

# XM Radio

## Digital Standard for

# R&S<sup>®</sup> Signal Generators

# Operating Manual



1171.5183.52 – 09

This document describes the following software options:

- R&S®AMU-K56  
1402.9905.02
- R&S®SMATE-K56  
1404.7751.02
- R&S®SMBV-K56  
1415.8183.02
- R&S®SMJ-K56  
1404.1806.02
- R&S®SMU-K56  
1161.1162.02

### **Customer Information Regarding Recording in the Sirius XM Band**

Sirius XM does not support recording of Sirius XM broadcast. If a customer purchases equipment from Rohde & Schwarz with the intention of recording the Sirius XM broadcast, this customer does so at its own risk. Sirius XM will not provide any support or assistance to this customer. Rohde & Schwarz decline to assist customers in recording the Sirius XM broadcast.

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Subject to change – Data without tolerance limits is not binding.

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.

Trade names are trademarks of the owners.

The following abbreviations are used throughout this manual: R&S®AMU is abbreviated as R&S AMU, R&S®AFQ is abbreviated as R&S AFQ, 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 purpose 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.








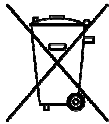

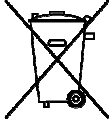

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English. 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. For product-specific information, see the data sheet and the product documentation.

## Symbols and safety labels

Symbol	Meaning	Symbol	Meaning
	Notice, general danger location Observe product documentation	○	ON/OFF supply voltage
	Caution when handling heavy equipment	⏻	Standby indication
	Danger of electric shock	— — —	Direct current (DC)

## Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Warning! Hot surface		Alternating current (AC)
	Protective conductor terminal		Direct/alternating current (DC/AC)
	Ground		Device fully protected by double (reinforced) insulation
	Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

### Signal words and their meaning

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



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



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



Indicates a potentially 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 signal words 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 signal words described here are always used only in connection with the related product documentation and the related product. The use of signal words in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

## Basic Safety Instructions

### 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, 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, overvoltage category 2, pollution severity 2.
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 even 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 even death.

### Electrical safety

*If the information on electrical safety is not observed either at all or 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 a protective conductor contact and protective conductor.
3. Intentionally breaking the protective conductor 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 there is no power switch for disconnecting the product from the AC supply network, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the AC supply network. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 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, the disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cables on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

## Basic Safety Instructions

6. The product may be operated only from TN/TT supply networks fuse-protected 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 provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages  $V_{rms} > 30$  V, suitable measures (e.g. appropriate measuring equipment, fuse protection, 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 protective conductor terminal on site and the product's protective 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 fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

## Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.

## Basic Safety Instructions

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/Environmental protection", 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. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. 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).
8. EMC classes (in line with CISPR 11)  
Class A: Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings.  
Class B: Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings.

### 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, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

## Basic Safety Instructions

### 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. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
5. 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.
6. 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.
7. 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/Environmental protection

1. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.



## Instrucciones de seguridad elementales

2. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately.  
Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
3. 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.
4. 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.

For additional information about environmental protection, visit the Rohde & Schwarz website.

# Instrucciones de seguridad elementales

### **¡Es imprescindible leer y cumplir 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.

## Instrucciones de seguridad elementales


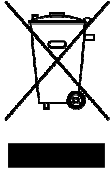

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto 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. Los datos específicos del producto figuran en la hoja de datos y en la documentación del producto.

### Símbolos y definiciones de seguridad

Símbolo	Significado	Símbolo	Significado
	Aviso: punto de peligro general Observar la documentación del producto		Tensión de alimentación de PUESTA EN MARCHA / PARADA
	Atención en el manejo de dispositivos de peso elevado		Indicación de estado de espera (standby)
	Peligro de choque eléctrico		Corriente continua (DC)
	Advertencia: superficie caliente		Corriente alterna (AC)
	Conexión a conductor de protección		Corriente continua / Corriente alterna (DC/AC)
	Conexión a tierra		El aparato está protegido en su totalidad por un aislamiento doble (reforzado)
	Conexión a masa		Distintivo de la UE para baterías y acumuladores Más información en la sección "Eliminación/protección del medio ambiente", punto 1.

## Instrucciones de seguridad elementales

Símbolo	Significado	Símbolo	Significado
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)		Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos  Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser  Más información en la sección "Funcionamiento", punto 7.		

### 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.*

## Instrucciones de seguridad elementales

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, 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. Categoría de sobrecarga eléctrica 2, índice de suciedad 2.
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, se pueden causar lesiones o, en determinadas circunstancias, 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, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión. El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m). Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se integran productos sin interruptor 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.

## Instrucciones de seguridad elementales

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.

## Instrucciones de seguridad elementales

### 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/protección del medio ambiente", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. 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).
8. Clases CEM (según CISPR 11)  
Clase A: dispositivo apropiado para el uso en cualquier zona excepto en áreas residenciales y en aquellas zonas que se encuentran conectadas a una red de suministro de baja tensión que alimenta un edificio de viviendas.  
Clase B: dispositivo apropiado para el uso en áreas residenciales y en aquellas zonas que se encuentran conectadas a una red de suministro de baja tensión que alimenta un edificio de viviendas.

### 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.

## Instrucciones de seguridad elementales

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. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
5. 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.
6. 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).
7. 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.

## Instrucciones de seguridad elementales

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/protección del medio ambiente

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.
2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado.  
Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, diríjase a su servicio de atención al cliente de Rohde & Schwarz.
3. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (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.
4. 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.

Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.



# Qualitätszertifikat

## Certificate of quality

## Certificat de qualité

Certified Quality System  
**ISO 9001**

Certified Environmental System  
**ISO 14001**

### **Sehr geehrter Kunde,**

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO9001 und ISO14001 zertifiziert.

### **Der Umwelt verpflichtet**

- ▮ Energie-effiziente, RoHS-konforme Produkte
- ▮ Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ▮ ISO 14001-zertifiziertes Umweltmanagementsystem

### **Dear Customer,**

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO9001 and ISO14001.

### **Environmental commitment**

- ▮ Energy-efficient products
- ▮ Continuous improvement in environmental sustainability
- ▮ ISO 14001-certified environmental management system

### **Cher client,**

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO9001 et ISO14001.

### **Engagement écologique**

- ▮ Produits à efficience énergétique
- ▮ Amélioration continue de la durabilité environnementale
- ▮ Système de gestion de l'environnement certifié selon ISO 14001

# Customer Support

## Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

## Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish. We will take care that you will get the right information.

### Europe, Africa, Middle East

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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

The Quick Start Guide 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

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

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

### Release Notes

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

## 1.2 Typographical Conventions

The following text markers are used throughout this documentation:

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

## 2 Introduction

The R&S Signal Generator enables you to generate signals in accordance with the XM-Radio standard.

The equipment layout of R&S SMx and R&S AMU instrument for generating XM-Radio signals includes the options Baseband Main Module (B13), Baseband Generator (B9/ B10/B11) and XM-Radio (K56).

Per baseband, one satellite signal or one terrestrial signal can be generated.

In the case of two-path instruments, at least one further option R&S B9/B10/B11 (Baseband Generator) is needed for generating a XM-Radio signal in the second path.

### 2.1 Modulation System XM-RADIO

The XM-Radio signal consists of ensemble A and ensemble B.

Within an ensemble, the XM-Radio signal is transmitted via two satellites (QPSK-modulation) and additionally via one terrestrial repeater (COFDM-modulation).

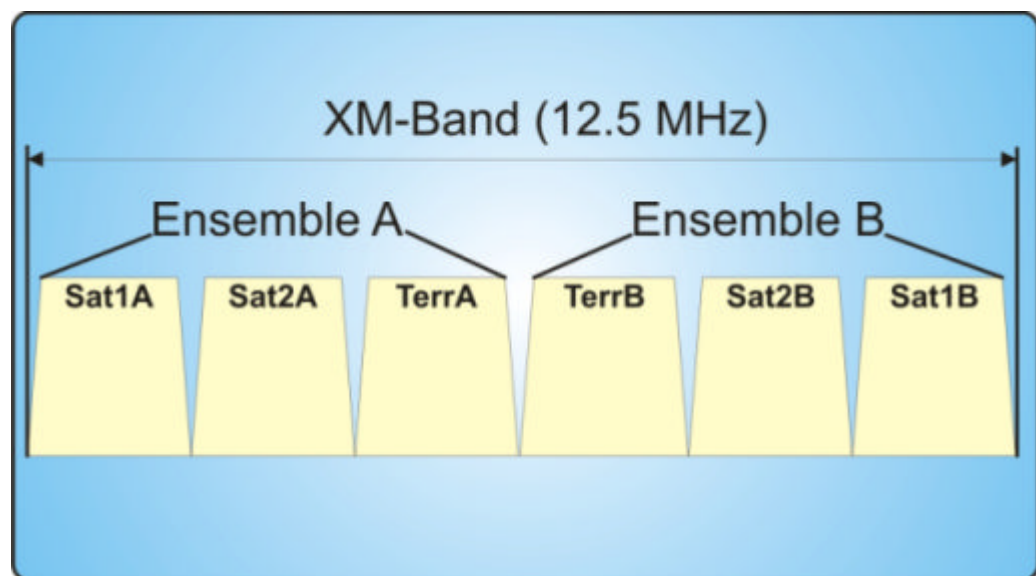


Fig. 2-1: XM-Radio Frequency Band

The following table shows the carrier frequencies for the corresponding channels:

Table 2-1: Carrier frequencies

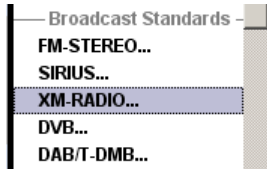
Ensemble	Channel	Frequency [MHz]	Polarization
A	Satellite 1 (Sat1A)	2333.465	LHCP
	Satellite 2 (Sat2A)	2335.305	LHCP
	Terrestrial (TerrA)	2337.490	vertically

Ensemble	Channel	Frequency [MHz]	Polarization
B	Terrestrial (TerrB)	2340.020	vertically
	Satellite 2 (Sat2B)	2342.205	LHCP
	Satellite 1 (Sat1B)	2344.045	LHCP



### 3 XM-RADIO User interface

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



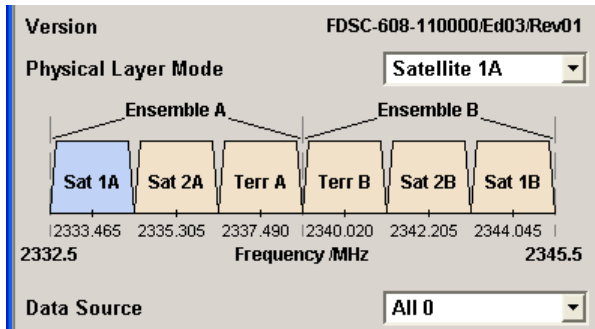
#### 3.1 Main Menu for XM-RADIO Signals

The menu is split into several sections for configuring the standard.

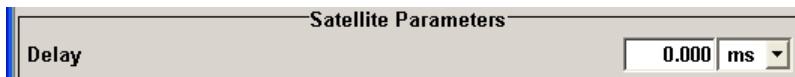
The upper menu section is where the XM-RADIO digital standard is activated and deactivated. Configuration settings can be stored and already stored configuration settings can be loaded.



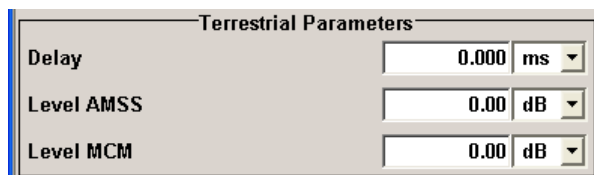
In the next section, the physical layer mode and the data source are selected.



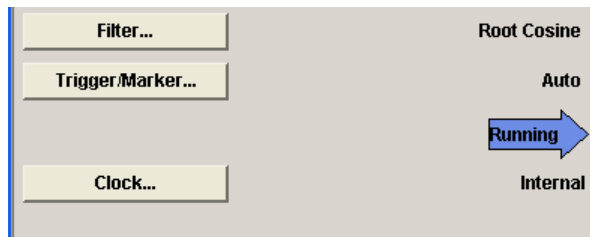
In the "Satellite Parameters" section, the parameter for the delay is set.



In the "Terrestrial Parameters" section, the parameters for the terrestrial transponder are set.



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



**State**

Activates or deactivates the XM-RADIO standard.

Activating this standard deactivates all the other digital standards and digital modulation modes.

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

The XM-RADIO signal is generated according to the performed settings.

SCPI command:

```
[ :SOURce<hw> ] :BB:XMRadio:STATe on page 30
```

**Set To Default**

Calls the default settings.

Parameter	Value
State	Remains unchanged
Physical Layer Mode	Satellite 1A
Data Source	PN9
Delay	0.000 ms
Filter	Root Cosine
Roll Off Factor	0.15
Symbol Rate Variation	1.64 Msym/s

SCPI command:

```
[ :SOURce<hw> ] :BB:XMRadio:PRESet on page 28
```

**Save/Recall...**

Calls the "Save/Recall" menu.

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



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

The complete settings in the "XM-RADIO" menu are saved and recalled.

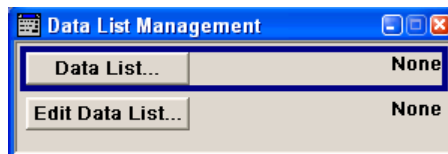
- "Recall XM-RADIO Setting" Opens the "File Select" window for loading a saved XM-RADIO configuration. The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.
- "Save XM-RADIO Setting" Opens the "File Select" window for saving the current XM-RADIO signal configuration. The name of the file is specified in the "File Name" entry field. The file is saved by pressing the "Save" button. The "Fast Save" checkbox determines whether the instrument performs an absolute or a differential storing of the settings. Enable this function to accelerate the saving process by saving only the settings with values different to the default ones. "Fast Save" is not affected by the "Preset" function.
- "File Manager" Calls the "File Manager". The "File Manager" is used to copy, delete, and rename files and to create new directories.

SCPI command:

- [\[:SOURce<hw>\]:BB:XMRadio:SETTING:CATalog?](#) on page 29
- [\[:SOURce<hw>\]:BB:XMRadio:SETTING:LOAD](#) on page 29
- [\[:SOURce<hw>\]:BB:XMRadio:SETTING:STORe](#) on page 30
- [\[:SOURce<hw>\]:BB:XMRadio:SETTING:STORe:FAST](#) on page 30
- [\[:SOURce<hw>\]:BB:XMRadio:SETTING:DELeTe](#) on page 29

### Data List Management

Calls the "Data List Management" menu. This menu 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, e.g. in the channel table of the base stations.

**Note:** All data lists are generated and edited by means of the `SOURce:BB:DM` subsystem commands. Files containing data lists usually end with \*.dm\_iqd. The data lists are selected as a data source for a specific function in the individual subsystems of the digital standard.

**Example: Creating and editing the data list**

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

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:DATA](#) on page 27

[\[:SOURce<hw>\]:BB:XMRadio:DATA:DSElect](#) on page 27

**Version**

Displays the current version of the XM-RADIO standard depending on the selected physical layer mode.

The default settings and parameters provided are oriented towards the specifications of the version displayed.

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:VERSion?](#) on page 31

**Physical Layer Mode**

Selects the physical layer mode.

"Satellite" Transmits the QPSK-modulated signal by means of a satellite.

"Terrestrial" Transmits the COFDM-modulated signal by means of a repeater.

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:LAYer](#) on page 28

**Data Source**

Selects the data source for the XM-Radio signal.

The following data sources are available for selection:

"ALL0, ALL1" 0 data and 1 data is generated internally.

"PNxx" PRBS data as per CCITT with period length between  $2^9-1$  and  $2^{23}-1$  is generated internally.

"Pattern" A user-definable bit pattern with a maximum length of 64 bits is generated internally.  
The bit pattern is defined in the "Pattern" entry field.

"Data List" Internal data from a programmable data list is used. The data list can be generated by the Data Editor or generated externally.  
Data lists are selected in the "Select Data List" field.

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:DATA](#) on page 27

[\[:SOURce<hw>\]:BB:XMRadio:DATA:PATTern](#) on page 27

[\[:SOURce<hw>\]:BB:XMRadio:DATA:DSElect](#) on page 27

**Frame Counter**

The parameter is available for Data List only.

Displays the number of frames.

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:FCOUNTER?](#) on page 28

### Delay

Sets the signal delay.

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:SATELLITE:DELAY](#) on page 28

[\[:SOURce<hw>\]:BB:XMRadio:TERRESTRIAL:DELAY](#) on page 30

### Level AMSS

Sets the level for the amplitude modulated synchronization symbol (AMSS).

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:TERRESTRIAL:POWER:AMSS](#) on page 31

### Level MCM

Sets the level for the multicarrier modulation (MCM).

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:TERRESTRIAL:POWER:MCM](#) on page 31

### Filter...

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

The menu is described in [chapter 3.2, "Filter Settings"](#), on page 14.

SCPI command:

n.a.

### Trigger /Marker

Calls the menu for selecting the trigger mode and trigger source, for configuring the marker signals, and for setting the time delay of an external trigger signal.

This menu is described in [chapter 3.3, "Trigger/Marker/Clock Settings"](#), on page 16.

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

SCPI command:

n.a.

### Execute Trigger

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

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:TRIGGER:EXECUTE](#) on page 37

### Arm

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

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

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:TRIGger:ARM:EXECute` on page 36

### Clock

Calls the menu for selecting the clock source and for setting a delay.

This menu is described in [chapter 3.3.4, "Clock Settings"](#), on page 24.

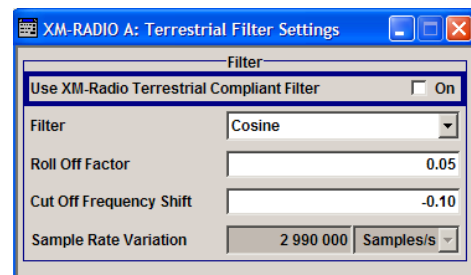
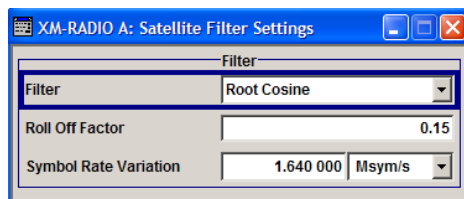
SCPI command:

n.a.

## 3.2 Filter Settings

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

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



### Use XM-Radio Terrestrial Compliant Filter

Activates or deactivates the usage of the filter which is in compliance with the spectral mask of the terrestrial standard.

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:TCFilter[:STATE]` on page 32

### Filter

Sets the baseband filter.

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:FILTer:TYPE` on page 32

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:TYPE` on page 32

### Roll Off Factor / BxT

Sets the filter parameter.

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

SCPI command:

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:FILTer:PARAmeter:APCO25
```

on page 33

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:FILTer:PARAmeter:COsine
```

on page 33

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:FILTer:PARAmeter:GAUSS
```

on page 33

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:FILTer:PARAmeter:PGAuss
```

on page 34

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:FILTer:PARAmeter:RCOSine
```

on page 34

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:FILTer:PARAmeter:SPHase
```

on page 35

```
[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:PARAmeter:APCO25
```

on page 33

```
[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:PARAmeter:COsine
```

on page 33

```
[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:PARAmeter:GAUSS
```

on page 33

```
[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:PARAmeter:PGAuss
```

on page 34

```
[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:PARAmeter:RCOSine
```

on page 34

```
[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:PARAmeter:SPHase
```

on page 35

### **Cut Off Frequency Shift**

(available for filter parameter Cosine only)

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

SCPI command:

```
[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:FILTer:PARAmeter:COsine:
```

COFS on page 35

### **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:XMRadio:SATellite:FILTer:PARAmeter:LPASs`

on page 33

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:FILTer:PARAmeter:LPASSEVM`

on page 34

`[ :SOURce<hw> ] :BB:XMRadio:TERReStrial:FILTer:PARAmeter:LPASs`

on page 33

`[ :SOURce<hw> ] :BB:XMRadio:TERReStrial:FILTer:PARAmeter:LPASSEVM`

on page 34

**Symbol Rate Variation**

(available for physical layer mode Satellite only).

Sets the symbol rate of the signal.

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:SRATe:VARiation` on page 35

**Sample Rate Variation**

(available for physical layer mode Terrestrial only).

Displays the terrestrial sample rate variation.

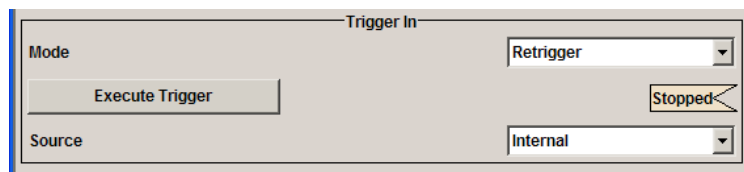
SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:TERReStrial:SRATe:VARiation?` on page 35

### 3.3 Trigger/Marker/Clock Settings

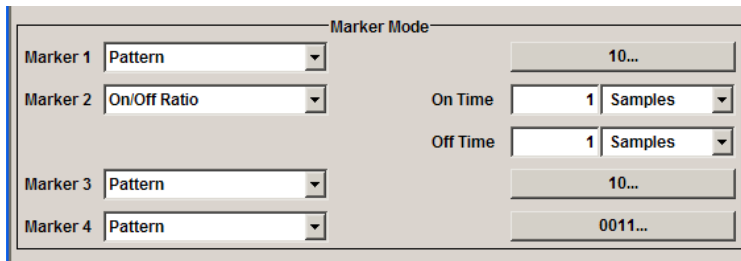
To access this dialog, select "Main Menu > Trigger/Marker".

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.

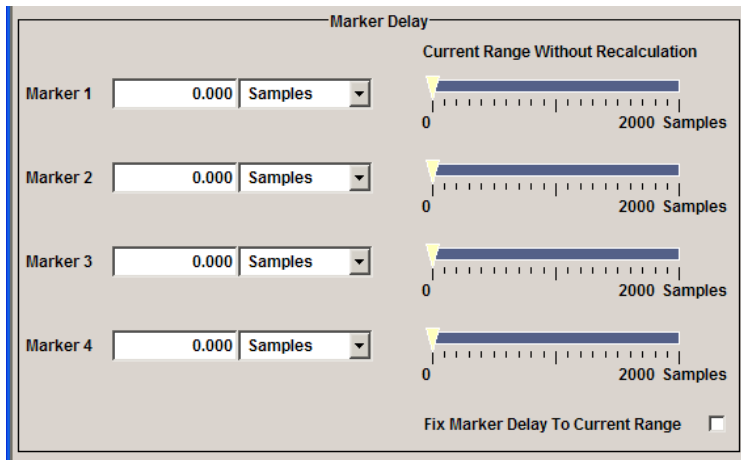


The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.

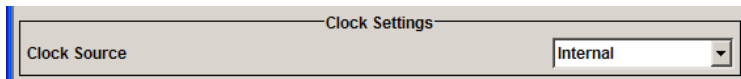




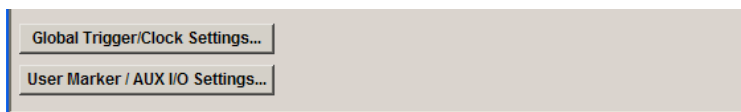
The "Marker Delay" section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.



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.



### 3.3.1 Trigger In

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:XMRadio:SATellite\[:TRIGGER\]:SEQUENCE](#) on page 39

[\[:SOURCE<hw>\]:BB:XMRadio:TERRESTRIAL\[:TRIGGER\]:SEQUENCE](#)  
on page 39

### Signal Duration Unit

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

SCPI command:

[\[:SOURCE<hw>\]:BB:XMRadio:TERRESTRIAL:TRIGGER:SLUNIT](#) on page 42

### Signal Duration

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

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

SCPI command:

[\[:SOURCE<hw>\]:BB:XMRadio:SATellite:TRIGGER:SLLENGTH](#) on page 40

[\[:SOURCE<hw>\]:BB:XMRadio:TERRESTRIAL:TRIGGER:SLLENGTH](#) on page 42

### 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:XMRadio:TRIGger:RMODE?](#) on page 37

### Arm

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

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

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:TRIGger:ARM:EXECute](#) on page 36

### Execute Trigger

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

SCPI command:

[\[:SOURce<hw>\]:BB:XMRadio:TRIGger:EXECute](#) on page 37

### 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            (two-path instruments only)

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

"External            The trigger event is executed with the aid of the active edge of an external trigger signal.

(TRIGGER 1 /  
2)"            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:XMRadio:SATellite:TRIGger:SOURce](#) on page 38

[\[:SOURce<hw>\]:BB:XMRadio:TERRestrial:TRIGger:SOURce](#) on page 38

### Sync. Output to External Trigger

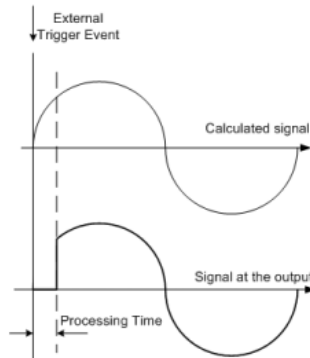
(enabled for Trigger Source External)

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

"On"

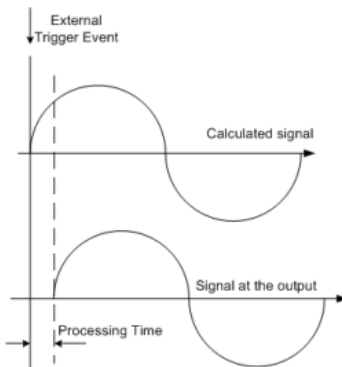
Corresponds to the default state of this parameter.

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:XMRadio:SATellite:TRIGger:EXTernal:SYNChronize:OUTPut` on page 37

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger:EXTernal:SYNChronize:OUTPut` on page 37

**Trigger Delay**

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

Sets the trigger signal delay in samples on external triggering.

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

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

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger [ :EXTernal<ch> ] :DELay`  
on page 40

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger [ :EXTernal<ch> ] :`  
`DELay` on page 42

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OBASeband:DELay`  
on page 39

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger:OBASeband:DELay`  
on page 41

### 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:XMRadio:SATellite:TRIGger [ :EXTernal<ch> ] :`  
`INHibit` on page 41

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger [ :EXTernal<ch> ] :`  
`INHibit` on page 43

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OBASeband:INHibit`  
on page 40

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger:OBASeband:INHibit`  
on page 41

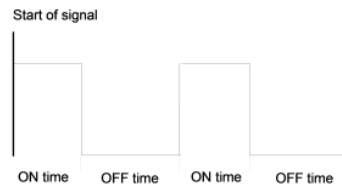
### 3.3.2 Marker Mode

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

#### Marker Mode

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

"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:XMRadio:SATellite:TRIGger:OUTPut<ch>:ONTime`  
on page 47

`[ :SOURce<hw> ] :BB:XMRadio:TERrestrial:TRIGger:OUTPut<ch>:ONTime`  
on page 50

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:OFFTime`  
on page 47

`[ :SOURce<hw> ] :BB:XMRadio:TERrestrial:TRIGger:OUTPut<ch>:OFFTime`  
on page 49

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

"TPL Frame " (available for Physical Layer Mode Terrestrial only)  
A marker signal is generated at the start of each TPL (Terrestrial Physical Layer) frame.

"MCM Symbol" (available for Physical Layer Mode Terrestrial only)  
A marker signal is generated at the beginning of each MCM (Multicarrier Modulation) symbol.

"User Period" A marker signal is generated at the beginning of every user-defined period. The period is defined in "Period."

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:PERiod`  
on page 48

`[ :SOURce<hw> ] :BB:XMRadio:TERrestrial:TRIGger:OUTPut<ch>:PERiod`  
on page 50

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

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:PULSe:DIVider` on page 48

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:PULSe:FREQuency?` on page 48

"Pattern " (available for Physical Layer Mode Satellite only)  
 A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 32 bits and is defined in an input field which opens when pattern is selected.

SCPI command:

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:PATtern
```

on page 47

SCPI command:

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:MODE
```

on page 46

```
[ :SOURce<hw> ] :BB:XMRadio:TERrestrial:TRIGger:OUTPut<ch>:MODE
```

on page 46

### MCM Position

(available for Physical Layer Mode Terrestrial only)

Sets the position of the MCM symbol.

SCPI command:

```
[ :SOURce<hw> ] :BB:XMRadio:TERrestrial:TRIGger:OUTPut<ch>:
```

MCMPosition on page 49

## 3.3.3 Marker Delay

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

### Marker x Delay

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

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

SCPI command:

```
[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:DELay
```

on page 44

```
[ :SOURce<hw> ] :BB:XMRadio:TERrestrial:TRIGger:OUTPut<ch>:DELay
```

on page 45

### 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:XMRadio:SATellite:TRIGger:OUTPut<ch>:DELay:MINimum?` on page 45

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger:OUTPut<ch>:DELay:MINimum?` on page 46

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:DELay:MAXimum?` on page 44

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger:OUTPut<ch>:DELay:MAXimum?` on page 45

#### 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:XMRadio:SATellite:TRIGger:OUTPut:DELay:FIXed` on page 44

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger:OUTPut:DELay:FIXed` on page 44

### 3.3.4 Clock Settings

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

#### 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.<br>The symbol rate must be correctly set to an accuracy of +/-2 % (see data sheet).<br>The polarity of the clock input can be changed with the aid of "Global Trigger/Clock Settings".<br>In the case of two-path instruments this selection applies to path A. |

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:CLOCK:SOURCE` on page 51

`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:CLOCK:SOURCE` on page 51

#### Clock Mode

Enters the type of externally supplied clock.

- |                 |   |
|-----------------|---|
| "Sample/Symbol" | A sample clock (for physical layer mode Terrestrial) or a symbol clock (for physical layer mode Satellite) is supplied via the CLOCK connector. |
|-----------------|---|



"Multiple Sample/Symbol" A multiple of the sample clock (for physical layer mode Terrestrial) or a multiple of the symbol clock (for physical layer mode Satellite) is supplied via the CLOCK connector; the sample clock is derived internally from this.  
The Clock Multiplier window provided allows the multiplication factor to be entered.

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:CLOCK:MODE` on page 51

`[ :SOURce<hw> ] :BB:XMRadio:TERrestrial:CLOCK:MODE` on page 51

### **Clock Multiplier**

Enters the multiplication factor for clock type "Multiple".

SCPI command:

`[ :SOURce<hw> ] :BB:XMRadio:SATellite:CLOCK:MULTIplier` on page 52

`[ :SOURce<hw> ] :BB:XMRadio:TERrestrial:CLOCK:MULTIplier` on page 52

### **Measured External Clock**

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

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

SCPI command:

`CLOCK:INPut:FREQuency?`

## **3.3.5 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 to map the connector on the rear of the instruments.

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

## 4 Remote-Control Commands

The commands in the `Source:BB:XMR` subsystem are described in the following section.

This subsystem contains commands for the XM Radio standard. These settings concern activation and deactivation of the standard, filter, clock, and trigger settings, defining satellite parameters and the terrestrial parameters.

### **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.

### **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.

### 4.1 Main Settings

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**`[:SOURce<hw>]:BB:XMRadio:DATA <Data>`**

This command selects the data source for the XM-Radio signal.

**Parameters:**

`<Data>` ZERO | ONE | PATtern | PN9 | PN11 | PN15 | PN16 | PN20 |  
 PN21 | PN23 | DLISt  
 \*RST: PN9

**Example:**

`BB:XM:DATA PN9`  
 PN9 is the data source for the XM-Radio signal.

**`[:SOURce<hw>]:BB:XMRadio:DATA:DSElect <Dselect>`**

The command selects the data list for the DLISt data source selection.

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

**Parameters:**

`<Dselect>` string

**Example:**

`BB:XM:DATA DLIS`  
 selects Data Lists as data source.  
`MMEM:CDIR '<root>\Lists\DM\IqData'`  
 selects the directory for the data lists.  
`BB:XM:DATA:DSEL 'XMRadio_list1'`  
 selects file 'XMRadio\_list1' as the data source. This file must  
 be in the directory `<root>\Lists\DM\IqData` and have the file  
 extension `*.dm_iqd`.

**`[:SOURce<hw>]:BB:XMRadio:DATA:PATtern <Pattern>`**

The command selects the bit pattern for the Data selection. The maximum length is 64 bits.

**Parameters:**

`<Pattern>` integer  
 \*RST: #B10

**Example:** `BB:XMR:DATA:PATT #B10`  
defines the bit pattern.

---

#### **[:SOURCE<hw>]:BB:XMRadio:FCOUNTER?**

Queries the number of frames.

**Return values:**

<> float

**Example:** `BB:XMR:FCO?`  
queries the number of frames.

**Usage:** Query only

---

#### **[:SOURCE<hw>]:BB:XMRadio:LAYER <Layer>**

The command selects the physical layer mode for the transmission of the XM-Radio signal.

**Parameters:**

<Layer> SAT1A/SAT2A/SAT2B/SAT1B | TERRA/TERRB

**SAT1A/SAT2A/SAT2B/SAT1B**

Transmits the QPSK-modulated signal via up to two satellites.

**TERRA|TERRB**

Transmits the COFDM-modulated signal by means of a repeater.

\*RST: SAT1A

**Example:** `BB:XMR:LAY SAT1A`  
selects SAT1A as physical layer mode.

---

#### **[:SOURCE<hw>]:BB:XMRadio:PRESET**

The command produces a standardized default for the XM-RADIO standard. The settings correspond to the \*RST values specified for the commands.

All XM-RADIO settings are preset.

**Example:** `BB:XMR:PRES`  
resets all the XM-RADIO settings to default values.

**Usage:** Event

---

#### **[:SOURCE<hw>]:BB:XMRadio:SATELLITE:DELAY <Delay>**

This command sets the signal delay in physical layer mode satellite.

**Parameters:**

<Delay> float  
Range: 0 ms to 63 ms  
Increment: 0.001 ms  
\*RST: 0 ms

**Example:** BB:XMR:SAT:DEL 5.0MS  
sets a signal delay of 5 ms.

---

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

This command reads out the files with XM-RADIO settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. Only files with the file extension `*.xmradio` will be listed.

**Return values:**

<Catalog> string

**Example:** MMEM:CDIR '<root>\user\XMRADIO'  
sets the default directory to <root>\user\XMRADIO.  
BB:XMR:SETT:CAT?  
reads out all the files with XM-RADIO settings in the default directory.  
Response: "xmradio\_1, xmradio\_2"  
the files xmradio1 and xmradio2' are available.

**Usage:** Query only

---

### **[:SOURCE<hw>]:BB:XMRadio:SETTING:DELeTe <Delete>**

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

**Setting parameters:**

<Delete> string

**Example:** BB:XMR:SETT:DEL 'xmradio\_1'  
deletes file 'xmradio\_1'.

**Usage:** Setting only

---

### **[:SOURCE<hw>]:BB:XMRadio:SETTING:LOAD <Load>**

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

**Setting parameters:**

<Load> string

**Example:** BB:XMR:SETT:LOAD 'xmradio\_1'  
loads file 'xmradio\_1'.

**Usage:** Setting only

**[[:SOURce<hw>]:BB:XMRadio:SETTING:STORE <Store>**

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

**Setting parameters:**

<Store> string

**Example:** `BB:XMR:SETT:STOR 'xmradio_1'`  
stores the current settings into file 'xmradio\_1'.

**Usage:** Setting only

**[[:SOURce<hw>]:BB:XMRadio:SETTING:STORE:FAST <Fast>**

Determines whether the instrument performs an absolute or a differential storing of the settings.

Enable this function to accelerate the saving process by saving only the settings with values different to the default ones.

**Note:** This function is not affected by the "Preset" function.

**Parameters:**

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

**[[:SOURce<hw>]:BB:XMRadio:STATE <State>**

The command activates modulation in accordance with the "XM-RADIO" standard. Activating this standard deactivates all the other digital standards and digital modulation modes.

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

**Parameters:**

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

**Example:** `BB:XMR:STAT ON`  
activates modulation in accordance with the "XM-RADIO" standard.

**[[:SOURce<hw>]:BB:XMRadio:TERRESTRIAL:DELAY <Delay>**

This command sets the signal delay in physical layer mode terrestrial.

**Parameters:**

<Delay> float  
 Range: 0 ms to 63 ms  
 Increment: 0.001 ms  
 \*RST: 0 ms

**Example:**

BB:XMR:TERR:DEL 5.0MS  
 sets a signal delay of 5 ms.

**[:SOURce<hw>]:BB:XMRadio:TERRestrial:POWER:AMSS <Amss>**

This command sets the level for the amplitude modulated synchronization symbol (AMSS).

**Parameters:**

<Amss> float  
 Range: -12 dB to 12 dB  
 Increment: 0.01 dB  
 \*RST: 0 dB

**Example:**

BB:XMR:TERR:POW:AMSS 12dB  
 sets the AMSS level to 12 dB.

**[:SOURce<hw>]:BB:XMRadio:TERRestrial:POWER:MCM <Mcm>**

This command sets the level for the multicarrier modulation(MCM).

**Parameters:**

<Mcm> float  
 Range: -12 dB to 12 dB  
 Increment: 0.01 dB  
 \*RST: 0 dB

**Example:**

BB:XMR:TERR:POW:MCM 12dB  
 sets the MCM to 12 dB.

**[:SOURce<hw>]:BB:XMRadio:VERSion?**

The command queries the version of the XM-RADIO standard underlying the definitions. The displayed version is depends on the selected physical layer mode.

**Return values:**

<Version> string

**Example:**

BB:XMR:VERS?  
 queries the XM-RADIO version.  
 Response:  
 FDSC-608-110000/Ed03/Rev01

**Usage:**

Query only

## 4.2 Filter Settings

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---

### `[:SOURce<hw>]:BB:XMRadio:TERRestial:FILTer:TCFilter[:STATe]` <State>

Activates or deactivates the XM-Radio filter which is in compliance with the spectral mask of the terrestrial standard.

**Parameters:**

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

**Example:**

`BB:XM:TER:FIL:TCF:STAT ON`  
 activates the XM-Radio terrestrial compliant filter.

---

### `[:SOURce<hw>]:BB:XMRadio:SATellite:FILTer:TYPE` <Type>

### `[:SOURce<hw>]:BB:XMRadio:TERRestial:FILTer:TYPE` <Type>

The command selects the baseband filter type for the terrestrial physical layer mode.

**Parameters:**

<Type>                    RCOSine | COSSine | GAUSSs | LGAuss | CONE | COF705 |  
 COEQUALizer | COFEQUALizer | C2K3x | APCO25 | SPHase |  
 RECTangle | PGAuss | LPASSs | LPASSEVM | DIRac | ENPShape |  
 EWPSHape  
 \*RST:                    COSSine

**Example:**

`BB:XM:TER:FIL:TYPE COS`  
 sets the cosine filter type.



---

```
[ :SOURce<hw>]:BB:XMRadio:SATellite:FILTer:PARAmeter:APCO25 <Apco25>
[:SOURce<hw>]:BB:XMRadio:TERRestrial:FILTer:PARAmeter:APCO25 <Apco25>
```

The command sets the roll-off factor for the APCO25 filter type.

**Parameters:**

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

**Example:**

```
BB:XM:TERR:FILT:PAR:APCO25 0.05
the roll-off factor is set to 0.05.
```

---

```
[ :SOURce<hw>]:BB:XMRadio:SATellite:FILTer:PARAmeter:COSine <Cosine>
[:SOURce<hw>]:BB:XMRadio:TERRestrial:FILTer:PARAmeter:COSine <Cosine>
```

The command sets the roll-off factor for the cosine filter type.

**Parameters:**

```
<Cosine>         float
                  Range:    0.05 to 1.0
                  Increment: 0.05
                  *RST:     0.20
```

**Example:**

```
BB:XM:TERR:FILT:PAR:COS 0.05
the roll-off factor is set to 0.05.
```

---

```
[ :SOURce<hw>]:BB:XMRadio:SATellite:FILTer:PARAmeter:GAUSSs <Gauss>
[:SOURce<hw>]:BB:XMRadio:TERRestrial:FILTer:PARAmeter:GAUSSs <Gauss>
```

The command sets the BxT for the gauss filter type.

**Parameters:**

```
<Gauss>         float
                  Range:    0.15 to 2.5
                  Increment: 0.01
                  *RST:     0.20
```

**Example:**

```
BB:XM:TERR:FILT:PAR:GAUS 0.15
the BxT is set to 0.15.
```

---

```
[ :SOURce<hw>]:BB:XMRadio:SATellite:FILTer:PARAmeter:LPASs <Lpass>
[:SOURce<hw>]:BB:XMRadio:TERRestrial:FILTer:PARAmeter:LPASs <Lpass>
```

The command sets the cut off frequency factor for the Lowpass (ACP optimization) filter type.

**Parameters:**

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

**Example:**

BB:XMR:TERR:FILT:PAR:LPAS 0.15  
 the cut of frequency factor is set to 0.15.

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

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

The command sets the cut off frequency factor for the Lowpass (EVM optimization ) filter type.

**Parameters:**

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

**Example:**

BB:XMR:TERR:FILT:PAR:LPASSEVM 0.15  
 the cut of frequency factor is set to 0.15.

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

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

The command sets the BxT for the pure gauss filter type.

**Parameters:**

<Pgauss> float  
 Range: 0.15 to 2.5  
 Increment: 0.01  
 \*RST: 0.20

**Example:**

BB:XMR:TERR:FILT:PAR:PGA 0.15  
 the BxT is set to 0.15.

**[ :SOURce<hw>]:BB:XMRadio:SATellite:FILTer:PARAmeter:RCOSine <RCosine>**

**[ :SOURce<hw>]:BB:XMRadio:TERRestrial:FILTer:PARAmeter:RCOSine**  
 <RCosine>

The command sets the roll-off factor for the root cosine filter type.

**Parameters:**

<RCosine> float  
 Range: 0.05 to 1.0  
 Increment: 0.01  
 \*RST: 0.20

**Example:** `BB:XMR:TERR:FILT:PAR:RCOS 0.15`  
the roll-off factor is set to 0.15.

---

**[:SOURce<hw>]:BB:XMRadio:SATellite:FILTer:PARAmeter:SPHase <Sphase>**  
**[:SOURce<hw>]:BB:XMRadio:TERRestrial:FILTer:PARAmeter:SPHase <Sphase>**

The command sets the BxT for the split phase filter type.

**Parameters:**

<Sphase> float  
Range: 0.15 to 2.5  
Increment: 0.01  
\*RST: 0.20

**Example:** `BB:XMR:TERR:FILT:PAR:SPH 0.15`  
the BxT is set to 0.15.

---

**[:SOURce<hw>]:BB:XMRadio:TERRestrial:FILTer:PARAmeter:COSSine:COFS**  
**<Cofs>**

The command sets the cut of frequency shift value for the Cosine filter type.

**Parameters:**

<Cofs> float  
Range: -0.1 to 1  
Increment: 0.01  
\*RST: -0.1

**Example:** `BB:XMR:TERR:FILT:PAR:COSS:COFS 0.04`  
the "cut of frequency shift" value is set to 0.04.

---

**[:SOURce<hw>]:BB:XMRadio:SATellite:SRATe:VARiation <Variation>**

The command enters the output symbol rate.

**Parameters:**

<Variation> float  
Range: 1.0e6 symb/s to 2.0e6 symb/s  
Increment: 1.0 symb/s  
\*RST: 1.64e6 symb/s

**Example:** `BB:XMR:SAT:SRAT:VAR 4000000`  
sets the output sample rate to 4e6 symbols/s.

---

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

Queries the output sample rate.

**Return values:**

<Variation> float

**Example:** BB : XMR : TERR : SRAT : VAR?  
 queries the output sample rate.  
 Response:  
 2990000  
 the output sample rate is 2990000 samples/s.

**Usage:** Query only

### 4.3 Trigger Settings

**EXTernal<ch>**

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

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---

**[ :SOURce<hw> ]:BB:XMRadio:TRIGger:ARM:EXECute**

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

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

**Usage:** Event

**[[:SOURce<hw>]:BB:XMRadio:TRIGger:EXECute**

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

**Example:**

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

**Usage:** Event

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

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

**Return values:**

<Rmode>

**STOP | RUN**

**STOP**  
The signal is generated. A trigger event occurred in the triggered mode.

**RUN**  
The signal is not generated. A trigger event did not occur in the triggered modes, or signal generation was stopped by the command `BB:XMR:TRIG:ARM:EXECute` (armed trigger modes only).

\*RST: RST value

**Example:**

```
BB:XMR:SAT|TERR:TRIG:SOUR EXT
sets external triggering via the TRIGGER connector.
BB:XMR:SAT|TERR:TRIG:MODE ARET
selects the Armed_Retrigger mode
BB:XMR:TRIG:RMODE?
queries the current status of signal generation.
Response: Run
the signal is generated, an external trigger was executed.
```

**Usage:** Query only

**[[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:EXTernal:SYNChronize:OUTPut <Output>****[[:SOURce<hw>]:BB:XMRadio:TERRestrial:TRIGger:EXTernal:SYNChronize:OUTPut <Output>**

(enabled for "Trigger Source" External)

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

**Parameters:**

<Output>

ON | OFF

**ON**

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

**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.

\*RST: ON

**Example:**

BB:XMR:TERR:TRIG:SOUR EXT

sets external triggering.

BB:XMR:TERR:TRIG:EXT:SYNC:OUTP ON

enables synchronous output to external trigger

**[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:SOURce <Source>**

**[:SOURce<hw>]:BB:XMRadio:TERRestrial:TRIGger:SOURce <Source>**

The command selects the trigger source.

**Parameters:**

<Source>

INTernal | EXTernal | BEXTernal | OBASeband

**INTernal**

Triggering is executed by means of the Trigger command

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

**EXTernal**

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

**BEXTernal**

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

**OBASeband**

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

\*RST: INTernal

**Example:**

BB:XMR:TERR:TRIG:SOUR EXT

sets external triggering via the TRIGGER 1 connector.

---

```
[:SOURce<hw>]:BB:XMRadio:SATellite[:TRIGger]:SEQuence <Sequence>
[:SOURce<hw>]:BB:XMRadio:TERRestrial[:TRIGger]:SEQuence <Sequence>
```

The command selects the trigger mode.

**Parameters:**

<Sequence>

AUTO | RETRigger | AAUTo | ARETrigger | SINGLE

**AUTO**

The modulation signal is generated continuously.

**RETRigger**

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

**AAUTo**

The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command

`SOUR:BB:XM:TRIG:ARM:EXEC` and started again when a trigger event occurs.

**ARETrigger**

The modulation signal is generated only when a trigger event occurs. The device automatically toggles to RETRIG mode. Every subsequent trigger event causes a restart.

Signal generation is stopped with command

`SOUR:BB:XM:TRIG:ARM:EXEC` and started again when a trigger event occurs.

**SINGLE**

The modulation signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified with command `SOUR:BB:XM:TERR:TRIG:SLen`. Every subsequent trigger event causes a restart.

\*RST: AUTO

**Example:**

```
BB:XM:TERR:SEQ AAUT
```

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

---

```
[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OBASeband:DELay <Delay>
```

The command specifies the trigger delay (expressed as a number of symbols) for triggering by the trigger signal from the second path.

**Parameters:**

<Delay>

float

Range: 0 to 2<sup>32</sup>-1 symbols

Increment: 1 symbol

\*RST: 0

**Example:** `BB:XMR:SAT:TRIG:SOUR OBAS`  
 sets for path A the internal trigger executed by the trigger signal from the second path (path B).  
`BB:XMR:SAT:TRIG:OBAS:DEL 50`  
 sets a delay of 50 symbols for the trigger.

**[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OBASband:INHibit <Inhibit>**

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

**Parameters:**

<Inhibit> float  
 Range: 0 to  $2^{32}-1$  symbols  
 Increment: 1 symbol  
 \*RST: 0 symbols

**Example:** `BB:XMR:SAT:TRIG:SOUR OBAS`  
 sets for path A the internal trigger executed by the trigger signal from the second path (path B).  
`BB:XMR:SAT:TRIG:INH 200`  
 sets a restart inhibit for 200 symbols following a trigger event.

**[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:SLENgth <Slength>**

The command sets the sequence length of the signal in symbols.

**Parameters:**

<Slength> float  
 Range: 1 to max  
 \*RST: 1

**Example:** `BB:XMR:SAT:TRIG:SLEN 5000`  
 selects the generation of 5000 symbols.

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

The command specifies the trigger delay (expressed as a number of symbols) for external triggering.

**Parameters:**

<Delay> float  
 Range: 0.0 to  $2^{32}-1$  symbols  
 Increment: 1 symbol  
 \*RST: 0.0

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



---

**[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>**

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

**Parameters:**

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

**Example:**

BB:XMR:SAT:TRIG:SOUR EXT  
 selects an external trigger via the TRIGGER 1 connector.  
 BB:XMR:SAT:TRIG:INH 200  
 sets a restart inhibit for 200 symbols following a trigger event.

---

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

The command specifies the trigger delay (expressed as a number of samples) for triggering by the trigger signal from the second path.

**Parameters:**

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

**Example:**

BB:XMR:TERR:TRIG:SOUR OBAS  
 sets for path A the internal trigger executed by the trigger signal from the second path (path B).  
 BB:XMR:TERR:TRIG:OBAS:DEL 50  
 sets a delay of 50 samples for the trigger.

---

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

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

**Parameters:**

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

**Example:**

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

---

**[:SOURce<hw>]:BB:XMRadio:TERRestrial:TRIGger:SEnGth <SLength>**

The command sets the sequence length of the signal in number of samples.

**Parameters:**

<SLength>                    float  
                                  Range:     1 to max  
                                  \*RST:     1

**Example:**                    BB:XMRadio:TERRestrial:TRIG:SEnG 5000  
                                  selects the generation of 5000 samples.

---

**[:SOURce<hw>]:BB:XMRadio:TERRestrial:TRIGger:SLUNit <Slunit>**

The command defines the unit for the entry of the length of the signal sequence (`[ :SOURce<hw> ] :BB:XMRadio:TERRestrial:TRIGger:SEnGth`) to be output in the "Single" trigger mode (`SOUR:BB:XMRadio:TERRestrial:TRIG:SEQ SING`).

**Parameters:**

<Slunit>                    TPL | MCM | SAMPlE  
**TPL**  
 The signal sequence is entered in TPL frames.  
**MCM**  
 The signal sequence is entered in MCM symbols.  
**SAMPlE**  
 The signal sequence is entered in samples.  
 \*RST:                    SAMPlE

**Example:**                    BB:XMRadio:TERRestrial:SEQ SING  
                                  sets trigger mode Single.  
                                  BB:XMRadio:TERRestrial:TRIG:SLUN TPL  
                                  sets unit TPL frame for the entry of sequence length.  
                                  BB:XMRadio:TERRestrial:TRIG:SEnG 2  
                                  sets a sequence length of 2 TPL frames. Two TPL frames will be output after the next trigger event.

---

**[:SOURce<hw>]:BB:XMRadio:TERRestrial:TRIGger[:EXtErnal<ch>]:DELay <Delay>**

The command specifies the trigger delay (expressed as a number of samples) for external triggering.

**Parameters:**

<Delay>                    float  
                                  Range:     0.0 to 2<sup>32</sup>-1 samples  
                                  Increment: 1 sample  
                                  \*RST:     0 samples

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

**[:SOURce<hw>]:BB:XMRadio:TERRestrial:TRIGger[:EXTernal<ch>]:INHibit**  
 <Inhibit>

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

**Parameters:**

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

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

## 4.4 Marker Settings

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

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---

```
[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut:DELAy:FIXed <Fixed>
[:SOURce<hw>]:BB:XMRadio:TERRestrial:TRIGger:OUTPut:DELAy:FIXed
<Fixed>
```

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

**Parameters:**

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

**Example:**

```
BB:XM R: TERR: TRIG: OUTP: DEL: FIX ON
restricts the marker signal delay setting range to the dynamic
range.
```

---

```
[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:DELAy <Delay>
```

The command defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of symbols. Command `:BB:XMRadio:SATellite:TRIGger:OUTPut:DELAy:FIXed` can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

**Parameters:**

```
<Delay>          float
                 Range:    0 to 2^32 - 1 symbols
                 Increment: 1 symbol
                 *RST:    0
```

**Example:**

```
BB:XM R: SAT: TRIG: OUTP2: DEL 1600
sets a delay of 1600 symbols for the signal on connector MARKER
2.
```

---

```
[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:DELAy:MAXimum?
```

The command queries the maximum marker delay for setting `:BB:XMRadio:SAT:TRIG:OUTP:DEL:FIX ON`.

**Return values:**

```
<Maximum>       float
```

**Example:**

```
BB:XM R: TRIG: OUTP: DEL: FIX ON
restricts the marker signal delay setting range to the dynamic
range.
BB:XM R: TRIG: OUTP: DEL: MAX?
queries the maximum of the dynamic range.
Response: 2000
the maximum for the marker delay setting is 2000 symbols.
```

**Usage:** Query only

**[ :SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:DELay:MINimum?**

The command queries the minimum marker delay for setting :BB:XMRadio:SATellite:TRIGger:OUTPut:DELay:FIXed ON.

**Return values:**

<Minimum> float

**Example:**

BB:XM:R:SAT:TRIG:OUTP:DEL:FIX ON  
restricts the marker signal delay setting range to the dynamic range.

BB:XM:R:SAT:TRIG:OUTP:DEL:MIN?  
queries the minimum of the dynamic range.

Response: "0"  
the minimum for the marker delay setting is 0 symbols.

**Usage:** Query only

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

The command defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of samples. Command :BB:XMRadio:TERRestrial:TRIGger:OUTPut:DELay:FIXed can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

**Parameters:**

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

**Example:**

BB:XM:R:TERR:TRIG:OUTP2:DEL 1600  
sets a delay of 1600 samples for the signal on connector MARKER 2.

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

The command queries the maximum marker delay for setting SOURce:BB:XMRadio:TERR:TRIG:OUTP:DEL:FIX ON.

**Return values:**

<Maximum> float

**Example:**

BB:XM:R:TERR:TRIG:OUTP:DEL:FIX ON  
restricts the marker signal delay setting range to the dynamic range.

BB:XM:R:TERR:TRIG:OUTP:DEL:MAX?  
queries the maximum of the dynamic range.

Response: 2000  
the maximum for the marker delay setting is 2000 samples.

**Usage:** Query only

---

**[[:SOURce<hw>]:BB:XMRadio:TERRestial:TRIGger:OUTPut<ch>:DELay:MINimum?**

The command queries the minimum marker delay for setting

SOURce:BB:XMRadio:TERRestial:TRIGger:OUTPut:DELay:FIXed ON.

**Return values:**

<Minimum> float

**Example:**

BB:XMR:TERR:TRIG:OUTP:DEL:FIX ON

restricts the marker signal delay setting range to the dynamic range.

BB:XMR:TERR:TRIG:OUTP:DEL:MIN

queries the minimum of the dynamic range.

Response: 0

the minimum for the marker delay setting is 0 samples.

**Usage:** Query only

---

**[[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:MODE <Mode>[:SOURce<hw>]:BB:XMRadio:TERRestial:TRIGger:OUTPut<ch>:MODE <Mode>**

The command defines the signal for the selected marker output.

**Parameters:**

<Mode> TPL | MCM | USER | RATio | PATtern | PULSe

**TPL**

A marker signal is generated at the beginning of each TPL (Terrestrial Physical Layer) frame.

**MCM**

A marker signal is generated at the beginning of each MCM (Multicarrier Modulation) symbol.

**USER**

A marker signal is generated at the beginning of every user-defined period. The period is defined with

BB:XMR:SAT | TERR:TRIG:OUT:PER.

**RATio**

A marker signal corresponding to the Time Off / Time On specifications in the commands

SOURce:BB:XMRadio:TRIGger:OUTPut:OFFT and

SOURce:BB:XMRadio:TRIGger:OUTPut:ONT is generated.

**PATtern**

A marker signal is generated according to the user defined pattern (command

SOURce:BB:XMRadio:SATellite:TRIGger:OUTPut: PATtern).

\*RST: RATio

**Example:** `BB:XMR:TERR:TRIG:OUTP2:MODE TPL`  
 a marker signal is generated at the beginning of each TPL frame.

**[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:OFFTime <Offtime>**

The command sets the number of symbols in a period (ON time + OFF time) during which the marker signal in setting

`SOURce:BB:XMRadio:SATellite:TRIGger:OUTPut:MODE RATio` on the marker outputs is OFF.

**Parameters:**

<Offtime> float  
 Range: 1 to 2<sup>24</sup>-1 symbols  
 Increment: 1 symbol  
 \*RST: 1

**Example:** `BB:XMR:SAT:TRIG:OUTP2:OFFT 200`  
 sets an OFF time of 200 symbols for marker signal 2.

**[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:ONTime <Ontime>**

The command sets the number of symbols in a period (ON time + OFF time) during which the marker signal in setting `SOURce:BB:XMR:SATellite:TRIGger:OUTPut:MODE RATio` on the marker outputs is ON.

**Parameters:**

<Ontime> float  
 Range: 1 to 2<sup>24</sup> - 1 symbols  
 Increment: 1 symbol  
 \*RST: 1

**Example:** `BB:XMR:SAT:TRIG:OUTP2:ONT 200`  
 sets an ON time of 200 symbols for marker 2.

**[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:PATTern <Pattern>**

The command defines the bit pattern used to generate the marker signal in the setting `SOURce:BB:XMRRadio:SATellite:TRIGger:OUTPut:MODE PATTern`. 0 is marker off, 1 is marker on.

**Parameters:**

<Pattern> <32 bit pattern>  
 \*RST: #B,1

**Example:** `BB:XMR:SAT:TRIG:OUTP2:PATT #B000000011111111,15`  
 sets a bit pattern.

`BB:XMR:SAT:TRIG:OUTP2:MODE PATT`  
 activates the marker signal according to a bit pattern on output MARKER 2.

---

```
[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:PERiod <Period>
```

The command sets the repetition rate for the signal at the marker outputs, expressed in terms of symbols. The setting is only valid for selection "USER" in  
 SOURce:BB:XMR:TERR:TRIG:OUTP:MODE.

**Parameters:**

```
<Period>          float
                  Range:    1 symbol to (1^24-1) symbols
                  Increment: 1 symbol
                  *RST:     1
```

**Example:**

```
BB:XMR:SAT:TRIG:OUTP2:MODE USER
selects the user marker for the signal on connector MARKER 2.
BB:XMR:SAT:TRIG:OUTP2:PER 1600
sets a period of 1600 symbols, i.e. the marker signal is repeated
every 1600th symbol.
```

---

```
[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:PULSe:DIVider  

  <Divider>
```

The command sets the divider for Pulse marker mode  
 (SOUR:BB:XMR:SAT:TRIG:OUTP:MODE PULSe). The resulting pulse frequency is  
 derived by dividing the symbol rate by the divider.

**Parameters:**

```
<Divider>        float
                  Range:    2 to 2^10
                  Increment: 1
                  *RST:     2
```

**Example:**

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

---

```
[:SOURce<hw>]:BB:XMRadio:SATellite:TRIGger:OUTPut<ch>:PULSe:  

FREQUENCY?
```

The command queries the pulse frequency of the pulsed marker signal in the setting  
 SOURce:BB:XMRRadio:SATellite:TRIGger:OUTPut:MODE PULSe. The pulse fre-  
 quency is derived by dividing the symbol rate by the divider.

**Return values:**

```
<Frequency>      float
```



**Example:** `BB:XMR:SAT:TRIG:OUTP2:PULS:DIV 2`  
 sets the divider marker signal on output MARKER 2 to the value 2.  
`BB:XMR:SAT:TRIG:OUTP2:MODE PULS`  
 enables the pulsed marker signal.  
`BB:XMR:SAT:TRIG:OUTP2:PULS:FREQ?`  
 queries the pulse frequency of the marker signal.  
**Response:**  
`33 000`  
 the resulting pulse frequency is 33 kHz.

**Usage:** Query only

**[:SOURCE<hw>]:BB:XMRadio:TERrestrial:TRIGger:OUTPut<ch>:MCMPosition <Mcmposition>**

(available for Physical Layer Mode Terrestrial only)

Sets the position of the MCM symbol.

The setting is only valid for selection "MCM" in `SOURCE:BB:XMRadio:TERR:TRIG:OUTP:MODE`.

**Parameters:**

<Mcmposition> float  
 Range: 1 to 23  
 Increment: 1  
 \*RST: 1

**Example:** `BB:XMR:TERR:TRIG:OUTP2:MODE MCM`  
 selects the MCM marker for the signal on connector MARKER 2.  
`BB:XMR:TERR:TRIG:OUTP2:MCMP 20`  
 sets the MCM position.

**[:SOURCE<hw>]:BB:XMRadio:TERrestrial:TRIGger:OUTPut<ch>:OFFTime <Offtime>**

The command sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting

`SOURCE:BB:XMRadio:TERR:TRIG:OUTP:MODE RATIO` on the marker outputs is OFF.

**Parameters:**

<Offtime> float  
 Range: 1 to 2<sup>24</sup>-1 samples  
 Increment: 1 sample  
 \*RST: 1 sample

**Example:** `BB:XMR:TERR:TRIG:OUTP2:OFFT 200`  
 sets an OFF time of 200 samples for marker signal 2.

**[ :SOURce<hw> ]:BB:XMRadio:TERRestrial:TRIGger:OUTPut<ch>:ONTime  
<Ontime>**

The command sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting

SOURce:BB:XMRadio:TERRestrial:TRIGger:OUTPut:MODE RATIO on the marker outputs is ON.

**Parameters:**

<Ontime> float  
 Range: 1 to 2<sup>24</sup>-1 samples  
 Increment: 1 sample  
 \*RST: 1 sample

**Example:** BB:XMRadio:TERRestrial:TRIG:OUTP2:ONT 200  
 sets an ON time of 200 samples for marker 2.

**[ :SOURce<hw> ]:BB:XMRadio:TERRestrial:TRIGger:OUTPut<ch>:PERiod  
<Period>**

The command sets the repetition rate for the signal at the marker outputs, expressed in terms of samples. The setting is only valid for selection "USER" in

SOURce:BB:XMRadio:TERRestrial:TRIG:OUTP:MODE.

**Parameters:**

<Period> float  
 Range: 1 to 1<sup>24</sup>-1 samples  
 Increment: 1 sample  
 \*RST: 1 sample

**Example:** BB:XMRadio:TERRestrial:TRIG:OUTP2:MODE USER  
 selects the user marker for the signal on connector MARKER 2.  
 BB:XMRadio:TERRestrial:TRIG:OUTP2:PER 1600  
 sets a period of 1600 samples, i.e. the marker signal is repeated every 1600th sample.

## 4.5 Clock Settings

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

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---

```
[ :SOURce<hw>]:BB:XMRadio:SATellite:CLOCK:MODE <Mode>
```

```
[ :SOURce<hw>]:BB:XMRadio:TERrestrial:CLOCK:MODE <Mode>
```

The command enters the type of externally supplied clock (:BB:<root>:CLOCK:SOUR EXT).

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

**Parameters:**

<Mode>

SAMPLE | MSAMPLE

(for physical layer transmission Terrestrial)

When MSAMPLE is used, a multiple of the sample clock is supplied via the CLOCK connector and the sample clock is derived internally from this. The multiplier is entered with the command BB:XMRadio:TERrestrial:CLOCK:MULTIPLIER.

\*RST: SAMPLE

<Mode>

SYMBOL | MSYMBOL

(for physical layer transmission Satellite)

When MSYMBOL is used, a multiple of the symbol clock is supplied via the CLOCK connector and the symbol clock is derived internally from this. The multiplier is entered with the command :BB:XMRadio:SATellite:CLOCK:MULTIPLIER.

\*RST: SYMBOL

**Example:**

```
BB:XM:TER:TERR:CLOCK:MODE SAMP
```

selects clock type "Sample", i.e. the supplied clock is a sample clock.

---

```
[ :SOURce<hw>]:BB:XMRadio:SATellite:CLOCK:SOURce <Source>
```

```
[ :SOURce<hw>]:BB:XMRadio:TERrestrial:CLOCK:SOURce <Source>
```

The command selects the clock source.

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

**Parameters:**

<Source>

INTERNAL | EXTERNAL | AINTERNAL

**INTERNAL**

The internal clock reference is used.

**EXTERNAL**

The external clock reference is supplied to the CLOCK connector.

\*RST: INTERNAL

**Example:** `BB:XMR:TERR:CLOC:SOUR EXT`  
 selects an external clock reference. The clock is supplied via the CLOCK connector.

`BB:XMR:TERR:CLOC:MODE SAMP`  
 specifies that a sample clock is supplied via the CLOCK connector.

---

**[ :SOURce<hw> ]:BB:XMRadio:SATellite:CLOCK:MULTIplier <Multiplier>**  
**[ :SOURce<hw> ]:BB:XMRadio:TERRestrial:CLOCK:MULTIplier <Multiplier>**

The command specifies the multiplier for clock mode Multiple Sample (`:BB:XMRadio:TERRestrial:CLOCK:MODE MSAMple`) in the case of an external clock source.

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

**Parameters:**

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

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

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

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

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