

TETRA Release 2

Digital Standard for

R&S[®] Signal Generators

Operating Manual



1173.0843.12 – 03

This document describes the following software options:

- R&S®AMU-K68/-268
1403.0601.02, 1403.0647.02
- R&S®SMATE-K68
1404.8664.02
- R&S®SMBV-K68/-268
1415.8490.xx, 1415.8502.xx
- R&S®SMJ-K68/-268
1409.3102.02, 1409.3154.02
- R&S®SMU-K68/-268
1408.8217.02, 1408.8269.02
- R&S®SFU-268
2115.2420.02

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

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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.
Links	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 provides you with the ability to generate signals in accordance with the standard Terrestrial Trunked Radio Release 2 (TETRA2) .

The following list gives an overview of the main options provided by the R&S Signal Generator for generating an TETRA signal in accordance with ETSI EN 300 392-2.

- The TETRA frame (bit stream) is generated according to the selected burst type, i.e. control burst (CB), normal burst (NB) or synchronization burst (SB).
- The frames are generated for the uplink (mobile station [MS] transmitting) or the downlink (base station [BS] transmitting).
- The channel types AACH, BSCH, BNCH, TCH, STCH, SCH as well as the TETRA Release 2 specific channels like SCH-Q, etc. are generated.
- Channel coding including scrambling with system code, base color code, mobile country code and mobile network code is performed for all channels.
- Frame repetition can be selected via sequence length.
- The T1 test signal is generated for the V+D (voice and data) test on MS and BS DUTs.
- Test channel types can be set for the downlink and for the uplink.
- The bit stream can be generated either from pseudo-random sequences (CCITT O. 153) or from user-selectable sequences.
- The R&S Signal Generator calculates the appropriate TETRA2 T1, T2, T3 and T4 signal according to the specification.
- Additionally, user-defined test signal can be generated.

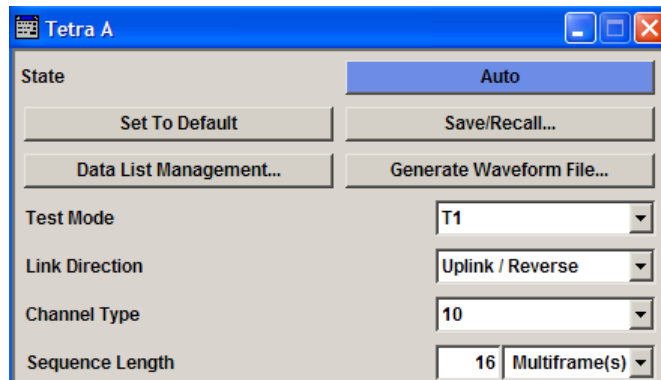
3 User Interface

To access the menu for setting the TETRA digital standard, select "Baseband Block > Config > TETRA" or press the MENU key and select "Baseband > TETRA".

3.1 TETRA Main Menu

The menu is split into three sections for configuring the standard. The choice of transmission direction determines which displays and parameters are made available in the middle section.

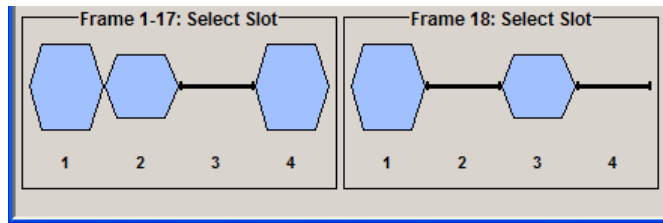
The upper section of the menu is where the TETRA digital standard is enabled, the default settings are called, the transmission direction selected and the test mode is set.



The submenus for setting the trigger and clock parameters, data list management, or saving and loading a frame and for setting the power ramping and slot attenuation are available for the modes T1, T2, T4 and User.



The lower part of the menu displays the chosen frame configuration. In this graphical display you can select the slot that you wish to edit. The frame editor then opens. Slots for frame 1 to 17 and frame 18 can be activated and configured independently.



State

Enables/disables the TETRA standard.

Enabling this standard disables all the other digital standards and digital modulation modes.

In case of two-path instruments, this affects the same path.

SCPI command:

`[:SOURce<hw>] :BB:TETRa:STATe` on page 43

Set to Default

Calls the default settings.

The following table gives an overview of the settings. The preset value for each parameter is specified in the description of the remote-control commands.

Parameter	Value
"State"	Off
"Test Mode"	T1
"Link Direction"	Downlink / Forward
"Channel Type"	0
"Sequence Length"	1 Multiframe
"Power Ramp/Slot Attenuation"	cosine/ 2 / 0 / 0sym
"Filter/Clipping"	Root Cosine / clipping Off
"Trigger/Marker"	Auto/ Int
"Clock"	Internal

SCPI command:

`[:SOURce<hw>] :BB:TETRa:PRESet` on page 41

Save/Recall

Calls the Save/Recall menu.

From the "Save/Recall" dialog the "Save/Recall Settings" windows for saving and recalling the configurations and the "File Manager" can be called.

TETRA configurations are stored as files with the predefined file extension `*.tetra`.

The file name and the directory they are stored in are user-definable.

The complete settings in the TETRA menu are saved and recalled.

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

SCPI command:

`[:SOURCE<hw>] :BB:TETRA:SETTING:LOAD` on page 42

"Save Settings" Opens the "Save Settings" window for saving the current TETRA signal configuration.

The name of the file is specified in the "File name" entry field. The file is saved by pressing the "Save" button.

SCPI command:

`[:SOURCE<hw>] :BB:TETRA:SETTING:STORE` on page 42

"File Manager" Calls the "File Manager" dialog.

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

SCPI command:

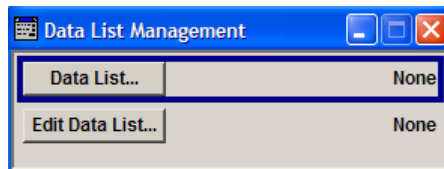
`[:SOURCE<hw>] :BB:TETRA:SETTING:CATALOG` on page 41

SCPI command:

`[:SOURCE<hw>] :BB:TETRA:SETTING:DELETE` on page 42

Data List Management

Calls the "Data List Management" dialog. This dialog is used to create and edit a data list.



All data lists are stored as files with the predefined file extension `*.dm_iqd`. The file name and the directory they are stored in are user-definable.

The data lists must be selected as a data source from the submenus under the individual function.

Example: Creating and editing the data list

```
SOUR:BB:DM:DLIS:SEL "TETRA"
```

```
SOUR:BB:DM:DLIS:DATA 1,1,0,1,0,1,0,1,1,1,1,0,0,0
```

```
SOUR:BB:DM:DLIS:DATA:APP 1,1,0,1,0,1,0,1,1,1,1,0,0,0
```

SCPI command:

`[:SOURCE<hw>] :BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:LDIRrection<ch>:DATA` on page 48

`[:SOURCE<hw>] :BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:LDIRrection<ch>:DATA:DSElection` on page 49

Generate Waveform File

Opens the submenu for storing the current TETRA signal as ARB signal in a waveform file. This file can be loaded in the "ARB" dialog and processed as multicarrier or multi-segment signal.

The file name is entered in the submenu. The file is stored with the predefined file extension *.wv. The file name and the directory it is stored in are user-definable.

SCPI command:

[:SOURce<hw>] :BB:TETRa:WAVeform:CREate on page 44

Test Mode

Selects the test mode.

Several settings depends on the selected test model.

- | | |
|----------------|---|
| "T1" | <p>Test signal T1 (TETRA wanted signal, phase modulated)
This test mode enables the generation of test signal that comply with the TETRA air interface multiframe, frame and slot structure. The T1 test signal is generated according to EN 300 394-1V3.1.1 and is intended to be the wanted signal transmitted by the test system during frames 1 to 17 in all receiver tests.
The signal is pi/4-DQPSK or pi/8-D8PSK modulated. Frame 18 transmits information for control purposes.
To enable configuration of the T1 signal for different receiver tests, the channel type for the "T1" signal is user-selectable. Channel types 0 to 4, 21, 22 and 25 are available in the Downlink/Forward "Link Direction" and channel types 7 to 11, 21, 23 and 24 for the Uplink/Reverse direction.
The burst types Uplink/Reverse and Downlink/Forward are derived from the channel types. The instrument generates the Tx data for complete multiframes for the V+D service (voice and data). The contents of data fields are automatically inserted according to the burst type. The control block (cb), blocks 1 + 2 (bk), the synchronization block (sb) and the broadcast block (bb) for test signal T1 are generated according to the frame number and the channel type.</p> |
| "T4" | <p>Test signal T4 (TETRA wanted signal, QAM modulated)
The test signal T4 comply with the TETRA air interface multiframe, frame and slot structure. The T4 test signal is intended to be the wanted signal transmitted by the test system during frames 1 to 17 in all receiver tests. Except form frame 18, the signal is 4-QAM, 16-QAM or 64-QAM modulated. Frame 18 transmits information for control purposes and is QAM and phase modulated (QAM + pi/4-DQPSK); the frame is generated according to EN 300 394-1.</p> |
| "User Defined" | <p>Enables the generation of user-defined test signal.</p> |
| "T2" | <p>Test signal T2 (TETRA interfer)
The T2 test signal is phase or QAM modulated, depending on the selected Modulation Type.</p> |

"T3" Test signal T3 (unmodulated interferer)
 The T3 test signal is an unmodulated continuous sinusoidal out-of-band interfering signal.

SCPI command:

[:SOURce<hw>] :BB:TETRa:TMODE on page 43

Link Direction

Selects the transmission direction.

This parameter determines the available "Channel Types".

"Downlink/Forward" The transmission direction selected is from the base station (BS) to the terminal (MS). The signal corresponds to that of a BS.

"Uplink/Reverse" The transmission direction selected is from MS to the BS. The signal corresponds to that of a terminal.

SCPI command:

[:SOURce<hw>] :BB:TETRa:LDIRectIon on page 41

Channel Type

(for "Test Model" set to T1 or T4)

Determines the channel type.

SCPI command:

[:SOURce<hw>] :BB:TETRa:CTYPe on page 40

Modulation Type

(for "Test Model" set to User Defined)

Determines the modulation type, "Phase" or "QAM."

"Phase" The T2 test signal is a pi/4-DQPSK modulated continuous radio signal.

"QAM" The T2 test signal is 4-QAM, 16-QAM or 64-QAM modulated and spans a bandwidth of 25kHz, 50kHz, 100kHz or 150kHz.

SCPI command:

[:SOURce<hw>] :BB:TETRa:MTYPe on page 41

Downlink Burst Type

(in Downlink "Link Direction" and for "Test Model" set to T2 or User Defined)

Determines whether a discontinuous or continuous downlink burst type is used.

SCPI command:

[:SOURce<hw>] :BB:TETRa:DBTYpe on page 40

Sequence Length

Selects the sequence length of the arbitrary waveform file in the number of multiframe. One multiframe is the minimum sequence length for a T1 signal.

SCPI command:

[:SOURce<hw>] :BB:TETRa:SLENgth on page 43

Power Ramp/Slot Attenuations

Calls the "Power Ramp Control" dialog. This dialog is used to set the power ramping parameters and for setting values for the level attenuation in dB (see [chapter 3.2, "Power Ramp Control"](#), on page 14).

The currently selected ramp function and ramp time are displayed.

BSCH / BNCH/T

Calls the "BSCH / BNCH/T" dialog. This dialog is used to configure the frequency settings, the scrambling code and the content of the Broadcast Synchronization Channel (BSCH) and the Broadcast Network Channel (BNCH/T) (see [chapter 3.3, "BSCH / BNCH/T"](#), on page 16).

Filter/Clipping

Calls the dialog for setting baseband filtering, clipping and modulation settings (see [chapter 3.5, "Filter/Clipping Settings"](#), on page 26).

The current settings are displayed.

Trigger/Marker/Clock

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

Calls the dialog for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal, and for selecting the clock source. This dialog is described in [chapter 3.6, "Trigger/Marker/Clock Settings"](#), on page 29.

The current settings are displayed.

Execute Trigger

for R&S SMx and R&S AMU instruments only

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

SCPI command:

[:SOURce<hw>] :BB:TETRa:TRIGger:EXECute on page 64

Clock

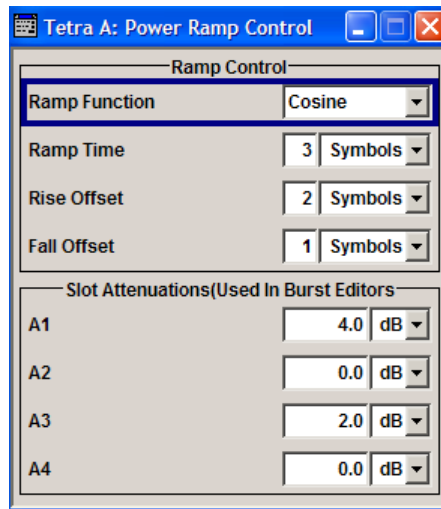
The clock functions are available for R&S SMx and R&S AMU instruments only.

3.2 Power Ramp Control

The "Power Ramp Control" dialog is accessed via the TETRA main menu.

This dialog is used to enter the settings for power ramping and level attenuation. The "Slot Attenuations" (used in "Frame Editor"s) section is used to define four possible values for level attenuation. These values can be selected from the frame editor for the slot currently being edited.

"Slot Level Full" setting in the frame editor corresponds to 0 dB attenuation.



Ramp Function

Enters the form of the transmitted power during the switching operation, i.e. the shape of the rising and falling edges of the envelope.

"Linear" The transmitted power rises and falls linear fashion.

"Cosine" The transmitted power rises and falls with a cosine-shaped edge. This gives rise to a more favorable spectrum than the "Linear" setting.

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:PRAMping:RFUNction](#) on page 44

Ramp Time

Enters the power ramping rise time and fall time for a frame. The setting is expressed in symbols.

The transmitted power must not be switched abruptly at the start and end of a frame, because the switching operation would otherwise generate excessively strong non-harmonics; the switching operation is therefore stretched over several symbol clocks

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:PRAMping:RTIME](#) on page 45

Rise Offset

Sets the offset in the rising edge of the envelope at the start of a frame. A positive value gives rise to a delay and a negative value causes an advance. The setting is expressed in symbols.

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:PRAMping:ROFFset](#) on page 45

Fall Offset

Sets the offset in the falling edge of the envelope at the end of a frame. A positive value gives rise to a delay and a negative value causes an advance. The setting is expressed in symbols.

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:PRAMping:FOFFset](#) on page 44

Slot Attenuation A1 to A4

Enters four different values for level attenuation.

The frame editor can be used to set the level attenuation for the four slots to one of these predefined values independently of one another.

The entered value determines the slot output power (slot power = RF power - attenuation). 0 dB attenuation corresponds to "Slot Level" = Full.

This feature is provided to set a sequence of slots to different levels in order to measure transmission stability.

The frame editor is likewise used to assign the "Slot Level" attribute Attenuated to individual slots.

SCPI command:

[:SOURce<hw>] :BB:TETRa:SATTenuation<ch> on page 45

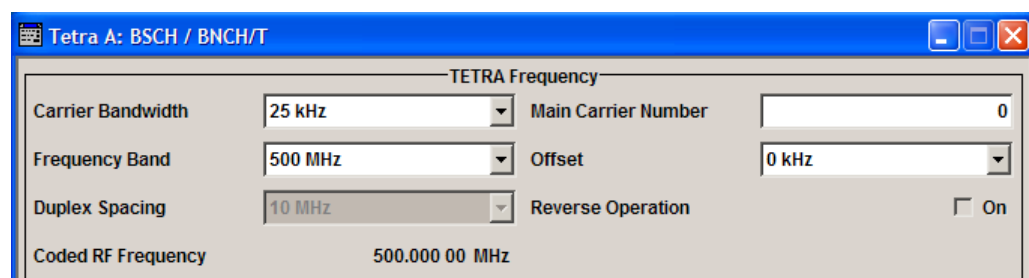
3.3 BSCH / BNCH/T

To access this dialog, select "Main Menu > BSCH / BNCH/T".

In the "BSCH / BNCH/T" dialog the contents of the Broadcast Synchronization Channel (BSCH) and the Broadcast Network Channel (BNCH/T) are configured.

The BSCH and the BNCH are the two possible Broadcast Control Channels (BCCH) that are transmitted in downlink direction only. Hence, the parameters in this dialog provided to configure the content of the channels are enabled only for "Link Direction" set to Downlink/Forward.

The "BSCH / BNCH/T" dialog is divided into three section. The "TETRA Frequency" section comprises of the parameters necessary to set the carrier bandwidth and the frequency band. The section is enabled in both link directions.



The "Contents Setting" section is enabled in downlink direction only. In the downlink mode, a synchronization burst is used to control the MS messages. In this burst, protocol elements are transmitted in BSCH and BNCH. The parameters are used to form the commands for the mobile station.

Contents Setting			
System Code	4	Sharing Mode	Continuous Transmission
TS reserved frames	1 frame	U-plane DTX	<input type="checkbox"/> Allowed
Frame 18 extension	<input type="checkbox"/> Allowed		
Neighbour Cell Broadcast			
D-NWRK-BROADCAST broadcast	<input type="checkbox"/> Supported	D-NWRK-BROADCAST enquiry	<input type="checkbox"/> Supported
Cell service level	Cell load unknown	Late Entry	<input type="checkbox"/> Supported
MS_TXPWR_MAX_CELL	15 dBm	ACCESS_PARAMETER	-53 MHz
Tx_on	Reception ON	Tx_burst_type	Normal uplink burst
T1_T4_Burst_Type	TCH/2,4 N=1(Down)	Loop Back	<input type="checkbox"/> On
Error Correction	<input checked="" type="checkbox"/> On		

The "Srcambling" section comprises of the parameters necessary to configure the scrambling sequence.

Srcambling			
Base Colour Code	1	Mobile Country Code	262
Mobile Network Code	5 519		

3.3.1 TETRA Frequency

Carrier Bandwidth

Selects the carrier bandwidth, i.e. determines the carrier spacing.

The default value for all standard test modes is 25kHz; carrier spacing of 50, 100 and 150 kHz is enabled for "Test Mode" set to User Defined or T4.

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNChT:CBANdwidth](#) on page 54

Main Carrier Number

The "Main Carrier Number" divides the TETRA band into carriers with a spacing as set with the parameter "Carrier Bandwidth". The range is 0 to 4095 (12 bits).

The Main Carrier Frequency is calculated as follow:

Main Carrier Frequency, kHz = "Main Carrier Number" * "Carrier Bandwidth"

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNChT:MCNNumber](#) on page 57

Frequency Band

Sets the "Frequency Band".

This setting has an effect on the calculation of the transmission frequency. The Frequency Band Information is inserted only in the TETRA BSCH protocol channel.

SCPI command:

`[:SOURCE<hw>] :BB:TETRa:BBNChT:FBANd` on page 56

Offset

Set the "Offset" to shift the center frequency in the channel spacing. The allowed offsets are +6.25, 0, -6.25 and +12.50 kHz.

SCPI command:

`[:SOURCE<hw>] :BB:TETRa:BBNChT:OFFSet` on page 58

Duplex Spacing

(for Uplink direction only)

The "Duplex Spacing" and "Reverse Operation" parameters in the BNCH/T indicate the required uplink frequency with respect to the indicated downlink frequency. These parameters are defined in ETSI 300 392-2.

SCPI command:

`[:SOURCE<hw>] :BB:TETRa:BBNChT:DSPacing` on page 55

Reverse Operation

(for Uplink direction only)

Enables/disables reverse operation.

Reverse operation is used to fix the uplink frequency relative to the downlink frequency. In normal operation, the uplink frequency is lower than the downlink frequency and in reverse operation, the uplink frequency is higher than the downlink frequency.

SCPI command:

`[:SOURCE<hw>] :BB:TETRa:BBNChT:ROPeration` on page 58

Coded RF Frequency

Displays the resulting RF frequency, calculated from the previous settings. The frequency is calculated from the "Frequency Band", "Main Carrier Number", "Offset", "Duplex Spacing" and "Reverse Operation" and transmitted in message channel BNCH/T when Downlink MS V+D Testing is selected.

The "Coded RF Frequency" is calculated as described in [table 3-1](#).

Table 3-1: Calculation of Coded RF Frequency

"Link Direction"	"Reverse Operation"	"Coded RF Frequency", MHz
Downlink	-	Downlink Coded RF Frequency = "Frequency Band" + ("Main Carrier Number"* "Carrier Bandwidth") + "Offset"
Uplink	Off (Normal operation)	Uplink Coded RF Frequency = Downlink Coded RF Frequency - "Duplex Spacing"
	On	Uplink Coded RF Frequency = Downlink Coded RF Frequency + "Duplex Spacing"

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNChT:CRFrequency](#) on page 54

3.3.2 Contents Settings

The "Contents Setting" section is enabled in downlink direction only.

System Code

Indicate whether the system is a TETRA V+D system or whether this is a Direct Mode transmission.

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNChT:SCODE](#) on page 59

TS reserved frames

Determines the number of frames reserved over two multiframe period.

The way this field is processed, depends on the selected "[Sharing Mode](#)" on page 19. If MCCH sharing is indicated, the TS reserved frames field shall indicate which frames are reserved in this mode of operation. For the other values of sharing mode, the contents of the TS reserved frames field shall be ignored.

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNChT:TRFRames](#) on page 59

Frame 18 extension

Enables/disables the frame 18 extension element, i.e. indicates whether an MS is allowed to receive downlink information on all slots of the frame 18. If extension is allowed, only MSs which are capable of receiving consecutive slots are able to perform this function.

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNChT:FEEXtension](#) on page 56

Sharing Mode

The sharing mode field indicates whether the BS is using continuous transmission, carrier sharing, MCCH sharing or traffic carrier sharing.

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNChT:SMODE](#) on page 59

U-plane DTX

The "U-plane DTX" element indicates whether or not the BS supports discontinuous traffic transmission by the MS.

SCPI command:

[:SOURCE<hw>] :BB:TETRa:BBNChT:UPDTx on page 60

D-NWRK-BROADCAST broadcast

Enables/disables support of the D-NWRK-BROADCAST PDU.

SCPI command:

[:SOURCE<hw>] :BB:TETRa:BBNChT:DNBBroadcast on page 55

D-NWRK-BROADCAST enquiry

Enables/disables support of the D-NWRK-BROADCAST enquiry.

SCPI command:

[:SOURCE<hw>] :BB:TETRa:BBNChT:DNBenquiry on page 55

Cell service level

Sets the cell service level information element, i.e. define the level of service a MS may receive in a cell. It may relate to the traffic loading in a cell.

The following service levels are supported:

- "Cell load unknown"
- "Low cell load"
- "Medium cell load"
- "High cell load"

SCPI command:

[:SOURCE<hw>] :BB:TETRa:BBNChT:CSLevel on page 54

MS_TXPWR_MAX_CELL

Sets the protocol information on the maximum transmission power for the mobile station. Allowed are values from 15 dBm to 45 dBm in 5 dB steps.

The MS_TXPWR_MAX_CELL parameter is used for cell selection and reselection, and for power adjustments.

SCPI command:

[:SOURCE<hw>] :BB:TETRa:BBNChT:MTMCell on page 58

Tx_on

Determines the value of the Tx_on parameter, i.e. selects the test mode the MS operates in, "Reception ON" or "Transmission ON".

This parameter is necessary for the generation of test signal T1 or T4 transmitted by the test system.

"Transmission ON" The mobile station is requested to transmit.

"Reception ON" The mobile station is requested to receive.

SCPI command:

[:SOURCE<hw>] :BB:TETRa:BBNChT:TXON on page 60

T1_T4_Burst_Type

Sets the value of the special parameter T1_T4_Burst_Type, i.e. determines the logical channel the BS is expecting to receive.

SCPI command:

[:SOURce<hw>] :BB:TETRa:BBNChT:TTBType on page 60

Error Correction

Enables/disables error correction.

SCPI command:

[:SOURce<hw>] :BB:TETRa:BBNChT:ECORrection on page 56

Late Entry

Sets the value of the late entry supported information element, used to indicate to the MS whether or not late entry can be supported by the cell.

SCPI command:

[:SOURce<hw>] :BB:TETRa:BBNChT:LENTry on page 57

ACCESS_PARAMETER

Sets the value of the ACCESS_PARAMETER information field. This parameter is used for subsequent power adjustments for the mobile station.

This protocol information field can takes values from -53 dBm to -23 dBm in 2 dB steps.

SCPI command:

[:SOURce<hw>] :BB:TETRa:BBNChT:APARameter on page 53

Tx_burst_type

Sets the parameter Tx_burst_type and determines whether the MS under test transmit either a normal uplink burst or control uplink burst.

"Normal uplink The mobile station should transmit using normal uplink burst.
burst"

"Control uplink The mobile station should transmit using control uplink burst.
burst"

SCPI command:

[:SOURce<hw>] :BB:TETRa:BBNChT:TBTYpe on page 59

Loop Back

Enables/disables loop back for test purposes.

If enabled, the mobile station should set up a loop and return the data when requested by the Tx_burst_type.

SCPI command:

[:SOURce<hw>] :BB:TETRa:BBNChT:LBACK on page 56

3.3.3 Scrambling

The "Srcambling" section comprises of the parameters necessary to configure the scrambling sequence.

The scrambling code is a 24-bit field composed of the Mobile Country Code (MCC) and Mobile Network Code (MNC) and is calculated as defined in EN 300 392. The MCC and MNC is a part of the MLE information contained within the SYNC PDU broadcast by the BS on the BSCH. The upper MAC adds to this a 6-bit color code which is contained in the SYNC PDU. The combination of MCC, MNC and color code make up the scrambling code which the upper MAC passes to the lower MAC via the TMV-SAP. This scrambling code corresponds to the extended color code used for scrambling and descrambling in the lower MAC. The scrambling code corresponds to the 30-bit extended color code $e(1)$, $e(2)$, ..., $e(30)$.

Table 3-2: Building of scrambling code

"Mobile Country Code (MCC)"	"Mobile Network Code (MNC)"	"Colour Code"
10 bits	14 bits	6 bits
$e(1) - e(10)$	$e(11) - e(24)$	$e(25) - e(30)$
$e(1) = \text{msb}^{1)}$ of MCC	$e(11) = \text{msb}$ of MNC	$e(25) = \text{msb}$ of Colour Code
¹⁾ Most Significant Bit		

Base Colour Code

Sets the colour code.

The base color code is the number of subscriber group in a network.

See [table 3-2](#) for information on how the scrambling code is calculated.

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNcht:BCCode](#) on page 53

Mobile Network Code

Sets the Mobile Network Code (MNC).

The MNC is the number of the TETRA network operator.

See [table 3-2](#) for information on how the scrambling code is calculated.

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNcht:MNCCode](#) on page 57

Mobile Country Code

Sets the Mobile Country Code.

The MCC is the number of the country in which the unit is operated.

See [table 3-2](#) for information on how the scrambling code is calculated.

SCPI command:

[\[:SOURCE<hw>\]:BB:TETRa:BBNcht:MCCCode](#) on page 57

3.4 Burst Editor

To call the frame editor, select a slot from the graphical display in the TETRA main menu.

At the top of the menu the structure of the current burst type for the selected slot is displayed. Individual fields of the frame are color-coded:

Field	Color
Data, Fixed, Mixed, Stealing	white
white Training Sequences: TSC, ETSC, SYNC	yellow
Tail, extended Tail	green
Guard, extended Guard	blue

The rest of the menu displays the data contained in fields predefined by the standard for the current burst type. Data fields with variable content can be edited. The value at which they are currently set is shown on a button. Pressing the button activates the value that has been entered. Values in fields with permanently predefined content are not highlighted in any way.

The following sections list all possible settings and displays for the various burst types. If a setting applies only to a particular burst type, this is mentioned for the parameter concerned.

T2 Burst Type

Selects the burst type for "Test Mode T2".

SCPI command:

`[:SOURCE<hw>] :BB:TETRA:SCONfiguration:SLOT<st>:LDIRrection<ch>:TBType` on page 47

Slot Level

Sets the level for the selected slot.

- "Off" Attenuation is maximum. The slot is inactive.
- "Full" The level corresponds to the level indicated in the display.
- "Attenuated" Level is reduced by the level attenuation set in "Slot Attenuation".

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRection<ch>:SLEVel on page 52
```

Slot Attenuation

Selects the level attenuation for the "Slot Level" Attenuated setting.

Use the [Power Ramp Control](#) dialog to define four different values for level attenuation.

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRection<ch>:BSAttenuation on page 48
```

Data Source

Selects a data source for the DATA field.

The data source for both channels can be defined separately.

If a burst contains multiple DATA fields, these are treated as a continuous field, and for instance a pseudo-random sequence is continued without interruption from one DATA field to the next.

The same data is used in each slot.

You may choose from the following data sources:

- "All 0/All 1" 0 data or 1 data is internally generated.
- "PRBS" PRBS data in accordance with the IUT-T with period lengths between 29-1 and 223-1 are internally generated.
- "Pattern" A user-definable bit pattern with a maximum length of 64 bits is internally generated. The bit pattern is defined in the Pattern input box.

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRection<ch>:DATA:DPATtern on page 49
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRection<ch>:SDATa:SDPattern on page 51
```

"Data List" Uses data from a programmable data list. The data can be generated internally with the aid of the binary editor in the R&S Signal Generator or externally by the user with the aid of any editor. Data lists are selected from the "Select List" file menu.

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRectioN<ch>:DATA:DSElection on page 49
```

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRectioN<ch>:SDATa:SDSelection on page 51
```

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRectioN<ch>:DATA on page 48
```

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRectioN<ch>:SDATa on page 50
```

Logical Channel Type

Selects the logical channel type.

The available channels depend on the selected "Test Mode" and "Link Direction".

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRectioN<ch>:LCTYpe on page 50
```

Scrambling

Enables/disables auto scrambling.

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRectioN<ch>:SCRambling on page 50
```

Training Sequence

Determines whether the default or a user-defined training sequence (TSC) is used.

A user-defined training sequence can be created in the field "TSC User Defined".

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRectioN<ch>:TSource on page 52
```

TSC User Defined

Enters a user-defined TSC. The length of the training sequences depends on the burst type. The first user bit is equivalent to the first bit of the training sequence. All further will be inserted successively.

SCPI command:

```
[ :SOURce<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRectioN<ch>:TPATtern on page 52
```

AACH-Q Mode

(enabled for Frame 1- 17)

Sets the AACH-Q Mode element that indicates whether the Access-Assign PDU follows in the AACH-Q.

The AACH-Q (Access Assignment Channel, QAM) channel is present on all transmitted downlink slots (except slots containing BLCH-Q) and is used to indicate on each QAM physical channel the assignment of the uplink and downlink slots.

"Access-Assign PDU" The value of the AACH-Q Mode element is set to 0, i.e. contents of Access-Assign PDU are present.

The Access-Assign PDU is used to convey information about the downlink slot in which it appears and also the access rights for the corresponding (same-numbered) uplink slot.

The fields of the "Access-Assign PDU" are defined with the corresponding parameters.

"Reserved Element" The value shall be set to all zeros.

SCPI command:

```
[ :SOURCE<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRection<ch>:AMODE on page 47
```

Access-Assign PDU

(enabled for Frame 1- 17)

Enables configuration of the Access-Assign PDU content.

"Header" Sets the value for the information element Header.

SCPI command:

```
[ :SOURCE<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRection<ch>:APHeader on page 48
```

"Field1" Sets the value for the information element Field 1.

SCPI command:

```
[ :SOURCE<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRection<ch>:APF1 on page 47
```

"Field2" Sets the value for the information element Field 2.

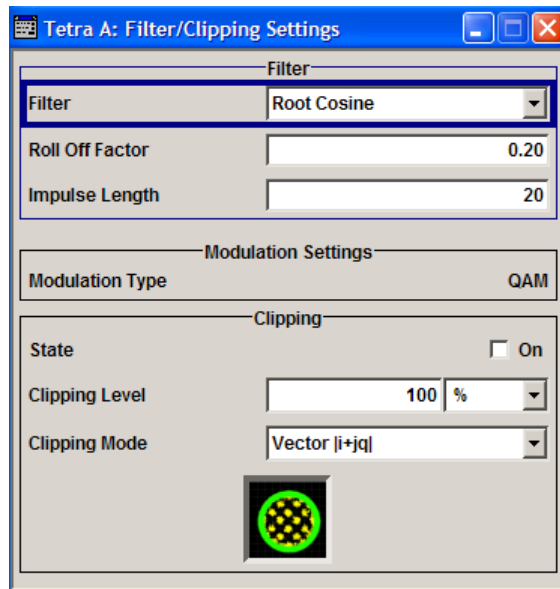
SCPI command:

```
[ :SOURCE<hw> ] :BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
LDIRection<ch>:APF2 on page 48
```

3.5 Filter/Clipping Settings

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

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



3.5.1 Filter Settings

Filter

Sets the baseband filter.

SCPI command:

[\[:SOURce<hw>\]:BB:TETRA:FILTer:TYPE](#) on page 73

Roll Off Factor or BxT

Sets the filter parameter.

For the default cosine filter, a roll off factor of 0.10 is used.

SCPI command:

[\[:SOURce<hw>\]:BB:TETRA:FILTer:PARAMeter:COSSine](#) on page 72

[\[:SOURce<hw>\]:BB:TETRA:FILTer:PARAMeter:RCOSSine](#) on page 72

[\[:SOURce<hw>\]:BB:TETRA:FILTer:PARAMeter:PGAuss](#) on page 72

[\[:SOURce<hw>\]:BB:TETRA:FILTer:PARAMeter:GAUSS](#) on page 72

[\[:SOURce<hw>\]:BB:TETRA:FILTer:PARAMeter:SPHase](#) on page 72

[\[:SOURce<hw>\]:BB:TETRA:FILTer:PARAMeter:APCO25](#) on page 72

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.

The value range is -1.0 to 1.0.

SCPI command:

[\[:SOURce<hw>\]:BB:TETRA:FILTer:PARAMeter:COSSine:COFS](#) on page 72

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:TETRa:FILTer:PARAmeter:LPASs` on page 72

Impulse Length

Displays the number of filter tabs.

SCPI command:

`[:SOURce<hw>] :BB:TETRa:FILTer:ILENgtH` on page 72

3.5.2 Modulation Settings

Modulation Type

Displays the modulation type as selected with the parameter "Modulation Type" in the "Main Menu".

SCPI command:

`[:SOURce<hw>] :BB:TETRa:MTYPe` on page 41

3.5.3 Clipping Settings

The settings for clipping are collected in the "Clipping" section.

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:TETRa:CLIPping:STATe` on page 71

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:TETRa:CLIPping:LEVel` on page 71

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 (see also "Clipping State" on page 28).



"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:TETRa:CLIPping:MODE` on page 71

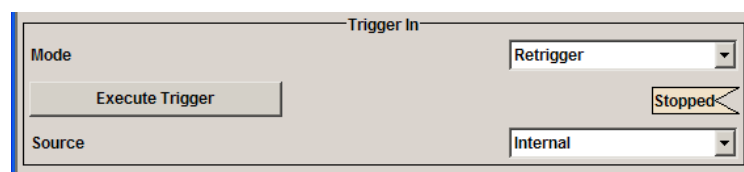
3.6 Trigger/Marker/Clock Settings



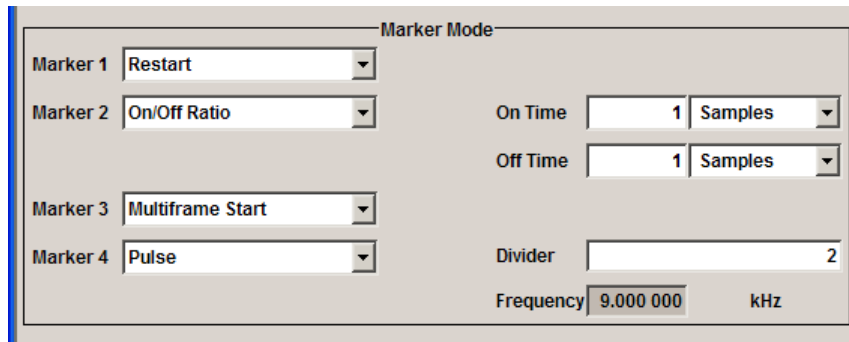
The trigger, clock, and marker delay functions are available for R&S SMx and R&S AMU instruments only.

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

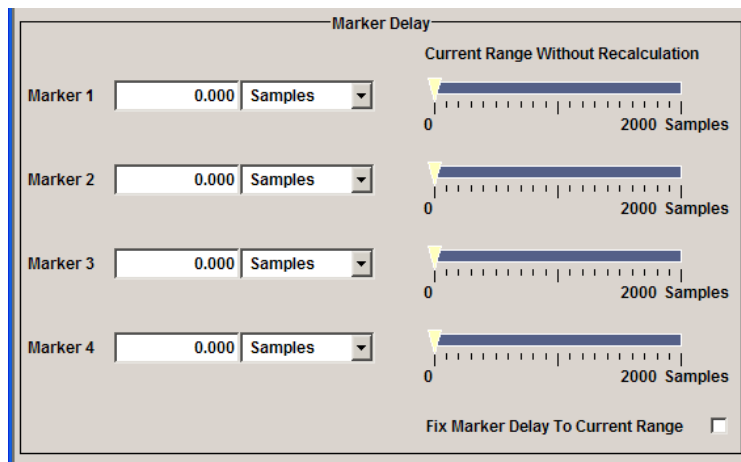
The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.



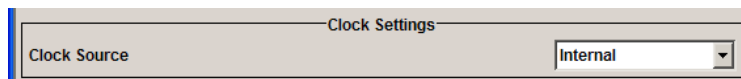
The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.



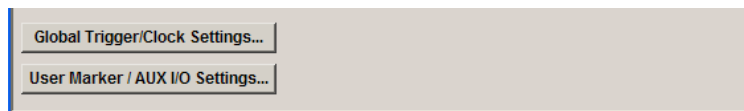
The "Marker Delay" section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.



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.



3.6.1 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. 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. 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". Every subsequent trigger event (internal with "Execute Trigger" or external) causes a restart.

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:TRIGger:SEQuence](#) on page 67

Signal Duration Unit

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

Available units are sequence length (SL) and multiframe.

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:TRIGger:SLUNit](#) on page 66

Signal Duration

Defines the length of the signal sequence to be output in the "Single" trigger mode. The unit of the entry is defined under "Signal Duration Unit". It is then 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:TETRa:TRIGger:SLENgth](#) on page 66

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:TETRa:TRIGger:RMODE](#) on page 65

Arm

Stops signal generation. 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:TETRa:TRIGger:ARM:EXECute](#) on page 63

Execute Trigger

for R&S SMx and R&S AMU instruments only

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

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:TRIGger:EXECute](#) on page 64

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:TETRa:TRIGger:SOURce](#) on page 66

Sync. Output to External Trigger

(enabled for Trigger Source External)

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

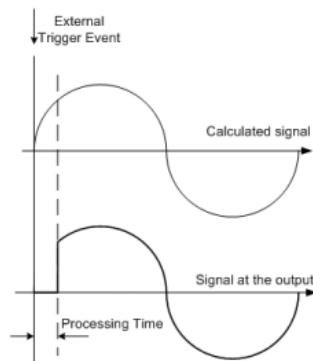
For R&S SMBV instruments:

For one 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 [table 3-3](#) for an overview of the required settings.

Table 3-3: 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

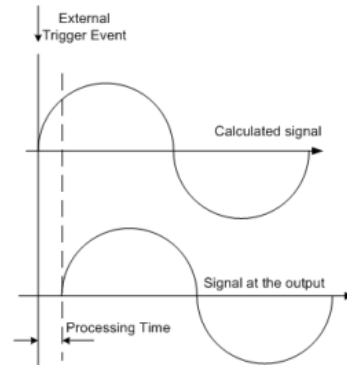
"On" Corresponds to the default state of this parameter. The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is outputted. After elapsing of the internal processing time, the output signal 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:TETRa:TRIGger [:EXTeRnal<ch>] :SYNChronize:OUTPut`
on page 64

Trigger Delay

Sets the trigger signal delay in samples on external triggering and enables shifting of the complete signal by a time offset equal to the trigger delay.

Trigger delay can also be set on internal triggering via the second path.

This enables the instrument 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:TETRa:TRIGger [:EXTeRnal<ch>] :DELay` on page 67
`[:SOURce<hw>] :BB:TETRa:TRIGger:OBASeband:DELay` on page 64

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:TETRa:TRIGger [:EXTeRnal<ch>] :INHibit` on page 67
`[:SOURce<hw>] :BB:TETRa:TRIGger:OBASeband:INHibit` on page 64

3.6.2 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.

"Restart"	A marker signal is generated at the start of each ARB sequence.
"Slot Start "	A marker signal is generated at the start of each slot.
"Frame Start"	A marker signal is generated at the start of each frame.
"Multiframe Start"	A marker signal is generated at the start of each multiframe.
"Hyperframe Start"	A marker signal is generated at the start of each hyperframe.
"Pulse"	A regular marker signal is generated. 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:TETRa:TRIGger:OUTPut<ch>:PULSe:DIVider](#)
on page 70

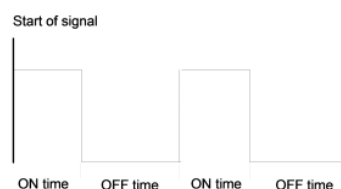
[\[:SOURce<hw>\]:BB:TETRa:TRIGger:OUTPut<ch>:PULSe:FREQuency](#)
on page 70

"Pattern "	A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 64 bits and is defined in an input field which opens when pattern is selected.
------------	---

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:TRIGger:OUTPut<ch>:PATtern](#) on page 70

"ON/OFF Period"	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.
-----------------	---



SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:TRIGger:OUTPut<ch>:ONTIME](#) on page 69

[\[:SOURce<hw>\]:BB:TETRa:TRIGger:OUTPut<ch>:OFFTime](#) on page 69

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:TRIGger:OUTPut<ch>:MODE](#) on page 68

3.6.3 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. 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:TETRa:TRIGger:OUTPut<ch>:DELay` on page 65

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:TETRa:TRIGger:OUTPut<ch>:DELay:MINimum`
on page 65

`[:SOURCE<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:DELay:MAXimum`
on page 65

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:TETRa:TRIGger:OUTPut:DELay:FIXed` on page 65

3.6.4 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.

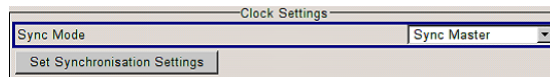
This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

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:TETRa:CLOCK:SYNChronization:MODE` on page 62

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:TETRa:CLOCK:SYNChronization:EXECute` on page 62

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:TETRa:CLOCK:SOURce` on page 61

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:TETRa:CLOCK:MODE` on page 61

Clock Multiplier

Enters the multiplication factor for clock type "Multiple".

SCPI command:

[\[:SOURce<hw>\]:BB:TETRa:CLOCK:MULTIplier](#) on page 61

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:

:CLOC:INP:FREQ?

3.6.5 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

This subsystem contains the commands for setting the TETRA standards.

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.

Placeholder <root>

For commands that read out or save files in the default directory, the default directory is set using command **MMEM:CDIRectory**. The examples in this description use the placeholder **<root>** in the syntax of the command.

- **D:** - for selecting the internal hard disk of Windows instruments
- **E:** - for selecting the memory stick which is inserted at the USB interface of Windows instruments
- **/var/<instrument>** - for selecting the internal flash card of Linux instrument, where **<instrument>** is the instrument name, e.g. **smbv**.
- **/usb** - for selecting the memory stick which is inserted at the USB interface of Linux instrument.

TMODe<di>

The numeric suffix to **TMODe** distinguishes between the test modes:

- **TMODe1** = Test Mode 1
- **TMODe2** = Test Mode 4
- **TMODe3** = User Defined
- **TMODe4** = Test Mode 2

SLOT<st>

The numeric suffix to **SLOT** distinguishes between the slot numbers:

- **SLOT<1..4>** = Slots#1 .. Slot#4 in Frame 1..17
- **SLOT<5..8>** = Slots#1 .. Slot#4 in Frame 18

LDIRection<ch>

The numeric suffix to `LDIRection` distinguishes between the link directions:

- `LDIRection1` = Downlink
- `LDIRection2` = Uplink

4.1 Primary Settings

<code>[:SOURCE<hw>]:BB:TETRa:CTYPe</code>	40
<code>[:SOURCE<hw>]:BB:TETRa:DBTYpe</code>	40
<code>[:SOURCE<hw>]:BB:TETRa:LDIRection</code>	41
<code>[:SOURCE<hw>]:BB:TETRa:MTYPe</code>	41
<code>[:SOURCE<hw>]:BB:TETRa:PRESet</code>	41
<code>[:SOURCE<hw>]:BB:TETRa:SETTing:CATalog</code>	41
<code>[:SOURCE<hw>]:BB:TETRa:SETTing:DELeTe</code>	42
<code>[:SOURCE<hw>]:BB:TETRa:SETTing:LOAD</code>	42
<code>[:SOURCE<hw>]:BB:TETRa:SETTing:STORe</code>	42
<code>[:SOURCE<hw>]:BB:TETRa:SLENgth</code>	43
<code>[:SOURCE<hw>]:BB:TETRa:STATe</code>	43
<code>[:SOURCE<hw>]:BB:TETRa:TMODe</code>	43
<code>[:SOURCE<hw>]:BB:TETRa:WAVeform:CREate</code>	44

`[:SOURCE<hw>]:BB:TETRa:CTYPe <Ctype>`

(for "Test Model" set to T1 or T4)

Determines the channel type.

Parameters:

`<Ctype>` CH0|CH1|CH2|CH3|CH4|CH7|CH8|CH9|CH10|CH11|CH21|CH22|CH23|CH24|CH25|CH26|CH27

*RST: CH0

Example: `BB:TETR:CTYP CH2`

`[:SOURCE<hw>]:BB:TETRa:DBTYpe <Dbtype>`

(in Downlink "Link Direction" and for "Test Model" set to T2 or User Defined)

Determines whether a discontinuous or continuous downlink burst type is used.

Parameters:

`<Dbtype>` CONTInuous|DCONTInuous

*RST: CONTInuous

Example: `BB:TETR:DBTY CONT`

[[:SOURce<hw>]:BB:TETRa:LDIRection <Ldirection>

Selects the transmission direction.

This parameter determines the available "Channel Types".

Parameters:

<Ldirection> DOWN|UP

DOWN

The transmission direction selected is from the base station (BS) to the terminal (MS). The signal corresponds to that of a BS.

UP

The transmission direction selected is from MS to the BS. The signal corresponds to that of a terminal.

*RST: DOWN

Example: BB:TETR:LDIR UP

[[:SOURce<hw>]:BB:TETRa:MTYPE <Mtype>

(for "Test Model" set to User Defined)

Determines the modulation type, "Phase" or "QAM."

Parameters:

<Mtype> PHASe|QAM

PHASe

The T2 test signal is a pi/4-DQPSK modulated continuous radio signal.

QAM

The T2 test signal is 4-QAM, 16-QAM or 64-QAM modulated and spans a bandwidth of 25kHz, 50kHz, 100kHz or 150kHz.

Example: BB:TETR:MTYP QAM

[[:SOURce<hw>]:BB:TETRa:PRESet

Calls the default settings.

Example: BB:TETR:PRES

Usage: Event

[[:SOURce<hw>]:BB:TETRa:SETTing:CATalog <Catalog>

Reads out the files with TETRA settings in the default directory. The default directory is set using command `M MEM:CDIRectory`. Only files with the file extension `*.tetra` will be listed.

Parameters:

<Catalog> string

Example:

```
MMEM:CDIR '[variable not defined: var1]\user\'
BB:TETR:SETT:CAT?
Response: 'tetra_t1_dl'
```

[:SOURCE<hw>]:BB:TETRA:SETTING:DELETE <Delete>

This command deletes the selected file with TETRA settings in the specified directory. The file extension may be omitted. Only files with the file extension *.tetra will be deleted.

Parameters:

<Delete> <file name>

Example:

```
BB:TETR:SETT:DEL '[variable not defined:
var1]\user\tetra_t1_dl'
```

[:SOURCE<hw>]:BB:TETRA:SETTING:LOAD <Load>

Loads the selected file with TETRA settings in the specified directory. The file extension may be omitted. Only files with the file extension *.tetra will be loaded.

Parameters:

<Load> <file name>

Example:

```
MMEM:CDIR '[variable not defined: var1]\user\'
BB:TETR:SETT:CAT?
Response: 'tetra_t1_dl'
BB:TETR:SETT:LOAD '[variable not defined:
var1]\user\tetra_t1_dl'
```

[:SOURCE<hw>]:BB:TETRA:SETTING:STORE <Store>

Stores the current TETRA settings into the selected file in the specified directory. The file extension may be omitted. TETRA settings are stored as files with the specific file extensions *.tetra.

Setting parameters:

<Store> <file name>

Example: BB:TETR:SETT:STOR '[variable not defined:
var1]\user\tetra_t1_dl'
MMEM:CDIR '[variable not defined: var1]\user\
BB:TETR:SETT:CAT?
Response: 'tetra_t1_dl'

Usage: Setting only

[:SOURce<hw>]:BB:TETRa:SEnGth <Slength>

Selects the sequence length of the arbitrary waveform file in the number of multiframe. One multiframe is the minimum sequence length for a T1 signal.

Parameters:

<Slength> float
Range: 1 to 53687
*RST: 3

Example: BB:TETR:SLEN 51500

[:SOURce<hw>]:BB:TETRa:STATe <State>

Enables/disables the TETRA standard.

Enabling this standard disables all the other digital standards and digital modulation modes.

Parameters:

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

Example: BB:TETR:STAT ON

[:SOURce<hw>]:BB:TETRa:TMODe <Tmode>

Selects the test mode.

Several settings depends on the selected test mode.

Parameters:

<Tmode> T1|T4|USER|T2|T3
*RST: T1

Example: BB:TETR:TMOD T3

[[:SOURce<hw>]:BB:TETRa:WAVeform:CREate <Create>

Opens the submenu for storing the current TETRA signal as ARB signal in a waveform file. This file can be loaded in the "ARB" dialog and processed as multicarrier or multi-segment signal.

The file name is entered in the submenu. The file is stored with the predefined file extension *.wv. The file name and the directory it is stored in are user-definable.

Setting parameters:

<Create> string

Example: BB:TETR:WAV:CRE "[variable not defined: var1]\temp\tetra_waveform"

Usage: Setting only

4.2 Power Ramp Settings

[[:SOURce<hw>]:BB:TETRa:PRAMping:FOFFset.....	44
[[:SOURce<hw>]:BB:TETRa:PRAMping:RFUNction.....	44
[[:SOURce<hw>]:BB:TETRa:PRAMping:ROFFset.....	45
[[:SOURce<hw>]:BB:TETRa:PRAMping:RTIME.....	45
[[:SOURce<hw>]:BB:TETRa:SATTenuation<ch>.....	45

[[:SOURce<hw>]:BB:TETRa:PRAMping:FOFFset <Foffset>

Sets the offset in the falling edge of the envelope at the end of a frame. A positive value gives rise to a delay and a negative value causes an advance. The setting is expressed in symbols.

Parameters:

<Foffset> float

Range: -32 to 32

*RST: 0

Example: BB:TETR:PRAM:FOFF 10

[[:SOURce<hw>]:BB:TETRa:PRAMping:RFUNction <Rfunction>

Enters the form of the transmitted power during the switching operation, i.e. the shape of the rising and falling edges of the envelope.

Parameters:

<Rfunction> LINear|COSine

LINear

The transmitted power rises and falls linear fashion.

COSine

The transmitted power rises and falls with a cosine-shaped edge. This gives rise to a more favorable spectrum than the "Linear" setting.

*RST: COSine

Example:

BB:TETR:PRAM:RFUN LIN

[:SOURCE<hw>]:BB:TETRa:PRAMping:ROFFset <Roffset>

Sets the offset in the rising edge of the envelope at the start of a frame. A positive value gives rise to a delay and a negative value causes an advance. The setting is expressed in symbols.

Parameters:

<Roffset> float

Range: -32 to 32

*RST: 0

Example:

BB:TETR:PRAM:ROFF 6

[:SOURCE<hw>]:BB:TETRa:PRAMping:RTIME <Rtime>

Enters the power ramping rise time and fall time for a frame. The setting is expressed in symbols.

The transmitted power must not be switched abruptly at the start and end of a frame, because the switching operation would otherwise generate excessively strong non-harmonics; the switching operation is therefore stretched over several symbol clocks.

Parameters:

<Rtime> float

Range: 1 to 32

*RST: 1

Example:

BB:TETR:PRAM:RTIM 25

[:SOURCE<hw>]:BB:TETRa:SATTenuation<ch> <Sattenuation>

Enters four different values for level attenuation.

The frame editor can be used to set the level attenuation for the four slots to one of these predefined values independently of one another.

The entered value determines the slot output power (slot power = RF power - attenuation). 0 dB attenuation corresponds to "Slot Level" = Full.

This feature is provided to set a sequence of slots to different levels in order to measure transmission stability.

The frame editor is likewise used to assign the "Slot Level" attribute Attenuated to individual slots.

Parameters:

<Sattenuation> float
 Range: 0.0 to 50.0
 *RST: 0.0

Example: BB:TETR:SATT1 30

4.3 Slot Configuration Settings

[:SOURce<hw>]:BB:TETRa:SCONfiguration:SLOT<st>:LDIRection<ch>:TBTyPe.....	47
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: AMODe.....	47
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: APF1.....	47
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: APF2.....	48
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: APHeader.....	48
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: BSATtenuation.....	48
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: DATA.....	48
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: DATA:DPATtern.....	49
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: DATA:DSELection.....	49
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: LCTyPe.....	50
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: SCRambling.....	50
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: SDATa.....	50
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: SDATa:SDPattern.....	51
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: SDATa:SDSelection.....	51
[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>: SLEVel.....	52

<code>[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:TPATtern</code>	52
<code>[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:TSourc</code>	52

`[:SOURce<hw>]:BB:TETRa:SCONfiguration:SLOT<st>:LDIRection<ch>:TBTYpe`
`<Tbtype>`

Selects the burst type for "Test Mode T2".

Parameters:

`<Tbtype>` NCDB|SCDB|NDDb|SDDb|ND4|ND16|ND64|NUb|CUB|NU4|NU16|NU64|CU4|CU16|CU64|RAB

*RST: NCDB

Example: BB:TETR:SCON:SLOT3:LDIR1:TBTY NCDB

`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:AMODE` `<Amode>`

(enabled for Frame 1- 17)

Sets the AACH-Q Mode element that indicates whether the Access-Assign PDU follows in the AACH-Q.

The AACH-Q (Access Assignment Channel, QAM) channel is present on all transmitted downlink slots (except slots containing BLCH-Q) and is used to indicate on each QAM physical channel the assignment of the uplink and downlink slots.

Parameters:

`<Amode>` AAPDu|RElement

AAPDu

The value of the AACH-Q Mode element is set to 0, i.e. contents of Access-Assign PDU are present.

The Access-Assign PDU is used to convey information about the downlink slot in which it appears and also the access rights for the corresponding (same-numbered) uplink slot.

The fields of the "Access-Assign PDU" are defined with the corresponding parameters.

RElement

The value shall be set to all zeros.

*RST: AAPDu

Example: BB:TETR:SCON:TMOD1:SLOT2:LDIR1:AMOD REL

`[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:APF1` `<Apf1>`

Sets the value for the information element Field 1 of the Access-Assign PDU.

Parameters:

<Apf1> 6 bit hex value

Range: #B000000,6 to #B111111,6
 *RST: #B000011,6

Example: BB:TETR:SCON:TMOD2:SLOT3:LDIR1:APF1 #B000000,6

**[:SOURCE<hw>]:BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:
 LDIREction<ch>:APF2 <Apf2>**

Sets the value for the information element Field 2 of the Access-Assign PDU.

Parameters:

<Apf2> 6 bit hex value

Range: #B000000,6 to #B111111,6
 *RST: #B000011,6

Example: BB:TETR:SCON:TMOD2:SLOT3:LDIR1:APF2 #B000000,6

**[:SOURCE<hw>]:BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:
 LDIREction<ch>:APHeader <Apheader>**

Sets the value for the information element Header 0f the Access-Assign PDU.

Parameters:

<Apheader> integer

Range: #B00,2 to #B11,2
 *RST: #B00,2

Example: BB:TETR:SCON:TMOD3:SLOT5:LDIR1:APH #B01,2

**[:SOURCE<hw>]:BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:
 LDIREction<ch>:BSATTenuation <Bsattenuation>**

Selects the level attenuation for the "Slot Level" Attenuated setting.

Parameters:

<Bsattenuation> A1|A2|A3|A4

*RST: A1

Example: BB:TETR:SCON:TMOD1:SLOT3:LDIR1:BSAT A1

**[:SOURCE<hw>]:BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:
 LDIREction<ch>:DATA <Data>**

Defines the data source for the DATA fields in the burst.

Parameters:

<Data>

ALL0|ALL1|PATT|PN09|PN11|PN15|PN16|PN20|PN21|PN23|DLIST

ALL0|ALL1|

Internal 0 or 1 data is used.

PATT

Internal data is used. The bit pattern for the data is defined with the aid of command `[:SOURCE<hw>] :BB:TETRa :`

`SCONfiguration:TMODE<di>:SLOT<st>:`

`LDIRection<ch>:DATA:DPATtern` on page 49.

PNxx

The pseudo-random sequence generator is used as the data source. There is a choice of different lengths of random sequence.

DLIST

A data list is used. The data list is selected with the aid of command

`[:SOURCE<hw>] :BB:TETRa :SCONfiguration:`

`TMODE<di>:SLOT<st>:LDIRection<ch>:DATA:`

`DSElection` on page 49.

*RST: PN9

Example:

BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA PN23

[:SOURCE<hw>] :BB:TETRa:SCONfiguration:TMODE<di>:SLOT<st>:LDIRection<ch>:DATA:DPATtern <Dpattern>

Selects the data pattern with a maximum length of 64 bits for the internal data when PATTern is selected as the data source (`[:SOURCE<hw>] :BB:TETRa :SCONfiguration:TMODE<di>:SLOT<st>:LDIRection<ch>:DATA` on page 48).

Parameters:

<Dpattern>

<bit pattern>

Example:

BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA PATT

BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA:DPAT #H3F,8

[:SOURCE<hw>] :BB:TETRa:SCONfiguration:TMODE<di>:SLOT<st>:LDIRection<ch>:DATA:DSElection <Dselection>

Selects a data list. This command is only valid for bursts with DATA fields. This data list is only used if it is set as the data source with the aid of command `[:SOURCE<hw>] :BB:TETRa :SCONfiguration:TMODE<di>:SLOT<st>:LDIRection<ch>:DATA` on page 48.

Parameters:

<Dselection>

<data list name>

Example: BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA DLIS
 BB:TETR:SCON:TMOD1:SLOT2:LDIR1:DATA:DSEL
 'dl_tetra_t2_ul'

**[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
 LDIRection<ch>:LCTYpe <Lctype>**

Selects the logical channel type.

The available channels depend on the selected Test Mode and Link Direction.

Parameters:

<Lctype> T72|T48|T24|TCHF|TCHH|STCH|SSTCh|SCHF|T108|SP8F|
 SSHD|BSHD|SBNCh|BBNCh|S8HD|D4H|D16H|D64H|D64M|
 D16U|D64U|B4H|B16H|B64H|B64M|B16U|B64U|SSHU|S8HU|
 S4S8|S8S4|U4H|U16H|U64H|U64M|U16U|U64U|H4H|H16H|
 H64H|H64M|H16U|H64U|SQRA
 *RST: T72

Example: BB:TETR:SCON:TMOD2:SLOT3:LDIR1:LCTY T72

**[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
 LDIRection<ch>:SCRambling <Scrambling>**

Enables/disables auto scrambling.

Parameters:

<Scrambling> 0|1|OFF|ON
 *RST: ON

Example: BB:TETR:SCON:TMOD2:SLOT3:LDIR1:SCR ON

**[:SOURce<hw>]:BB:TETRa:SCONfiguration:TMODe<di>:SLOT<st>:
 LDIRection<ch>:SDATa <Sdata>**

Defines the data source for the DATA fields in the burst.

Parameters:

<Sdata>

ALL0|ALL1|PATT|PN09|PN11|PN15|PN16|PN20|PN21|PN23|DLIST

ALL0|ALL1|

Internal 0 or 1 data is used.

PATT

Internal data is used. The bit pattern for the data is defined with the aid of command `[:SOURCE<hw>] :BB:TETRa :`

`SCONfiguration:TMODe<di>:SLOT<st>:`

`LDIRection<ch>:SDATa:SDPattern` on page 51.

PNxx

The pseudo-random sequence generator is used as the data source. There is a choice of different lengths of random sequence.

DLIST

A data list is used. The data list is selected with the aid of command

`[:SOURCE<hw>] :BB:TETRa :SCONfiguration :`

`TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa :`

`SDSelection` on page 51.

*RST: PN9

Example:

BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT PN23

[:SOURCE<hw>] :BB:TETRa :SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa:SDPattern <Sdpattern>

Selects the data pattern with a maximum length of 64 bits for the internal data when

PATTern is selected as the data source (`[:SOURCE<hw>] :BB:TETRa :`

`SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa` on page 50).

Parameters:

<Sdpattern>

<bit pattern>

Example:

BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT PATT

BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT:SDP #H3F,8

[:SOURCE<hw>] :BB:TETRa :SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa:SDSelection <Sdselection>

Selects a data list. This command is only valid for bursts with DATA fields. This data list

is only used if it is set as the data source with the aid of command `[:SOURCE<hw>] :`

`BB:TETRa :SCONfiguration:TMODe<di>:SLOT<st>:LDIRection<ch>:SDATa`

on page 50.

Parameters:

<Sdselection>

<data list name>

Example: BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT DLIS
 BB:TETR:SCON:TMOD4:SLOT2:LDIR2:SDAT:SDS
 'dl_tetra_t4_ul_2'

**[:SOURCE<hw>]:BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:
 LDIRection<ch>:SLEVel <Slevel>**

Sets the level for the selected slot.

Parameters:

<Slevel> OFF|ATTenuated|FULL

OFF

Attenuation is maximum. The slot is inactive.

ATT

Level is reduced by the level attenuation set in "Slot Attenuation".

FULL

The level corresponds to the level indicated in the display.

*RST: FULL

Example: BB:TETR:SCON:TMOD1:SLOT3:LDIR1:SLEV FULL

**[:SOURCE<hw>]:BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:
 LDIRection<ch>:TPATtern <Tpattern>**

Enters a user-defined TSC. The length of the training sequences depends on the burst type. The first user bit is equivalent to the first bit of the training sequence. All further will be inserted successively.

Parameters:

<Tpattern> integer

Example: BB:TETR:SCON:TMOD1:SLOT2:LDIR1:TPAT

**[:SOURCE<hw>]:BB:TETRA:SCONfiguration:TMODE<di>:SLOT<st>:
 LDIRection<ch>:TSourCe <Tsource>**

Determines whether the default or a user-defined training sequence (TSC) is used.

A user-defined training sequence can be created in the field "TSC User Defined".

Parameters:

<Tsource> DEFault|UDEFined

*RST: DEFault

Example: BB:TETR:SCON:TMOD1:SLOT2:LDIR1:TSC DEF

4.4 BSCH / BNCH/T Settings

<code>[SOURce<hw>]:BB:TETRa:BBNChT:APARameter</code>	53
<code>[SOURce<hw>]:BB:TETRa:BBNChT:BCCode</code>	53
<code>[SOURce<hw>]:BB:TETRa:BBNChT:CBANdwidth</code>	54
<code>[SOURce<hw>]:BB:TETRa:BBNChT:CRFRequency</code>	54
<code>[SOURce<hw>]:BB:TETRa:BBNChT:CSLevel</code>	54
<code>[SOURce<hw>]:BB:TETRa:BBNChT:DNBBroadcast</code>	55
<code>[SOURce<hw>]:BB:TETRa:BBNChT:DNBenquiry</code>	55
<code>[SOURce<hw>]:BB:TETRa:BBNChT:DSPacing</code>	55
<code>[SOURce<hw>]:BB:TETRa:BBNChT:ECORrection</code>	56
<code>[SOURce<hw>]:BB:TETRa:BBNChT:FBANd</code>	56
<code>[SOURce<hw>]:BB:TETRa:BBNChT:FEEExtension</code>	56
<code>[SOURce<hw>]:BB:TETRa:BBNChT:LBACK</code>	56
<code>[SOURce<hw>]:BB:TETRa:BBNChT:LENTry</code>	57
<code>[SOURce<hw>]:BB:TETRa:BBNChT:MCCode</code>	57
<code>[SOURce<hw>]:BB:TETRa:BBNChT:MCNumber</code>	57
<code>[SOURce<hw>]:BB:TETRa:BBNChT:MNCODE</code>	57
<code>[SOURce<hw>]:BB:TETRa:BBNChT:MTMCell</code>	58
<code>[SOURce<hw>]:BB:TETRa:BBNChT:OFFSet</code>	58
<code>[SOURce<hw>]:BB:TETRa:BBNChT:ROPeration</code>	58
<code>[SOURce<hw>]:BB:TETRa:BBNChT:SCODE</code>	59
<code>[SOURce<hw>]:BB:TETRa:BBNChT:SMODE</code>	59
<code>[SOURce<hw>]:BB:TETRa:BBNChT:TBTyPe</code>	59
<code>[SOURce<hw>]:BB:TETRa:BBNChT:TRFRames</code>	59
<code>[SOURce<hw>]:BB:TETRa:BBNChT:TTBType</code>	60
<code>[SOURce<hw>]:BB:TETRa:BBNChT:TXON</code>	60
<code>[SOURce<hw>]:BB:TETRa:BBNChT:UPDTx</code>	60

`[SOURce<hw>]:BB:TETRa:BBNChT:APARameter <Aparameter>`

Sets the value of the ACCESS_PARAMETER information field. This parameter is used for subsequent power adjustments for the mobile station.

This protocol information field can takes values from -53 dBm to -23 dBm in 2 dB steps.

Parameters:

<Aparameter> AP53|AP51|AP49|AP47|AP45|AP43|AP41|AP39|AP37|AP35|
AP33|AP31|AP29|AP27|AP25|AP23

*RST: AP53

Example:

BB:TETR:BBNC:APAR AP31

`[SOURce<hw>]:BB:TETRa:BBNChT:BCCode <Bccode>`

Sets the colour code.

The base color code is the number of subscriber group in a network.

See [table 3-2](#) for information on how the scrambling code is calculated.

Parameters:

<Bccode> float
 Range: 1 to 63
 *RST: 1

Example: BB:TETR:BBNC:BCC 55

[:SOURCE<hw>]:BB:TETRa:BBNCht:CBANDwidth <Cbandwidth>

Selects the carrier bandwidth, i.e. determines the carrier spacing.

The default value for all standard test modes is 25kHz; carrier spacing of 50, 100 and 150 kHz is enabled for "Test Mode" set to User Defined or T4.

Parameters:

<Cbandwidth> C25|C50|C100|C150
 *RST: C25

Example: BB:TETR:BBNC:CBAN C25

[:SOURCE<hw>]:BB:TETRa:BBNCht:CRFRequency?

Displays the resulting RF frequency, calculated from the previous settings. The frequency is calculated from the "Frequency Band", "Main Carrier Number", "Offset", "Duplex Spacing" and "Reverse Operation" and transmitted in message channel BNCH/T when Downlink MS V+D Testing is selected.

The "Coded RF Frequency" is calculated as described in [table 3-1](#).

Return values:

<Crfrequency> float

Example: BB:TETR:BBNC:CRFR?

Usage: Query only

[:SOURCE<hw>]:BB:TETRa:BBNCht:CSLevel <Cslevel>

Sets the cell service level information element, i.e. define the level of service a MS may receive in a cell. It may relate to the traffic loading in a cell.

Parameters:

<Cslevel> CLUNknown|LCLoad|MCLoad|HCLoad

CLUNknown
Cell load unknown

LCLoad
Low cell load

MCLoad
Medium cell load

HCLoad
High cell load

*RST: CLUNknown

Example:

BB:TETR:BBNC:CSL LCL

[:SOURCE<hw>]:BB:TETRa:BBNChT:DNBBroadcast <Dnbbroadcast>

Enables/disables support of the D-NWRK-BROADCAST PDU.

Parameters:

<Dnbbroadcast> 0|1|OFF|ON

*RST: OFF

Example:

BB:TETR:BBNC:DNBB ON

[:SOURCE<hw>]:BB:TETRa:BBNChT:DNBenquiry <Dnbenquiry>

Enables/disables support of the D-NWRK-BROADCAST enquiry.

Parameters:

<Dnbenquiry> 0|1|OFF|ON

*RST: OFF

Example:

BB:TETR:BBNC:DNB ON

[:SOURCE<hw>]:BB:TETRa:BBNChT:DSPacing <Dspacing>

(for Uplink direction only)

The "Duplex Spacing" and "Reverse Operation" parameters in the BNCH/T indicate the required uplink frequency with respect to the indicated downlink frequency. These parameters are defined in ETSI 300 392-2.

Parameters:

<Dspacing> DS0|DS1|DS2|DS3|DS4|DS5|DS6|DS7

Example:

BB:TETR:BBNC:DSP DS2

[:SOURCE<hw>]:BB:TETRa:BBNCht:ECORrection <Ecorrection>

Enables/disables error correction.

Parameters:

<Ecorrection> 0|1|OFF|ON

*RST: ON

Example:

BB:TETR:BBNC:ECOR ON

[:SOURCE<hw>]:BB:TETRa:BBNCht:FBAND <Fband>

Sets the Frequency Band.

This setting has an effect on the calculation of the transmission frequency. The Frequency Band Information is inserted only in the TETRA BSCH protocol channel.

Parameters:

<Fband> F100|F200|F300|F400|F500|F600|F700|F800|F900

*RST: F100

Example:

BB:TETR:BBNC:FBAN F700

[:SOURCE<hw>]:BB:TETRa:BBNCht:FEEXTension <Feextension>

Enables/disables the frame 18 extension element, i.e. indicates whether an MS is allowed to receive downlink information on all slots of the frame 18. If extension is allowed, only MSs which are capable of receiving consecutive slots are able to perform this function.

Parameters:

<Feextension> 0|1|OFF|ON

*RST: OFF

Example:

BB:TETR:BBNC:FEEX ON

[:SOURCE<hw>]:BB:TETRa:BBNCht:LBACk <Lback>

Enables/disables loop back for test purposes.

If enabled, the mobile station should set up a loop and return the data when requested by the Tx_burst_type.

Parameters:

<Lback> 0|1|OFF|ON

*RST: OFF

Example:

BB:TETR:BBNC:LBAC ON

[[:SOURce<hw>]:BB:TETRa:BBNCht:LENTry <Lentry>

Sets the value of the late entry supported information element, used to indicate to the MS whether or not late entry can be supported by the cell.

Parameters:

<Lentry> 0|1|OFF|ON
 *RST: OFF

Example: BB:TETR:BBNC:LENT ON

[[:SOURce<hw>]:BB:TETRa:BBNCht:MCCode <Mccode>

Sets the Mobile Country Code.

The MCC is the number of the country in which the unit is operated.

See [table 3-2](#) for information on how the scrambling code is calculated.

Parameters:

<Mccode> float
 Range: 0 to 1023
 *RST: 262

Example: BB:TETR:BBNC:MCC 900

[[:SOURce<hw>]:BB:TETRa:BBNCht:MCNumber <Mcnnumber>

The "Main Carrier Number" divides the TETRA band into carriers with a spacing as set with the parameter "Carrier Bandwidth". The range is 0 to 4095 (12 bits).

The Main Carrier Frequency is calculated as follow:

Main Carrier Frequency, kHz = "Main Carrier Number" * "Carrier Bandwidth"

Parameters:

<Mcnnumber> float
 Range: 0 to 4095
 *RST: 0

Example: BB:TETR:BBNC:MCN 2300

[[:SOURce<hw>]:BB:TETRa:BBNCht:MNCCode <Mncode>

Sets the Mobile Network Code (MNC).

The MNC is the number of the TETRA network operator.

See [table 3-2](#) for information on how the scrambling code is calculated.

Parameters:

<Mncode> float
 Range: 0 to 16383
 *RST: 5519

Example: BB:TETR:BBNC:MNC 230

[:SOURCE<hw>]:BB:TETRa:BBNCht:MTMCell <Mtmcell>

Sets the protocol information on the maximum transmission power for the mobile station. Allowed are values from 15 dBm to 45 dBm in 5 dB steps.

The MS_TXPWR_MAX_CELL parameter is used for cell selection and reselection, and for power adjustments.

Parameters:

<Mtmcell> M15|M20|M25|M30|M35|M40|M45
 *RST: M15

Example: BB:TETR:BBNC:MTMC M25

[:SOURCE<hw>]:BB:TETRa:BBNCht:OFFSet <Offset>

Set the "Offset" to shift the center frequency in the channel spacing. The allowed offsets are +6.25, 0, -6.25 and +12.50 kHz.

Parameters:

<Offset> ZERO|P625|M625|P125
 *RST: ZERO

Example: BB:TETR:BBNC:OFFS P125

[:SOURCE<hw>]:BB:TETRa:BBNCht:ROPeration <Roperation>

(for Uplink direction only)

Enables/disables reverse operation.

Reverse operation is used to fix the uplink frequency relative to the downlink frequency. In normal operation, the uplink frequency is lower than the downlink frequency and in reverse operation, the uplink frequency is higher than the downlink frequency.

Parameters:

<Roperation> 0|1|OFF|ON
 *RST: OFF

Example: BB:TETR:BBNC:ROP ON

[:SOURce<hw>]:BB:TETRa:BBNCht:SCODE <Scode>

Indicate whether the system is a TETRA V+D system or whether this is a Direct Mode transmission.

Parameters:

<Scode> S0|S1|S2|S3|S4|S5|S6|S7
*RST: S4

Example: BB:TETR:BBNC:SCOD S3

[:SOURce<hw>]:BB:TETRa:BBNCht:SMODE <Smode>

The sharing mode field indicates whether the BS is using continuous transmission, carrier sharing, MCCH sharing or traffic carrier sharing.

Parameters:

<Smode> CTRansmission|CSHaring|MSHaring|TCSHaring
*RST: CTRansmission

Example: BB:TETR:BBNC:SMOD CSHaring

[:SOURce<hw>]:BB:TETRa:BBNCht:TBTYpe <Tbtype>

Sets the parameter Tx_burst_type and determines whether the MS under test transmit either a normal uplink burst or control uplink burst.

Parameters:

<Tbtype> NUB|CUB
NUB
The mobile station should transmit using normal uplink burst.
CUB
The mobile station should transmit using control uplink burst.
*RST: NUB

Example: BB:TETR:BBNC:TBTY NUB

[:SOURce<hw>]:BB:TETRa:BBNCht:TRFRames <Trframes>

Determines the number of frames reserved over two multiframe period.

The way this field is processed, depends on the selected "[Sharing Mode](#)" on page 19. If MCCH sharing is indicated, the TS reserved frames field shall indicate which frames are reserved in this mode of operation. For the other values of sharing mode, the contents of the TS reserved frames field shall be ignored.

Parameters:

<Trframes> F1|F2|F3|F4|F6|F9|F12|F18

*RST: F1

Example:

BB:TETR:BBNC:TRFR F2

[[:SOURce<hw>]:BB:TETRa:BBNChT:TTBType <Ttbtype>

Sets the value of the special parameter T1_T4_Burst_Type, i.e. determines the logical channel the BS is expecting to receive.

Parameters:

<Ttbtype> T72F|T72S|SFD|BSHD|T24D|RSV1|RSV2|T72U|SFU|SSTCh|
T24U|SSCH|RSV3|RSBurst|RSSBurst|TPTD|TPTU|T48D|T48U|
TSCD|TSCU|T108|SPHD|SPHU|SPF|SQHU|SQU|SQD|SQRA

*RST: T72F

Example:

BB:TETR:BBNC:TTBT T48D

[[:SOURce<hw>]:BB:TETRa:BBNChT:TXON <Txon>

Determines the value of the Tx_on parameter, i.e. selects the test mode the MS operates in, "Reception ON" or "Transmission ON".

This parameter is necessary for the generation of test signal T1 or T4 transmitted by the test system.

Parameters:

<Txon> RON|TON

RON

The mobile station is requested to receipt.

TON

The mobile station is requested to transmit.

*RST: RON

Example:

BB:TETR:BBNC:TXON RON

[[:SOURce<hw>]:BB:TETRa:BBNChT:UPDTx <Updtx>

The "U-plane DTX" element indicates whether or not the BS supports discontinuous traffic transmission by the MS.

Parameters:

<Updtx> 0|1|OFF|ON

*RST: OFF

Example: BB:TETR:BBNC:UPDT ON

4.5 Trigger/Marker/Clock Settings



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

4.5.1 Clock Settings

[:SOURce<hw>]:BB:TETRa:CLOCK:MODE	61
[:SOURce<hw>]:BB:TETRa:CLOCK:MULTiplier	61
[:SOURce<hw>]:BB:TETRa:CLOCK:SOURce	61
[:SOURce<hw>]:BB:TETRa:CLOCK:SYNChronization:EXECute	62
[:SOURce<hw>]:BB:TETRa:CLOCK:SYNChronization:MODE	62

[:SOURce<hw>]:BB:TETRa:CLOCK:MODE <Mode>

Enters the type of externally supplied clock.

Parameters:

<Mode> SAMPLE|MSAMPLE
 *RST: SMAP

Example: BB:TETR:CLOC:MODE SAMP

[:SOURce<hw>]:BB:TETRa:CLOCK:MULTiplier <Multiplier>

Enters the multiplication factor for clock type Multiple ([\[:SOURce<hw>\]:BB:TETRa:CLOCK:MODE](#) on page 61).

Parameters:

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

Example: BB:TETR:CLOC:MODE MULT
 BB:TETR:CLOC:MULT 12

[:SOURce<hw>]:BB:TETRa:CLOCK:SOURce <Source>

Selects the clock source.

Parameters:

<Source> INTernal|EXTernal

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.

In the case of two-path instruments this selection applies to path A.

*RST: INTernal

Example:

BB:TETR:CLOC:SOUR INT

[:SOURce<hw>]:BB:TETRa:CLOCK:SYNChronization:EXECute

(for R&S SMBV only)

Performs automatically adjustment of the instrument's settings required for the synchronization mode (`[:SOURce<hw>]:BB:TETRa:CLOCK:SYNChronization:MODE` on page 62).**Example:**BB:TETR:CLOC:SYNC:MODE SLAV
BB:TETR:CLOC:SYNC:EXEC**Usage:**

Event

[:SOURce<hw>]:BB:TETRa:CLOCK:SYNChronization:MODE <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.

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:TETR:CLOC:SYNC:MODE MAST

4.5.2 Trigger Settings

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.

<code>[:SOURce<hw>]:BB:TETRa:TRIGger:ARM:EXECute</code>	63
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:EXECute</code>	64
<code>[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]:SYNChronize:OUTPut</code>	64
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:OBASeband:DELay</code>	64
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:OBASeband:INHibit</code>	64
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut:DELay:FIXed</code>	65
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay</code>	65
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay:MINimum</code>	65
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay:MAXimum</code>	65
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:RMODE</code>	65
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:SLENgth</code>	66
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:SLUNit</code>	66
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:SOURce</code>	66
<code>[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]:DELay</code>	67
<code>[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]:INHibit</code>	67
<code>[:SOURce<hw>]:BB:TETRa:TRIGger:SEQuence</code>	67

`[:SOURce<hw>]:BB:TETRa:TRIGger:ARM:EXECute`

(for `Armed_Auto` and `Armed_Retrigger` trigger modes)

Stops signal generation. Signal generation can be restarted by a new trigger (internally or externally).

Example: BB:TETR:TRIG:ARM:EXEC

Usage: Event

[[:SOURce<hw>]:BB:TETRa:TRIGger:EXECute

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

Example: BB:TETR:TRIG:EXEC

Usage: Event

[[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTErnal<ch>]:SYNChronize:OUTPut <Output>

(enabled for Trigger Source External)

Enables/disables output of the signal synchronous to the external trigger event (see ["Sync. Output to External Trigger"](#) on page 32).

Parameters:

<Output> 0|1|OFF|ON

Example: BB:TETR:TRIG:SYNC:OUTP ON

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

(two-path instruments only)

Specifies the trigger delay for triggering by the trigger signal from the second path.

Parameters:

<Delay> float

Range: 0 to 65535

*RST: 0

Example: BB:TETR:TRIG:OBAS:DEL 100

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

This command applies only for triggering by the second path.

Specifies the number of samples by which a restart is to be inhibited following a trigger event.

Parameters:

<Inhibit> float

Range: 0 to $2^{32}-1$

*RST: 0

Example: BB:TETR:TRIG:SOUR OBAS
BB:TETR:TRIG:OBAS:INH 50

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

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

Parameters:

<Fixed> 0|1|OFF|ON

Example: BB:TETR:TRIG:OUTP:DEL:FIX ON

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

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

Parameters:

<Delay> float

Range: 0 to 16777215

*RST: 0

Example: BB:TETR:TRIG:OUTP1:DEL 1600

[[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:DELay:MINimum?

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

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

Return values:

<Maximum> float

Example: BB:GSM:TRIG:OUTP:DEL:FIX ON
 BB:GSM:TRIG:OUTP:DEL:MAX?
 Response: 2000
 BB:GSM:TRIG:OUTP:DEL:MIN?

Usage: Query only

[[:SOURce<hw>]:BB:TETRa:TRIGger:RMODE <Rmode>

Queries the status of signal generation for all trigger modes.

Parameters:

<Rmode> STOP|RUN

Example: BB:TETR:TRIG:RMOD?

[:SOURCE<hw>]:BB:TETRa:TRIGger:SLEnGth <Slength>

Defines the length of the signal sequence to be output in the "Single" trigger mode. The unit of the entry is defined with the command `[:SOURCE<hw>]:BB:TETRa:TRIGger:SLUNit` on page 66. It is then possible to output deliberately just part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Parameters:

<Slength> float
 Range: 1 to 7000
 *RST: 1.0

Example: BB:TETR:TRIG:SLen 100

[:SOURCE<hw>]:BB:TETRa:TRIGger:SLUNit <Slunit>

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

Available units are sequence length (SL) and multiframe.

Parameters:

<Slunit> SEquence|MFRame

Example: BB:TETR:TRIG:SLUN MFRame

[:SOURCE<hw>]:BB:TETRa:TRIGger:SOURce <Source>

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

Parameters:

<Source> INTernal|EXTernal|BEXTernal|OBASeband

INTernal

The trigger event is executed by "Execute Trigger".

OBASeband

(two-path instruments only)

The trigger event is executed by the trigger signal from the second path

EXTernal|BEXTernal

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.

*RST: INTernal

Example: BB:TETR:TRIG:SOUR EXT

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

Sets the trigger signal delay in samples on external triggering and enables shifting of the complete signal by a time offset equal to the trigger delay.

This enables the instrument to be synchronized with the device under test or other external devices.

Parameters:

<Delay> float
Range: 0.0 to 65535.0
*RST: 0.0

Example: BB:TETR:TRIG:DEL 100

[:SOURce<hw>]:BB:TETRa:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>

Sets the duration for inhibiting a new trigger event subsequent to triggering.

Parameters:

<Inhibit> float
Range: 0 to 2³²-1
*RST: 0

Example: BB:TETR:TRIG:EXT1:INH 50

[:SOURce<hw>]:BB:TETRa:TRIGger:SEQuence <Sequence>

Selects trigger mode.

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

Parameters:

<Sequence>

AUTO|RETRigger|AAUTo|ARETrigger|SINGle

AUTO

The signal is generated continuously.

RETRigger

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

AAUTo

The signal is generated only when a trigger event occurs. Then the signal is generated continuously.

Command `[:SOURce<hw>] :BB:TETRa:TRIGger:ARM:EXECute` stops signal generation. A subsequent trigger event (internal or external) causes a restart.**ARETrigger**

The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.

ARETrigger

The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.

*RST: AUTO

Example:

BB:TETR:TRIG:SEQ AUTO

4.5.3 Marker Settings

<code>[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:MODE</code>	68
<code>[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:ONTime</code>	69
<code>[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:OFFTime</code>	69
<code>[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:PATTern</code>	70
<code>[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:PULSe:DIVider</code>	70
<code>[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:PULSe:FREQuency</code>	70

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

Defines the signal for the selected marker output.

Parameters:

<Mode>

REStart|SStart|FStart|MFStart|HFStart|PULSe|PATTern|
RATio**REStart**

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

SStart

A marker signal is generated at the start of each slot.

FStart

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

MFStart

A marker signal is generated at the start of each multiframe.

HFStart

A marker signal is generated at the start of each hyperframe.

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.

PATTernA marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 64 bits and is defined with the command `[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:PATTern` on page 70.**RATio**A marker signal corresponding to the Time Off / Time On specifications in the commands `[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:ONTime` on page 69 and `[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:OFFTime` on page 69 is generated.

*RST: REStart

Example:

BB:TETR:TRIG:OUTP2:MODE SST

`[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:ONTime <Ontime>``[:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:OFFTime <Offtime>`

Sets the number of symbols in a period (ON time + OFF time) during which the marker signal On/Off Ratio on the marker outputs is OFF.

Parameters:

<Offtime>

float

Range: 1 to 16777215

*RST: 1

Example:

```
BB:TETR:TRIG:OUTP2:MODE RAT
BB:TETR:TRIG:OUTP2:ONT 20
BB:TETR:TRIG:OUTP2:OFF 20
```

[:SOURce<hw>]:BB:TETRa:TRIGger:OUTPut<ch>:PATTern <Pattern>

Defines the bit pattern used to generate the marker signal ([:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:MODE on page 68). 0 is marker off, 1 is marker on.

Parameters:

<Pattern> 64-bit pattern

Example:

```
BB:TETR:TRIG:OUTP2:MODE PATT
BB:TETR:TRIG:OUTP2:PATT #H1,4
```

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

The command sets the divider for the pulsed marker signal ([:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:MODE on page 68).

Parameters:

<Divider> float

Range: 2 to 1024

*RST: 2

Example:

```
BB:TETR:TRIG:OUTP2:PULS:DIV 2
```

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

Queries the pulse frequency of the pulsed marker signal ([:SOURce<hw>] :BB:TETRa:TRIGger:OUTPut<ch>:MODE on page 68).

Return values:

<Frequency> float

Example:

```
BB:TETR:TRIG:OUTP2:MODE PULS
BB:TETR:TRIG:OUTP2:PULS:DIV 4
BB:TETR:TRIG:OUTP2:PULS:FREQ?
Response: 600.000 Hz
```

Usage: Query only

4.6 Filter/Clipping Settings

<code>[:SOURce<hw>]:BB:TETRa:CLIPping:LEVel</code>	71
<code>[:SOURce<hw>]:BB:TETRa:CLIPping:MODE</code>	71
<code>[:SOURce<hw>]:BB:TETRa:CLIPping:STATe</code>	71
<code>[:SOURce<hw>]:BB:TETRa:FILTer:ILENgtH</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:COsine</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:GAUSs</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:LPASS</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:PGAuss</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:RCOSine</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:SPHase</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:APCO25</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:COsine:COFS</code>	72
<code>[:SOURce<hw>]:BB:TETRa:FILTer:TYPE</code>	73

`[:SOURce<hw>]:BB:TETRa:CLIPping:LEVel <Level>`

Sets the limit for clipping.

Parameters:

<code><Level></code>	float
	Range: 1 to 100
	Increment: 1
	*RST: 100
	Default unit: PCT

Example: `BB:TETR:CLIP:LEV 25`

`[:SOURce<hw>]:BB:TETRa:CLIPping:MODE <Mode>`

Selects the clipping method.

Parameters:

<code><Mode></code>	VECTor SCALar
	*RST: VECTor

Example: `BB:TETR:CLIP:MODE SCAL`

`[:SOURce<hw>]:BB:TETRa:CLIPping:STATe <State>`

Switches baseband clipping on and off.

Parameters:

<code><State></code>	0 1 OFF ON
	*RST: OFF

Example: BB:TETR:CLIP:STAT ON

[:SOURce<hw>]:BB:TETRa:FILTer:ILENgtH <llength>

Sets the impulse length (number of filter tabs).

Parameters:

<llength> float
Range: 1 to 320

Example: BB:TETR:FILT:ILEN:AUTO:STAT OFF
BB:TETR:FILT:ILEN 20

[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:COsine <Cosine>
[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:GAUSs <Gauss>
[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:LPASs <Lpass>
[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:PGAuss <Pgauss>
[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:RCOSine <Rcosine>
[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:SPHase <Sphase>
[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:APCO25 <Apco25>

Sets the filter parameter.

Parameters:

<Apco25> Range: 0.05 to 0.99
 <Cosine> Range: 0.0 to 0.99
 <Gauss> Range: 0.15 to 2.5
 <Lpass> Range: 0.05 to 2.0
 <Pgauss> Range: 0.15 to 2.5
 <Rcosine> Range: 0.0 to 0.99
 <Sphase> Range: 0.15 to 2.5

Example: BB:TETR:FILT:TYPE APCO25
BB:TETR:FILT:PAR:APCO25 0.1

[:SOURce<hw>]:BB:TETRa:FILTer:PARAmeter:COsine:COFS <Cofs>

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.

Parameters:

<Cofs> float
 Range: -1.0 to 1.0
 *RST: -0.1

Example:

```
BB:TETR:FILT:TYPE COS
BB:TETR:FILT:PAR:COS:COFS 0.5
```

[:SOURCE<hw>]:BB:TETRA:FILT:TYPE <Type>

Sets the baseband filter.

Parameters:

<Type> RCOSine|COSine|GAUSS|LGAuss|CONE|COF705|
 COEQUALizer|COFEQUALizer|C2K3x|APCO25|SPHase|
 RECTangle|PGAuss|LPASS|DIRac|ENPSHape|EWPSHape
 *RST: COSine

Example:

```
BB:TETR:FILT:TYPE GAUS
```


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