondition that this is indicated in the corresponding service component properties dialog.
Golden Key Length	16 bit, 32 bit or 51 bit	
Aux Content File	Name of a file from which various control information can be read (see 7.2)	The name can be entered either directly or via a File Open dialog (click button). For a detailed description of file format see 7.2
Dyn. Label File	Name of a file from which texts can be entered into the ***Dynamic Label*** field of the service control header (see 7.3)	The name can either be entered directly or via a File Open dialog (click button). For a detailed description of file format see 7.3
Audience	Determination of audience (public or private)	
BCID	Identification number of BC	The identification number within TDM has to be unique

The entered values will be stored when the dialog is closed by clicking ***OK***, otherwise, the values will be discarded.

4.6.4 Defining Service Component Properties

Service component properties are entered into the service component control field when the TDM is generated (see 4.6.6).

The following dialog will be displayed when a new service component is created or an already available component is changed. If a SC consists of several dynamic services, their values can be edited without having to leave the dialog.

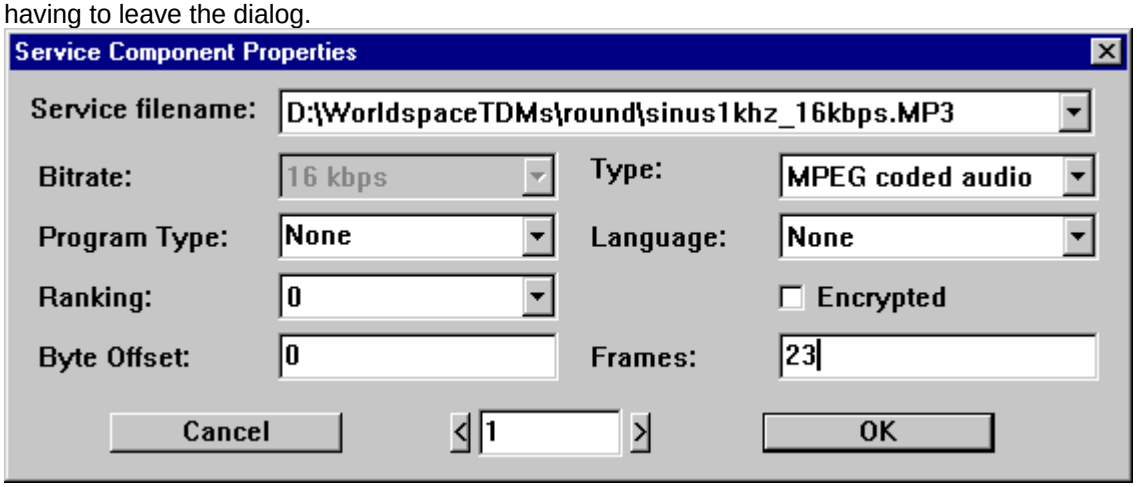
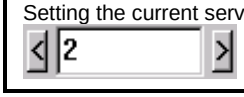


Fig. 4-15 Service component properties

The following settings are offered by the dialog:

Table 4-8 Service component properties

Name of parameter	Meaning/range of values	Remark
Service filename	Name of file comprising the (MPEG) bit stream	The name is to be selected from a given list. The list corresponds to the audio source list (see 4.3).
Bitrate	Bit rate of SC/bit stream	The bit rate is indicated automatically if a service file name is selected and cannot be changed.
Type	Type of SC (up to now only MPEG coded audio has been possible)	
Program Type	Type of program	
Language	Language of program	
Ranking	Rank of this SC	
Encrypted	Activation of encryption	The encryption method is defined in the BC properties (4.6.3).
Byte Offset	file offset in bytes which is applied when reading the bitstream	normally set to 0 (begin coding with the first byte)
Frames	Number of BC frames to be coded (432 ms each)	To generate a superframe, this value has to be set to 23. If the indicated file is too short for the number of frames, the remaining frames are filled with silence.
Setting the current service 	Selection of one of the defined dynamic services (1,2, N)	If no dynamic service is used, this field is set to 1.

The entered values will be stored when the dialog is closed by clicking ***OK***, otherwise, the values will be discarded.

4.6.5 Setting Space Segment Parameters

The values of this dialog will be entered into the TDM identifier during generation.

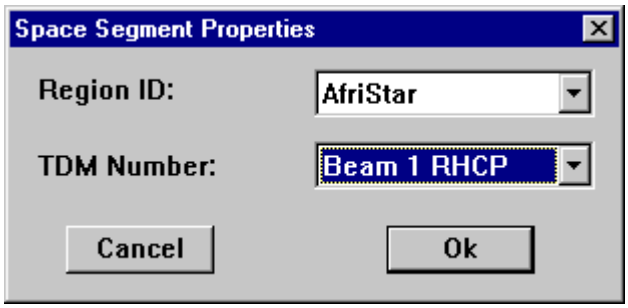


Fig. 4-16 Space segment properties

The following settings are offered by the dialog:

Table 4-9 Space segment properties

Name of parameter	Meaning/range of values
Region ID	AfriStar, AsiaStar or CaribStar
TDM Number	Beam 1 RHCP, ... Beam 3 LHCP

The entered values will be stored when the dialog is closed by clicking ***OK***, otherwise, the values will be discarded.

4.6.6 TDM Bit Stream Generation

- Click ***Generate*** or select menu item ***File/Generate***.
  If the field for the TDM file name is empty, a file select dialog will be displayed.
- Enter a new file name or select an already existing one.
  If this file is already available, it will be overwritten during generation.

Note: *We recommend to use the extension .tdm, to indicate that this file is a WorldSpace bit stream.*

The following display will appear during generation:

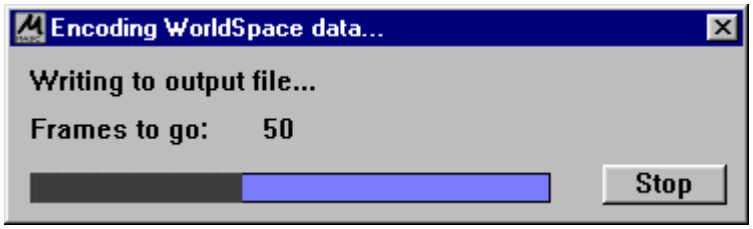


Fig. 4-17 Progress display of TDM encoder

This display indicates the current action and the remaining number of TDM frames. If the service components process 23 BC frames (superframe = 9.936s), 72 (+1) TDM frames will be generated.
The size of the file is approx. 4.6 Mbyte for 72 TDM frames and is independent of the BC/SC number/bit rates and their content.

Generation can be cancelled by clicking ***Stop***. The part of TDM already generated will be retained.

4.7 SMIQ Control

The SMIQ control dialog will be displayed after selecting the menu item ***SMIQ...*** or clicking the SMIQ control icon 

.

This dialog allows access to all WorldSpace-relevant functions of Rohde&Schwarz Signal Generator SMIQ.

These functions include

- TDM bit stream management (the bit streams are available in the form of data lists in the SMIQ data generator)
- control of modulation and RF parameters
- management of TWTA characteristics
- intentional degradation of signal quality (non-linear distortion, noise)
- display of information about the SMIQ connected

4.7.1 Dialog Structure

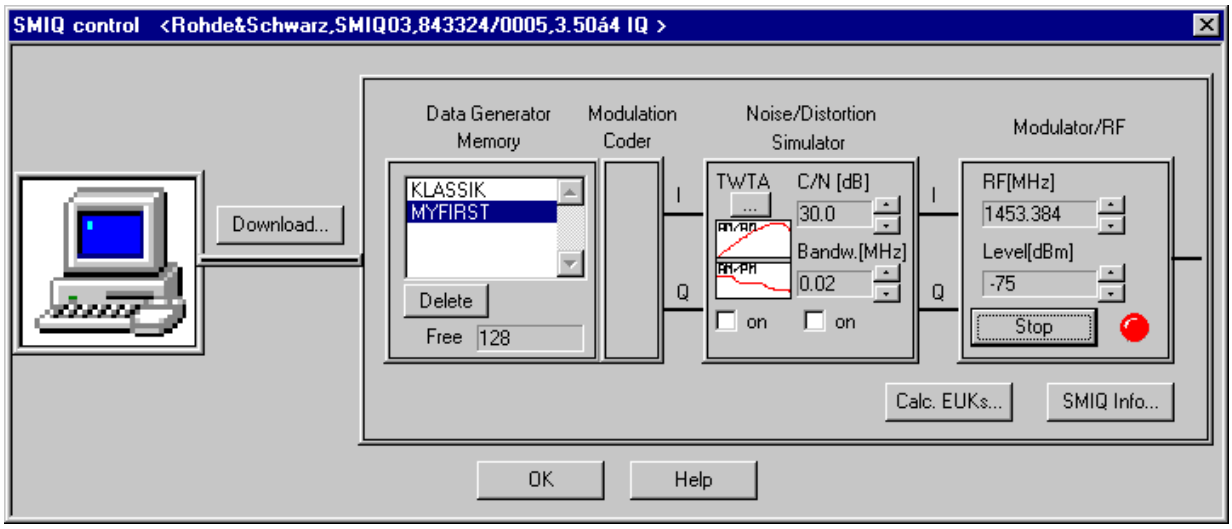


Fig. 4-18 SMIQ control

The heading line provides information on the SMIQ (serial number, version) following the SMIQ control string.
Then comes the block diagram (PC/SMIQ).
The two buttons at the bottom of the display are used to close the application (***OK***) or call up the online help (***Help***).

4.7.2 WorldSpace TDM Bit Stream Management

TDM bit streams are stored in the memory of the data generator option. An 80 Mbit memory is available which is sufficient for more than 20 seconds of WorldSpace signals.
2 superframes of 9.936 seconds each (corresponds to 36 564 480 bits) can be stored, for example. The bit streams are maintained after switch-off and can be used again immediately after switch-on.

The TDM bit streams currently stored in the SMIQ memory are listed in the Data Generator Memory block.
TDMs currently marked can be deleted by clicking the ***Delete*** button, ***Free*** shows the remaining memory capacity in bits.
The ***Download*** button is used to download a new TDM into SMIQ.

The following dialog will be displayed:

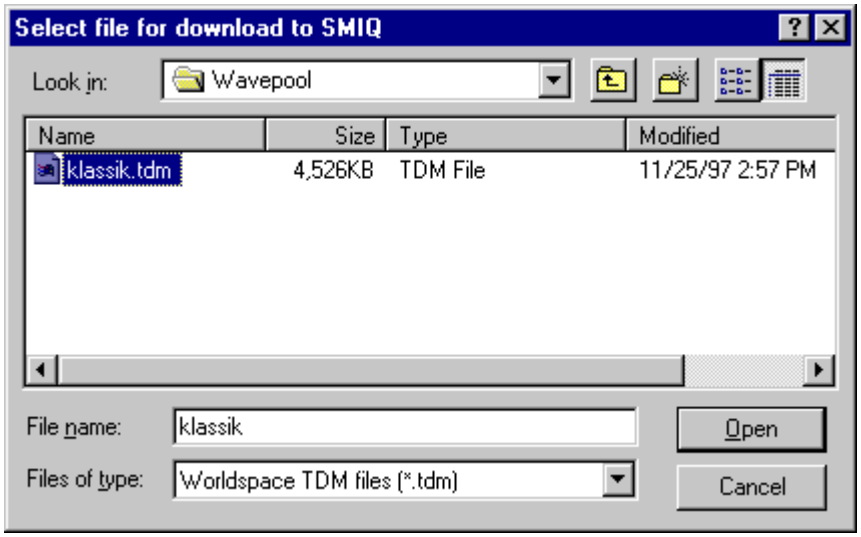


Fig. 4-19 Selection of a TDM file for downloading

➢ Select the file to be downloaded and click ***OK***.

Note: *Since the file has no format information, it cannot be determined automatically whether the file is suitable or not. Mistakes can be avoided by using the extension tdm for WorldSpace TDMs only.*

The following progress display will appear during downloading:

Fig. 4-20 Progress display during downloading

Besides indicating the remaining time this dialog also offers to abort the application (***Abort***).
On abort, the part of TDM already transmitted is maintained in the SMIQ memory. If required, this part can be deleted by using ***Delete***.

4.7.3 Modulation and RF Parameter Control

When the dialog is started, all parameters that are relevant for operation as a WorldSpace generator are automatically set to values complying with WorldSpace.
They include:

Table 4-10 Parameters of the SMIQ control dialog

SMIQ parameter	**Set value**	**Remark**
Digital modulation	on	**Cannot** be changed
Data source	DLIST	**Cannot** be changed
Symbol rate	1.84 MHz	**Cannot** be changed
Modulation type	Inmarsat	**Cannot** be changed
Filter	Squareroot cosine 0.4	**Cannot** be changed
RF frequency	1453.384 MHz	Can be changed
RF level	-75 dBm	Can be changed

After the start (clicking ***Start***) the RF signal is available at the RF connector with a given frequency and level. (On front panel at bottom right with labelling ***RF 50Ω***)
The LED next to the ***Start*** button lights up (on air). At the same time, the labelling of the button changes from **Start** to **Stop**.
The modulated WorldSpace signal is available until ***Stop*** is pressed.

The frequency and level of the signal can be changed in the inactive and active state.

Warning:

Make sure that the set values match with your DUT. The DUT may be destroyed if the levels are too high.

4.7.4 Managing TWTA Characteristics

Thanks to the distortion simulator (Noise/Distortion Simulator block) SMIQ can apply non-linear distortions (AM/AM, AM/PM) to the baseband signal.
It is thus possible to simulate distortions as they occur with the TWTA satellite technique.
SMIQ can manage several characteristics.

After clicking ***...*** below the ***TWTA***, the following dialog will be displayed:

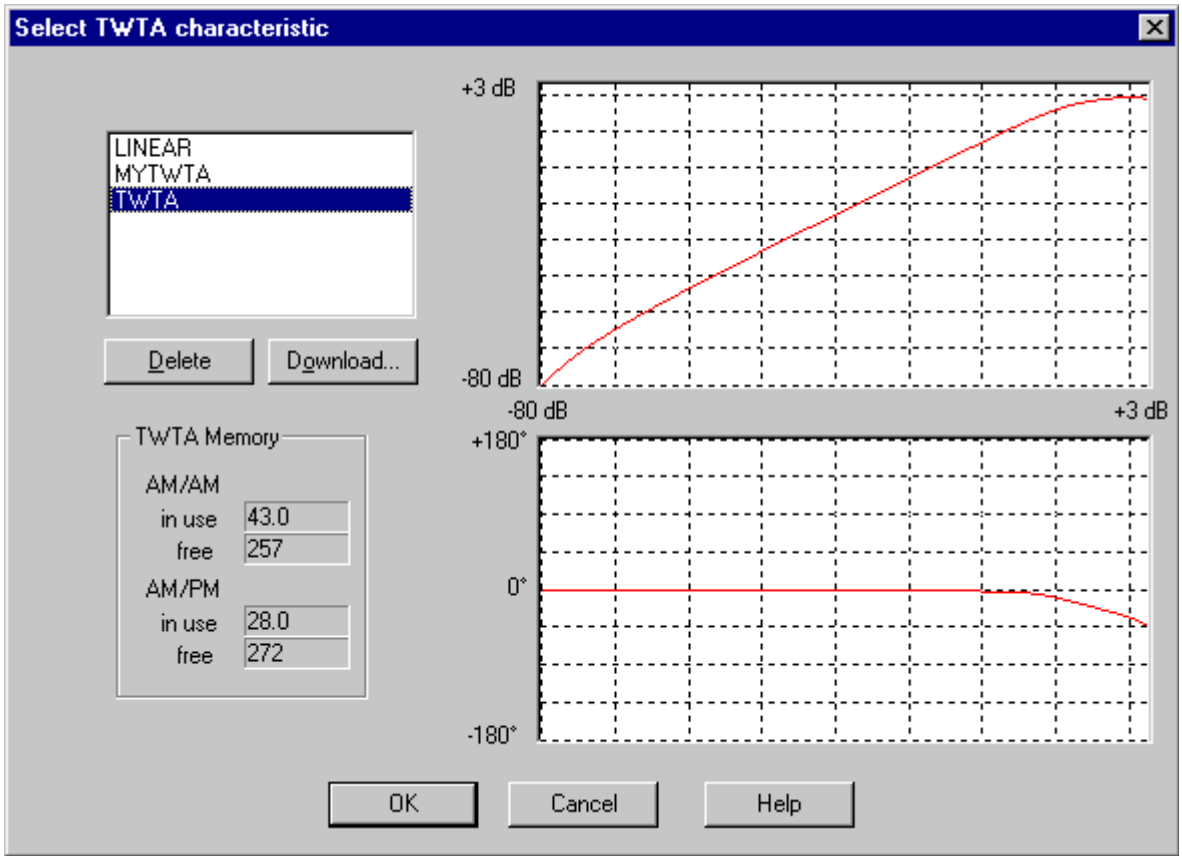


Fig. 4-21 Managing TWTA characteristics

The list indicates all available TWTA characteristics.
The current characteristic can be deleted by clicking ***Delete*** .

Note: *The two characteristics TWTA and LINEAR are an integral part of SMIQ02W/SMIQ03W and cannot be deleted.*

After pressing the ***Download*** button the following dialog is displayed:

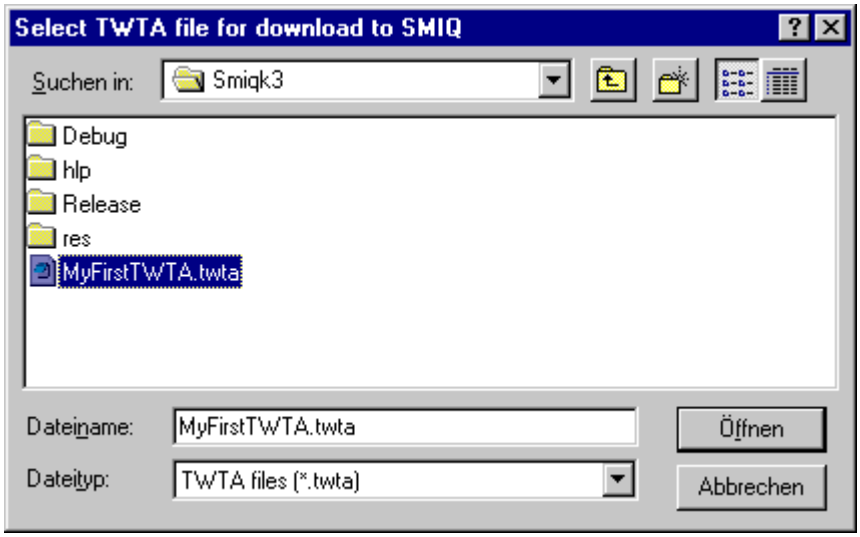


Fig. 4-22 Select dialog for downloading TWTA files

➢ Select name of a new TWTA characteristic and click ***OK***.

For file format of characteristic see Annex 7.1.

The ***TWTA Memory*** area comprises information about the available TWTA memory space. It is divided into AM/AM and AM/PM.

The two displays indicate the AM/AM and AM/PM curves of the selected characteristic.

➢ Leave dialog by clicking **O*K*** after selecting the corresponding characteristic.

4.7.5 Intentional Degradation of Signal Quality

The signal can be impaired on purpose to simulate real conditions. One possibility is the use of a non-linear characteristic (AM/AM or AM/PM distortion) .
Moreover, the signal can be superimposed by white Gaussian noise.
The two functions can be called up in the Noise/Distortion Simulator block.

The lefthand side of the block serves for TWTA distortion. A special dialog which is displayed after pressing the ... button allows to select characteristic and offers further management functions (see 4.7.4).
The current characteristic is activated or deactivated by clicking ***on*** below the ***TWTA*** icon.

The righthand side of the block serves for controlling the noise generator.
Switch-on/off is by clicking ***on***.
The carrier/noise ratio can be set below the factor ***C/N*** [dB]. (Range of values: -3 dB to +30 dB, entry can be changed by clicking the arrows).

Note: *Only the noise power is changed after a change of the C/N ratio. The carrier power is kept constant.*

4.7.6 Displaying Information on SMIQ

After clicking ***SMIQ Info*** the following dialog will be displayed:

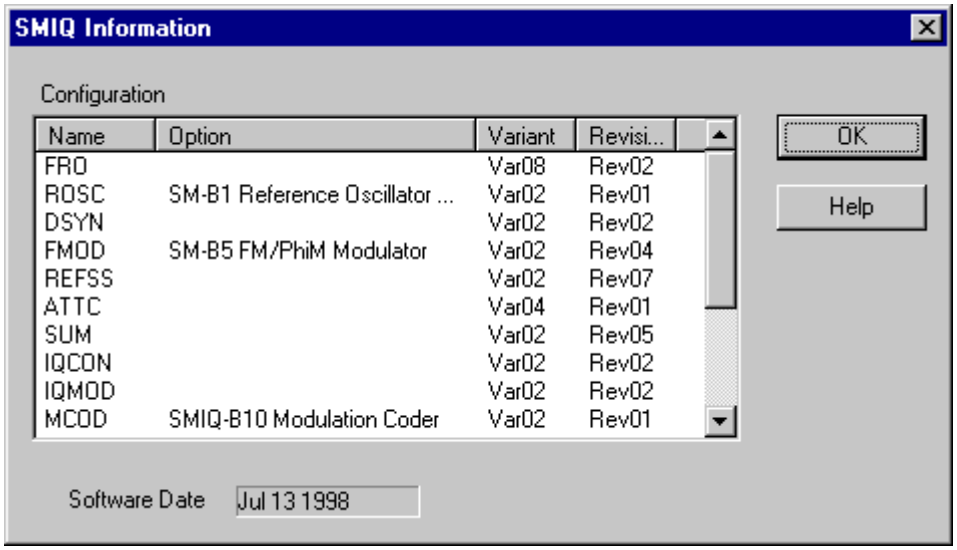


Fig. 4-23 SMIQ information

It shows the configuration of the SMIQ connected.

The list shows the relevant abbreviation and - in case of an option- also the name of the option. The model and version are also indicated for each component.

The date of the SMIQ firmware currently used follows.

4.7.7 Generating Extended User Keys

SMIQ is able to calculate Extended User Keys (EUKs). After clicking "Calc. EUKs" the following dialog is displayed:

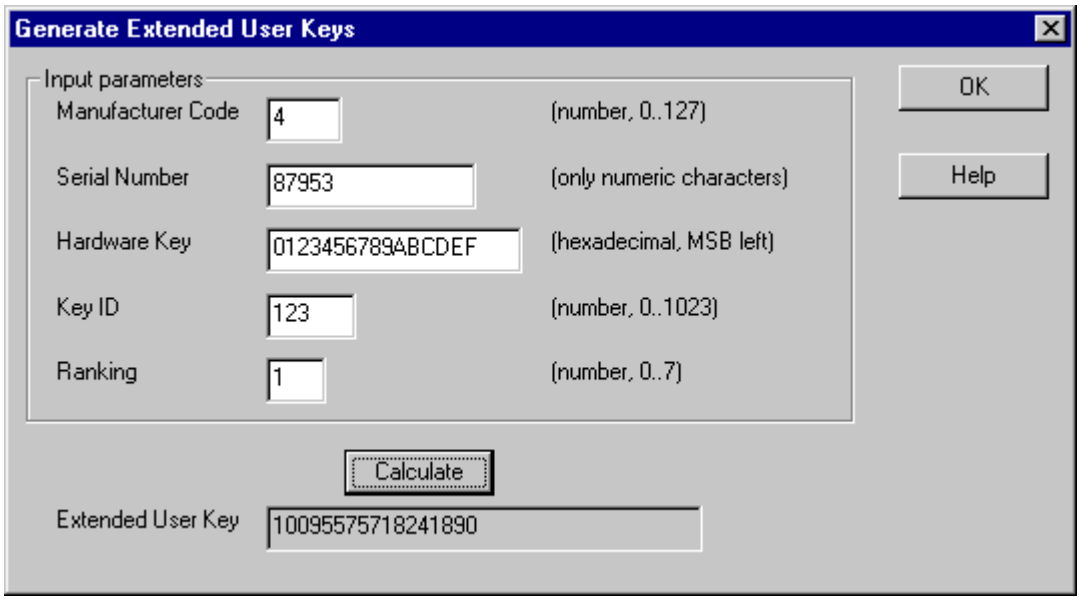


Fig. 4-24 Generating Extended User Keys

After entering the input parameters and clicking on "Calculate", the computed EUK is displayed in the last line.

Table 4-11 Meaning and range of the input parameters

Parameter	Meaning	Range
Manufacturer Code	unique number of the manufacturer	0 to 127
Serial Number	serial number of the tested receiver	up to 14 digits in the range '0' to '9'
Hardware Key	hardware key of the tested receiver	up to 16 hexadecimal digits in the range '0 to '9', 'A' to 'F'
Key ID	Key ID	0 to 1023
Ranking	Ranking	0 to 7

Note: *The Golden Key is fixed to "CODE" (0x434F4445) anf can not be changed!*

To realize this EUK calculation feature, the IEC/IEEE488 command set of SMIQ0xW has been extended by the following commands:

Table 4-12 New IEC/IEEE488 commands to control EUK generation

Command	Parameter	Example/Remark
:TEST		
:EUK		
:MANufacturer	0 to 30	:TEST:EUK:MAN 9
:SN	decimal data string	:TEST:EUK:SN '123456789'
:HK	hex data string	:TEST:EUK:HK '12345678ABCD'
:KEYid	0 to 1023	:TEST:EUK:KEY 123
:RANK	0 to .7	:TEST:EUK:RANK 3
:TEST:EUK?		Query only: decimal EUK is put in output queue

4.7.8 Error Messages and Warnings

The following error messages/warnings could occur:

Fig. 4-25 Error message if driver is missing

The National Instruments GPIB drivers could not be found. Make sure that the GPIB.DLL file is in the Windows directory and matches with the GPIB card installed.

Fig. 4-26 Error message if SMIQ is missing

A connection to SMIQ cannot be established since

- SMIQ is switched off
- address set in option dialog (see 3.3) does not match with set SMIQ address

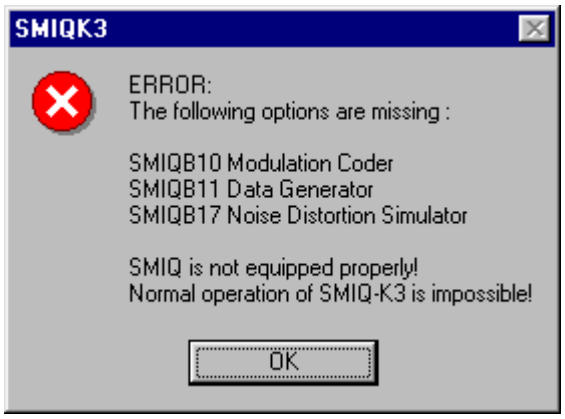


Fig. 4-27 Error message if options are missing

SMIQ is not equipped with the options that are required for WorldSpace generator operation.
The SMIQ control dialog cannot be fully used.

4.8 Setting Options

The following dialog will be displayed after selecting ***Options...:***

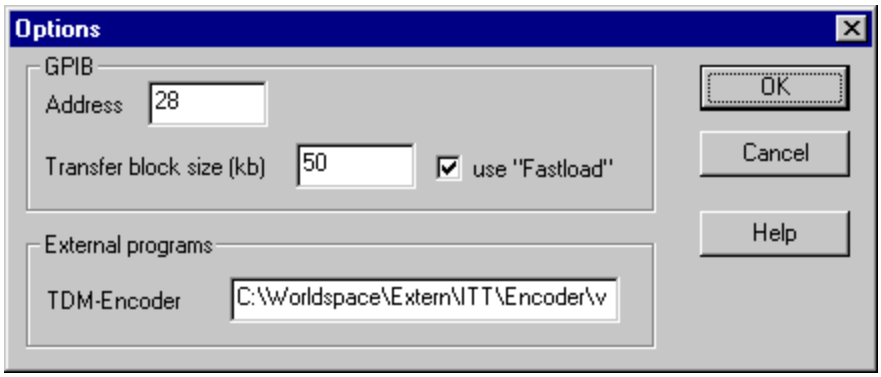


Fig. 4-28 Option dialog

The following settings are offered by the dialog:

Table 4-13 Settings in option dialog

Name	**Meaning/range of values**	**Remark**
Address	IEC/IEEE address under which SMIQ is connected (1 to 31)	This value has to correspond to the address set in SMIQ (default : 28).
Transfer block size (kb)	Size of block during TDM bit stream transfer (downloading) (1 to 1000)	Large values cause higher transfer rates but a coarse progress display, small values cause lower transfer rates but finely stepped progress displays. Appropriate values are: 20 to 200
use "Fastload"	With this box ticked, downloading is faster.	This switch should be activated. Downloading a TDM can be accelerated (by a factor of 3). In case of any problems with data downloading this switch should be switched off.
TDM -Encoder	Command line executed after selecting ***TDM-Encoder*** in the menu or after pressing the corresponding icon in the tool bar.	This value must not be changed since troublefree operation of SMIQ-K3 can otherwise no longer be guaranteed. This field is suitable for future extensions.

4.9 View Menu

This menu allows to switch on/off tool bars and status bars. This is useful in case of low resolution as more space will be obtained to work with the audio source list.

4.10 Help Menu

Two items are offered:

- Help Topics: Display of online help contents
- About SMIQ-K3: Display of About box (see 4.13)

4.11 Tool Bars

The tool bars allow intuitive and quick access to all important functions.
A tool bar can be shifted and changed in size. To shift it, put mouse in grey area and drag tool bar to desired position.
It can also be dragged to the side of the window and dropped there.

Example:

Fig. 4-29 Example 1 to shift tool bars

If the tool bar is dragged to another position it will be framed and can then be changed in size.

Example :

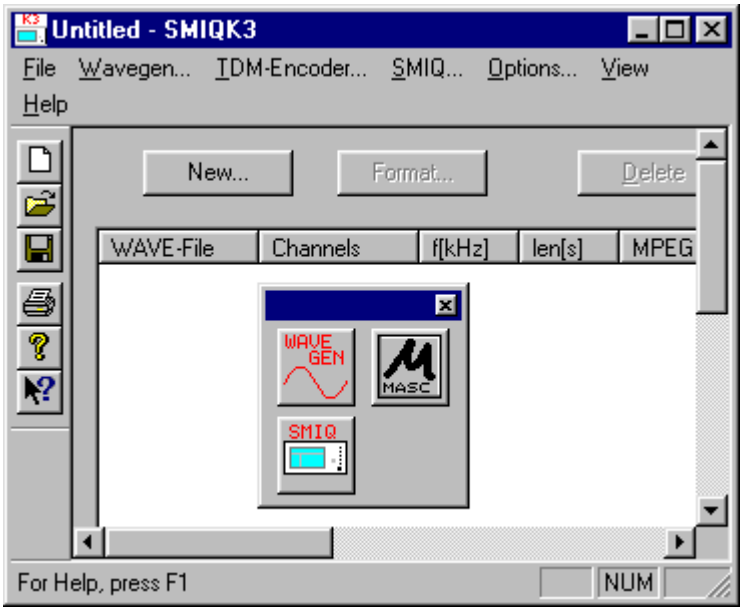


Fig. 4-30 Example 2 to shift tool bars

4.11.1 Standard Tool Bar

This tool bar comprises standard functions that are already known from other applications. Meanings of icons from left to right:

- creating a new audio source list (corresponds to File/New...)
- opening an audio source list (corresponds to File/Open...)
- storing the current audio source list (corresponds to File/Save)
- printing the current audio source list (corresponds to File/Print)
- starting the About box (corresponds to Help/About SMIQ-K3)
- calling for help because of a special control
  - ➢ Select this icon and then click corresponding control for which information is required

4.11.2 SMIQ-K3 Tool Bar

Meaning of icons from left to right:

- calling up wave file generator (corresponds to Wavegen...)
- starting TDM encoder (corresponds to TDM-Encoder...)
- displaying SMIQ control (corresponds to SMIQ...)

4.12 Initial Mask

The following mask is displayed when the application is started:

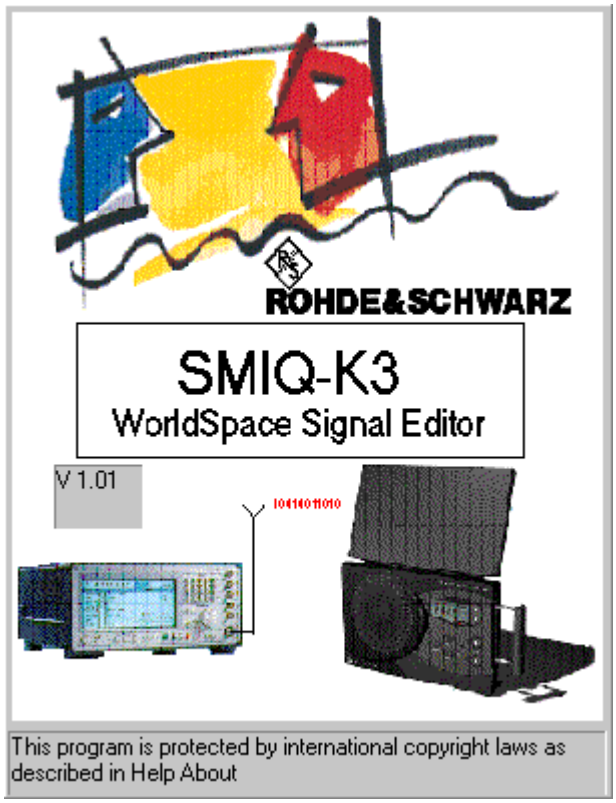


Fig. 4-31 Initial mask

Besides copyright information this mask shows the current version.
The mask is displayed for five seconds but can be aborted any time with a mouse or keyboard entry.

4.13 About Box

This dialog is displayed after selection of ***Help/About SMIQ-K3*** from the menu or after pressing  in the standard tool bar.

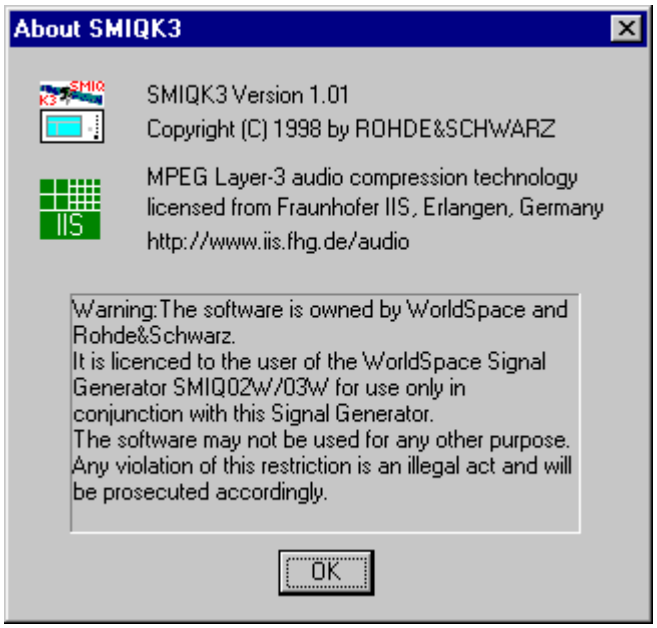


Fig. 4-32 About box

Besides the version, copyright information is also displayed.

➢ Confirm this dialog with ***OK***.

5 Tutorial

5.1 Step 1: Generating Simple Test Signals With Wave File Generator

A First create a wave file.

- Start wave file generator by clicking the 

icon in the tool bar.
The dialog for selecting the file name will be displayed.
- Select SMIQ-K3 directory (eg C:\SMIQ-K3) and create a new folder called Tutorial by means of the  icon. Open this folder, enter file name *sinus_mono_1kHz_8.wav* in the corresponding area and close dialog with ***Save***.

Note: *Any file name can be used for wave files. A certain systematic structure is useful however to recognize the file again: file name **sinus_mono_1kHz_8.wav** was entered according to the following principle <content>_<channels>_<additional information>_<sampling rate>.*

B Then set the format and length of the wave file.

- Set the following values:
  Sampling Rate = 8 kHz
  Channels = Mono
  use frequency grid = off

C After setting these global parameters the signal can be compiled from individual components. This first step of the Tutorial only deals with signals consisting of a single sinusoidal tone.

- Select signal type ***Sinus Tone***, enter 1 kHz for frequency and -10 dB for level.
- Click ***Select*** to add sinusoidal tone to list of ***Active Signal Components***.

D The signal will be generated after completion of the list and the indicated file will be stored.

- Click ***Generate***

The file will be generated. The signal can be viewed to check it or played via the Windows sound system.

- Select ***Playmode Display*** and click ***Play***.

The signal will now be displayed in the two areas provided at the bottom of the window. The left area displays the signal in the time domain (as shown on an oscilloscope), the right area displays the signal in the frequency domain (as shown on a spectrum analyzer).

E Signal generation is completed, the wave file generator can be left.

- Click ***OK***.

5.2 Step 2 : Working with Audio Source Manager

A A working directory is created to get shorter file names for ***Wave-File*** and ***MPEG-File***.

- Click the ***...*** button next to the ***Working Dir*** field and select folder ***<Install Dir>\Tutorial***.

B The audio files will be added to the audio source list.

- Click ***New...*** and select ***Generated by Wavegen***
- Generate file ***<Install Dir>\Tutorial\sinus_stereo_2kHz_16.wav*** that contains a stereo sinusoidal tone with a frequency of 2 kHz at a sampling rate of 16 kHz.
- Leave the wave file generator using ***OK***.

A dialog for setting the MPEG parameters will be displayed.

- Select ***MPEG Layer 3*** as format and ***32 kbit/s, 8000 Hz, Stereo*** as attribute.

C An entry has now been created in the audio source list. Two further audio files are added without using Wavegen.

- Click **New...** and select ***External (by file system)***
- Select file ***sinus_mono_1kHz_8.wav*** created in step 1.
- Code this file with 8 kbit/s

The list now has two audio sources.

- Repeat last three instructions to get a third entry which is identical to second one.
- Mark last line (click file name) and click ***Format***
- Change format to ***16 kbit/s***

D The list is now complete. After definition of all the parameters the MPEG files will be generated.

- Click ***Make***.

A message will be displayed after coding (Info: or Error). The last column of the audio source list indicates the result.

E The audio source list is stored.

- Select menu item ***Save As...*** from file menu and enter file name ***MyFirstProject.skc***.

5.3 Step 3: Enhanced Functions of Wavefile Generator

A A second wave file is created at first.

- Start wave file generator with ***New....***
- Enter file name ***Mixed1_mono_32.wav***.
- Set global parameters ***Sampling Rate*** = 32 kHz, ***Channels*** =Mono.
- Activate ***use frequency grid***.
  the signal can be continued without interruption at the end of a superframe
- Activate frequency grid and add a sinusoidal tone with a frequency of 1.1kHz and a level of -10dB.

The value of the frequency will change to ***1.10004025764895 kHz*** (the frequency grid is obtained by 1/9.936s = 0.100644122 Hz) .
Only ***1.100 kHz*** will be displayed in the component list as no more space is available to display the complete frequency value.

B The sinusoidal tone is now superimposed with a frequency sweep.

- Select ***Sweep*** and set the following values:
  f1 = 3 kHz
  f2 = 15 kHz
  N = 20
  dwell = 0.1 s
  level = -20 dB
  log = inactive
- Enter signal into signal list (***Select***).

The sweep will now be displayed on the righthand side.
Please note that the original frequencies have been maintained since they are already within the grid.

C Noise is added to the signal as the last component.

- Select signal type ***White Gaussian Noise*** and noise level -30 dB.
- Generate wave file.

D Wave files of other formats can also be generated with the same components.

- Change file name to ***Mixed1_stereol_48.wav***.
- Set sampling rate to 48 kHz, channel configuration to ***Stereo L***.
- Click ***Generate*** again.
- Leave the wave file generator using ***OK***.

A dialog for setting the MPEG parameters will be displayed.

- Select ***MPEG Layer 3*** as format and ***128 kbit/s, 48000 Hz, Stereo*** as attribute.

E The list is now complete but some MPEG files are still missing and have to be created.

- Click ***Make***.

After coding, a message will be issued (OK or error). The last column indicates the result.

F After changing the audio source list it will be stored again.

- Select ***Save*** from the file menu.

5.4 Step 4 : Using TDM Encoder

A First start the TDM encoder.

- Click the  icon.

The TDM encoder will be displayed with an empty workspace.

B A broadcast channel comprising a 32 kbps service is now created.

- Click ***New Broadcast Channel***.
- Enter ***BC1***.
- Set service bit rate to ***32 kbps***.
- Use the default values for all other parameters and close the dialog using ***OK***.

The new broadcast channel will now be displayed in the workspace. The list ***1,2*** contains the number of the prime rate channels used.

C Bit stream ***sinus_stereo_2kHz_16_32kbps.mp3*** is to be assigned to this BC.

- Mark broadcast channel ***BC1***.
- Click ***New Service Component***.
- Click ***Service Component*** and select ***sinus_stereo_2kHz_16_32kbps.mp3*** from the list.
- Set frames to ***23***.
- Use the default values for all other parameters and close the dialog using ***OK***.

The service component will now be displayed under the broadcast channel.

D All necessary steps have now been taken to generate the first TDM.

- Click ***Generate***.
- When asked to enter a file name enter ***MyFirstProject.tdm***.

The TDM is generated.

5.5 Step 5 : Advanced Working with TDM Encoder

After creation of this first simple TDM a more complex one is to be generated.

A A second BC comprising the two mono sinusoidal tones is to be created.

- Click ***New Broadcast Channel***.
- Enter ***Sinus Mono***.
- Set service bit rate to ***32 kbps***.
- Set BC ID to 2.
- Use the default values for all other parameters and close the dialog using ***OK***.

This new broadcast channel will now be displayed in the workspace. The list ***3,4*** contains the numbers of the prime rate channels used.

C Bit streams **sinus_mono_1kHz_8_8kbps.mp3** and **sinus_mono_1kHz_8_16kbps.mp3** are now to be assigned to this BC.

- Mark broadcast channel ***BC1***.
- Click ***New Service Component***.
- Click ***Service Component*** and select ***sinus_mono_1kHz_8_8kbps.mp3*** from the list.
- Set frames to ***23***.
- Use the default values for all other parameters and close the dialog using ***OK***.
- Repeat the last 4 steps to also add ***sinus_mono_1kHz_8_16kbps.mp3*** to the list.

D Now create a third BC.

- Click ***New Broadcast Channel***.
- Enter ***Mixed***.
- Set service bit rate to ***128 kbps***.
- Set BC ID to 3.
- Click ***Aux Content File*** and enter ***AuxDATA.TXT***.
- Use the default values for all other parameters and close the dialog using ***OK***.
- Assign bit stream ***Mixed1_stereol_48_128kbps*** to this BC (23 frames).

E The new TDM can now be generated.

- Click ***Generate.***

The TDM is generated.

5.6 Step 6 : Working with SMIQ-control

A First start SMIQ control.

➢ Click icon 

.

B The newly coded WorldSpace TDM bit stream will now be downloaded to SMIQ.

➢ Click ***Download...*** and select following file ***<Install Dir>\Tutorial\MyFirstProject.tdm***.

Note: *If a warning has been issued, SMIQ has not enough memory capacity for this new bit stream and the required space has to be made first. Then repeat the above step.*

A progress display will be appear during downloading.

C The following is based on the precondition that a WorldSpace receiver including a tuner is connected.

➢ If not yet done, connect RF output of SMIQ to input of radio receiver.

Warning:
The SMIQ control dialog only supports the generation of signals that are in the WorldSpace RF with a level range from -144 to +16 dBm. Make sure that your settings match with your DUT. Too high levels may destroy the connected DUT.

Note: *For testing radio receivers without a tuner the signal has to be generated at the IF. In this case do not start generator from this dialog but by local operation after setting the correct frequency.*

➢ Set frequency and level to the values expected by your DUT. When testing a radio receiver, the receive frequency has to match with the SMIQ transmit frequency.

➢ Set a broadcast channel ID on the receiver that was defined beforehand in the TDM encoder.

The test signal is now applied to the AF output of your radio receiver.

D Signal quality is impaired to test the characteristics of your receiver.

➢ Add white Gaussian noise to your signal by activating the noise (mark the right ***on*** button in the ***Noise/Distortion Simulator*** block) and then reduce C/N ratio step by step.

➢ Reduce output level of signal.

5.7 Step 7 : Working with TWTA Characteristics

A Fist select TWTA characteristic.

- Start TWTA management dialog by clicking ***...*** below ***TWTA***.
- Select ***TWTA*** characteristic and close dialog with ***OK***.
- Activate TWTA distortion by marking the left ***on*** button in the ***Noise/Distortion Simulator*** block

B The characteristic ***TWTA*** is now applied and the signal will thus be impaired. In this case, a higher C/N ratio has to be selected to assure that the signal can still be used by the receiver.

- Copy file ***Sample.twta*** from ***<Install Dir>\Sample*** to ***<Install Dir>\Tutorial*** and change file name to ***MyFirstProject.twta***.
- Edit file thus generated using a text editor and change last value of PM list from -140 to 0, for example.
- Store modified file and activate SMIQ-K3 application.
- Start TWTA dialog and click ***Download***.
- Select new file ***<Install Dir>\Tutorial\MyFirstProject.twta***.

After clicking ***OK*** the new characteristic ***MyTWTA*** will be displayed and set as the latest one.

6 Glossary

ACM	Audio Codec Manager Operating system component of Windows95™/NT™. by which applications can control converters and coders via a defined interface.
Audio Source List/Manager	The Audio Source List is a list of audio files that is prepared for use in the TDM encoder.
AWGN	Additive White Gaussian Noise Noise signal with a Gaussian probability density distribution that is added to the wanted signal. In SMIQ-K3, a noise signal can be added in two ways: - during the generation of audio test signals using ***Wavegen*** - to the modulated baseband signal in the NDSIM module of SMIQ
BCID	Broadcast Channel Identifier Defined number of a BC to identify it within the TDMs
Bit rate	Speed to indicate the succession of bits (bps = bits per second) WorldSpace supports information bit rates from 8 kbps to 128 kbps.
Broadcast Channel (BC)	Component of WorldSpace TDM that may consist of several service components. A broadcast channel is the smallest unit that can be subscribed in the Pay Audio mode.
Data Generator (DGEN)	SMIQ module allowing bit stream management.
DDE	Dynamic Data Exchange Standard interface for data exchange between Windows applications.
Dynamic Service	Instead of indicating only one service component (SC), the Service Component Properties dialog allows to indicate several service components. The number of BC frames can be indicated for each SC. After coding this number of frames, switchover is made to the next SC indicated.
Encryption	Method to make the contents of messages inaccessible to unauthorized persons.
Frame	Many digital signals are arranged in frames. Frames consist of control information and the actual user data. Two important frames have to be distinguished in the WorldSpace system: - BC frames with a length of 432 ms - TDM frames with a length of 138 ms
Golden Key	Also called Season Key Part of WorldSpace encryption allowing the coding of subscription period .
IEC/IEEE488	Standard method to control measuring instruments. Is called GPIB by National Instruments.
Modulation Coder	SMIQ component allowing conversion of a bit stream into symbols with complex numbers.
MPEG	Moving Pictures Expert Group Method to compress audio and video data. Wave files become more redundant by removal via the MPEG encoder. Irrelevant parts are converted into the MPEG format.

PCM format	Pulse Code Modulation The amplitude of the analog signal is quantized during sampling and is assigned to a certain numeric value. The digitized signal can be processed word by word or can be stored.
RF	Radio frequency Frequency at which signals are transmitted from transmitters to receivers. WorldSpace uses the 1.4 GHz band for downlink (ie form satellite to radio receiver).
Sampling rate	Frequency at which an analog signal is sampled during digitization. WorldSpace allows sampling rates 8 kHz, 12 kHz, 16 kHz, 24 kHz, 32 kHz and 48 kHz.
Service	Sum of all service components in a broadcast channel
Service Component (SC)	Part of a BCs to which an MPEG bit stream is assigned
Service Component Control Field (SCCF)	Bit block comprising SC-specific control information
Service Control Header (SCH)	Bit block, comprising SC-specific control information
Superframe	Length of WorldSpaceTDM comprising both BC and TDM frames (integers). This frame has a length of 9.936 seconds.
TDM	Time Division Multiplex Signal For WorldSpace especially the bit stream that is generated by the TDM encoder
TDM-Encoder	SMIQ-K3 component generating the TDM bit stream in several steps based on MPEG files and control information. This program section also serves for the hierarchical arrangement of BCs and SCs in TDM.
Tuner	Part of receiver converting the receive signal from a variable RF frequency to a fixed IF.
TWTA	Travelling Wave Tube Amplifier Transmit component of satellites allowing a non-linear distortion of the signal. These distortions can be simulated in the NDSIM module of SMIQ.
Wavefile	File comprising audio samples in industrial standard format WAVE/RIFF. Comprises the samples in the PCM format in addition to a header.
WorldSpace	Satellite-supported broadcasting system for the coverage of developing countries

7 Annex - File Formats

Many file formats are generated and used in option SMIQ-K3 :

File extension	Meaning	Use within option SMIQ-K3
WAV	Wave file Comprises audio samples in industrial standard format WAVE.	Generated by wave file generator ***Wavegen***. The MPEG encoder uses these files as input .
MP3	MPEG Layer 3 Comprises audio samples coded in MPEG format.	The MPEG encoder produces these files. For the TDM encoder, these files serve as input.
SKC	SMIQ-K3 configuration file	Represents an audio source list
SSC	SMIQ-K3 audio component	Represents the list of signal components of a wave file
ENC	Configuration of TDM encoder	Comprises the structure of the TDM bit stream and all other TDM parameters
DYN	Dynamic Label File	Including dynamic labels into the service control header. Files are generated with a text editor.
AUX	Auxiliary Content File	Reading some parameters that are included into the service control header. Files are generated with a text editor.
TDM	WorldSpace TDM bit stream file	Is generated by the TDM encoder and can be transmitted to SMIQ in the SMIQ control dialog.
TWTA	File comprising the TWTA characteristic	see 7.1

7.1 Format for Storing TWTA Characteristics

TWTA characteristics have to be available in a special file format to be downloaded into SMIQ. This format corresponds to the Windows™ format for initialization files.
The file can be generated and processed by a text editor.

The following conventions apply:

- lines starting with a semicolon are interpreted as comment.
- the file is subdivided into sections. The individual names are in brackets.
- each section has entries consisting of a keyword, equals sign and the value of the key.

The following sections are defined for TWTA files:

- [General] (key Name = <Name of characteristic in SMIQ>)
- [AMBase] (key Data = <List of X values of AM/AM characteristic>)
- [AM] (key Data = <List of Y values of AM/AM characteristic >)
- [PMBase] (key Data = < List of X values of AM//PM characteristic>)
- [PM] (key Data = <List of Y values of AM/PM characteristic>)

Note: *The lists of X and Y values of characteristics are transferred to SMIQ without being checked.*
The definitions described in the SMIQ operating manual apply to the structure of these lists.

Example of a TWTA file:

```
;ROHDE&SCHWARZ SMIQ-K3 TWTA-File
;
;     DATE : 97/12/04
;     DESC.: this characteristic belongs to TWTA No. 08/15....
;   (insert any other comment in lines starting with ';')

[General]
;this name is used to reference the characteristic
;if there is no entry, the filename is used instead

Name = MyTWTA

[AMBase]
;Enter here a list of input magnitudes in dB, separated by ','
Data = -80,-70,-60,-50,-40,-30,-20,-10,-6,-3,0,3

[AM]
;Enter here a list of output magnitudes in dB, separated by ','
Data = -80,-75,-65,-52,-45,-27,-12,-4,-2,-1,0,-10

[PMBase]
;Enter here a list of input magnitudes in dB, separated by ','
Data = -80,-70,-60,-50,-40,-30,-20,-10,-6,-3,0,3

[PM]
;Enter here a list of output phases in degree, separated by ','
Data = 0,10,15,12,8, 3, -5, -20, -40, -50, -80, -140
```

7.2 Format of Auxiliary Contents Files

Auxiliary contents files can be generated and processed with a text editor. The name of one of these files can be entered in the Broadcast Channel Properties dialog.
These files contain control information which is inserted into the service control header during TDM coding.

This control information includes:

- Auxiliary Data Field 1
- Auxiliary Data Field 2
- ADF Multiframe Start Flag
- ADF Segment Offset
- ADF Length Field
- AUX Field Content Indicator

The following definitions apply to the structure of the file:

- A line of the auxiliary contents file provides values for a service control header
- Several instructions in a line are separated by commas
- Each instruction starts with the name of the field, whose value has to be set, and with a colon. Fields AUX1 and AUX2 are possible.
- The intended purpose of this field is then indicated. For AUX1, KEY (16 bit key selector), RDS, ASP, RCN or ASP are possible.
  AUX2 can be used for KEY (64 bit key selector), LABEL (service label), DATE, COUNTRY or SUBCOUNTRY.
- After indication of the intended purpose follows the equals sign and then the value of the field. According to the notation of programming language C, this value can be indicated in decimal (eg 24) or hexadecimal form (eg 0x18) or as text (eg TEST).
- If the AUX2 field is used to indicate a label, it is also possible to specify values for the fields SF and SOLF.

All Keywords for AUX1

ACI1	Keyword	Data	Example
0x1	KEY	16 bit hexadecimal or decimal number	AUX1 : KEY = 0x1234 AUX1 : KEY = 65523
0x2	RDS	16 bit hexadecimal or decimal number	AUX1 : RDS = 0xABCD AUX1 : RDS = 1
0x3	ASP	16 bit hexadecimal or decimal number	AUX1 : ASP = 0x1801
0x4	RCN	16 bit hexadecimal or decimal or split into 3 codes	AUX1 : RCN = 0x0034 AUX1 : RCN = { CCF = 0, NNSC = 3, NBRI = 4 }
0x5	SLF	16 bit hexadecimal or decimal number	AUX1 : SLF = 0xFF00

All Keywords for AUX2

ACI2	Keyword	Data	Example
0x1	KEY	64 bit hexadecimal or decimal number	AUX2 : KEY = 0x0123456789ABCDEF
0x2	LABEL	String (up to 8 chracters) in double quotes or split into 3 codes SF, SOLF and SEGMENT	AUX2 : LABEL = "12345678" AUX2 : LABEL = { SF = 1, SOLF = 5, SEGMENT = "ABCDEFGH" }
0x3	DATE	Day/Month/Year Hour/Minutes/Seconds or Now	AUX2 : DATE = 13/8/97 11:55 AUX2 : DATE = Now
0x4	COUNTRY	64 bit hexadecimal or decimal number	AUX2 : COUNTRY = 0x0123456789ABCDEF
0x5	SUBCOUNTRY	64 bit hexadecimal or decimal number	AUX2 : COUNTRY = 0x0123456789ABCDEF

Example of an auxiliary contents file:

```
AUX1: KEY = 0x1234, AUX2: LABEL = " Hello  "
AUX1: KEY = 0x5678, AUX2: LABEL = " World  "
AUX1: KEY = "TEST", AUX2: DATE = 13/8/97 11:55
AUX2: LABEL = { SF = 1, SOLF = 5, SEGMENT = "12345678" }
AUX1: RCN = { CCF = 1, NNSC = 2, NBRI = 12 }
```

7.3 Format of Dynamic Labels Files

The name of one of these files can be indicated in the Broadcast Channel Properties dialog.
These files comprise text information that is inserted into the service control header (dynamic labels section) during TDM coding.
The format of these texts is defined in **WST-PMO-DDS-002-000000, DIGF SLBS 801**.

8 Index

K

L

M

N

O

P

R

S

T

U

V

W