

# DAB / T-DMB

## Digital Standard for

### R&S<sup>®</sup> Signal Generators

# Operating Manual



1171.5531.12 – 08

This document describes the following software options:

- R&S®AMU-K53/-K253  
1402.9957.02, 1403.0682.02
- R&S®SMATE-K53  
1400.6409.02
- R&S®SMBV-K53/-K253  
1415.8154.xx, 1415.8525.xx
- R&S®SMJ-K53/-K253  
1400.6309.02, 1409.3202.02
- R&S®SMU-K53/-K253  
1400.6209.02, 1408.8317.02
- R&S®SFU-K253  
2115.2414.02

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Trade names are trademarks of the owners.

The following abbreviations are used throughout this manual: R&S®AMU is abbreviated as R&S AMU, R&S®SMATE is abbreviated as R&S SMATE, R&S®SMBV is abbreviated as R&S SMBV, R&S®SMJ is abbreviated as R&S SMJ, R&S®SMU is abbreviated as R&S SMU, R&S®WinIQSIM2 is abbreviated as R&S WinIQSIM2

# Basic Safety Instructions

## Always read through and comply with the following safety instructions!

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







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

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

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

## Symbols and safety labels

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

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

### Tags and their meaning

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



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



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



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



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

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

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

### Operating states and operating positions

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

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

### Electrical safety

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

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.
3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
6. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages  $V_{\text{rms}} > 30 \text{ V}$ , suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

## Basic Safety Instructions

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

### Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

### Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

### Batteries and rechargeable batteries/cells

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

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

### Transport

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

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

### **Waste disposal**

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

## Informaciones elementales de seguridad

### **Es imprescindible leer y observar las siguientes instrucciones e informaciones de seguridad!**

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

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



## Informaciones elementales de seguridad

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

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

### Símbolos y definiciones de seguridad

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

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

## Palabras de señal y su significado

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



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



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



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



AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.

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

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

## Estados operativos y posiciones de funcionamiento

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

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

## Seguridad eléctrica

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

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

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

## Funcionamiento

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

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

### **Reparación y mantenimiento**

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

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

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

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

## Informaciones elementales de seguridad

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

### Transporte

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

### Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polveros con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

# Contents

<b>1</b>	<b>Preface</b> .....	<b>5</b>
1.1	Documentation Overview.....	5
1.2	Typographical Conventions.....	6
<b>2</b>	<b>Introduction</b> .....	<b>7</b>
2.1	DAB Network.....	7
2.2	DAB Transmission System.....	8
2.3	Transport Mechanisms.....	8
2.3.1	Transmission channels.....	9
2.3.2	Transport Modes.....	10
2.4	Pseudo Noise (PN) Scrambling.....	10
2.5	Convolutional Coding.....	10
2.6	Time Interleaving.....	11
<b>3</b>	<b>DAB/T-DMB User Interface</b> .....	<b>12</b>
3.1	General Settings for DAB/T-DMB Signals.....	12
3.2	System Configuration.....	16
3.3	Filter Settings.....	17
3.4	Clipping Settings.....	18
3.5	Trigger/Marker/Clock Settings.....	20
3.5.1	Trigger In.....	21
3.5.2	Marker Mode.....	25
3.5.3	Marker Delay.....	26
3.5.4	Clock Settings.....	27
3.5.5	Global Settings.....	28
<b>4</b>	<b>Remote-control commands</b> .....	<b>30</b>
4.1	General Commands.....	30
4.2	System Configuration.....	35
4.3	Filter Settings.....	36
4.4	Clipping Settings.....	41
4.5	Trigger Settings.....	42
4.6	Marker Settings.....	48

**4.7 Clock Settings.....53**

**List of Commands.....56**

**Index.....58**



# 1 Preface

## 1.1 Documentation Overview

The user documentation for the R&S Signal Generator consists of the following parts:

- Online Help system on the instrument,
- "Quick Start Guide" printed manual,
- Documentation CD-ROM with:
  - Online help system (\*.chm) as a standalone help,
  - Operating Manuals for base unit and options,
  - Service Manual,
  - Data sheet and specifications,
  - Links to useful sites on the R&S internet.

### Online Help

The Online Help is embedded in the instrument's firmware. It offers quick, context-sensitive access to the complete information needed for operation and programming. The online help contains help on operating the R&S Signal Generator and all available options.

### Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the Documentation CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and an example of setup are described. The manual includes also general information, e.g., Safety Instructions.

### Operating Manuals

The Operating Manuals are a supplement to the Quick Start Guide. Operating Manuals are provided for the base unit and each additional (software) option.

These manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In the Operating Manual for the base unit, all instrument functions are described in detail. Furthermore, it provides an introduction to remote control and a complete description of the remote control commands with programming examples. Information on maintenance, instrument interfaces and error messages is also given.

In the individual option manuals, the specific instrument functions of the option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S Signal Generator is not included in the option manuals.

These manuals can also be ordered in printed form (see ordering information in the data sheet).

### Service Manual

This Service Manual is available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. It describes how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the instrument by the replacement of modules.

This manual can also be orderd in printed form (see ordering information in the data sheet).

### Release Notes

The release notes describe new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The current release notes are provided in the Internet.

## 1.2 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.
File names, commands, program code	File names, commands, coding samples and screen output are distinguished by their font.
<i>Input</i>	Input to be entered by the user is displayed in italics.
<a href="#">Links</a>	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

## 2 Introduction

The R&S Signal Generator enables you to easily generate signals in accordance with the Digital Audio Broadcasting (DAB)/Terrestrial Digital Multimedia Broadcasting (T-DMB) standard.

The generated signals are compliant with ETSI EN 300 401 standard. Via the user-friendly graphical interface of R&S Signal Generator, you can adjust several DAB signal parameters. You are enabled to generate a signal corresponding to one of the four standard transport modes, Transmission Mode I, II, III or IV. You can also choose to enable or disable channel coding, time interleaving and/or pseudo noise scrambling.

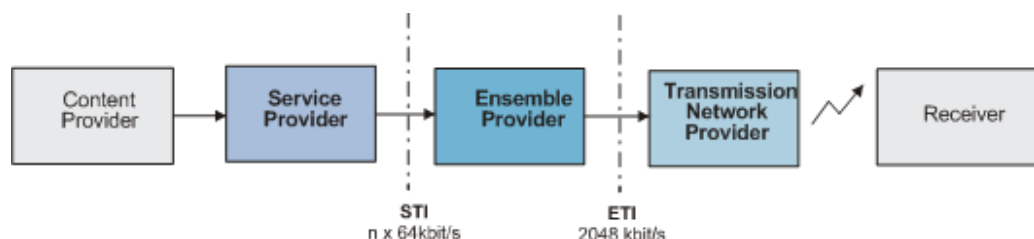
The R&S Signal Generator allows you to choose between different data sources. You can either use some of the predefined data sources (two different pseudo noise sequences, fixed all "0", fixed all "1") or you can use your own ETI (Ensemble Transport Interface) compliant source file. To create an ETI compliant source file, you can for instance use the R&S STI Ensemble Mux DM001 or the R&S ETI Builder. However, the ETI source file must fulfill some prerequisites.

The DAB system is designed for delivery of high-quality digital audio programs and data services for mobile, portable and fixed reception from terrestrial or satellite transmitters in the Very High Frequency (VHF)/Ultra High Frequency (UHF) frequency bands as well as for distribution through cable networks.

The DAB system is designed to provide spectrum and power efficient techniques in terrestrial transmitter network planning, known as the Single Frequency Network (SFN) and the gap-filling technique. The DAB system is suitable for satellite as well as hybrid/mixed terrestrial/satellite broadcasting, using a simple, nearly omni-directional receiving antenna. The DAB system meets the required sharing criteria with other radio communication services.

### 2.1 DAB Network

The figure below illustrates the outline of a DAB network.



**Fig. 2-1: DAB network**

The DAB network has three main parts: the service or service component provider, the multiplex or ensemble provision and the transmission network provision.

The interfaces between these three blocks are scope of ETSI standards. The STI (Service Transport Interface) is defined to provide a standardized way of transporting DAB service components, service information and control messages in a DAB collection network.

The Ensemble Transport Interface (ETI) links the Multiplexer of the Ensemble Provider with the transmitters of the Transmission Network Provider.

## 2.2 DAB Transmission System

The following block diagram shows the components of the DAB transmission system.

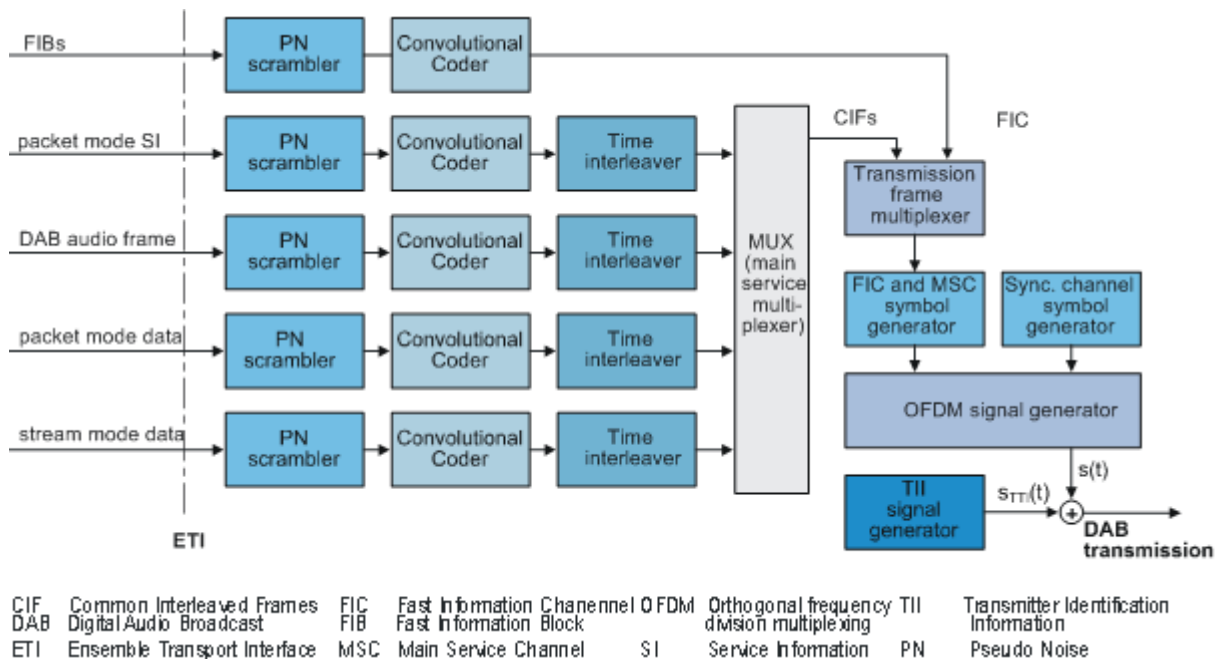


Fig. 2-2: Components of the Transmission System DAB

The DAB transmission signal is defined as the sum of two signals; the main signal  $s(t)$  and an optional signal  $s_{TII}(t)$  as illustrated in the figure above.

## 2.3 Transport Mechanisms

The DAB system is designed to carry several digital audio signals together with data signals. Audio and data signals are considered to be service components which can be grouped together to form services.

The DAB system transmission frame consists of three different channels:

- Main Service Channel (MSC)
- Fast Information Channel (FIC)
- Synchronization Channel

### 2.3.1 Transmission channels

The MSC is a time-interleaved data channel used to carry the audio and data service components, together with possible supporting and additional data service components. The MSC is divided into a number of sub-channels. Each of the sub-channels is individually convolutionally coded with equal or unequal error protection. Each sub-channel may carry one or more service components.

The FIC is a non time-interleaved data channel with fixed equal error correction. FIC carries information about the organization of the MSC sub-channels, such as information on the multiplex structure and, when necessary, its reconfiguration. Optionally FIC may include service information, conditional access management information and data service.

The Synchronization Channel provides a phase reference and is used internally for demodulator functions such as transmission frame synchronization, automatic frequency control, transmitter identification, and channel state estimation.

The Synchronization channel, the Fast Information Channel and the Main Service Channel form a transmission frame (see figure 2-3). The MSC occupies the major part of the transmission frame.

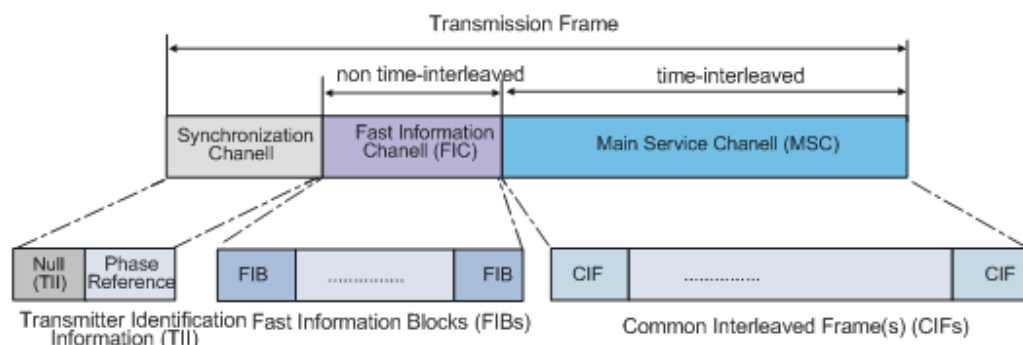


Fig. 2-3: DAB transmission frame

Each transmission frame is divided into a sequence of OFDM symbols, each symbol consisting of a number of carriers.

The Fast Information Block (FIB) and the Common Interleaved Frame (CIF) are introduced in order to provide transmission mode independent data transport packages associated with the FIC and MSC respectively.

The data, carried in the MSC, is divided at source into regular 24 ms bursts corresponding to the sub-channel data capacity of each CIF. The CIF contains 55 296 bits, divided at 864 capacity units, 64 bits each.

Fast Information Block (FIB) is a data burst of 256 bits. The sequence of FIBs is carried by the Fast Information Channel FIC. The structure of the FIB is common to all transmission modes.

The synchronization channel symbols comprise the null symbol and the phase reference symbol. The null symbols are also used to allow a limited number of OFDM carriers to convey the Transmitter Identification Information (TII).

### 2.3.2 Transport Modes

Transmission mode is specific set of transmission parameters (e.g. number of carriers, OFDM symbol duration). Four transmission modes (i.e. I, II, III and IV) are defined to allow the system to be used for different network configurations and a range of operating frequencies. Depending on the transport mode, the transmission frame has different organization and length, i.e. the transmission frame is specific to the four transmission modes.

The table below gives the transmission frame duration and the number of FIBs and CIFs which are associated with each transmission frame for the four transport modes.

*Table 2-1: Transmission Mode Characteristics*

Transport Mode	Duration of transmission frame	Number of FIBs per transmission frame	Number of CIFs per transmission frame	Number of carriers	Carrier Spacing
I	96 ms	12	4	1536	1 KHz
II	24 ms	3	1	384	4 KHz
III	24 ms	4	1	192	8 KHz
IV	48 ms	6	2	768	2 KHz

## 2.4 Pseudo Noise (PN) Scrambling

Prior to convolution encoding, the transmitted signal can be scrambled by a modulo-2 addition with a pseudo-random binary sequence (PRBS).

The PRBS polynomial is of degree 9 and specified as  $P(X) = x^9 + x^5 + 1$ .

The initialization word is applied in such a way that the first bit of the PRBS is obtained when the outputs of all shift register stages are set to value "1".

## 2.5 Convolutional Coding

The process of convolution coding is applied at the output of each PN scrambler. The channel encoding process is based on punctured convolutional coding, which allows both equal and unequal error protection. Unequal error protection (UEP) is designed for audio services, equal error protection (EEP) for audio and data services. The sampling frequency is respectively 48 kHz and 24 kHz.

The convolutional coder is a punctured convolution code, based on a mother convolutional code with constraint length 7 and rate 1/4.

The generator polynomials are  $G_1=(1,0,1,1,0,1,1)$ ,  $G_2=(1,1,1,1,0,0,1)$ ,  $G_3=(1,1,0,0,1,0,1)$  and  $G_4=(1,0,1,1,0,1,1)$ .

To avoid the need for additional signaling overhead, the data in the FIC are encoded with fixed, equal channel coding, with a constant 1/3 coding rate.

The puncturing procedures applied for the coding in the MSC is a combination of protection profile and protection level. There are number of permissible protection profiles defined for each of the allowed bit rates. Each protection profile is associated with a protection level. Protection level 1 is the highest level within the same profile.

Error protection	Protection Profile	Bit rate	Protection Level	Code Rate
UEP	four different protection profiles	14 different bit rates	1, 2, 3, 4, 5	0,34..0,75 (64 different data rates - protection level combinations)
EEP	A	Multiples of 8 kbit/s	1-A	1/4
			2-A	3/8
			3-A	1/2
			4-A	3/4
	B	Multiples of 32 kbit/s	1-B	4/9
			2-B	4/7
			3-B	2/3
			4-B	4/5

## 2.6 Time Interleaving

Time interleaving is applied prior to block generation at the output of each convolutional encode contributing to the sub-channels in the MSC. It is not applied to the FIC.

The time interleaving process covers 16 CIFs, 24 ms each. This results in an overall processing delay of 384 ms.

## 3 DAB/T-DMB User Interface

The menu for setting the DAB digital standard is either called from the baseband block or from the menu tree under "Baseband".



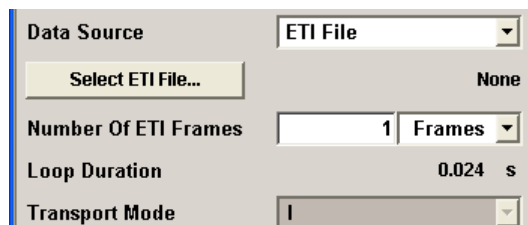
### 3.1 General Settings for DAB/T-DMB Signals

The menu is split into three main sections for configuring the standard.

The upper menu section is where the DAB digital standard is enabled and reset.



In the Data Source section, the data source file and the ETI file can be selected and source file relevant parameters can be set.



The buttons in the lower menu section lead to submenus to configure the system and setting the filter, trigger, and clock parameters.



#### State

Activates or deactivates the DAB standard.



Activating this standard disables all the other digital standards and digital modulation modes (in case of two-path instruments, this affects the same path).

The DAB signal is generated according to the performed settings.

SCPI command:

[ :SOURce<hw> ] :BB:DAB:STATe on page 34

**Set To Default**

Calls the default settings.

Parameter	Value
State	Off
Data Source	PN15
Transport Mode	I
Pseudo Noise Scrambler	On
Coder	On
Interleaver	On
Filter	Cosine
Sample Rate Variation	2.048 MHz
Trigger Mode	Auto
Marker Mode	Frame Start
Clock	Internal

SCPI command:

[ :SOURce<hw> ] :BB:DAB:PRESet on page 33

**Save/Recall...**

Calls the Save/Recall menu.

From the "Save/Recall" menu, the "File Select" windows for saving and recalling "DAB" configurations and the "File Manager" is called.



DAB configurations are stored as files with the predefined file extension \*.DAB. The file name and the directory they are stored in are user-definable.

The complete settings in the "DAB" menu are saved and recalled.

"Recall DAB Setting" Opens the "File Select" window for loading a saved DAB configuration. The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.

"Save DAB Set-Opens the "File Select" window for saving the current DAB signal configuration"

figuration.

The name of the file is specified in the "File name" entry field, the directory selected in the "save into" field. The file is saved by pressing the "Save" button.

"File Manager" Calls the "File Manager".

The "File Manager" is used to copy, delete, and rename files and to create new directories.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:SETTING:CATalog](#) on page 33

[\[:SOURce<hw>\]:BB:DAB:SETTING:LOAD](#) on page 34

[\[:SOURce<hw>\]:BB:DAB:SETTING:STORE](#) on page 34

[\[:SOURce<hw>\]:BB:DAB:SETTING:DELeTe](#) on page 33

### Data Source

Selects the data source to be used to generate the modulation signal.

"All 0, All 1" 0 or 1 data is generated internally.

"PN15, PN23" PRBS data in accordance with the IUT-T with period lengths between  $2^9-1$  and  $2^{23}-1$  are internally generated.

"ETI File" Uses data from an ETI file. The ETI file can be selected via the "Select ETI File" button.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:DATA](#) on page 31

### Select ETI File

(Available for Data Source is set to ETI File only)

Calls the menu for selecting an ETI (Ensemble Transport Interface) or Scrambled ETI file.

#### Note:

The ETI File must fulfill the following prerequisites:

- ETI file compliant with ETI (NI, G.703)
- Frame duration 24 ms (48 KHz sampling rate)
- Constant multiplex configuration
- Same stream configuration of all the frames
- 15 streams maximum.

A scrambled ETI file is an encrypted ETI file with an extension `*.xeti`. The file is generated with the R&S ETI Builder software tool and can only be used (or decrypted respectively) with the DAB/T-DMB option SMx-K53.

The R&S ETI Builder is a freeware tool designed to build own DAB ensembles with mp2 audio content in ETI format.

For more information, refer to the description "Creation of ETI Files for DAB testing with R&S SMU, R&S SMJ and R&S SMATE" on the Rohde&Schwarz Internet page.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:DATA:DSELection](#) on page 31

**Number of ETI Frames**

This menu option is available only if the data source is set to ETI File. Enters the desired sequence length in form of frames.

SCPI command:

[ :SOURce<hw> ] :BB:DAB:EFRames on page 32

**Loop Duration**

This menu option is available only if the data source is set to ETI File. Displays the sequence length.

SCPI command:

[ :SOURce<hw> ] :BB:DAB:LDURation on page 33

**Transport Mode**

Selects the transport mode. Selecting of transport mode is only enabled for data source other than ETI files. For ETI data source files this field is read only. The transport mode is read from the ETI file.

SCPI command:

[ :SOURce<hw> ] :BB:DAB:DATA on page 31

[ :SOURce<hw> ] :BB:DAB:TMODe on page 35

**System Configuration...**

Calls the "System Configuration" menu for configuring the DAB system.

The menu is described in [chapter 3.2, "System Configuration"](#), on page 16.

SCPI command:

n.a.

**Filter ...**

Calls the menu for setting baseband filtering. The current filter is displayed next to the button.

The menu is described in [chapter 3.3, "Filter Settings"](#), on page 17

SCPI command:

n.a.

**Trigger/Marker/Clock**

(Trigger and clock settings for R&S SMx and R&S AMU instruments only)

Calls the menu for selecting the trigger mode and trigger source, for configuring the marker signals, for setting the time delay of an external trigger signal and for selecting the clock source. This menu is described in [chapter 3.5, "Trigger/Marker/Clock Settings"](#), on page 20.

The currently selected trigger mode and trigger source are displayed next to the button.

SCPI command:

n.a.

**Execute Trigger**

(R&S SMx and R&S AMU instruments only)

Executes the trigger manually. A manual trigger can be executed only if an internal trigger source and a trigger mode other than "Auto" have been selected.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:TRIGger:EXECute` on page 43

### Arm

(R&S SMx and R&S AMU instruments only)

Stops signal generation manually. This button appears only with "Running" signal generation in the "Armed\_Auto" and "Armed\_Retrigger" trigger modes.

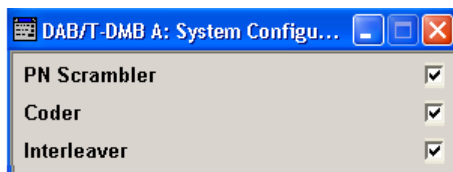
Signal generation can be restarted by a new trigger (internally with "Execute Trigger" or externally).

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:TRIGger:ARM:EXECute` on page 43

## 3.2 System Configuration

The "System Configuration" menu allows configuration of the DAB system.



### PN Scrambler

Activates/deactivates the PN scrambling. The data packets of the incoming transport stream are transformed to a Pseudo Random Binary Sequence (PRBS) in order to obtain a bit sequence that has a positive effect on the transmitted RF spectrum. This feature is enabled for ETI data source files only.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:PNSCrAmbler [ :STATe ]` on page 36

### Coder

Activates/deactivates the coder. The coder applies a Reed-Solomon error correction code to the PRBS data stream. This feature is enabled for ETI data source files only. If the convolutional encoder is switched off, the number of bits delivered from the coder in enabled state is now fetched from the scrambler and therefore from data source. So please keep in mind that the data framing is not valid anymore.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:CODer [ :STATe ]` on page 35

### Interleaver

Activates/deactivates the convolutional interleaver.

This feature is enabled for ETI data source files only.

After turning on the standard, the MSC values are not valid during the first 16 CIFs, because of the time interleaver's depth.

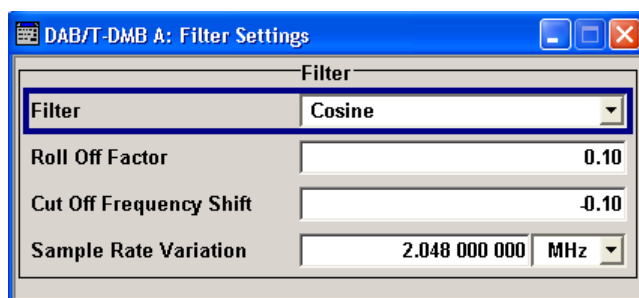
SCPI command:

`[ :SOURce<hw> ] :BB:DAB:ILEaver [ :STATe ]` on page 36

### 3.3 Filter Settings

To access this dialog, select "Main Menu > Filter".

The baseband filter and sample rate variation are defined in this menu.



#### Filter

Sets the baseband filter.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:FILTer:TYPE` on page 38

#### Roll Off Factor / BxT

Sets the filter parameter.

The filter parameter offered ("Roll Off Factor" or "BxT") depends on the currently selected filter type. This parameter is preset to the default for each of the predefined filters.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:APCO25` on page 38

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:COSSine` on page 38

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:RCOSSine` on page 40

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:PGAuss` on page 40

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:GAUSS` on page 39

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:SPHase` on page 40

#### Cut Off Frequency Shift

(available for filter parameter Cosine only)

Sets the value for the cut off frequency shift. The cut off frequency of the cosine filter can be adjusted to reach spectrum mask requirements.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:FILTer:PARAmeter:COSSine:COFS` on page 39

**Cut Off Frequency Factor**

(available for filter parameter Lowpass only)

Sets the value for the cut off frequency factor. The cut off frequency of the filter can be adjusted to reach spectrum mask requirements.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:FILTer:PARAmeter:LPASs](#) on page 39

[\[:SOURce<hw>\]:BB:DAB:FILTer:PARAmeter:LPASSEVM](#) on page 40

**Impulse Length**

(For WinIQSIM2 only)

Displays the number of filter tabs. If the check box is activated, the most sensible parameter values are selected. The value depends on the coherence check. If the check box is deactivated, the values can be changed manually.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:FILTer:ILENgtH:AUTO\[:STATe\]](#) on page 37

[\[:SOURce<hw>\]:BB:DAB:FILTer:ILENgtH](#) on page 37

**Oversampling**

(For WinIQSIM2 only)

Determines the upsampling factor. If the check box is activated, the most sensible parameter values are selected. The value depends on the coherence check. If the check box is deactivated, the values can be changed manually.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:FILTer:OSAMplInng:AUTO\[:STATe\]](#) on page 38

[\[:SOURce<hw>\]:BB:DAB:FILTer:OSAMplInng](#) on page 37

**Sample Rate Variation**

Sets the sample rate of the signal. A variation of this parameter only affects the ARB clock rate; all other signal parameters remain unchanged.

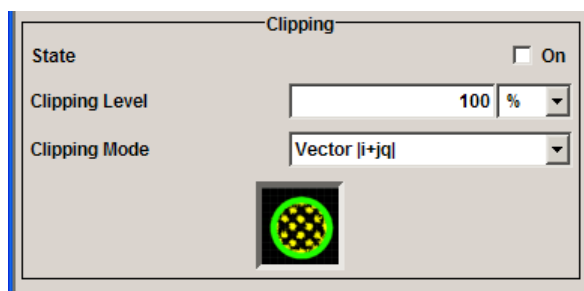
SCPI command:

[\[:SOURce<hw>\]:BB:DAB:SRATe:VARiAtion](#) on page 41

## 3.4 Clipping Settings

Clipping Settings are available for R&S WinIQSIM2 only.

To access this dialog, select "Main Menu > Filter/Clipping".



### Clipping State

Switches baseband clipping on and off.

Baseband clipping is a very simple and effective way of reducing the crest factor of the signal.

With baseband clipping, the signal level is limited to a settable value ("Clipping Level"). This level is specified as a percentage of the highest peak value. Since clipping is done prior to filtering, the procedure does not influence the spectrum. The EVM however increases.

SCPI command:

[\[:SOURCE<hw>\]:BB:DAB:CLIPPING:STATE](#) on page 42

### Clipping Level

Sets the limit for clipping.

This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

SCPI command:

[\[:SOURCE<hw>\]:BB:DAB:CLIPPING:LEVEL](#) on page 41

### Clipping Mode

Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the menu.

"Vector  $|i + q|$ " The limit is related to the amplitude  $|i + q|$ . The I and Q components are mapped together, the angle is retained.



"Scalar  $|i| + |q|$ " The limit is related to the absolute maximum of all the I and Q values  $|i| + |q|$ .



The I and Q components are mapped separately, the angle changes.

SCPI command:

[\[:SOURCE<hw>\]:BB:DAB:CLIPPING:MODE](#) on page 42

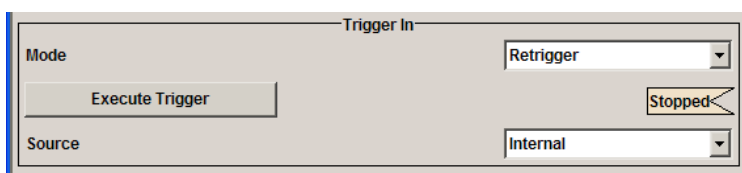
### 3.5 Trigger/Marker/Clock Settings



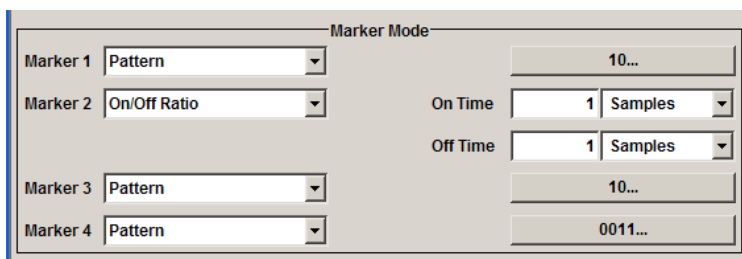
The trigger, clock, and marker delay functions are available for R&S SMx and R&S AMU instruments only.

To access this dialog, select "Main Menu > Trigger/Marker".

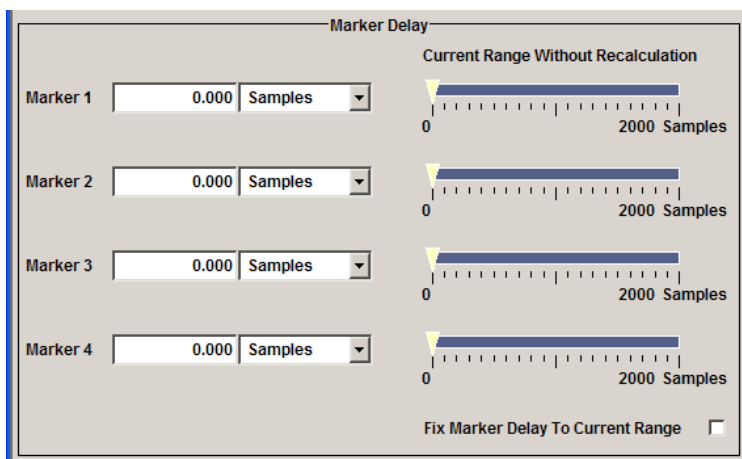
The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.



The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.

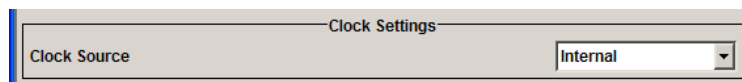


The "Marker Delay" section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.

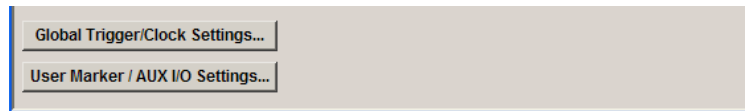


The "Clock Settings" section is where the clock source is selected and - in the case of an external source - the clock type.





The buttons in the last section lead to submenu for general trigger, clock and mapping settings.



### 3.5.1 Trigger In



The trigger functions are available for R&S SMx and R&S AMU instruments only.

The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.

#### Trigger Mode

Selects trigger mode.

The trigger mode determines the effect of a trigger on the signal generation.

- |                   |   |
|-------------------|---|
| "Auto"            | The signal is generated continuously.   |
| "Retrigger"       | The signal is generated continuously. A trigger event (internal or external) causes a restart.  |
| "Armed_Auto"      | The signal is generated only when a trigger event occurs. Then the signal is generated continuously.<br>Button "Arm" stops signal generation. A subsequent trigger event (internal with "Execute Trigger" or external) causes a restart.  |
| "Armed_Retrigger" | The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.<br>Button "Arm" stops signal generation. A subsequent trigger event (internal with "Execute Trigger" or external) causes a restart. |
| "Single"          | The signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at "Signal Duration".<br>Every subsequent trigger event (internal with "Execute Trigger" or external) causes a restart.   |

SCPI command:

[\[:SOURce<hw>\]:BB:DAB\[:TRIGger\]:SEQUence](#) on page 47

#### Signal Duration

Defines the length of the signal sequence to be output in the "Single" trigger mode.

It is possible to output deliberately just part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:SLENgth](#) on page 45

### Running/Stopped

Displays the status of signal generation for all trigger modes. This display appears only when signal generation is enabled ("State" On).

"Running"      The modulation signal is generated; a trigger was (internally or externally) initiated in triggered mode.  
If "Armed\_Auto" and "Armed\_Retrigger" have been selected, generation of signals can be stopped with the "Arm" button. A new trigger (internally with "Execute Trigger" or externally) causes a restart.

"Stopped"      The signal is not generated, and the instrument waits for a trigger event (internal or external).

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:RMODe](#) on page 45

### Arm

(R&S SMx and R&S AMU instruments only)

Stops signal generation manually. This button appears only with "Running" signal generation in the "Armed\_Auto" and "Armed\_Retrigger" trigger modes.

Signal generation can be restarted by a new trigger (internally with "Execute Trigger" or externally).

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:ARM:EXECute](#) on page 43

### Execute Trigger

(R&S SMx and R&S AMU instruments only)

Executes the trigger manually. A manual trigger can be executed only if an internal trigger source and a trigger mode other than "Auto" have been selected.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:EXECute](#) on page 43

### Trigger Source

Selects trigger source. This setting is effective only when a trigger mode other than "Auto" has been selected.

"Internal"      The trigger event is executed by "Execute Trigger".

"Internal (Base- (two-path instruments only)

band A/B)"      The trigger event is executed by the trigger signal from the second path

"External (TRIGGER 1 / 2)" The trigger event is executed with the aid of the active edge of an external trigger signal.  
 The trigger signal is supplied via the TRIGGER connector.  
 The polarity, the trigger threshold and the input impedance of the TRIGGER input can be set in the "Global Trigger/Clock Settings" dialog.

SCPI command:

[ :SOURce<hw> ] :BB:DAB:TRIGger:SOURce on page 46

**Sync. Output to External Trigger**

(enabled for Trigger Source External)

Enables/disables output of the signal synchronous to the external trigger event.

For R&S SMBV instruments:

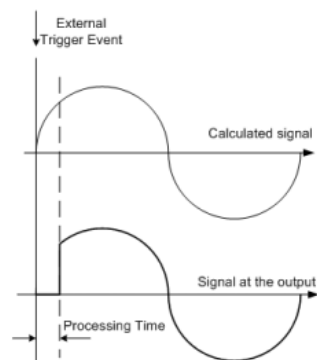
For or two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, configure this parameter depending on the provided system trigger event and the properties of the output signal. See the table below for an overview of the required settings.

*Table 3-1: Typical Applications*

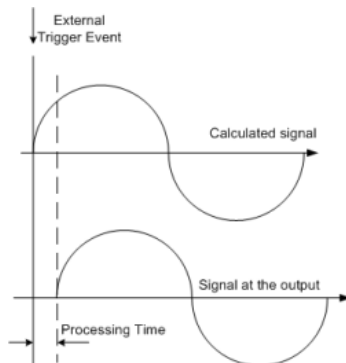
System Trigger	Application	"Sync. Output to External Trigger"
Common External Trigger event for the master and the slave instruments	All instruments are synchronous to the external trigger event	ON
	All instruments are synchronous among themselves but starting the signal from first symbol is more important than synchronicity with external trigger event	OFF
Internal trigger signal of the master R&S SMBV for the slave instruments	All instruments are synchronous among themselves	OFF

"On"

Corresponds to the default state of this parameter.  
 The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is outputted. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.



"Off" The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is outputted. This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.



SCPI command:

`[ :SOURce<hw> ] :BB:DAB:TRIGger:EXTernal:SYNChronize:OUTPut`

on page 43

### Trigger Delay

Sets the trigger signal delay in samples on external triggering or on internal triggering via the second path.

Sets the trigger signal delay in samples on external triggering.

This enables the R&S Signal Generator to be synchronized with the device under test or other external devices.

For two-path instruments, the delay can be set separately for each of the two paths.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:TRIGger [ :EXTernal<ch> ] :DELay` on page 46

`[ :SOURce<hw> ] :BB:DAB:TRIGger:OBASeband:DELay` on page 44

### Trigger Inhibit

Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in samples.

In the "Retrigger" mode, every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of samples.

This parameter is only available on external triggering or on internal triggering via the second path.

For two-path instruments, the trigger inhibit can be set separately for each of the two paths.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:TRIGger [ :EXTernal<ch> ] :INHibit` on page 47

`[ :SOURce<hw> ] :BB:DAB:TRIGger:OBASeband:INHibit` on page 44

### 3.5.2 Marker Mode

The marker output signal for synchronizing external instruments is configured in the marker settings section "Marker Mode".

The R&S SMBV supports only two markers.

#### Marker Mode

Selects a marker signal for the associated "MARKER" output.

A screenshot of a software interface showing a dropdown menu. The menu is open, displaying five options: "Frame Start" (which is highlighted in blue), "Restart", "Pulse", "Pattern", and "On/Off Ratio". The dropdown is positioned over a text field that currently contains "Frame Start".

"Restart" A marker signal is generated at the start of each ARB sequence.

"Frame Start" A marker signal is generated at the start of each frame.

"Pulse" A regular marker signal is generated. The pulse frequency is defined by entering a divider. The frequency is derived by dividing the sample rate by the divider. The input box for the divider opens when "Pulse" is selected, and the resulting pulse frequency is displayed below it.

SCPI command:

[\[:SOURCE<hw>\]:BB:DAB:TRIGGER:OUTPUT<ch>:PULSE:DIVIDER](#) on page 52

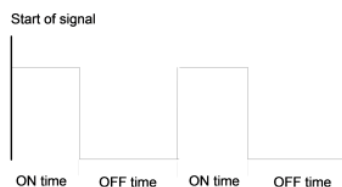
[\[:SOURCE<hw>\]:BB:DAB:TRIGGER:OUTPUT<ch>:PULSE:FREQUENCY](#)  
on page 52

"Pattern" A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 32 bits and is defined in an input field which opens when pattern is selected.

SCPI command:

[\[:SOURCE<hw>\]:BB:DAB:TRIGGER:OUTPUT<ch>:PATTERN](#) on page 51

"ON/OFF Ratio" A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.



The "ON Time" and "OFF Time" are each expressed as a number of samples and are set in an input field which opens when "ON/OFF Ratio" is selected.

On Time	<input type="text" value="1"/>	Samples ▾
Off Time	<input type="text" value="1"/>	Samples ▾

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:ONTime](#) on page 51

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:OFFTime](#) on page 51

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:MODE](#) on page 50

### 3.5.3 Marker Delay

The delay of the signals on the MARKER outputs is set in the "Marker Delay" section.



The marker delay functions are available for R&S SMx and R&S AMU instruments only.

The R&S SMBV supports only two markers.

#### Marker x Delay

Enters the delay between the marker signal at the marker outputs and the start of the frame or slot.

The input is expressed as a number of symbols/samples. If the setting "Fix marker delay to dynamic range" is enabled, the setting range is restricted to the dynamic range. In this range the delay of the marker signals can be set without restarting the marker and signal.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:DELay](#) on page 49

#### Current Range without Recalculation

Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.

The delay can be defined by moving the setting mark.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:DELay:MINimum](#) on page 50

[\[:SOURce<hw>\]:BB:DAB:TRIGger:OUTPut<ch>:DELay:MAXimum](#) on page 49

**Fix marker delay to current range**

Restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:TRIGger:OUTPut:DElay:FIXed` on page 49

**3.5.4 Clock Settings**

The Clock Settings is used to set the clock source and a delay if required.



The clock functions are available for R&S SMx and R&S AMU instruments only.

**Sync. Mode**

(for R&S SMBV only)

Selects the synchronization mode.

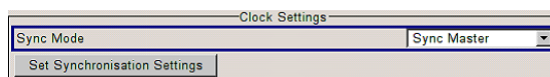
This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

**Note:** If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type.

Avoid unnecessary cable length and branching points.

"None" The instrument is working in stand-alone mode.

"Sync. Master" The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.



"Sync. Slave" The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:CLOCK:SYNChronization:MODE` on page 55

**Set Synchronization Settings**

(for R&S SMBV only)

Performs automatically adjustment of the instrument's settings required for the synchronization mode, selected with the parameter "Synchronization Mode".

SCPI command:

`[ :SOURce<hw> ] :BB:DAB:CLOCK:SYNChronization:EXECute` on page 54

**Clock Source**

Selects the clock source.

"Internal" The internal clock reference is used to generate the symbol clock.

"External" The external clock reference is fed in as the symbol clock or multiple thereof via the CLOCK connector.  
 The symbol rate must be correctly set to an accuracy of +/-2 % (see data sheet).  
 The polarity of the clock input can be changed with the aid of "Global Trigger/Clock Settings".  
 In the case of two-path instruments this selection applies to path A.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:CLOCK:SOURce](#) on page 54

#### **Clock Mode**

Enters the type of externally supplied clock.

"Sample" A sample clock is supplied via the CLOCK connector.

"Multiple Sample" A multiple of the sample clock is supplied via the CLOCK connector; the sample clock is derived internally from this.

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:CLOCK:MODE](#) on page 53

#### **Clock Multiplier**

Enters the multiplication factor for clock type "Multiple".

SCPI command:

[\[:SOURce<hw>\]:BB:DAB:CLOCK:MULTIplier](#) on page 53

#### **Measured External Clock**

Indicates the measured frequency of the external clock signal. This enables the user to permanently monitor the frequency of the externally introduced clock.

This information is displayed only if the external clock source has been selected.

SCPI command:

`CLOCK:INP:FREQ?`

### **3.5.5 Global Settings**

The buttons in this section lead to submenu for general trigger, clock and mapping settings.

This settings are available for R&S SMx and R&S AMU instruments only.

#### **Global Trigger/Clock Settings**

Calls the "Global Trigger/Clock/Input Settings" dialog.

This dialog is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

In the case of two-path instruments, these settings are valid for both paths.

The parameters in this menu affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the Operating Manual.



**User Marker / AUX I/O Settings**

Calls the "User Marker AUX I/O Settings" menu, used used to map the connector on the rear of the instruments.

See also "User Marker / AUX I/O Settings" in the Operating Manual.

## 4 Remote-control commands

The commands in the `SOURce:BB:DAB` subsystem are described in two sections, separated into general remote commands and commands for system configuration.

### **SOURce<hw>**

For one-path instruments, the keyword `SOURce` is optional and can be omitted.

The numeric suffix to `SOURce` distinguishes between signal generation for path A and path B in the case of two-path instruments:

- `SOURce[1]` = path A  
The keyword `SOURce` is optional and can be omitted
- `SOURce2` = path B  
The keyword `SOURce` is mandatory, i.e. the command must contain the keyword with suffix 2.

### **OUTPut<ch>**

The numeric suffix to `OUTPut` distinguishes between the available markers.

Only two markers are available for the R&S SMBV, i.e. the allowed values for the suffix are 1 or 2.

### 4.1 General Commands

This subsystem contains commands for the primary and general settings of the DAB standard. These settings concern activation and deactivation of the standard, filter, clock, and trigger settings.

The commands for setting the system configuration and the TPS parameter bits are described in [chapter 4.2, "System Configuration"](#), on page 35.

<code>[:SOURce&lt;hw&gt;]:BB:DAB:DATA</code> .....	31
<code>[:SOURce&lt;hw&gt;]:BB:DAB:DATA:DSElection</code> .....	31
<code>[:SOURce&lt;hw&gt;]:BB:DAB:EFRames</code> .....	32
<code>[:SOURce&lt;hw&gt;]:BB:DAB:ETI:CATalog</code> .....	32
<code>[:SOURce&lt;hw&gt;]:BB:DAB:LDURation</code> .....	33
<code>[:SOURce&lt;hw&gt;]:BB:DAB:PRESet</code> .....	33
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTing:CATalog</code> .....	33
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTing:DELeTe</code> .....	33
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTing:LOAD</code> .....	34
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SETTing:STORe</code> .....	34
<code>[:SOURce&lt;hw&gt;]:BB:DAB:STATe</code> .....	34
<code>[:SOURce&lt;hw&gt;]:BB:DAB:TMODe</code> .....	35

---

**[:SOURCE<hw>]:BB:DAB:DATA <Data>**

Sets the data source. To set the data source to ETI file, the existing of \*.eti file is required, otherwise an error is returned. An ETI File is select using the command `BB:DATA:DSElection`.

**Parameters:**

<Data>

ALL0|ALL1|PN15|PN23|ETI

**ALL0, ALL1**

0 or 1 data is generated internally.

**PN15, PN23**

PRBS data in accordance with the IUT-T with period lengths between 29-1 and 223-1 are internally generated.

**ETI File**

Uses data from an ETI file. The ETI file can be selected via the Select ETI File button.

**Example:**

`BB:DAB:DATA PN15`

selects PN15 as data source.

`BB:DAB:DATA:DSElection 'test.eti'`

selects the file 'test.eti' as data source.

`BB:DAB:DATA ETI`

sets the data source to ETI file.

---

**[:SOURCE<hw>]:BB:DAB:DATA:DSElection <Dselection>**

Selects the ETI file for the data source selection.

The ETI files are stored as files with the fixed file extensions \*.eti in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEemory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

**Note:** The ETI File must fulfill the following prerequisites:

- ETI file compliant with ETI (NI, G.703)
- Frame duration 24 ms (48 KHz sampling rate)
- Constant multiplex configuration
- Same stream configuration of all the frames
- 15 streams maximum.

Selects the ETI file for the data source selection. The ETI files are stored as files with the fixed file extensions \*.eti in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEemory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

**Parameters:**

<Dselection>

string

**Example:** MMEM:CDIR 'D:\DAB'  
 selects the directory for the ETI files.  
 BB:DAB:DATA:DSEL 'test.eti'  
 selects the file test.eti as the data source. This file must be in the directory D:\DAB and have the file extension \*.eti.  
 BB:DAB:DATA ETI  
 selects the ETI files as the data source.

---

#### **[:SOURCE<hw>]:BB:DAB:EFRAMES <Eframes>**

Sets the desired sequence length in form of ETI frames. This command is enabled only if the data source is set to ETI File.

The allowed minimum value of this parameter depends on the transport mode of the ETI file. For instance, for transport mode I with 96 ms transmission frame duration, minimum 4 frames must be selected.

#### **Parameters:**

<Eframes> float  
 Range: 1 to 10000  
 Increment: 1

**Example:** BB:DAB:DATA:DSEL 'test.eti'  
 selects the file 'test.eti' as the data source. This file must be in the directory D:DAB and have the file extension \*.eti.  
 BB:DAB:DATA ETI  
 selects the ETI files as the data source.  
 BB:DAB:EFR 50  
 sets the number of the transmitted ETI-frames to 50.

---

#### **[:SOURCE<hw>]:BB:DAB:ETI:CATALOG?**

Reads out the files with ETI File settings in the default directory. The default directory is set using command MMEM:CDIRECTORY. Only files with the file extension \*.eti will be listed.

#### **Return values:**

<Catalog> string

**Example:** MMEM:CDIR 'D:\DAB'  
 sets the default directory to D:\DAB.  
 BB:DAB:ETI:CAT?  
 reads out all the files with ETI file settings in the default directory.  
 Response: 'test.eti','dab.eti'  
 the files test.eti and dab.eti are available.

**Usage:** Query only

---

**[ :SOURCE<hw> ]:BB:DAB:LDURATION?**

Queries the sequence length of ETI file (loop duration).

**Return values:**

<Lduration> float

**Example:**

BB:DAB:LDUR?  
queries the loop duration.

**Usage:**

Query only

---

**[ :SOURCE<hw> ]:BB:DAB:PRESet**

Produces a standardized default for the DAB standard. The settings correspond to the \*RST values specified for the commands.

**Example:**

BB:DAB:PRES  
resets all the DAB settings to default values.

**Usage:**

Event

---

**[ :SOURCE<hw> ]:BB:DAB:SETTING:CATalog?**

Reads out the files with DAB settings in the default directory. The default directory is set using command `MMEM:CDIRECTORY`. A path can also be specified, in which case the files in the specified directory are read. Only files with the file extension `*.DAB` will be listed.

**Return values:**

<Catalog> string

**Example:**

MMEM:CDIR 'D:\DAB'  
sets the default directory to D:\DAB.  
BB:DAB:SETT:CAT?  
reads out all the files with DAB settings in the default directory.  
Response: 'DAB\_1', 'DAB\_2'  
the files DAB\_1 and DAB\_2 are available.

**Usage:**

Query only

---

**[ :SOURCE<hw> ]:BB:DAB:SETTING:DELEte <Delete>**

This command deletes the selected file with DAB settings. The directory is set using command `MMEM:CDIRECTORY`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension `*.DAB` will be deleted.

**Parameters:****<Delete>** string**Example:**

```
BB:DAB:SETT:DEL D:\DAB
deletes the specified file with DAB settings.
```

**[[:SOURce<hw>]:BB:DAB:SETTing:LOAD <Load>**

This command loads the selected file with DAB settings. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension `*.DAB` will be loaded.

**Setting parameters:****<Load>** string**Example:**

```
BB:DAB:SETT:LOAD 'DAB_1'
loads file 'DAB_1'.
```

**Usage:**

Setting only

**[[:SOURce<hw>]:BB:DAB:SETTing:STORe <Store>**

This command stores the current DAB settings into the selected file. The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only the file name has to be entered. DAB settings are stored as files with the specific file extensions `*.DAB`.

**Setting parameters:****<Store>** string**Example:**

```
BB:DAB:SETT:STOR 'test.DAB'
stores the current DAB settings into file 'test'.
```

**Usage:**

Setting only

**[[:SOURce<hw>]:BB:DAB:STATe <State>**

Activates modulation in accordance with the DAB standard. Activating this standard deactivates all the other digital standards and digital modulation modes (in case of two-path instruments, this affects the same path).

**Parameters:****<State>** 0|1|OFF|ON**\*RST:** OFF

**Example:** `BB:DAB:STAT ON`  
activates modulation in accordance with the DAB standard.

---

**[[:SOURce<hw>]:BB:DAB:TMODe <Tmode>**

Selects the transport mode. Depending on the transport mode selected, signal with different sequence length will be generated.

Transport mode selection is not enabled for ETI data source files; transport mode is a read only field for these files. The transport mode is read from the ETI file.

**Parameters:**

<Tmode>            I|II|III|IV  
**I**  
transport mode I, i.e. sequence length 96 ms.  
**II**  
transport mode II, i.e. sequence length 24 ms.  
**III**  
transport mode III, i.e. sequence length 24 ms.  
**IV**  
transport mode IV, i.e. sequence length 48 ms.  
\*RST:            I

**Example:** `BB:DAB:DATA PN15`  
selects PN15 as data source.  
`BB:DAB:TMOD II`  
sets the transport mode to Tx Mode II, i.e. sequence length 24ms.

## 4.2 System Configuration

This subsystem contains commands regarding the system configuration of the DAB standard.

[\[:SOURce<hw>\]:BB:DAB:CODer\[:STATe\].....](#)35  
[\[:SOURce<hw>\]:BB:DAB:ILEaver\[:STATe\].....](#)36  
[\[:SOURce<hw>\]:BB:DAB:PNSCrambler\[:STATe\].....](#)36

---

**[[:SOURce<hw>]:BB:DAB:CODer[:STATe] <State>**

Activates/deactivates the coder.. This feature is enabled for ETI data source files only.

**Parameters:**

<State>            0|1|OFF|ON  
\*RST:            ON

**Example:** `BB:DAB:CODer:STATe OFF`  
 deactivates the coder. The number of bits is now fetched from the scrambler and therefore from data source. So please keep in mind that the data framing is not valid anymore.

**[:SOURce<hw>]:BB:DAB:ILEaver[:STATe] <State>**

Activates/deactivates the interleaver. This feature is enabled for ETI data source files only.

**Parameters:**  
 <State> 0|1|OFF|ON  
 \*RST: ON

**Example:** `BB:DAB:ILE:STAT ON`  
 activates the outer interleaver. After turning on the standard, the MSC values are not valid during the first 16 CIFs, because of the time interleaver's depth.

**[:SOURce<hw>]:BB:DAB:PNSCrambler[:STATe] <State>**

Activates/deactivates the PN scrambler. This feature is enabled for ETI data source files only.

**Parameters:**  
 <State> 0|1|OFF|ON  
 \*RST: ON

**Example:** `BB:DAB:PNSC:STAT ON`  
 activates the PN scrambling, that is, transforming the data packets of the incoming transport stream to a Pseudo Random Binary Sequence (PRBS).

### 4.3 Filter Settings

[\[:SOURce<hw>\]:BB:DAB:FILTer:ILENght.....](#)37  
[\[:SOURce<hw>\]:BB:DAB:FILTer:ILENght:AUTO\[:STATe\].....](#)37  
[\[:SOURce<hw>\]:BB:DAB:FILTer:OSAMpling.....](#)37  
[\[:SOURce<hw>\]:BB:DAB:FILTer:OSAMplinnG:AUTO\[:STATe\].....](#)38  
[\[:SOURce<hw>\]:BB:DAB:FILTer:TYPE.....](#)38  
[\[:SOURce<hw>\]:BB:DAB:FILTer:PARAmeter:APCO25.....](#)38  
[\[:SOURce<hw>\]:BB:DAB:FILTer:PARAmeter:COsine.....](#)38  
[\[:SOURce<hw>\]:BB:DAB:FILTer:PARAmeter:COsine:COFS.....](#)39  
[\[:SOURce<hw>\]:BB:DAB:FILTer:PARAmeter:GAUSS.....](#)39  
[\[:SOURce<hw>\]:BB:DAB:FILTer:PARAmeter:LPASS.....](#)39



<code>[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:LPASSEVM</code> .....	40
<code>[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:PGAuss</code> .....	40
<code>[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:RCOSine</code> .....	40
<code>[:SOURce&lt;hw&gt;]:BB:DAB:FILTer:PARAmeter:SPHase</code> .....	40
<code>[:SOURce&lt;hw&gt;]:BB:DAB:SRATe:VARiation</code> .....	41

---

### `[:SOURce<hw>]:BB:DAB:FILTer:ILENgtH <llength>`

for R&S WinIQSIM2 only

Sets the impulse length (number of filter tabs).

#### Parameters:

`<llength>` float

Range: 1 to 128  
 Increment: 1  
 \*RST: 10

**Example:** `BB:DAB:FILT:ILEN 10`  
 sets the number of filter tabs to 10.

---

### `[:SOURce<hw>]:BB:DAB:FILTer:ILENgtH:AUTO[:STATe] <State>`

(For WinIQSIM2 only)

Activates/ deactivates the impulse length state. If activated, the most sensible parameter values are selected. The value depends on the coherence check.

#### Parameters:

`<State>` 0|1|OFF|ON

\*RST: OFF

**Example:** `BB:DAB:FILT:ILEN:AUTO:STAT ON`

---

### `[:SOURce<hw>]:BB:DAB:FILTer:OSAMpling <Osampling>`

for WinIQSIM2 only

Sets the upsampling factor.

#### Parameters:

`<Osampling>` float

Range: 1 to 32

**Example:** `BB:DAB:FILT:OSAM 32`  
 sets the upsampling factor to 32.

---

**[[:SOURce<hw>]:BB:DAB:FILTer:OSAMpling:AUTO[:STATe] <State>**

for WinIQSIM2 only

Activates/ deactivates the upsampling factor state. If activated, the most sensible parameter values are selected. The value depends on the coherence check. If deactivated, the values can be changed manually.

**Parameters:**

<State>                    0|1|OFF|ON  
 \*RST:                    ON

**Example:**                    BB:DAB:FILT:OSAM:AUTO:STAT OFF

---

**[[:SOURce<hw>]:BB:DAB:FILTer:TYPE <Type>**

Selects the filter type.

**Parameters:**

<Type>                    RCOSine|COSine|GAUSs|LGAuss|CONE|COF705|  
 COEqualizer|COFequalizer|C2K3x|APCO25|SPHase|  
 RECTangle|PGAuss|LPASs|LPASSEVM|DIRac|ENPShape|  
 EWPSshape  
 \*RST:                    GAUSs (if layer mode OFDM), COSine (if layer mode  
 CCK or PBCC)

**Example:**                    BB:DAB:FILT:TYPE RCOS  
 sets the filter type RCOSine.

---

**[[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:APCO25 <Apco25>**

Sets the roll-off factor for filter type APCO25.

**Parameters:**

<Apco25>                    float  
 Range:                    0.05 to 0.99  
 Increment:                0.01  
 \*RST:                    0.20

**Example:**                    BB:DAB:FILT:PAR:APCO25 0.2  
 sets the roll-off factor to 0.2 for filter type APCO25.

---

**[[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:COSine <Cosine>**

Sets the roll-off factor for the Cosine filter type.

**Parameters:**

<Cosine> float  
 Range: 0.05 to 0.99  
 Increment: 0.01  
 \*RST: 0.35

**Example:**

BB:DAB:FILT:PAR:COS 0.35  
 sets the roll-off factor to 0.35 for filter type Cosine.

**[:SOURCE<hw>]:BB:DAB:FILT:PAR:PARAMeter:COsine:COFS <Cofs>**

Sets the "cut off frequency shift" value for the Cosine filter type.

**Parameters:**

<Cofs> float  
 Range: 0.05 to 2.0  
 \*RST: 0.5

**Example:**

BB:DAB:FILT:PAR:COS:COFS 0.35  
 sets the "cut of frequency shift" value to 0.35.

**[:SOURCE<hw>]:BB:DAB:FILT:PAR:PARAMeter:GAUSs <Gauss>**

Sets the B x T for the Gauss filter type.

**Parameters:**

<Gauss> float  
 Range: 0.15 to 2.5  
 Increment: 0.01  
 \*RST: 0.5

**Example:**

BB:DAB:FILT:PAR:GAUS 0.5  
 sets B x T to 0.5 for the Gauss filter type.

**[:SOURCE<hw>]:BB:DAB:FILT:PAR:PARAMeter:LPASs <Lpass>**

Sets the cut off frequency factor for the Lowpass filter (ACP Opt.) type.

**Parameters:**

<Lpass> float  
 Range: 0.05 to 2.0  
 Increment: 0.01  
 \*RST: 0.5

**Example:**

BB:DAB:FILT:PAR:LPAS 0.5  
 the cut of frequency factor is set to 0.5.

---

**[[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:LPASSEVM <Lpassevm>**

Sets the cut off frequency factor for the Lowpass filter (EVM Opt.) type.

**Parameters:**

<Lpassevm>            float

                         Range:     0.05 to 2.0

                         Increment: 0.01

                         \*RST:     0.5

**Example:**            BB:DAB:FILT:PAR:LPASSEVM 0.5  
the cut of frequency factor is set to 0.5.

---

**[[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:PGAuss <Pgauss>**

Sets the B x T for the Pure Gauss filter type.

**Parameters:**

<Pgauss>              float

                         Range:     0.15 to 2.5

                         Increment: 0.01

                         \*RST:     0.5

**Example:**            BB:DAB:FILT:PAR:GAUS 0.5  
sets B x T to 0.5 for the Pure Gauss filter type.

---

**[[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:RCOSine <Rcosine>**

Sets the roll-off factor for the Root Cosine filter type.

**Parameters:**

<Rcosine>             float

                         Range:     0.05 to 0.99

                         Increment: 0.01

                         \*RST:     0.22

**Example:**            BB:DAB:FILT:PAR:RCOS 0.22  
sets the roll-off factor to 0.22 for filter type Root Cosine.

---

**[[:SOURce<hw>]:BB:DAB:FILTer:PARAmeter:SPHase <Sphase>**

Sets the B x T for the Split Phase filter type.

**Parameters:**

<Sphase> float  
 Range: 0.15 to 2.5  
 Increment: 0.01  
 \*RST: 2.00

**Example:**

BB:DAB:FILT:PAR:SPH 0.5  
 sets B x T to 0.5 for the Split Phase filter type.

**[:SOURce<hw>]:BB:DAB:SRATe:VARiation?**

Enters the output sample rate.

A variation of this parameter only affects the ARB clock rate, all other signal parameters remain unchanged. If the sampling rate in the frame configuration menu is changed, this parameter is reset to the chosen sampling rate.

**Return values:**

<Variation> float  
 Increment: 0.001 Hz  
 \*RST: 2.048 MHz

**Example:**

BB:DAB:SRAT:VAR 40 MHz  
 sets the output sample rate to 40 MHz.

**Usage:**

Query only

## 4.4 Clipping Settings

This section list the remote control commands, necessary to configure the clipping setting.



Clipping settings are available for R&S WinIQSIM2 only.

<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CLIPping:LEVel</a> .....	41
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CLIPping:MODE</a> .....	42
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:CLIPping:STAtE</a> .....	42

**[:SOURce<hw>]:BB:DAB:CLIPping:LEVel <Level>**

Sets the limit for clipping.

**Parameters:**

<Level> float  
 Range: 1 to 100  
 \*RST: 100  
 Default unit: PCT

**Example:** BB:DAB:CLIP:LEV 25

**[:SOURce<hw>]:BB:DAB:CLIPping:MODE <Mode>**

Selects the clipping method.

**Parameters:**

<Mode> VECTor|SCALar  
 \*RST: VECTor

**Example:** BB:DAB:CLIP:MODE SCAL

**[:SOURce<hw>]:BB:DAB:CLIPping:STATe <State>**

Switches baseband clipping on and off.

**Parameters:**

<State> 0|1|OFF|ON  
 \*RST: OFF

**Example:** BB:DAB:CLIP:STAT ON

## 4.5 Trigger Settings



The trigger settings are available for R&S SMx and R&S AMU instruments only.

**EXTernal<ch>**

The numeric suffix to **EXTernal<ch>** distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:ARM:EXECute.....</a>	43
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:EXECute.....</a>	43
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:EXTernal:SYNChronize:OUTPut.....</a>	43
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OBASeband:DELay.....</a>	44
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OBASeband:INHibit.....</a>	44
<a href="#">[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:RMODE.....</a>	45

<code>[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:SLENgth</code> .....	45
<code>[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:SOURce</code> .....	46
<code>[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger[:EXTernal&lt;ch&gt;]:DELay</code> .....	46
<code>[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger[:EXTernal&lt;ch&gt;]:INHibit</code> .....	47
<code>[:SOURce&lt;hw&gt;]:BB:DAB[:TRIGger]:SEQuence</code> .....	47

---

#### **`[:SOURce<hw>]:BB:DAB:TRIGger:ARM:EXECute`**

Stops signal generation for trigger modes "Armed Auto" and "Armed Retrigger". A subsequent internal or external trigger event restart signal generation.

**Example:** `BB:DAB:TRIG:ARM:EXEC`  
stops signal generation for trigger modes "Armed Auto" and "Armed Retrigger".

**Usage:** Event

---

#### **`[:SOURce<hw>]:BB:DAB:TRIGger:EXECute`**

Executes a trigger. The internal trigger source must be selected using the command `SOUR:BB:DAB:TRIG:SOUR INT` and a trigger mode other than "AUTO" must be selected using the command `SOUR:BB:DAB:TRIG:SEQ`.

**Example:** `BB:DAB:TRIG:SOUR INT`  
sets internal triggering.  
`BB:DAB:TRIG:SEQ RETR`  
sets Retrigger mode, i.e. every trigger event causes signal generation to restart.  
`BB:DAB:TRIG:EXEC`  
executes a trigger.

**Usage:** Event

---

#### **`[:SOURce<hw>]:BB:DAB:TRIGger:EXTernal:SYNChronize:OUTPut <Output>`**

(enabled for "Trigger Source" External)

Enables/disables output of the signal synchronous to the external trigger event.

**Parameters:**

&lt;Output&gt;

0|1|OFF|ON

**ON**

The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is outputted. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.

For two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, enable this parameter in the slave instruments, in case the master instrument provides the slaves with its internal trigger signal.

**OFF**

The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is outputted.

This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.

While working in a master-slave mode and a common external trigger event is provided for the master and the slave instruments, disable this parameter in the slave instruments

\*RST: ON

**Example:**

BB:DAB:TRIG:SOUR EXT

sets external triggering.

BB:DAB:TRIG:EXT:SYNC:OUTP ON

enables synchronous output to external trigger

---

**[[:SOURce<hw>]:BB:DAB:TRIGger:OBASeband:DELay <Delay>**

Specifies the trigger delay (expressed as a number of samples) for external triggering.

**Parameters:**

&lt;Delay&gt;

float

Increment: 1 sample

\*RST: 0 samples

**Example:**

BB:DAB:TRIG:SOUR EXT

sets an external trigger via the TRIGGER 1 connector.

BB:DAB:TRIG:DEL 50

sets a delay of 50 symbols for the trigger.

---

**[[:SOURce<hw>]:BB:DAB:TRIGger:OBASeband:INHibit <Inhibit>**

Specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path.



**Parameters:**

<Inhibit> float  
 Range: 0 to 2<sup>32</sup>-1 samples  
 Increment: 1 sample  
 \*RST: 0 samples

**Example:**

BB:DAB:TRIG:SOUR OBAS  
 sets for path A the internal trigger executed by the trigger signal from the second path (path B).  
 BB:DAB:TRIG:INH 200  
 sets a restart inhibit for 200 samples following a trigger event.

**[ :SOURce<hw> ]:BB:DAB:TRIGger:RMODE?**

Queries the current status of signal generation for all trigger modes with DAB modulation on.

**Return values:**

<Rmode> STOP|RUN  
**RUN**  
 the signal is generated. A trigger event occurred in the triggered mode.  
**STOP**  
 the signal is not generated. A trigger event did not occur in the triggered modes, or signal generation was stopped by the command BB:DAB:TRIG:ARM:EXECute (armed trigger modes only).

**Example:**

BB:DAB:TRIG:SOUR EXT  
 sets external triggering via the TRIGGER 1 connector.  
 BB:DAB:TRIG:MODE ARET  
 selects the Armed\_Retrigger mode  
 BB:DAB:TRIG:RMOD?  
 queries the current status of signal generation.  
 Response:  
 RUN  
 the signal is generated, an external trigger was executed.

**Usage:** Query only

**[ :SOURce<hw> ]:BB:DAB:TRIGger:SLEnGth <Slength>**

Defines the length of the signal sequence in frames to be output in the "Single" trigger mode (SOUR:BB:DAB:SEQ SING).

**Parameters:**

<Slength> float

Range: 1 frame to 10000 frames  
 \*RST: 1.0 sequence length

**Example:**

```
BB:DAB:SEQ SING
sets trigger mode Single.
BB:DAB:TRIG:SLEN 200
sets a sequence length of 200 frames. The current frame will be
output 200 times after the next trigger event.
```

**[ :SOURce<hw>]:BB:DAB:TRIGger:SOURce <Source>**

Selects the trigger source.

**Parameters:**

<Source> INTernal|EXTernal|BEXTernal|OBASeband

**INTernal**

Triggering is executed by means of the Trigger command

BB:DAB:TRIGger:EXECute or \*TRG in the case of remote control and by means of "Execute Trigger" in the case of manual operation.

**EXTernal**

Triggering is executed by means of the signal on the TRIGGER 1 connector.

**BEXTernal**

Triggering is executed by means of the signal on the TRIGGER 2 connector.

**OBASeband**

Triggering is executed by means of the trigger signal from the second path (two-path instruments only).

\*RST: INTernal

**Example:**

```
BB:DAB:TRIG:SOUR EXT
executes triggering by means of the signal on the TRIGGER 1
connector.
```

**[ :SOURce<hw>]:BB:DAB:TRIGger[:EXTernal<ch>]:DELay <Delay>**

Specifies the trigger delay (expressed as a number of samples) for external triggering.

**Parameters:**

<Delay> float

Range: 0.0 samples to 65535.0 samples  
 Increment: 1 sample  
 \*RST: 0.0 samples

**Example:**            `BB:DAB:TRIG:SOUR EXT`  
                         sets an external trigger via the TRIGGER 1 connector.  
                         `BB:DAB:TRIG:DEL 50`  
                         sets a delay of 50 symbols for the trigger.

---

**`[:SOURce<hw>]:BB:DAB:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>`**

Specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only in the case of external triggering.

**Parameters:**

<Inhibit>            float

                         Range:     0 samples to  $2^{32}-1$  samples  
                         Increment: 1 sample  
                         \*RST:     0 samples

**Example:**            `BB:DAB:TRIG:SOUR EXT1`  
                         selects an external trigger via the TRIGGER 1 connector.  
                         `BB:DAB:TRIG:INH 200`  
                         sets a restart inhibit for 200 samples following a trigger event.

---

**`[:SOURce<hw>]:BB:DAB[:TRIGger]:SEQUence <Sequence>`**

Selects the trigger mode.

**Parameters:**

&lt;Sequence&gt;

AUTO|RETRigger|AAUTo|ARETrigger|SINGle

**AUTO**

The modulation signal is generated continuously.

**RETRigger**

The modulation signal is generated continuously. A trigger event (internal or external) causes a restart.

**AAUTo**

The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously, signal generation is stopped with command `SOUR:BB:DAB:TRIG:ARM:EXEC` and started again when a trigger event occurs.

**ARETrigger**

The modulation signal is generated only when a trigger event occurs. The device automatically toggles to RETRIG mode. Every subsequent trigger event causes a restart. Signal generation is stopped with command `SOUR:BB:DAB:TRIG:ARM:EXEC` and started again when a trigger event occurs.

**SINGle**

The modulation signal is generated only when a trigger event occurs. After the trigger event, the signal is generated once to the set sequence length (`SOUR:BB:DAB:TRIG:SLen`). Every subsequent trigger event causes a restart. Signal generation is stopped with command `SOUR:BB:DAB:TRIG:ARM:EXEC` and started again when a trigger event occurs.

\*RST: AUTO

**Example:**

BB:DAB:SEQ AAUT

sets the "Armed\_auto" trigger mode; the device waits for the first trigger (e.g. with \*TRG) and then generates the signal continuously.

## 4.6 Marker Settings

This section lists the remote control commands, necessary to configure the markers.



The marker delay settings are available for R&S SMx and R&S AMU instruments only.

<code>[SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut:DElAY:FIXed</code> .....	49
<code>[SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:DElAY</code> .....	49

[:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:DELay:MAXimum.....49  
 [:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:DELay:MINimum.....50  
 [:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:MODE.....50  
 [:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:OFFTime.....51  
 [:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:ONTime.....51  
 [:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PATTern.....51  
 [:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:DIVider.....52  
 [:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:FREQuency.....52

**[:SOURce<hw>]:BB:DAB:TRIGger:OUTPut:DELay:FIXed <Fixed>**

Restricts the marker delay setting range to the current range. In this range the delay can be set without restarting the marker and signal. If a delay is entered in setting ON but is outside this range, the maximum possible delay is set and an error message is generated.

The numeric suffix in `OUTPut` has no significance for this command, since the setting always affects every marker.

**Parameters:**

<Fixed>                    0|1|OFF|ON  
 \*RST:                    OFF

**Example:**

BB:DAB:TRIG:OUTP:DEL:FIX ON  
 restricts the marker signal delay setting range to the current range.

**[:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:DELay <Delay>**

Defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of samples.

Command `:BB:DAB:TRIGger:OUTPut:DELay:FIXed` can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

**Parameters:**

<Delay>                    float  
 Range:                    0 to 2^32-1samples  
 \*RST:                    0

**Example:**

BB:DAB:TRIG:OUTP2:DEL 16000  
 sets a delay of 16000 samples for the signal on connector MARKER 2.

**[:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:DELay:MAXimum?**

Queries the maximum marker delay for setting `:BB:DAB:TRIG:OUTP:DEL:FIX ON`.

**Return values:**

<Maximum>                float

**Example:** `BB:DAB:TRIG:OUTP:DEL:FIX ON`  
 restricts the marker signal delay setting range to the dynamic range.  
`BB:DAB:TRIG:OUTP:DEL:MAX?`  
 queries the maximum of the dynamic range.  
**Response:**  
`20000`  
 the maximum for the marker delay setting is 20000 samples.

**Usage:** Query only

---

**`[:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:DELaY:MINimum?`**

Queries the minimum marker delay for setting `:BB:DAB:TRIGger:OUTPut:DELaY:FIXed ON`.

**Return values:**  
 <Minimum> float

**Example:** `BB:DAB:TRIG:OUTP:DEL:FIX ON`  
 restricts the marker signal delay setting range to the dynamic range.  
`BB:DAB:TRIG:OUTP:DEL:MIN?`  
 queries the minimum of the dynamic range.  
**Response:** `"0"`  
 the minimum for the marker delay setting is 0 symbols.

**Usage:** Query only

---

**`[:SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:MODE <Mode>`**

Defines the signal for the selected marker output.

**Parameters:**

&lt;Mode&gt;

REStart|FRAMe|PULSe|PATTern|RATio|TRIGger

**REStart**

A marker signal is generated at the start of every sequence length loop. Restart mode is available only for ETI data source.

**FRAMe**

A marker signal is generated at the start of every frame.

**PULSe**

A marker pulse is generated continuously according to the frequency and frequency divider.

**PATTern**

A marker signal is generated due to a bit pattern given by the user. Each bit represents a sample and can be switched on or off.

**RATio**

A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.

\*RST: FRAMe

**Example:**

BB:DAB:TRIG:OUTP2:MODE FRAME

selects the frame marker signal on output MARKER 2.

[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:OFFTime &lt;Offtime&gt;

[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:ONTime &lt;Ontime&gt;

Sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting SOURce:BB:DAB:TRIGger:OUTPut:MODE RATio on the marker outputs is ON.

**Parameters:**

&lt;Ontime&gt;

float

Range: 1 to 2<sup>24</sup> - 1 samples

Increment: 1

\*RST: 1

**Example:**

BB:DAB:TRIG:OUTP2:ONT 2000

sets an ON time of 2000 samples for marker 2.

[:SOURce&lt;hw&gt;]:BB:DAB:TRIGger:OUTPut&lt;ch&gt;:PATTern &lt;Pattern&gt;

Defines the bit pattern used to generate the marker signal.

**Parameters:**

&lt;Pattern&gt;

&lt;32bit pattern&gt;

\*RST: 0

**Example:** `BB:DAB:TRIG:OUTP2:PATT #H39FE0000,32`  
 sets the bit pattern.  
`BB:DAB:TRIG:OUTP2:MODE PATT`  
 activates the marker signal according to a bit pattern on output  
 MARKER 2.

---

**[ :SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:DIVider <Divider>**

Sets the divider for the pulsed marker signal in the setting  
`SOURce:BB:DAB:TRIGger:OUTPut:MODE PULSe`. The pulse frequency is derived by  
 dividing the symbol rate by the divider.

**Parameters:**

<Divider> float  
 Range: 2 to 1024  
 Increment: 1  
 \*RST: 2

**Example:** `BB:DAB:TRIG:OUTP2:PULS:DIV 2`  
 sets the divider for the marker signal on output MARKER 2 to the  
 value 2.  
`BB:DAB:TRIG:OUTP2:FREQ?`  
 queries the resulting pulse frequency of the marker signal.  
 Response:  
 66 000  
 the resulting pulse frequency is 66kHz.

---

**[ :SOURce<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:FREQUency?**

Queries the pulse frequency of the pulsed marker signal in the set-  
 ting `:BB:DAB:TRIGger:OUTPut:MODE PULSe`. The pulse frequency is derived by  
 dividing the symbol rate by the divider. The divider is defined with com-  
 mand `:BB:DAB:TRIG:OUTP:PULS:DIV`.

**Return values:**

<Frequency> float

**Example:** `BB:DAB:TRIG:OUTP2:PULS:DIV 2`  
 sets the divider for the marker signal on output MARKER 2 to the  
 value 2.  
`BB:DAB:TRIG:OUTP2:MODE PULS`  
 enables the pulsed marker signal.  
`BB:DAB:TRIG:OUTP2:FREQ?`  
 queries the resulting pulse frequency of the marker signal.  
 Response: "66 000"  
 the resulting pulse frequency is 66kHz.

**Usage:** Query only



## 4.7 Clock Settings

This section lists the remote control commands, necessary to configure the clock.



The clock settings are available for R&S SMx and R&S AMU instruments only.

<code>[:SOURCE&lt;hw&gt;]:BB:DAB:CLOCK:MODE</code> .....	53
<code>[:SOURCE&lt;hw&gt;]:BB:DAB:CLOCK:MULTIPLIER</code> .....	53
<code>[:SOURCE&lt;hw&gt;]:BB:DAB:CLOCK:SOURCE</code> .....	54
<code>[:SOURCE&lt;hw&gt;]:BB:DAB:CLOCK:SYNCHRONIZATION:EXECUTE</code> .....	54
<code>[:SOURCE&lt;hw&gt;]:BB:DAB:CLOCK:SYNCHRONIZATION:MODE</code> .....	55

### `[:SOURCE<hw>]:BB:DAB:CLOCK:MODE <Mode>`

Enters the type of externally supplied clock (`BB:DAB:CLOCK:SOURCE EXTERNAL`). When MSAM is used, a multiple of the sample clock is supplied via the CLOCK connector and the sample clock is derived internally from this. The multiplier is entered with the command `BB:DAB:CLOCK:MULTIPLIER`.

For two-path instruments, the only numerical suffix allowed for SOURCE is 1, since the external clock source is permanently allocated to path A.

#### Parameters:

<Mode>                   SAMPLE|MSAMPLE  
\*RST:                   SAMP

#### Example:

```
BB:DAB:CLOCK:MODE MSAM
sets the type of externally supplied clock.
```

### `[:SOURCE<hw>]:BB:DAB:CLOCK:MULTIPLIER <Multiplier>`

Specifies the multiplier for clock type "Multiple Sample" (`BB:DAB:CLOCK:MODE MSAMP`) in the case of an external clock source.

For two-path instruments, the only numerical suffix allowed for SOURCE is 1, since the external clock source is permanently allocated to path A.

#### Parameters:

<Multiplier>           float  
Range:                1 to 64  
Increment:           1  
\*RST:                4

**Example:** `BB:DAB:CLOC:SOUR EXT`  
 selects the external clock source. The clock is supplied via the CLOCK connector.

`BB:DAB:CLOC:MODE MSAM`  
 selects clock type "Multiple Sample", i.e. the supplied clock has a rate which is a multiple of the sample rate.

`BB:DAB:CLOC:MULT 12`  
 the multiplier for the external clock rate is 12.

---

**[ :SOURce<hw> ]:BB:DAB:CLOCK:SOURce <Source>**

Selects the clock source.

For two-path instruments, selecting EXTERNAL is only possible for path A, since the external clock source is permanently allocated to path A.

**Parameters:**

<Source> INTERNAL|EXTERNAL

**INTERNAL**

The internal clock reference is used.

**EXTERNAL**

The external clock reference is supplied to the CLOCK connector.

Commands : `BB:DAB:CLOCK:MODE` and : `MULTIPLIER` are used to enter the type of the external clock.

Increment: INTERNAL

\*RST: INTERNAL

**Example:** `BB:DAB:CLOC:SOUR EXT`  
 selects the external clock source. The clock is supplied via the CLOCK connector.

`BB:DAB:CLOC:MODE MSAM`  
 selects clock type "Multiple Sample", i.e. the supplied clock has a rate which is a multiple of the sample rate.

`BB:DAB:CLOC:MULT 12`  
 the multiplier for the external clock rate is 12.

---

**[ :SOURce<hw> ]:BB:DAB:CLOCK:SYNCHRONIZATION:EXECute**

Performs automatic adjustment of the instrument's settings required for the synchronization mode, set with the command `BB:DAB:SYNC:MODE`.

**Example:** `BB:DAB:CLOC:SYNC:MODE MAST`  
 the instrument is configured to work as a master one.

`BB:DAB:CLOCK:SYNC:EXEC`  
 all synchronization's settings are adjusted accordingly.

**Usage:** Event

---

```
[ :SOURce<hw>]:BB:DAB:CLOCK:SYNChronization:MODE <Mode>
```

Selects the synchronization mode

This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

**Note:** If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type. Avoid unnecessary cable length and branching points.

**Parameters:**

<Mode>

NONE|MASTer|SLAVe

**NONE**

The instrument is working in stand-alone mode.

**MASTer**

The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.

**SLAVe**

The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

\*RST: NONE

**Example:**

```
BB:DAB:CLOC:SYNC:MODE MAST
```

the instrument is configured to work as a master one.

## List of Commands

[:SOURCE<hw>]:BB:DAB:CLIPPING:LEVEL.....	41
[:SOURCE<hw>]:BB:DAB:CLIPPING:MODE.....	42
[:SOURCE<hw>]:BB:DAB:CLIPPING:STATE.....	42
[:SOURCE<hw>]:BB:DAB:CLOCK:MODE.....	53
[:SOURCE<hw>]:BB:DAB:CLOCK:MULTIPLIER.....	53
[:SOURCE<hw>]:BB:DAB:CLOCK:SOURCE.....	54
[:SOURCE<hw>]:BB:DAB:CLOCK:SYNCHRONIZATION:EXECUTE.....	54
[:SOURCE<hw>]:BB:DAB:CLOCK:SYNCHRONIZATION:MODE.....	55
[:SOURCE<hw>]:BB:DAB:CODER[:STATE].....	35
[:SOURCE<hw>]:BB:DAB:DATA.....	31
[:SOURCE<hw>]:BB:DAB:DATA:DSELECTION.....	31
[:SOURCE<hw>]:BB:DAB:EFRAMES.....	32
[:SOURCE<hw>]:BB:DAB:ETI:CATALOG.....	32
[:SOURCE<hw>]:BB:DAB:FILTER:ILENGTH.....	37
[:SOURCE<hw>]:BB:DAB:FILTER:ILENGTH:AUTO[:STATE].....	37
[:SOURCE<hw>]:BB:DAB:FILTER:OSAMPLING.....	37
[:SOURCE<hw>]:BB:DAB:FILTER:OSAMPLING:AUTO[:STATE].....	38
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:APCO25.....	38
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:COSINE.....	38
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:COSINE:COFS.....	39
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:GAUSS.....	39
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:LPASS.....	39
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:LPASSEVM.....	40
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:PGAUSS.....	40
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:RCOSINE.....	40
[:SOURCE<hw>]:BB:DAB:FILTER:PARAMETER:SPHASE.....	40
[:SOURCE<hw>]:BB:DAB:FILTER:TYPE.....	38
[:SOURCE<hw>]:BB:DAB:ILEAVER[:STATE].....	36
[:SOURCE<hw>]:BB:DAB:LDURATION.....	33
[:SOURCE<hw>]:BB:DAB:PNSCRAMBLER[:STATE].....	36
[:SOURCE<hw>]:BB:DAB:PRESET.....	33
[:SOURCE<hw>]:BB:DAB:SETTING:CATALOG.....	33
[:SOURCE<hw>]:BB:DAB:SETTING:DELETE.....	33
[:SOURCE<hw>]:BB:DAB:SETTING:LOAD.....	34
[:SOURCE<hw>]:BB:DAB:SETTING:STORE.....	34
[:SOURCE<hw>]:BB:DAB:SRATE:VARIATION.....	41
[:SOURCE<hw>]:BB:DAB:STATE.....	34
[:SOURCE<hw>]:BB:DAB:TMODE.....	35
[:SOURCE<hw>]:BB:DAB:TRIGGER:ARM:EXECUTE.....	43
[:SOURCE<hw>]:BB:DAB:TRIGGER:EXECUTE.....	43
[:SOURCE<hw>]:BB:DAB:TRIGGER:EXTERNAL:SYNCHRONIZE:OUTPUT.....	43
[:SOURCE<hw>]:BB:DAB:TRIGGER:OBASEBAND:DELAY.....	44
[:SOURCE<hw>]:BB:DAB:TRIGGER:OBASEBAND:INHIBIT.....	44
[:SOURCE<hw>]:BB:DAB:TRIGGER:OUTPUT:DELAY:FIXED.....	49
[:SOURCE<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:DELAY.....	49
[:SOURCE<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:DELAY:MAXIMUM.....	49
[:SOURCE<hw>]:BB:DAB:TRIGGER:OUTPUT<ch>:DELAY:MINIMUM.....	50

[:SOURCE<hw>]:BB:DAB:TRIGger:OUTPut<ch>:MODE.....	50
[:SOURCE<hw>]:BB:DAB:TRIGger:OUTPut<ch>:OFFTime.....	51
[:SOURCE<hw>]:BB:DAB:TRIGger:OUTPut<ch>:ONTime.....	51
[:SOURCE<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PATtern.....	51
[:SOURCE<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:DIVider.....	52
[:SOURCE<hw>]:BB:DAB:TRIGger:OUTPut<ch>:PULSe:FREQuency.....	52
[:SOURCE<hw>]:BB:DAB:TRIGger:RMODE.....	45
[:SOURCE<hw>]:BB:DAB:TRIGger:SLENgth.....	45
[:SOURCE<hw>]:BB:DAB:TRIGger:SOURce.....	46
[:SOURCE<hw>]:BB:DAB:TRIGger[:EXTernal<ch>]:DELay.....	46
[:SOURCE<hw>]:BB:DAB:TRIGger[:EXTernal<ch>]:INHibit.....	47
[:SOURCE<hw>]:BB:DAB[:TRIGger]:SEQuence.....	47

# Index

## A

Activate DAB Standard .....	12
Arm Trigger .....	16, 22, 43

## B

Baseband Clipping .....	19
Baseband filter .....	17, 38
BxT .....	17
B x T .....	38

## C

Chip Clock Multiplier .....	53
Clipping Level .....	19
Clipping Mode .....	19, 42
Clipping State .....	19, 42
Clock Mode .....	28, 53
Clock Multiplier .....	28
Clock Source .....	27, 54
Coder .....	16, 35
Crest factor .....	19
Current Range Without Recalculation .....	26
Maximum .....	49
Minimum .....	50
Cut Off Frequency Factor .....	18
Cut Off Frequency Shift .....	17, 39

## D

Data source .....	31, 35
Data Source .....	14
Deactivate DAB Standard .....	12
Default settings .....	33
Default Settings .....	13
Delay - Marker .....	49
Delay - Trigger .....	44, 46
Divider .....	25
Documentation Overview .....	5

## E

Execute Trigger .....	15, 22, 43
External Trigger Delay .....	44, 46
External Trigger Inhibit .....	47

## F

File Manger .....	13
Filter .....	17
Filter Parameter .....	38
Filter Type .....	38
Fix marker delay to current range .....	27
Fix marker to dynamic range .....	49

## G

Global Trigger/Clock Settings .....	28
-------------------------------------	----

## I

Impulse Length .....	18, 37
Interleaver .....	16, 36

## L

Load DAB Settings .....	13
Loop Duration .....	15

## M

Manual Trigger .....	43
Marker .....	15
Marker Delay .....	49
Marker Mode .....	25, 50
Marker x Delay .....	26
Measured External Clock .....	28
Multiplier .....	53

## N

Number of ETI Frames .....	15, 32
Nyquist filter .....	38

## O

ON/OFF Ratio Marker .....	0
Open File Manager .....	13
Oversampling .....	18, 37

## P

PN Scrambler .....	16, 36
--------------------	--------

## R

Recall Configuration .....	13
Recall DAB Settings .....	13
Roll Off .....	38
Roll Off Factor .....	17
Running .....	22
Running - Trigger .....	45

## S

Sample Rate .....	33
Sample Rate Variation .....	18, 41
Save Configuration .....	13
Save DAB Settings .....	13
Select ETI File .....	14
Set Synchronization Settings .....	27, 54
Set to default .....	33
Set to Default .....	13
Signal Duration .....	21
Signal Duration - Trigger .....	45
Standard settings .....	33
Standard Settings .....	13
State .....	12, 34
Stopped .....	22
Stop Signal Generation .....	16, 22
Sync. Output to External Trigger .....	23
Synchronization mode .....	27
Synchronization Mode .....	55

## T

Transport Mode .....	15
Trigger .....	15, 22

Trigger Delay .....	24
Trigger Delay External .....	44, 46
Trigger Inhibit .....	24
Trigger Inhibit External .....	47
Trigger Inhibit Other Baseband .....	44
Trigger Mode	
Armed .....	21
Armed_Auto .....	47
Armed_Retrigger .....	47
Auto .....	21, 47
Retrigger .....	21, 47
Single .....	21
Trigger Source .....	22, 46

## U

User Marker / AUX I/O Settings .....	29
--------------------------------------	----