R&S®SMBV-P101
GNSS Production Tester
User Manual

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User Manual

ROHDE&SCHWARZ

This document describes the software option R&S®SMBV-P101 1419.2844.02 for generating a satellite signal in static mode with hybrid satellite configuration: GPS, Galileo, GLONASS and BeiDou.
This manual describes firmware version 4.15.125.xx and later of the R&S®SMBV100A.

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The following abbreviations are used throughout this manual: R&S®SMBV100A is abbreviated as R&S SMBV.

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 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.

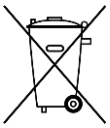
The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English.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

Safety labels on products

The following safety labels are used on products to warn against risks and dangers.

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

Symbol	Meaning	Symbol	Meaning
	Caution ! Hot surface		Alternating current (AC)
	Protective conductor terminal To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth		Direct/alternating current (DC/AC)
	Earth (Ground)		Class II Equipment to identify equipment meeting the safety requirements specified for Class II equipment (device protected by double or reinforced insulation)
	Frame or chassis 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.

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

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

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

NOTICE Indicates information considered important, but not hazard-related, e.g. messages relating to property damage.
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.

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 ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency, overvoltage category 2, pollution degree 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 mains-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 mains, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the mains. 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.

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 IEC 60950-1 / EN 60950-1 or IEC 61010-1 / 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.

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 EN 55011/CISPR 11, and analogously with EN 55022/CISPR 22, EN 55032/CISPR 32)
   - Class A equipment:
     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
     Note: Class A equipment is intended for use in an industrial environment. This equipment may cause radio disturbances in residential environments, due to possible conducted as well as radiated disturbances. In this case, the operator may be required to take appropriate measures to eliminate these disturbances.
   - Class B equipment:
     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.

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.
8. Follow the transport stipulations of the carrier (IATA-DGR, IMDG-Code, ADR, RID) when returning lithium batteries to Rohde & Schwarz subsidiaries.

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.
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 de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

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

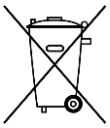
Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto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

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

Señalización de seguridad de los productos

Las siguientes señales de seguridad se utilizan en los productos para advertir sobre riesgos y peligros.

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)

Símbolo	Significado	Símbolo	Significado
	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.
	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.

	Indica una situación de peligro que, si no se evita, causa lesiones graves o incluso la muerte.
	Indica una situación de peligro que, si no se evita, puede causar lesiones graves o incluso la muerte.
	Indica una situación de peligro que, si no se evita, puede causar lesiones leves o moderadas.
	Indica información que se considera importante, pero no en relación con situaciones de peligro; p. ej., avisos sobre posibles daños materiales. En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

Estados operativos y posiciones de funcionamiento

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

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal. 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.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión U_{eff} > 30 V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.

17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados —los llamados alérgenos (p. ej. el níquel)—. Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación/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 de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
   - Aparato de clase A:
     Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
     Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos

pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.

- Aparato de clase B:
  Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. 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.

8. En caso de devolver baterías de litio a las filiales de Rohde & Schwarz, debe cumplirse las normativas sobre los modos de transporte (IATA-DGR, código IMDG, ADR, RID).

Transporte

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

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

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.

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Contents

1 Preface 7
1.1 About this Manual 7
1.2 Documentation Overview 8
1.2.1 Quick Start Guide Manual 8
1.2.2 Operating Manual and Help 8
1.2.3 Service Manual 8
1.2.4 Instrument Security Procedures 9
1.2.5 Basic Safety Instructions 9
1.2.6 Data Sheets and Brochures 9
1.2.7 Release Notes and Open Source Acknowledgment (OSA) 9
1.2.8 Application Notes, Application Cards, White Papers, etc. 9
2 Welcome to the R&S SMBV-P101 GNSS Production Tester 10
2.1 Accessing the GNSS Dialog 10
2.2 Scope 11
2.3 Description of the Non-GNSS-Related Settings 11
2.4 Contents 11
3 About the GNSS Production Tester 13
3.1 Real-time Generation 14
3.2 Multi-satellite GNSS Signal 14
3.3 Signal Dynamics 15
3.4 Modulation Control 15
3.5 Multiple Almanacs 15
3.6 Power Configuration 15
3.7 Configuration of the Atmospheric Parameters 16
3.8 Time Conversion Configuration 16
3.9 Leap Second Simulation 16
4 GNSS Production Configuration and Settings 17
4.1 GNSS Main Dialog 17
4.1.1 General Settings for GNSS Simulation 18
4.1.2 Navigation Data 21

4.2 Almanac Settings....24
4.3 Time Conversion Configuration Settings....25
4.4 Satellite Configuration Settings....27
4.4.1 Power Configuration....27
4.4.2 Configuration of the Satellite Constellation....28
4.4.3 Individual Satellite Settings....29
4.4.4 Modulation Control....32
4.4.5 Signal Dynamics....34
4.5 Navigation Message Configuration....37
4.6 Atmospheric Configuration Settings....47
4.7 Trigger/Marker/Clock Settings....48
4.7.1 Trigger In....49
4.7.2 Marker Settings....52
4.7.3 Clock Settings....54
4.7.4 Global Settings....55
5 How to Generate a GNSS Signal for Receiver Tests with Varying Signal Dynamics and Modulation Control....56
6 Remote-Control Commands....58
6.1 Primary Settings....59
6.2 Navigation Data....61
6.3 Almanac Configuration....64
6.4 Time Conversion Configuration....68
6.5 Satellites Configuration and Satellites Signal Settings....71
6.6 Modulation Control....76
6.7 Signal Dyamics....77
6.8 Power Settings....80
6.9 Navigation Message Configuration....81
6.10 Atmospheric Configuration....100
6.11 Trigger Settings....101
6.12 Marker Settings....103

6.13 Clock Settings..... 106

List of Commands.....108

Index.....114

1 Preface

1.1 About this Manual

This operating manual provides all the information **specific for the production tester**. All general instrument functions and settings common to all applications and operating modes are described in the main R&S SMBV operating manual.

The main focus in this manual is on the provided settings and the tasks required to generate a signal. The following topics are included:

- **Welcome to the Production Tester**
  Introduction to and getting familiar with the option R&S SMBV-P101
- **About the GNSS systems**
  Background information on basic terms and principles in the context of the signal generation
- **GNSS Configuration and Settings**
  A concise description of all functions and settings available to configure signal generation with their corresponding remote control command
- **How to Generate a Signal with the GNSS Production Tester**
  The basic procedure to perform signal generation tasks with varying signal dynamics and modulation control
- **Remote Control Commands**
  Remote commands required to configure and perform signal generation in a remote environment, sorted by tasks
  (Commands required to set up the instrument or to perform common tasks on the instrument are provided in the main R&S SMBV operating manual)
  Programming examples demonstrate the use of many commands and can usually be executed directly for test purposes
- **List of remote commands**
  Alphabetical list of all remote commands described in the manual
- **Index**

Contents and scope

This description assumes R&S SMBV equipped with all availabe options. Depending on your model and the installed options, some of the functions may not be available on your instrument.

Notes on screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as much as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic usage scenarios.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

1.2 Documentation Overview

This section provides an overview of the R&S SMBV user documentation. Unless specified otherwise, you find the documents on the R&S SMBV product page at:

www.rohde-schwarz.com/manual/smbv100a

1.2.1 Quick Start Guide Manual

Introduces the R&S SMBV and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc. A printed version is delivered with the instrument.

1.2.2 Operating Manual and Help

Separate manuals for the base unit and the software options are provided for download:

- Base unit manual
  Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the quick start guide manual.
- Software option manual
  Contains the description of the specific functions of an option. Basic information on operating the R&S SMBV is not included.

The contents of the user manuals are available as help in the R&S SMBV. The help offers quick, context-sensitive access to the complete information for the base unit and the software options.

All user manuals are also available for download or for immediate display on the Internet.

1.2.3 Service Manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS, https://gloris.rohde-schwarz.com).

1.2.4 Instrument Security Procedures

Deals with security issues when working with the R&S SMBV in secure areas. It is available for download on the Internet.

1.2.5 Basic Safety Instructions

Contains safety instructions, operating conditions and further important information. The printed document is delivered with the instrument.

1.2.6 Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S SMBV. It also lists the options and their order numbers and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/smbv100a

1.2.7 Release Notes and Open Source Acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation.

The open source acknowledgment document provides verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/smbv100a

1.2.8 Application Notes, Application Cards, White Papers, etc.

These documents deal with special applications or background information on particular topics.

See www.rohde-schwarz.com/application/smbv100a.

2 Welcome to the R&S SMBV-P101 GNSS Production Tester

The R&S SMBV-P101 GNSS Production Tester generates the signals of four satellites in static mode, in accordance with GPS, Galileo, GLONASS and COMPASS/BeiDou.

The GNSS solution for the R&S SMBV is suitable for production tests of GNSS receivers.

The key features are:

- Support of a default hybrid configuration
- Realtime simulation of four satellites with very long simulation time
- Signal for basic receiver testing using signals with zero, constant or varying Doppler profiles
- Signal for receiver sensitivity tests, e.g. Satellite power (dBm) vs. Receiver C/N (dB)
- Signal for GNSS Receiver Intersystem Time Calibration, e.g. GPS vs. Glonass

This operating manual contains a description of the functionality that the application provides, including remote control operation.

All functions not discussed in this manual are the same as in the base software and are described in the R&S SMBV operating manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMBV100A

2.1 Accessing the GNSS Dialog

To open the dialog with GNSS settings

► In the block diagram of the R&S SMBV, select "Baseband > Satellite Navigation > GNSS Production...".

A dialog box opens that displays the provided general settings.

The signal generation is not started immediately. To start signal generation with the default settings, select "State > On".

2.2 Scope

Tasks (in manual or remote operation) that are also performed in the base unit in the same way are not described here.

In particular, it includes:

- Managing settings and data lists, like storing and loading settings, creating and accessing data lists, or accessing files in a particular directory.
- Information on regular trigger, marker and clock signals and filter settings, if appropriate.
- General instrument configuration, such as configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S SMBV operating manual.

2.3 Description of the Non-GNSS-Related Settings

Refer to the R&S SMBV operating manual for description of the non-GNSS-related settings.

When the R&S SMBV-P101 GNSS production tester option is installed, the R&S SMBV operating manual applies *except* the following chapters:

- Local Oscillator - LO Coupling
- Pulse Modulation (PM)
- Pulse Generator
- AWGN - Noise Generator
- Digital I/Q Output Settings
- Digital Modulation - Custom Digital Modulation
- Arbitrary Waveform Generator ARB
- Multi Carrier Continuous Wave
- External Baseband Signal - Baseband Input
- the corresponding sections in chapter Remote Control Commands

For more information, refer to the instrument specification (data sheet).

2.4 Contents

This description assumes R&S SMBV equipped with all availabe options. Depending on your model and the installed options, some of the functions may not be available on your instrument.

Notes on screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as much as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic usage scenarios.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

3 About the GNSS Production Tester

In manufacturing, the sensitivity of a receiver for acquiring and tracking a satellite signal must be determined.

The R&S SMBV production tester enables you to generate hybrid satellite signals in static mode. It supports up to four satellite signals of the standards GPS, Galileo, GLONASS and BeiDou. In addition, you can configure various Doppler profiles for testing the receiver sensitivity under varying signal dynamics. It is also possible to activate the modulation components for the tests individually.

This section provides a short introduction to the GNSS standards and a functional overview of the Production Tester.

Brief introduction to the GNSS standards

Global navigation satellite system (GNSS) employs the radio signals of several navigation standards, like GPS, Galileo, GLONASS, BeiDou etc. For several years, GPS used to be the only standard available for civilian navigation through its C/A civilian code. Nowadays, the GNSS signals and systems are undergoing fast development, some systems are getting modernized and some are completely new. In the foreseeable future, several more GNSS satellites utilizing more signals and new frequencies will be available.

- **GPS**
  The Global Positioning System (GPS) consists of several satellites circling the earth in low orbits. The satellites transmit permanently information that can be used by the receivers to calculate their current position (ephemeris) and about the orbits of all satellites (almanac). The 3D position of a receiver on the earth can be determined by carrying out delay measurements of at least four signals emitted by different satellites.
  Being transmitted on a single carrier frequency, the signals of the individual satellites can be distinguished by means of correlation (Gold) codes. These ranging codes are used as spreading code for the navigation message which is transmitted at a rate of 50 baud.
- **Galileo**
  Galileo is the European global navigation satellite system that provides global positioning service under civilian control. It is planed to be inter-operable with GPS and GLONASS and other global satellite navigation systems.
  The fully deployed Galileo system consists of 30 satellites (27 operational and 3 spares). Three independent CDMA signals, named E5, E6 and E1, are permanently transmitted by all Galileo satellites. The E5 signal is further sub-divided into two signals denoted E5a and E5b (see Figure 3-1).
- **GLONASS**
  Glonass is the Russian global navigation satellite system. Together with GPS, up to 54 GNSS Satellites are provided, which will improve the availability and consequently the navigation performance in high urban areas.

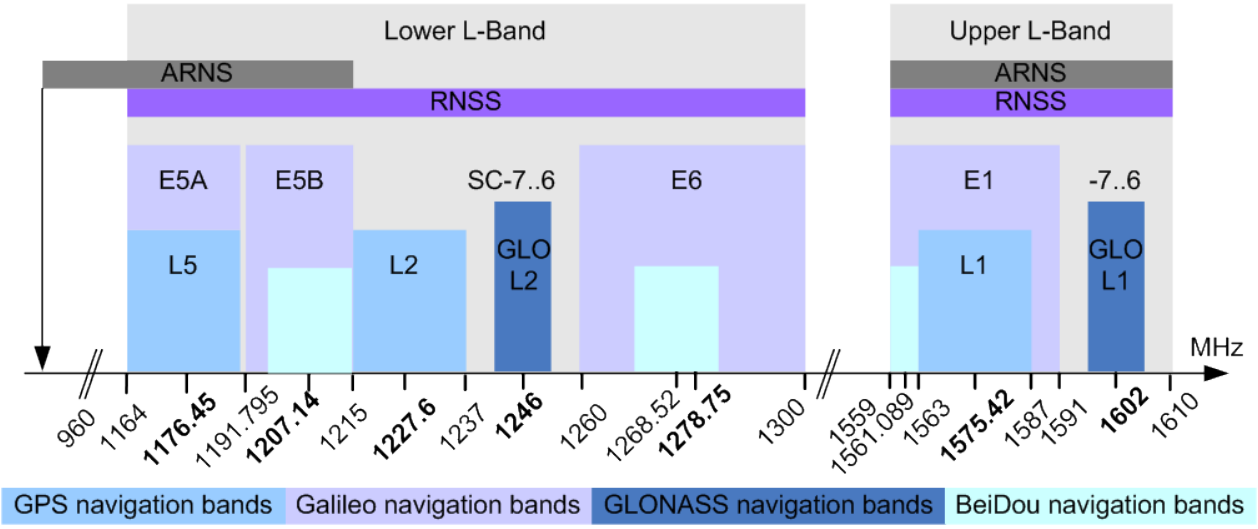


Figure 3-1: GNSS frequency bands

- **COMPASS/BeiDou**
  The fully deployed BeiDou Navigation Satellite System (BDS) is a Chinese satellite navigation system. This navigation system is also know as BeiDou-2 and is expected in 2020. The BDS is a global satellite navigation systems that uses a constellation of 35 satellites to cover the globe. This constellation includes 5 geostationary orbit satellites (GEO) and 30 non-geostationary satellites; 27 in medium earth orbit (MEO) and 3 in inclined geosynchronous orbit (IGSO).
  The BDS uses frequency allocated in the E1, E2, E5B, and E6 bands.

3.1 Real-time Generation

Up to four satellites can be simulated, transmitting the following signals:

- GPS: L1 signal with C/A-code.
- Galileo: E1 signal with E1-DEF code.
- GLONASS: L1 signal with R-C/A code.
- BeiDou: L1 signals with B-C/A code.

3.2 Multi-satellite GNSS Signal

The instrument calculates a multi-satellite GNSS signal, providing static satellites with constant, zero or varying Doppler profiles. You can perform simple sensitivity tests, acquisition and tracking test, production tests or test a receivers sensitivity even under varying signal dynamics, see Chapter 5, "How to Generate a GNSS Signal for Receiver Tests with Varying Signal Dynamics and Modulation Control", on page 56.

3.3 Signal Dynamics

For basic receiver testing, the R&S SMBV production tester generates signals with varying Doppler effects. Thus you can define Doppler profiles with configurable maximum dynamics (velocity, acceleration and jerk).

3.4 Modulation Control

The instrument allows you to disable modulation components individually, like data source, spreading code, time sequence, meandering, navigation message, etc.

3.5 Multiple Almanacs

The instrument supports the configuration of the almanac files used. One almanac file per GNSS navigation standard can be selected.

The Galileo and Beidou satellite constellation are not yet fully in orbit. Hence, no almanac files for Galileo and BeiDou are available. In this implementation, predicted Galileo and Beidou almanac files are provided for test purposes. The almanac files for GPS and Galileo use the same format.

Current GNSS almanac data can be downloaded via the Internet and stored on the hard disk of the instrument:

- U.S.Coast Guard Navigation Center GPS Homepage http://www.navcen.uscg.gov/?pageName=gpsAlmanacs
  The almanac files are named `xxx.alm` (for YUMA files) or `xxx.al3` (for SEM files),
  where xxx denotes the day of a year
- http://www.celestrak.com/GPS/almanac/
  The naming convention of the almanac file is: `almanac.sem/yuma.weekXXXX.YYYYYY.txt`,
  where `xxxx` denotes the GPS week and `yyyyyy` the time of almanac (TOA).
- ftp://ftp.glonass-iac.ru/MCC/ALMANAC/
  The file extension of the Glonass almanac file is: `xxx.agl`

For detailed information on the content and frame structure of navigation data, refer to the specifications.

3.6 Power Configuration

The instrument employs a dynamic power control concept for dynamical configuration of the power of each satellite separately and manually.

3.7 Configuration of the Atmospheric Parameters

The ionospheric navigation parameters of the provided GNSS standards are enabled for configuration.

The ionospheric navigation parameters define what the satellites are transmitting as ionospheric correction parameters.

3.8 Time Conversion Configuration

The instrument supports an advanced function for transformation of the GNSS time to the universal time coordinate basis (UTC) and vice versa. The provided GNSS system time conversion parameters are zero-order and first order system clock drift parameters in addition to the current leap second. The leap second describes the difference between the GPS, Galileo, GLONASS or BeiDou system time and UTC system time. It is for example possible to simulate a system time drift between GPS and Galileo by configuring different time conversion sets for both UTC-GPS and UTC-Galileo conversion parameters.

The time conversion parameters can be either manually configured or fetched from the RINEX header. It is recommenced to keep the default configurations without system time offset and/or drift.

3.9 Leap Second Simulation

The instrument enables the simulation of leap second in a straightforward way. The simulation requires only the date and sign of the next leap second, further calculations are performed automatically.

4 GNSS Production Configuration and Settings

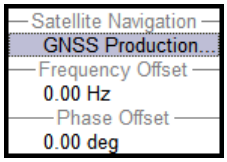
The GNSS R&S SMBV procduction tester supports up to four satellite signals of the standards GPS, Galileo, GLONASS and BeiDou. You can access the available satellite settings via the baseband block.

For non-GNSS-related settings refer to the R&S SMBV operating manual.

See Chapter 2.3, "Description of the Non-GNSS-Related Settings", on page 11.

- GNSS Main Dialog....17
- Almanac Settings....24
- Time Conversion Configuration Settings....25
- Satellite Configuration Settings....27
- Navigation Message Configuration....37
- Atmospheric Configuration Settings....47
- Trigger/Marker/Clock Settings....48

4.1 GNSS Main Dialog

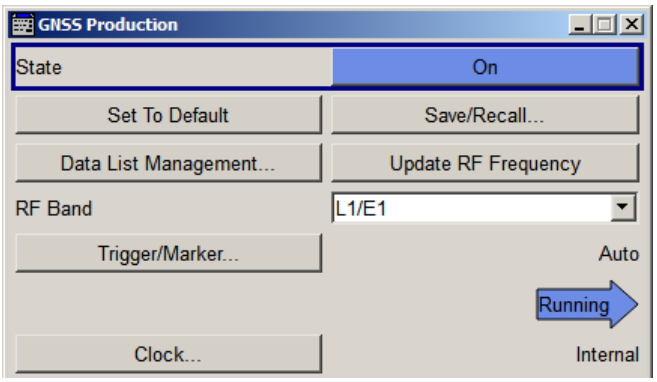


To access the available satellite standards:

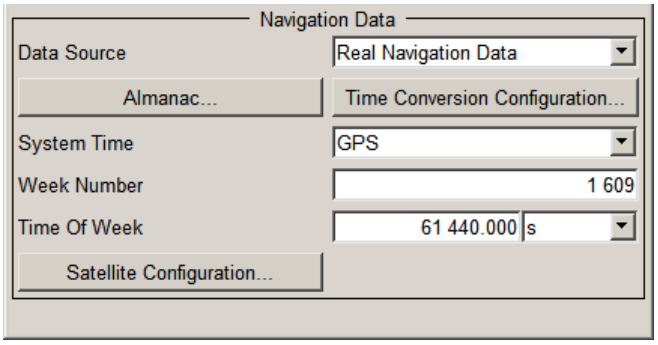
► Select "Baseband block > Satellite Navigation > GNSS Production...".

The dialog is split into several sections.

- In the upper section, you can set the general parameters and activate the GNSS production test signal, see Chapter 4.1.1, "General Settings for GNSS Simulation", on page 18.



- The "Navigation Data" section comprises the navigation data source settings.



- Additionally, you can access settings for configuring the satellite signals.

The remote commands required to define these settings are described in Chapter 6, "Remote-Control Commands", on page 58.

- General Settings for GNSS Simulation 18
- Navigation Data 21

4.1.1 General Settings for GNSS Simulation

To access these settings:

► Select "Baseband > Satellite Navigation > GNSS Production Tester".

The provided settings enable you to perform general configurations, like to set the default settings or access further dialogs.

State
Activates GNSS signal generation. A continuous GNSS signal is generated for four satellites in real time mode.

Note: Enabling the standard sets the "Frequency" and "Level" values in the status bar of the instrument according to the selected "RF Band" and "Total Power" at the simulation start time.

Remote command:
`[:SOURce<hw>]:BB:GNPR:STATe` on page 59

Set to default
Calls the default settings. The values of the main parameters are listed in the following table.

Note: Use Update RF Frequency function to preset the RF Frequency and level.

Parameter	Value
State	Not affected by "Set to default"
RF Band	L1/E1
Almanac	GPS_SEM678.txt/GAL_Yuma678.txt/GLO_678.agl/ Beidou_Yuma678.txt

Parameter	Value
Data Source	All 0 (GPS, BeiDou)/Zero oder Real Navigation Data (GLONASS)
System Time	GPS
Satellite configuration	
Maximum Number of Satellites	4
State satellite 1-4	On
Standard	GPS, Galileo, GLONASS and BeiDou
Signal	C/A, E1-DEF, R-C/A and B1-C/A

Remote command:
`[:SOURce<hw>]:BB:GNPR:PRESet` on page 59

Save/Recall
Accesses the "Save/Recall" dialog, that is the standard instrument function for saving and recalling the complete dialog-related settings in a file. The provided navigation possibilities in the dialog are self-explanatory.

The filename and the directory, in which the settings are stored, are user-definable; the file extension is however predefined.

The following file extensions are used: `*.gps`, `*.galileo`, `*.glonass` respectively.

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.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SETTing:CATalog?` on page 60
`[:SOURce<hw>]:BB:GNPR:SETTing:DELete` on page 60
`[:SOURce<hw>]:BB:GNPR:SETTing:LOAD` on page 60
`[:SOURce<hw>]:BB:GNPR:SETTing:STORe` on page 61
`[:SOURce<hw>]:BB:GNPR:SETTing:STORe:FAST` on page 61

Data List Management
Accesses the "Data List Management" dialog used to create and edit data lists.

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.

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.

Update RF Frequency
Sets the "Status Bar > Frequency" display to the resulting frequency. The RF Frequency is calculated automatically depending on the selected RF Band, on the entry standard and on the enabled navigation standards.

Note: RF Frequency vs RF Band.
- For navigation standards with overlapping carrier frequencies, e.g. GPS and Galileo in the L1/E1 upper RNSS band, the RF frequency is the carrier frequency L1 = E1 = 1.57542 GHz.
  See also Figure 3-1
- If different RF frequencies are used, e.g. GPS and GLONASS in the L1/E1 upper RNSS band, the resulting RF frequency is located between the GPS L1 and the GLONASS L1 frequency.

Remote command:
`[:SOURce<hw>]:BB:GNPR:PRFFrequency` on page 60

RF Band
Determines the RF band, i.e. the upper or lower RNSS band.

The different satellites are modulated on their corresponding standard carrier frequencies.

Table 4-1: Carrier frequencies

Navigation Standard	"RF Band"	Carrier Frequency, GHz
GPS	L1 L2	1.57542 1.2276
GALILEO	E1	1.57542
GLONASS	L1 L2	1.602 1.246
BeiDou	L1	1.561098

Remote command:
`[:SOURce<hw>]:BB:GNPR:RFBand` on page 59

Trigger/Marker, Marker
Accesses the dialog for selecting the trigger source, for setting the time delay of an external trigger signal and for configuring the marker signals (see Chapter 4.7, "Trigger/Marker/Clock Settings", on page 48).

The currently selected trigger source is displayed to the right of the button.

Remote command:
`n.a.`

Arm
Stops the signal generation until subsequent trigger event occurs.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:ARM:EXECute` on page 101

Execute Trigger
For internal trigger source, executes trigger manually.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:EXECute` on page 101

Clock
Accesses the dialog for selecting the clock source and for setting a delay (see Chapter 4.7, "Trigger/Marker/Clock Settings", on page 48).

Remote command:
`n.a.`

4.1.2 Navigation Data

Access:

► Select "GNSS Main Dialog > Navigation Data"

With the provided settings, you can define the data source for navigation information.

Data Source 21
Time Conversion Configuration 22
Simulation Start Time 22
Almanac 23
Satellite Configuration 23
Atmospheric Configuration 23

Data Source
Selects data source for the navigation information.

Navigation data is essential for calculating the positions of the satellites. It also contains the information about the currently valid space vehicle IDs.

"Real Navigation Data"
You can download Almanac files ("Real Navigation Data") from the Internet and store them on the hard disk of your instrument. If necessary, reconfigure manually these downloaded files.
Almanac files for Galileo and BeiDou are not available for download. To simulate the movement of Galileo and BeiDou satellites on their designed orbits, you find predicted almanacs provided with this software.
Use the Almanac Configuration parameter to select the almanac file per navigation standard.

"PRBSxx/Data List/Pattern"

Arbitrary data is available in "Static" mode.
A GNSS receiver recognizes signals generated in this way. There is no real navigation data modulated with the GNSS spreading code but the signal is sufficient for simple functional tests and sensitivity tests. The receiver measures and displays the carrier to noise ratio of the signal.

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

  See also "Main Dialog > Data List Management".

"Zero Navigation Data"

Navigation data with the ephemeris, almanac and satellite clock correction parameters set to zero.
Synchronization, timing and structure (e.g. channel coding) of the message are the same as for "Real Navigation Data".
In this mode, you can select from the full set of SV-IDs for all GNSS.
In the "Real Navigation Data" mode, available are only the almanac records that are existing in the almanac file and the healthy satellites.

Remote command:

`[:SOURce<hw>]:BB:GNPR:NAVigation:DATA` on page 61
`[:SOURce<hw>]:BB:GNPR:NAVigation:DATA:DSELect` on page 62
`[:SOURce<hw>]:BB:GNPR:NAVigation:DATA:PATTern` on page 62

Time Conversion Configuration

Opens the Time Conversion Configuration Settings dialog.

Simulation Start Time

Sets the simulation start time in the format of the selected "Time Basis".

"Time Basis" Per default, the timebase of the entry standard is used. If different timebase is selected, the time is automatically recalculated and displayed in the selected time format.

Note: Use the Time Conversion Configuration Settings dialog to configure the parameters, necessary for time conversion between the proprietary time of the navigation standard and the UTC.

Remote command:
`[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TBASis` on page 63

"Date [dd.mm.yyyy], Time [hh:mm:ss:xxx]"
(enabled for "Data Source > Real/Zero Navigation Data")
Enters the date for the simulation in DD.MM.YYYY format of the Gregorian calendar and the exact simulation start time in UTC time format. The simulation time is not limited to the almanac week.

Remote command:
`[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:DATE` on page 62
`[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TIME` on page 63

"Week Number, Time of Week (TOW)"
(enabled for "Time Basis > GPS" and "Data Source > Real/Zero Navigation Data")
The satellite clocks in the GPS and Galileo navigation systems are not synchronized to the UTC. They use a proprietary time, the GPS and the Galileo system time. The format used for these systems is week number (WN) and Time of Week (TOW), that is the simulation start time within this week.
The Time of Week (TOW) is expressed in number of seconds and covers an entire week. The value is reset to zero at the end of each week.
The weeks are numbered starting from a reference time point (WN_REF=0), that corresponds to GPS reference point: January 6, 1980 (00:00:00 UTC)

Remote command:
`[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:WNUMber` on page 64
`[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TOWeek` on page 63

Almanac
Accesses the Almanac Configuration dialog.

You can select one almanac file per navigation standard.

Satellite Configuration...
Accesses the dialog for configuring the satellite data (see Chapter 4.4, "Satellite Configuration Settings", on page 27).

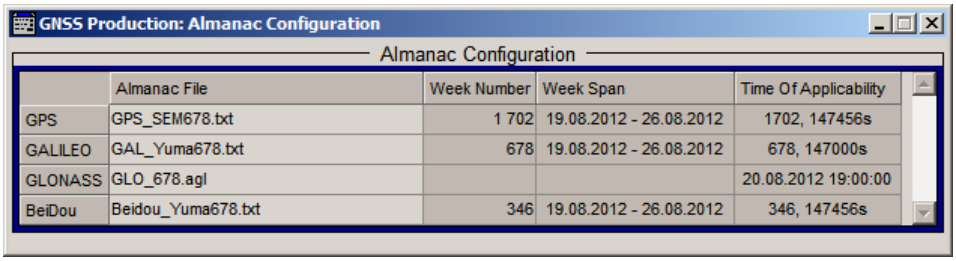
Atmospheric Configuration
Access the Atmospheric Configuration Settings dialog for configuring:

- The atmospheric parameters as transmitted in the corresponding GNSS navigation message.

4.2 Almanac Settings

To access this dialog:

1. Select "GNSS > General > Navigation Data"
2. Select "Navigation Data > Data Source > Real Navigation Data"
3. Select "Navigation Data > Almanac"



In this dialog, you select the almanac data files.

Almanac Configuration
Displays the settings of the selected almanac files per navigation standard.

One almanac file can be selected per navigation standard. Predefined or user-defined almanac files can be loaded.

When an almanac file is selected, the time information of the file (Week, SEM and TOA) is indicated in the table. The SEM and TOA are indicated in Greenwich Mean Time.

Parameter	SCPI command
"Almanac File"	`[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:FILE` on page 65
"Week Number"[1)]	`[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:WNUMber` on page 68
"Week Span"[1)]	`[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:DATE:BEGIn` on page 65 `[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:DATE:END` on page 66
"Time of Applicability (TOA)"[2)]	`[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:TOAPplicability:TOAWeek` on page 67 `[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:TOAPplicability:WNUMber` on page 68
"Time of Applicability (TOA)"	`[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GLONass:TOAPplicability:DATE?` on page 66 `[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GLONass:TOAPplicability:TIME?` on page 67

- [1)] TOA format for GPS: *(WN, TOW) WN_REF (6 Jan 1980 00:00:00 UTC)*
  TOA format for Galileo: *(WN, TOW) WN_REF (22 August 1999 00:00:00 UTC)*

- [2] "Week Number" and "Week Span": no SCPI command for Glonass

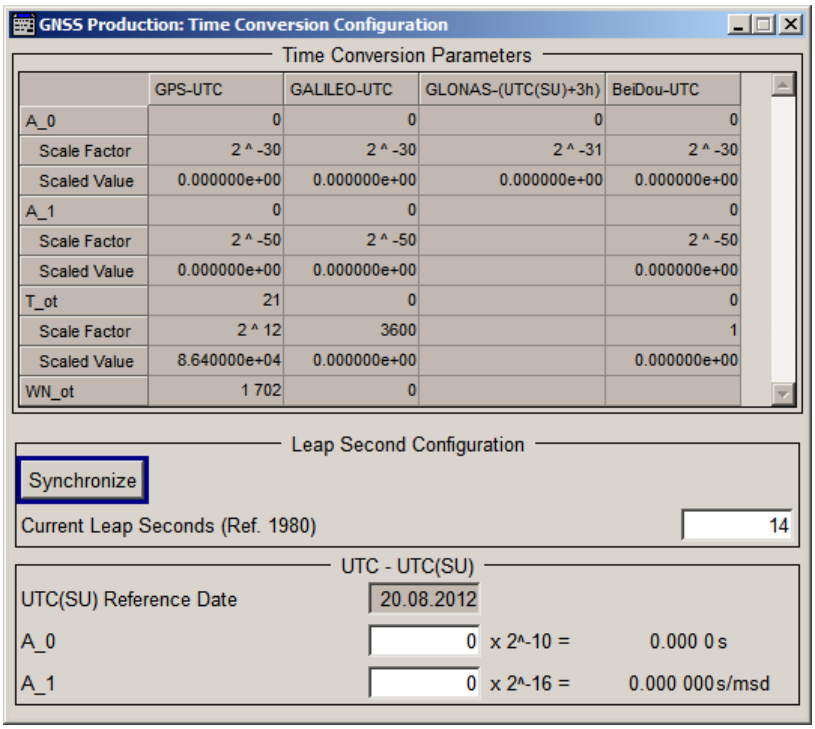
For an overview of the supported almanac files, see Chapter 3.5, "Multiple Almanacs", on page 15.

4.3 Time Conversion Configuration Settings

Access:

► Select "Baseband block > Satellite Navigation > GNSS Production...".

This dialog contains the settings required to configure the time conversion from a navigation standard, for example GPS to UTC. The conversion settings are necessary for switching from one time basis to another.



The time conversion is performed according to the following formula:

$t_{UTC} = (t_E - delta\_t_{UTC})$ *modulo 86400*, where $delta\_t_{UTC}$ and t_E are as follows:

$delta\_t_{UTC} = delta\_t_{LS} + A_0 + A_1 (t_E - T_{ot} + 604800(WN - WN_{ot}))$ and

$t_E = t_{GPS}$ or $t_{Galileo}$

Time Conversion Parameters..... 26
Leap Second Configuration..... 26
UTC-UTC(SU)..... 26

Time Conversion Parameters

The basis for the time conversion is the UTC. The parameters of each of the navigation standards are set as an offset to the UTC.

For better readability, the values of the time correction parameters are input as integer in the same way as they are included in the satellite's navigation message. The corresponding "Scale Factor" and the "Scaled Value" are also displayed.

Parameter	Description	SCPI Command
"A_0"	Constant term of polynomial, A_0	`[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:AZERo` on page 69
"A_1"	1st order term of polynomial, A_1	`[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:AONE` on page 69
"t_ot"	UTC data reference Time of Week, t_{ot}	`[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:TOT` on page 70
"WN_t"	UTC data reference Week Number, WN_t	`[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:WNOT` on page 70

Leap Second Configuration

The GPS time does not consider time corrections that are typical for the UTC, such as the leap second for instance.

As of June 30, 2012, the value of the "Current Leap Second", is 16 seconds.

Parameter	Description	SCPI Command
"Synchronize"	Synchronizes the leap second according to the simulation time.	`[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:LEAP:SYNC` on page 71
"Current Leap Seconds (Ref. 1980)"	Displays the currently used leap second.	`[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:LEAP:SEConds` on page 70

UTC-UTC(SU)

(for GLONASS satellites)

The Universal Time Coordinate (UTC) as used for GPS and Galileo can have a phase shift and a frequency drift compared to the Russian UTC basis (UTC(SU)). These settings are provided for configuration of the UTC differences UTC - UTC(SU) as transmitted by GLONASS satellites.

Parameter	Description	SCPI Command
"UTC(SU) Reference Date"	Indicates the UTC-UTC (SU) time conversion reference date.	`[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:DATE?` on page 69
"A_0"	Constant term of polynomial A_0 (virtual)	`[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:AZERo` on page 69
"A_1"	1st order term of polynomial, A_1 (virtual)	`[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:AONE` on page 69

The Glonass satellites transmit the offset between GPS and GLONASS system time as part of their navigation message. They assume only a delay and no frequency drift. The time offset is calculated as following:

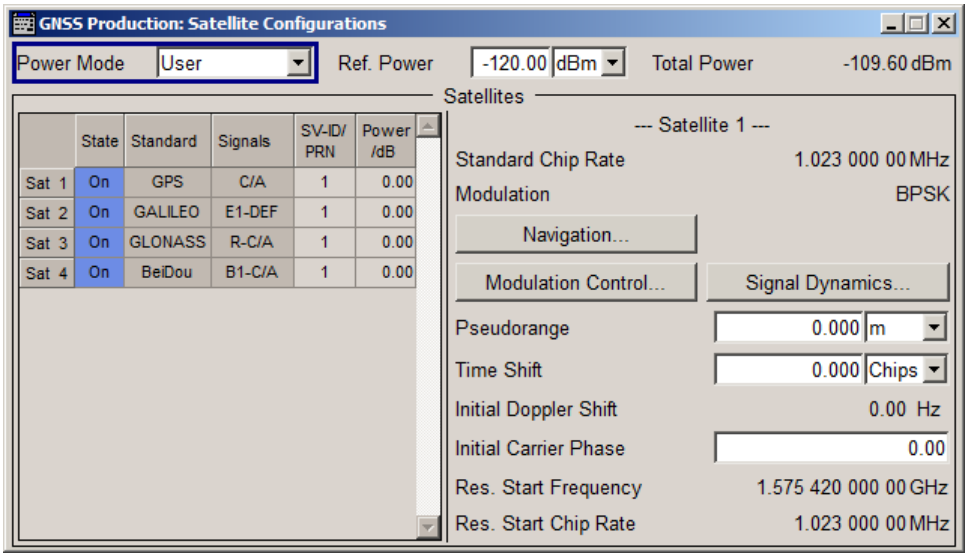
```
GPS – GLONASS = "GPS – UTC" + "UTC – UTC(SU)" – "GLONASS –
(UTC(SU) + 3h)" – 3h
```

For hybrid GNSS configuration with activated GLONASS satellites, this GPS – GLONASS time offset is maintained constant. This is done by automatically adjusting the "GPS-UTC" drift parameters ("A_1","T_ot" and "WN_ot") while changing the "UTC – UTC(SU)" parameters.

4.4 Satellite Configuration Settings

Access:

1. Select "Baseband block > Satellite Navigation > GNSS Production".
2. Select "Satellite Configuration".



In the "Satellite Configuration" dialog, you can activate and configure the signal simulation of the satellites, and configure the modulation control and signal dynamics.

4.4.1 Power Configuration

This section comprises the power control settings providing flexible real time configuration of the power settings per satellite. The power levels of the satellites are calculated as follows:

Absolute $Power_{Sat\#\_Signal}$ = Ref. Power + Relative $Power_{Sat\#\_Signal}$

The total power of the generated GNSS signal is displayed with the parameter Total Power.

Power Mode....28
Reference Power....28
Total Power....28

Power Mode
Indicates that the power calculation is based on user-defined settings.

Remote command:
`[:SOURce<hw>]:BB:GNPR:POWer:MODE` on page 80

Reference Power
Sets the power level that is used as a reference for the calculation of the power level of the satellites.

Remote command:
`[:SOURce<hw>]:BB:GNPR:POWer:REFerence[:POWer]` on page 80

Total Power
By enabled signal generation, displays the total power of the generated GNSS signal at a moment of time. The total power is a real time parameter that follows the real time changes in the absolute power levels of all active satellites.

Remote command:
`[:SOURce<hw>]:BB:GNPR:POWer:TOTal?` on page 81

4.4.2 Configuration of the Satellite Constellation

This section comprises the setting of the satellites constellation and the individual settings of each enabled satellite.

Maximum Number of Satellites....28
Constellation Table....28
└ Satellite State....29
└ Standard....29
└ Signals....29
└ SV-ID/PRN....29
└ Power....29

Maximum Number of Satellites
Displays the number of the 4 satellites that can be simulated.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite:COUNt?` on page 71

Constellation Table
Comprises the setting of the satellites constellation.

Satellite State ← Constellation Table
Activates/deactivates the satellite.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:STATe on page 75

Standard ← Constellation Table
Indicates the navigation standard the corresponding satellite belongs to.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:STANdard? on page 75

Signals ← Constellation Table
Selects the type of signal the corresponding satellite is using.

Table 4-2: Overview of the supported signals

Band	Entry Point	Standard	Signal
L1/E1	GPS	GPS	C/A
	Galileo	Galileo	E1-DEF
	GLONASS	GLONASS	R-C/A
	BeiDou	BeiDou	B-C/A

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SIGNal? on page 75

SV-ID/PRN ← Constellation Table
Enters the Space Vehicle ID (SV-ID) or Pseudo-Random Noise (PRN) of the satellite to be simulated. This value is used to generate the corresponding spreading code.

Note: The SV IDs of the GLONASS satellites are with 64 smaller than their PRN number, e.g to GLONASS satellite R5 corresponds PRN=69.

If "Real Navigation Data" is used, you can select healthy satellites from the almanac records; otherwise, any ID can be selected.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SVID on page 71

Power ← Constellation Table
Power offset of a satellite.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:POWer on page 74

4.4.3 Individual Satellite Settings

Comprises the settings of the selected satellite.

The values displayed in this section are the initial values of the parameters. The initial values are calculated at the beginning of the simulation or at the time the specific satellite is activated.

Standard Chip Rate....30
Frequency Number....30
Orbit Type....30
Modulation....30
Navigation....31
Modulation Control....31
Signal Dynamics....31
Initial Code Phase....31
Pseudorange....31
Time Shift/ chips....31
Initial Doppler Shift....31
Initial Carrier Phase....31
Resulting Start Frequency....32
Resulting Start Chip Rate....32

Standard Chip Rate
Displays the chip rate.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:SCRate?` on page 74

Frequency Number
(enabled for GLONASS satellites)

Frequency number indicates the subcarrier used to modulate the GLONASS satellite.

If you use "Data Source > Real Navigation Data", the frequency number is retrieved from the selected almanac file. If you use arbitrary data, the frequency number is configurable.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:FNUMber` on page 73

Orbit Type
(enabled for BeiDou satellites)

Indicates the orbit type the BeiDou satellite is using. The BeiDou global satellite navigation system uses a constellation of 35 satellites with following orbits:

"GEO"	Five geostationary orbit satellites with "SV-ID = 1 to 5"
"MEO"	27 middle earth orbits global satellites
"IGSO"	3 Inclined Geosynchronous Satellite Orbit regional satellites, visible only in China and Australia

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:ORBit?` on page 74

Modulation
Displays the modulation used for modulating the carrier signal.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MODulation? on page 73

Navigation...
Accesses the dialog for configuring the parameters of the navigation message.

Chapter 4.5, "Navigation Message Configuration", on page 37

Modulation Control
Accesses the Chapter 4.4.4, "Modulation Control", on page 32 dialog for enabling / disabling particular signal components.

Signal Dynamics
Accesses the Chapter 4.4.5, "Signal Dynamics", on page 34 dialog for configuring Doppler signal profiles.

Initial Code Phase
(enabled only in "Static" mode and for arbitrary navigation data source)

Sets the initial code phase.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:CPHase on page 73

Pseudorange
Displays the propagation delay from satellite to receiver in meters that is calculated as follows:

`Pseudorange = Time Shift * c / Standard Chip Rate`, where `c` is the speed of light.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:PRANge on page 74

Time Shift/ chips
Displays the propagation delay from satellite to receiver. The time shift is displayed in chips.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:TSHift on page 75

Initial Doppler Shift
Displays the **initial** Doppler shift, **at the beginning of the simulation**.

The value is set with the corresponding parameter in the Signal Dynamics dialog.

The instrument calculates also the variations in the chip rate of the code. Current values of the Doppler shifted carrier frequency and chip rate are displayed as:
- Resulting Start Frequency
- Resulting Start Chip Rate

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:DSHift on page 72

Initial Carrier Phase
Displays the initial carrier phase.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:ICPHase on page 73

Resulting Start Frequency
Indicates the currently valid values for Doppler shifted carrier frequency.

The resulting frequency is calculated according to the following:

- GPS, Galileo, BeiDou
  $f_{resulting} = f_{band} + f_{Doppler}$,
  Where f_{band} is set with parameter RF Band.
- Glonass
  $f_{band\_L1} = 1602$ MHz, $f_{band\_L2} = 1247$ MHz
  k = frequency number
  $f_{Glo\_L1\_resulting}$, MHz = $1602 + (k * 0.5625) + f_{Doppler}$
  $f_{Glo\_L2\_resulting}$, MHz = $1247 + (k * 0.4375) + f_{Doppler}$

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:FREQuency? on page 73

Resulting Start Chip Rate
Indicates the currently valid values for the chip rate. The relevant change to the chip rate is carried out automatically if the Doppler shift is changed.

The resulting chip rate is calculated according to the following:

- GPS, Galileo, BeiDou
  $f_{resulting} = f_{code} * \{1 + f_{Doppler} / f_{band}\}$,
  Where f_{band} is set with parameter RF Band,
  $f_{code\_GPS/Galileo} = 1.023$ MHz and $f_{code\_BeiDou} = 2.046$ MHz
- Glonass on L1/E1 band
  $f_{resulting} = f_{code} * \{1 + f_{Doppler} / [f_{band} + k * 562500 (Hz)]\}$
- Glonass on L2 band
  $f_{resulting} = f_{code} * \{1 + f_{Doppler} /[f_{band} + k * 437500 (Hz)]\}$

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:CACRate? on page 72

4.4.4 Modulation Control

In the "Modulation Control" dialog, you can enable or disable the signal components for the production tests individually. The components are denoted in a block diagram, which varies according to the selected satellite signal.

The R&S SMBV provides this feature for user defined test scenarios in static mode.

To access these settings:

1. Select "Baseband block > Satellite Navigation > GNSS Production..".
2. Select "Satellite Configuration > Satellite Table > e.g. Sat 3 > GLONASS".

3. Select "Modulation Control".

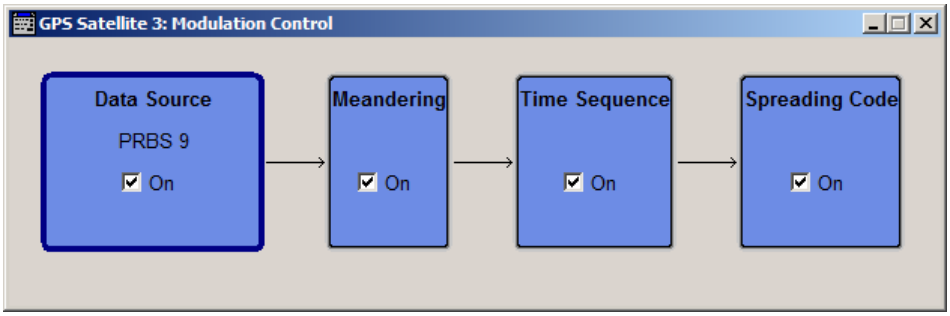


Figure 4-1: Example: GLONASS modulation control diagram

The dialog shows the signal components of the satellite navigation signal as functional blocks, representing the modulation scheme and the channels used.

Modulation Control
Enables you to turn off data or modulation signal components of the satellite navigation signals individually.

"Data Source" Signal data component, selected under "Data Source" on page 21. When disabled, you can evaluate the pure modulation signal.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:DATA<ch>[:STATe]` on page 76

"Spreading Code"
Modulation signal component. When disabled the pure navigation data is used.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:SPReading<ch>[:STATe]` on page 77

"Meandering" Doubles the default data rate of 50 Hz of GLONASS signals automatically.
If disabled, you can set the value manually in the "Data Source" block.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:MEANdering[:STATe]` on page 76
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:DRATe` on page 76

"Time Sequence"
Time signal component of GLONASS signals.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:TSEQuence[:STATe]` on page 77

"Secondary Code"
Data signal component in the pilot channel of Galileo or BeiDou signals.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:SECondary<ch>[:STATe]` on page 76

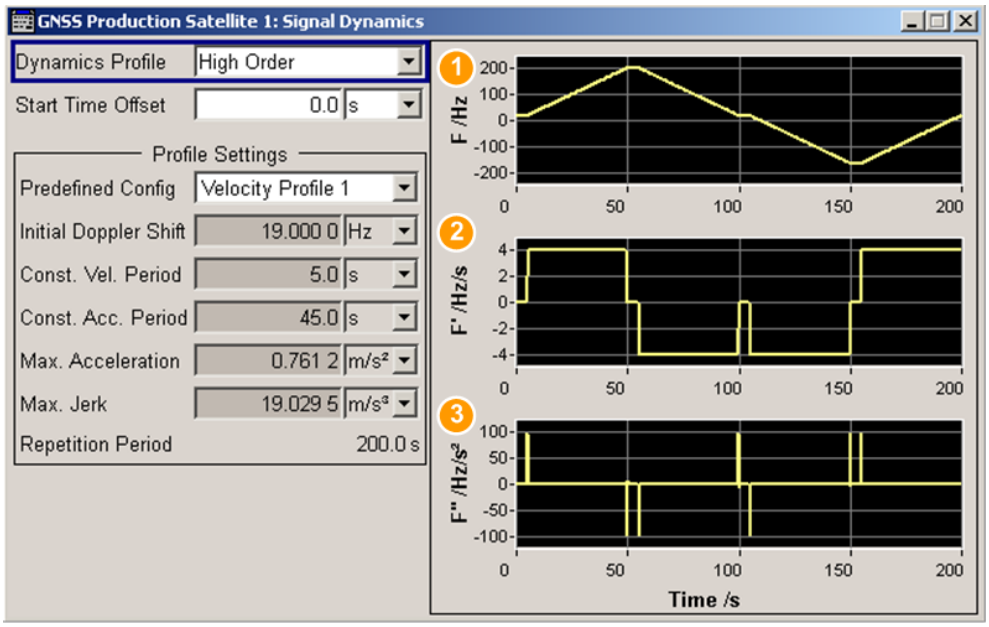
4.4.5 Signal Dynamics

Signal dynamics enables you to configure the signal dynamics. It is especially designed for testing the receiver sensitivity under varying signal dynamics. You can select a predefined or constant Doppler profile, or define a user-specific Doppler profile.

The R&S SMBV provides this feature for user defined test scenarios in static mode.

To access these settings:

1. Select "Baseband block > Satellite Navigation > GNSS Production..".
2. Select "Satellite Configuration > Satellite Table > e.g. Sat 3 > GPS".
3. Select "Signal Dynamics".



1 = Velocity (rate of position change over time)
2 = Acceleration (rate of velocity change over time)
3 = Jerk (rate of acceleration change over time)

The dialog contains the parameters required to define a profile of a Doppler signal, and shows the selected settings graphically.

Dynamics Profile
Selects a Doppler profile.

"Constant" Generates a constant signal with definable Doppler shift, see Constant profile settings.

"High Order" Enables Doppler profiles with higher dynamics.
There are two predefined profiles, or you can define a specific profile, see High-order profile settings.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:PROFile` on page 79

Constant profile settings
The constant Doppler profile is defined with:

Doppler Shift Unit ← Constant profile settings
With Dynamics Profile > "Constant", selects the unit of the parameter Doppler Shift (Constant).

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:DSHift:UNIT` on page 79

Doppler Shift (Constant) ← Constant profile settings
Sets the Doppler shift for a constant signal profile.

The simulation of Doppler-shifted signals can be used to check the receiver characteristics under more realistic conditions than with zero Doppler.

The value of the parameter "Satellite Configuration" > Initial Doppler Shift is set automatically.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:DSHift` on page 78

High-order profile settings
The Doppler profiles with higher dynamics are defined with:

Start Time Offset ← High-order profile settings
Sets a time delay before the generation of the Doppler signal starts.

This parameter is enabled for Dynamics Profile > "High Order".

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:TOFFset` on page 80

Predefined Config. ← High-order profile settings
Selects between the predefined high-order Doppler profiles or a user-defined one.

"Velocity Profile 1, 2"
Generates a Doppler signal using the settings of one of the predefined Doppler profiles.

"User Dynamics"
Generates a Doppler signal with user-defined parameters.
The profile parameters are configurable.

Remote command:
`[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CONFig` on page 78

Initial Doppler Shift ← High-order profile settings
Displays the Doppler shift set for predefined high-order profile.

Select Predefined Config. > "User Dynamics" to change the value.

The value of the parameter "Satellite Configuration" > Initial Doppler Shift is set automatically.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:IDSHift on page 79

Const. Vel. Period ← High-order profile settings
Displays the constant velocity duration of a predefined high-order velocity profile, that is the period where acceleration is assumed to be 0

Select Predefined Config. > "User Dynamics" to change the value.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CVPeriod on page 78

Const. Acc. Period ← High-order profile settings
Displays the constant acceleration duration of a predefined high-order velocity profile.

Select Predefined Config. > "User Dynamics" to change the value.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CAPeriod on page 78

Max. Acceleration ← High-order profile settings
Displays the maximum acceleration of a predefined high-order velocity profile.

Select Predefined Config. > "User Dynamics" to change the value.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:ACCel:MAX
on page 77

Max. Jerk ← High-order profile settings
Displays the maximum jerk of a predefined high-order velocity profile, with respect to time.

Select Predefined Config. > "User Dynamics" to change the value.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:JERK:MAX on page 79

Repetition Period ← High-order profile settings
Displays the time that elapses until the Doppler signal of a predefined high-order velocity profile repeats.

Remote command:
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:RPERiod? on page 80

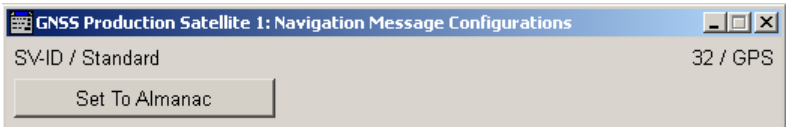
4.5 Navigation Message Configuration

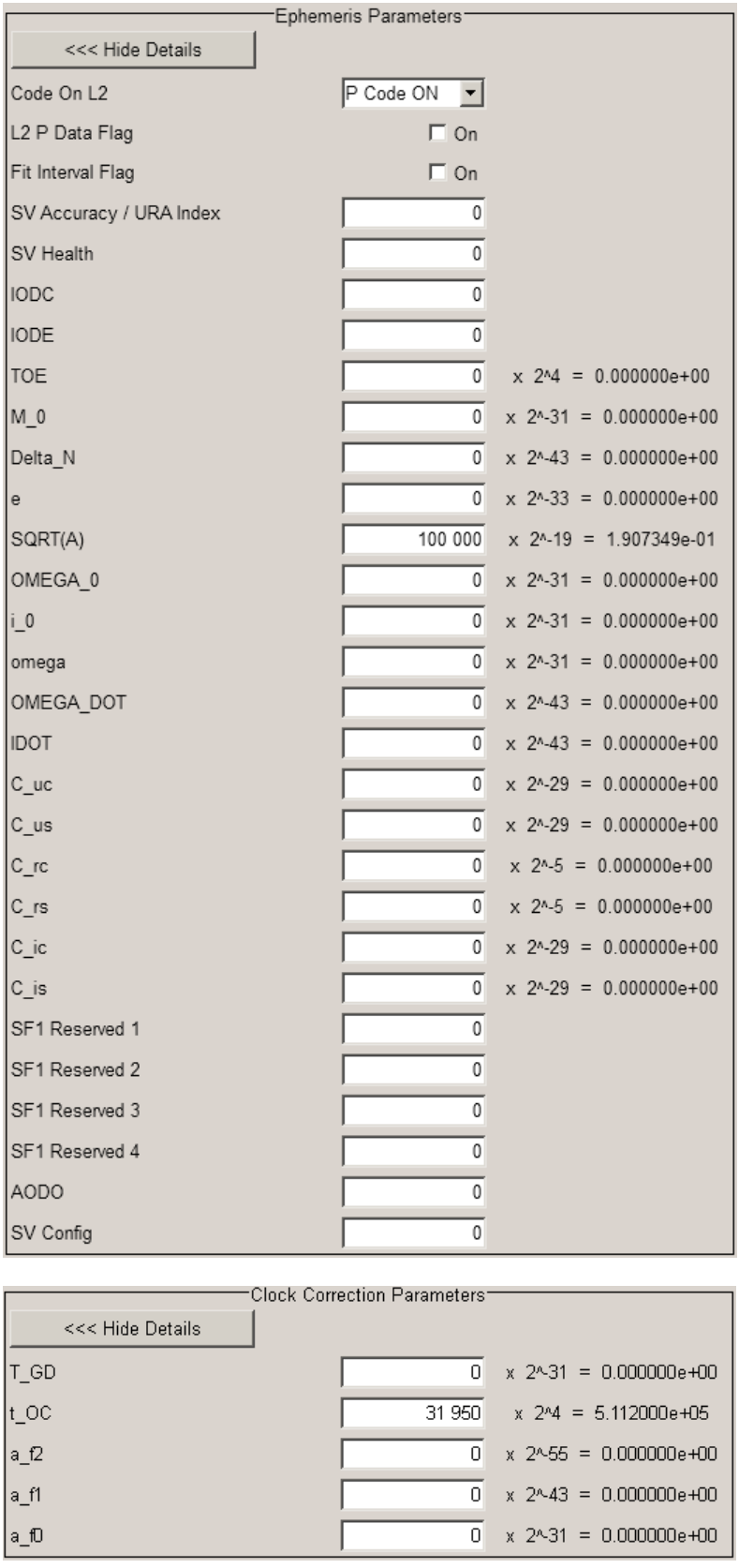
To access these settings:

1. Select "Baseband block > Satellite Navigation > GNSS Production...".
2. Select "GNSS Production > Navigation Data > Data Source > Real Navigation Data"
3. Select "Satellite Configuration > Satellite Table > e.g. Sat 1 > GPS" and select "Navigation... ".

   Although the navigation messages are fully configurable, it is recommended to use the almanac's parameter as basis for further configurations.
4. Select "Set To Almanac" on page 39.

   For better readability of the parameters in the "Navigation Message Configurations" dialog, the corresponding values are input as integer in the same way as they are included in the satellite's navigation message, but the scaled values and the scaling factors are also displayed. Different scaling factors may apply for the same parameters in the different GNSS standards.




Ephemeris Parameters
<<< Hide Details
Code On L2
P Code ON
L2 P Data Flag
On
Fit Interval Flag
On
SV Accuracy / URA Index 0
SV Health 0
IODC 0
IODE 0
TOE 0 x 2^4 = 0.000000e+00
M_0 0 x 2^-31 = 0.000000e+00
Delta_N 0 x 2^-43 = 0.000000e+00
e 0 x 2^-33 = 0.000000e+00
SQRT(A) 100 000 x 2^-19 = 1.907349e-01
OMEGA_0 0 x 2^-31 = 0.000000e+00
i_0 0 x 2^-31 = 0.000000e+00
omega 0 x 2^-31 = 0.000000e+00
OMEGA_DOT 0 x 2^-43 = 0.000000e+00
IDOT 0 x 2^-43 = 0.000000e+00
C_uc 0 x 2^-29 = 0.000000e+00
C_us 0 x 2^-29 = 0.000000e+00
C_rc 0 x 2^-5 = 0.000000e+00
C_rs 0 x 2^-5 = 0.000000e+00
C_ic 0 x 2^-29 = 0.000000e+00
C_is 0 x 2^-29 = 0.000000e+00
SF1 Reserved 1 0
SF1 Reserved 2 0
SF1 Reserved 3 0
SF1 Reserved 4 0
AODO 0
SV Config 0
Clock Correction Parameters
<<< Hide Details
T_GD 0 x 2^-31 = 0.000000e+00
t_OC 31 950 x 2^4 = 5.112000e+05
a_f2 0 x 2^-55 = 0.000000e+00
a_f1 0 x 2^-43 = 0.000000e+00
a_f0 0 x 2^-31 = 0.000000e+00

The provided parameters depend on the GNSS standard the satellite belongs to.

SV-ID / Standard....39
Set To Almanac....39
GPS, Galileo and BeiDou Common Ephemeris Parameters....39
GPS, BeiDou Ephemeris Parameters....40
GPS Ephemeris Parameters....41
Galileo Ephemeris Parameters....41
GPS, BeiDou Clock Correction Parameters....42
GLONASS Ephemeris Parameters....42
GLONASS Clock Correction Parameters....45
Galileo INAV Parameters....45
Galileo FNAV Parameters....46

SV-ID / Standard
Displays the SV ID and the navigation standard the navigation message is related to.

Remote command:
n.a.

Set To Almanac
The navigation message's parameters will be calculated according to the selected almanac.

Using this option as basis for further reconfiguration is recommended.

Remote command:
`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:PRESet` on page 84

GPS, Galileo and BeiDou Common Ephemeris Parameters
The ephemeris parameters correspond to the SV ID and navigation standard displayed with the parameter SV-ID / Standard.

Table 4-3: Common Ephemeris Parameters

Parameter	Description	SCPI command
M_0	Mean Anomaly at Reference Time	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:MZERo` on page 90
Delta_N	Mean Motion Difference From Computed Value	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:NDELta` on page 91
e	Eccentricity	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:ECCentricity` on page 88
SQRT(A)	Square Root of the Semi-Major Axis	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:SQRA` on page 92
OMEGA_0	Longitude of Ascending Node of Orbit Plane at Weekly Epoch (1)	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:OZERo` on page 92

Parameter	Description	SCPI command
i_0	Inclination Angle at Reference Time	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IZERo on page 90
Omega	Argument of Perigee	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:OMEGa on page 91
OMEGA_DOT	Rate of Right Ascension	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:ODOT on page 91
IDOT	Rate of Inclination Angle	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IDOT on page 88
C_uc	Amplitude of the Cosine Harmonic Correction Term to the Argument of Latitude	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CUC on page 87
C_us	Amplitude of the Sine Harmonic Correction Term to the Argument of Latitude	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CUS on page 87
C_rc	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CRC on page 86
C_rs	Amplitude of the Sine Harmonic Correction Term to the Orbit Radius	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CRS on page 87
C_ic	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CIC on page 85
C_is	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CIS on page 86
TOE	Time Of Ephemeris	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:TOE on page 93

GPS, BeiDou Ephemeris Parameters

The ephemeris parameters correspond to the SV ID and navigation standard displayed with the parameter SV-ID / Standard.

Table 4-4: GPS, QZSS and BeiDou Ephemeris Parameters

Parameter	Description	SCPI command
SV accuracy / URA Index		[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:URA on page 93
SV Health	This value does not have an impact on the actual health status of the generated satellite.	[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:HEALth on page 88

Parameter	Description	SCPI command
IODC (GPS) AODC (BeiDou)	Issue of Data, Clock Age Of Data Clock	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IODC` on page 89
IODE (GPS) AODE (BeiDOu)	Issue of Data, Ephemeris Age Of Data Ephemeris	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IODE` on page 89

GPS Ephemeris Parameters

The ephemeris parameters correspond to the SV ID and navigation standard displayed with the parameter SV-ID / Standard.

Table 4-5: GPS Ephemeris Parameters

Parameter	Description	SCPI command
Code on L2	Type of code for L2; This value does not have any impact on the actual used ranging code of the generated satellite. The used "Ranging Code" is set in the "Satellite Configuration" menu. • "Reserved" Reserved for future use. • "P Code ON" Carrier L2 (f_L2= 1.2276 GHz) is modulated by P-code (BPSK). • "C/A Code ON" Carrier L2 (f_L2= 1.2276 GHz) is modulated by C/A-code (BPSK).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CLTMode` on page 86
L2 P Data Flag	Use of carrier L2 P data flag This value does not have an impact on whether really data is transmitted on the satellite's carrier L2 or not.	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:LTPData` on page 90
Fit Interval Flag	Indicates the curve-fit interval used by the CS (Control Segment) in determining the ephemeris parameters	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:FIFLag` on page 88
SF1 Reserved 1/2/3/4		`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SF1Reserved<gr>` on page 92
AODO	Age of Data Offset	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:AODO` on page 85
SV Configurations		`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SVConfig` on page 93

Galileo Ephemeris Parameters

Comprises the Galileo specific ephemeris parameters.

Table 4-6: Galileo Specific Ephemeris Parameters

Parameter	Description	SCPI command
SISA	Signal In Space Accuracy	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:SISA` on page 92
IODnav	Issue Of Data (Ephemeris and Clock correction)	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IODNav` on page 89
IODa	Issue Of Data (Almanacs)	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IODA` on page 89

GPS, BeiDou Clock Correction Parameters

The ephemeris parameters correspond to the SV ID and navigation standard displayed with the parameter SV-ID / Standard.

Table 4-7: GPS and BeiDou Clock Correction Parameters

Parameter	Description	SCPI command
T_GD	L1-L2 Correction Term	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:TGD` on page 85
t_OC a_f2 a_f1 a_f0	Clock Correction Parameter	`[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:TOC` on page 85 `[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:AF<gr0>` on page 84

GLONASS Ephemeris Parameters

Comprises the GLONASS specific ephemeris parameters.

Table 4-8: GLONASS Specific Ephemeris Parameters

Parameter	Description	SCPI command
Satellite Ephemeris Type (M)	Satellite ephemeris types GLONASS, GLONASS-M	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:SEType` on page 98
SV accuracy / URA Index (F_T)	Provides the predicted satellite user range accuracy (URA).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:URA` on page 93
SV Health (B_n,1_n)	A health value. The user navigation equipment analyzes only the MSB of this word. • B_n[3] = 1_n = 1 Satellite not healthy • B_n[3] = 1_n = 0 Satellite is healthy	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:HEALth` on page 88

Parameter	Description	SCPI command
Age of Ephemeris Page (P1)	Time interval between 2 adjacent values of TOE. It defines hence the age of the current Glonass Ephemeris page. This parameter maps to the P1 parameter in the navigation message as follows: • 01 Age of Ephemeris = 30 min • 10 Age of Ephemeris = 45 min • 11 Age of Ephemeris = 60 min **Note:** Tb-Interval and TOE displays depend on this value.	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:AOEP` on page 97
Tb-Index	Index of the Tb-time interval. Time of Ephemeris (TOE) corresponds to this value multiplied by 15 minutes. This value is actually a scaled TOE value with a unit of 15 minutes. **Note:** Tb-Interval and TOE displays depend on this value. Condition to be always met: • (Tb-Index – 1) should be an integer multiple of `(Age of Ephemeris[min]/15)` • Case 1: Age of Ephemeris = 30 min Tb-Index = 1, 3, 5... 95 • Case 2: Age of Ephemeris=45 min Tb-Index = 1, 4, 7... 94 • Case 3: Age of Ephemeris = 60 min Tb-Index = 1, 5, 9... 93	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TINDex` on page 98
Tb-Alignment (P2)	Configures TOE to be aligned to an even or odd scale of 15 min for "Age of Ephemeris" = 30 or 60 min. Forced to "1", hence odd in case of Age of Ephemeris = 45 min **Note:** All Ephemeris pages of an SVID have the same Tb alignment (P2). The **Tb-Interval** and **TOE** parameters depend on this value.	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TALignment` on page 98
Tb-Interval	Displays the Tb-Interval in the current day where the Ephemeris set page is valid. `Tb-Interval = [((Tb - 1 + P2) * 15 * 60) -AgeOfEphemeris / 2` Examples: • tb = 45, P2 = 1 and Age of Eph = 30 Tb-Interval = [11:00:00 11:30:00] • tb = 45, P2 = 1 and Age of Eph = 45 Tb-Interval = [10:52:30 11:37:30] • tb = 45, P2 = 0 and Age of Eph = 60 Tb-Interval=[10:30:00 11:30:00]	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TINTerval?` on page 98

Parameter	Description	SCPI command
TOE (tb)	Displays the time of Ephemeris in the current day. Also referred to in the standard as the middle of the Tb-Interval or tb. This parameter is equivalent to `DayTime[(Tb - 1 + P2) * 15 * 60 seconds]` and independent of "Age of Ephemeris". Examples: • tb = 45, P2 = 1 • tb = 45, P2 = 1 • tb = 45, P2 = 0 TOE = 11:00:00	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TOE?` on page 99
p	Reliability measure of system time conversion parameters. • 00 TAU_C and TAU_GPS relayed from control segment. • 01 TAU_C from control segment; TAU_GPS calculated on board GLONASS-M satellite. • 10 TAU_C on board Glonass-M satellite and TAU_GPS relayed from CS. • 11 TAU_C and TAU_GPS calculated on board Glonass-M satellites.	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:P` on page 97
X_n	The OX **position** coordinate of the current satellite at TOE(tb), i.e. the middle of the Tb-Interval(1).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XN` on page 99
Y_n	The OY **position** coordinate of the current satellite at TOE(tb), i.e. the middle of Tb-Interval(1).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YN` on page 99
Z-n	The OZ **position** coordinate of the current satellite at TOE(tb), i.e. the middle of Tb-Interval(1).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZN` on page 99
XDOT_n	The OX **velocity** coordinate of the current satellite at TOE(tb), i.e. the middle of Tb-Interval(1).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XDN` on page 100
YDOT_n	The OY **velocity** coordinate of the current satellite at TOE(tb), i.e. the middle of Tb-Interval(1).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YDN` on page 100
ZDOT_n	The OZ **velocity** coordinate of the current satellite at TOE(tb), i.e. the middle of Tb-Interval(1).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZDN` on page 100
XDDOT_n	The OX **acceleration** coordinate of the current satellite due to solar and lunar gravitational effects at TOE(tb), i.e. the middle of Tb-Interval(1).	`[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XDDN` on page 99

Parameter	Description	SCPI command
YDDOT_n	The OY **acceleration** coordinate of the current satellite due to solar and lunar gravitational effects at TOE(tb), i.e. the middle of Tb-Interval(1).	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YDDN on page 99
ZDDOT_n	The OZ **acceleration** coordinate of the current satellite due to solar and lunar gravitational effects at TOE(tb), i.e. the middle of Tb-Interval(1).	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZDDN on page 99

1: The coordinates correspond to the PZ-90 coordinate system.

GLONASS Clock Correction Parameters

Comprises the GLONASS specific parameters for clock correction.

Table 4-9: GLONASS Clock Correction Parameters

Parameter	Description	SCPI command
TAU_n (-a_f0)	SV Clock bias correction coefficient	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:TAUN on page 97
GAMMA_n (a_f1)	SV Clock drift correction coefficient	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:GAMN on page 96
Delta_TAU_n	Time difference between navigation RF signal transmitted in L2 and navigation RF signal transmitted in L1 band	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:DTAU on page 96
E_n	Age of operation information	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:EN on page 96

Galileo INAV Parameters

Comprises the parameters of the Integrity navigation message I/NAV, provided by E5b and E1-B signals and supporting Safety of Life Service. The I/NAV message carries extended system integrity information.

Table 4-10: INAV Parameters

Parameter	Description	SCPI command
B_GD (E1-E5B)	E1-E5b Broadcast Group Delay BGD(E1,E5b)	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:BGD on page 94
T_OC (E1-E5B)	Clock correction data reference Time of Week t_{oC}(E1,E5b)	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:TOC on page 94
a_f2 (E1-E5B)	SV clock drift rate correction coefficient a_{f2}(E1,E5b)	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:AF<gr0> on page 94
a_f1 (E1-E5B)	SV clock drift correction coefficient a_{f1}(E1,E5b)	

Parameter	Description	SCPI command
a_f0 (E1-E5B)	SV clock bias correction coefficient a_{fo}(E1,E5b)	
E1B_DVS	Data Validity Satellite Status, transmitted on E1-B (E1-B_{DVS})	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E1BDVS on page 95
E5B_DVS	Data Validity Satellite Status, transmitted on E5b (E5b_{DVS})	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E5BDVS on page 95
E1B_HS	Signal Health Status for E1 (E1-B_{HS})	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E1BHS on page 95
E5B_HS	Signal Health Status for E5b (E5b_{HS})	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E5BHS on page 96

Galileo FNAV Parameters

Comprises the parameters of the freely accessible navigation message F/NAV, provided by the E5a signal for Open Service.

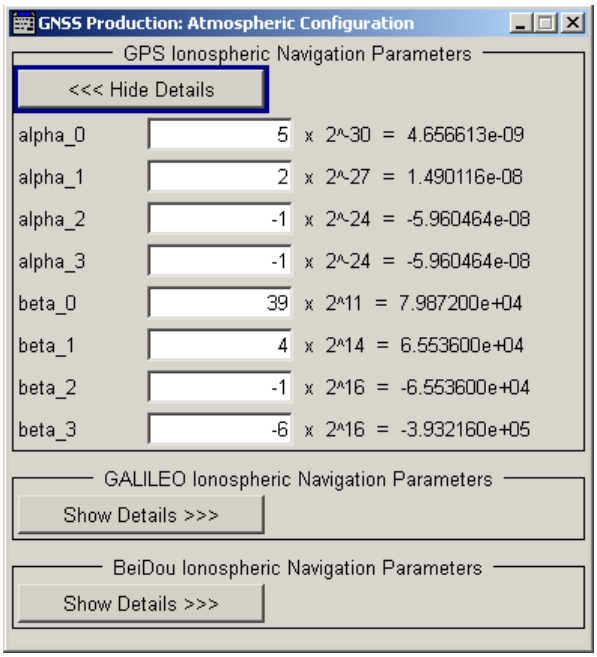
Table 4-11: FNAV Parameters

Parameter	Description	SCPI command
B_GD (E1-E5A)	E1-E5a Broadcast Group Delay BGD(E1,E5a)	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:BGD on page 94
T_OC (E1-E5A)	Clock correction data reference Time of Week t_{oC}(E1,E5a)	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:TOC on page 94
a_f2 .. a_f0 (E1-E5A)	SV clock drift rate correction coefficient cient a_{f2}, a_{f1} and a_{fo} (E1,E5a)	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:AF<gr0> on page 94
E5A_DVS	Data Validity Satellite Status, transmitted on E5a (E5a_{DVS})	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:E5ADVS on page 94
E5A_HS	Signal Health Status for E5a (E5a_{HS})	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:E5AHS on page 95
K	F-NAV Almanac Scheduling start index	[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:K on page 95

4.6 Atmospheric Configuration Settings

Access:

► Select "Main Dialog > Atmospheric Configuration".



The atmospheric configuration comprises the ionospheric navigation parameters, that are what the GNSS satellites are transmitting as ionospheric correction parameters.

- GPS, Galileo and BeiDou assume specific ionospheric models and hence transmit different atmospheric navigation parameters
- By the time this firmware had been developed, the ionospheric model for GLONASS is not yet specified and hence Glonass satellites transmit no data on the atmosphere.

BeiDou and GPS Ionospheric (Klobuchar) Navigation Parameters.....47
GALILEO Ionospheric Navigation Parameters.....48

BeiDou and GPS Ionospheric (Klobuchar) Navigation Parameters
The GPS and BeiDou Klobuchar ionospheric parameters includes the broadcast coefficients "alpha_0 to alpha_3" and "beta_0 to beta_3".

Remote command:
`[:SOURce<hw>]:BB:GNPR:ATMospheric:BEIDou:IONospheric:ALPHa<ch0>`
on page 100
`[:SOURce<hw>]:BB:GNPR:ATMospheric:BEIDou:IONospheric:BETA<ch0>`
on page 100

GALILEO Ionospheric Navigation Parameters
The GALILEO ionospheric model includes the broadcast coefficients a_{i0}, a_{i1} and a_{i2} used to compute the Effective Ionization Level Az and the Ionospheric Disturbance Flag, given for five different regions.

Remote command:
`[:SOURce<hw>]:BB:GNPR:ATMospheric:GALileo:IONospheric:AI<ch0>`
on page 101
`[:SOURce<hw>]:BB:GNPR:ATMospheric:GALileo:IONospheric:SF<ch>`
on page 101

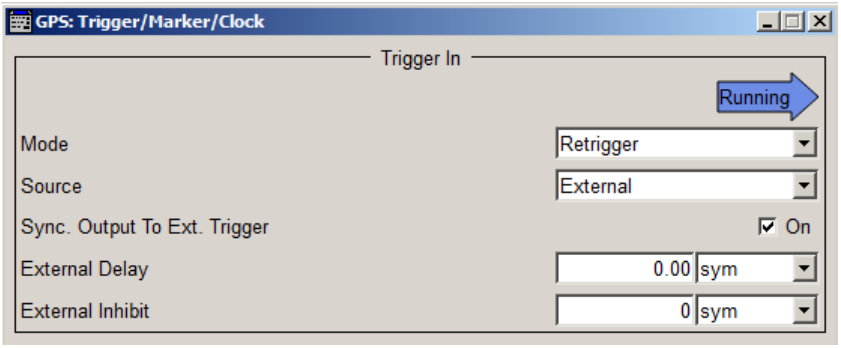
4.7 Trigger/Marker/Clock Settings

This dialog provides access to the settings necessary to select and configure the trigger, the marker output signal and the clock mode.

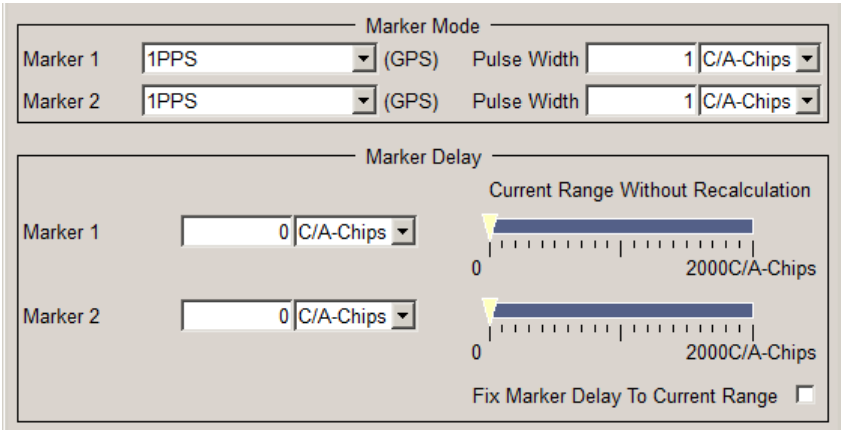
To access this dialog, perform one of the following:

1. Select "Main Dialog > Trigger/Marker".
2. Select "Main Dialog > Clock".

- In the "Trigger In" section, you can determine the settings of the trigger for the signal. The parameters provided vary according to the used trigger source. "Running" or "Stopped" indicates the status of signal generation.

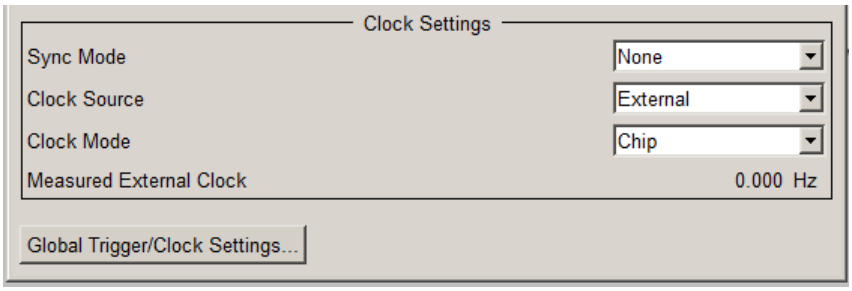


- The "Marker Mode" and "Marker Delay" sections contain the parameters for configuring the marker output signal.



You can define a marker delay either without restriction, or restricted to the current range, that means you can modify the settings without restarting signal and marker signal generation.

- In the "Clock Settings" section, you can set the clock parameters.



"Global Trigger/Clock Settings" provide access to dialogs for configuring general trigger, clock and mapping settings.

4.7.1 Trigger In

This section provides the parameters for configuring the trigger. The selected trigger source determines the associated parameters.

Trigger Mode....49
Signal Duration....50
Running/Stopped....50
Arm....50
Execute Trigger....50
Trigger Source....51
Sync. Output to External Trigger....51
External Delay....52
External Inhibit....52

Trigger Mode
Selects trigger mode, i.e. determines the effect of a trigger event 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.
  An "Arm" stops the signal generation. A subsequent trigger event (internal with 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.
  An "Arm" stops signal generation. A subsequent trigger event (internal with 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 or external) causes a restart.

Remote command:
`[:SOURce<hw>]:BB:GNPR[:TRIGger]:SEQuence` on page 103

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.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:SLENgth` on page 102

Running/Stopped
With enabled modulation, displays the status of signal generation for all trigger modes.

- "Running"
  The signal is generated; a trigger was (internally or externally) initiated in triggered mode.
- "Stopped"
  The signal is not generated and the instrument waits for a trigger event.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:RMODe?` on page 102

Arm
Stops the signal generation until subsequent trigger event occurs.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:ARM:EXECute` on page 101

Execute Trigger
For internal trigger source, executes trigger manually.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:EXECute` on page 101

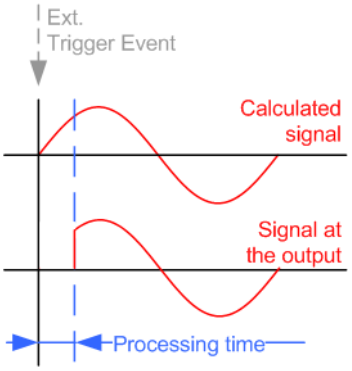
Trigger Source
Selects trigger source. This setting is effective when a trigger mode other than "Auto" has been selected.

- "Internal"
  The trigger event is executed by "Execute Trigger".
- "External"
  The trigger event is the active edge of an external trigger signal, supplied at the TRIGGER connector.
  Use the "Global Trigger/Clock Settings" dialog to define the polarity, the trigger threshold and the input impedance of the trigger signal.

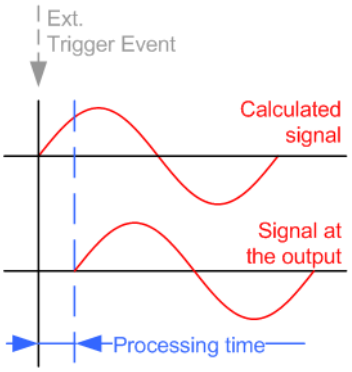
Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:SOURce` on page 102

Sync. Output to External Trigger
Enables signal output synchronous to the trigger event.

- "On"
  Corresponds to the default state of this parameter.
  The signal calculation starts simultaneously with the trigger event. Because of the processing time of the instrument, the first samples are cut off and no signal is output. 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. Signal output starts with sample 0. The complete signal is output.
  This mode is recommended for triggering of short signal sequences. Short sequences are sequences with signal duration comparable with the processing time of the instrument.



Remote command:
[:SOURce<hw>]:BB:GNPR:TRIGger:EXTernal:SYNChronize:OUTPut
on page 102

External Delay
Delays the trigger event of the signal from:
- The external trigger source

Use this setting to:
- Synchronize the instrument with the device under test (DUT) or other external devices

Remote command:
[:SOURce<hw>]:BB:GNPR:TRIGger[:EXTernal<ch>]:DELay on page 102

External Inhibit
Available on external triggering.

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

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

Remote command:
[:SOURce<hw>]:BB:GNPR:TRIGger[:EXTernal<ch>]:INHibit on page 103

4.7.2 Marker Settings

Provides the settings necessary to define the marker output signal for synchronizing external instruments.

Marker Mode 52
Marker x Delay 53

Marker Mode
Marker configuration for up to two marker channels. The settings are used to select the marker mode defining the shape and periodicity of the markers. The contents of the dialog change with the selected marker mode; the settings are self-explanatory.

"1PPS" A marker signal is generated for every start of second. The used timebase is displayed right to the field.
The "Pulse Width" is set in the corresponding field. The input is expressed as a number of chips.

"10PPS" A marker signal is generated ten times per second or once every 100 ms.

"1PP2S" A marker signal is generated for every second start of second. The used timebase is displayed right to the field.
The "Pulse Width" is set in the corresponding field. The input is expressed as a number of chips.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:WIDTh` on page 105

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

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:DIVider` on page 104
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:FREQuency?` on page 104

"Pattern" Generated is a marker signal that is defined by a bit pattern. The pattern has a maximum length of 32 bits.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PATTern` on page 104

"ON/OFF Ratio" Generated is a regular marker signal that is defined by an on/off ratio. One period lasts one on and off cycle.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:ONTime` on page 104
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:OFFTime` on page 104

"Trigger" A marker signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:MODE` on page 103

Marker x Delay
Defines the delay between the marker signal at the marker outputs relative to the signal generation start.

"Marker x" For the corresponding marker, sets the delay as a number of symbols.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay` on page 105

"Current Range without Recalculation"
Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and the signal.
Move the setting mark to define the delay.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay:MINimum?`
on page 105
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay:MAXimum?`
on page 105

"Fix marker delay to current range"
Restricts the marker delay setting range to the dynamic range.

Remote command:
`[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut:DELay:FIXed` on page 105

4.7.3 Clock Settings

Use the provided settings to set the clock source and a delay, if necessary.

Sync. Mode 54
Set Synchronization Settings 54
Clock Source 55
Clock Mode 55
Clock Multiplier 55
Measured External Clock 55

Sync. Mode
(for R&S SMBV only)

Selects the synchronization mode.

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

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

- "None"
  The instrument is working in standalone mode.
- "Sync. Master"
  The instrument provides all connected instruments with its synchronization and reference clock signal, also including the trigger signal.
- "Sync. Slave"
  The instrument receives the synchronization and reference clock signal from another instrument working in a master mode.

Remote command:
`[:SOURce<hw>]:BB:GNPR:CLOCk:SYNChronization:MODE` on page 107

Set Synchronization Settings
(for R&S SMBV only)

Adjusts the instrument's settings required for the selected synchronization mode.

Remote command:
[:SOURce<hw>]:BB:GNPR:CLOCk:SYNChronization:EXECute on page 106

Clock Source
Selects the clock source.

- "Internal"
  The instrument uses its internal clock reference.
- "External"
  The instrument expects an external clock reference at the CLOCK connector.
  The symbol rate must be correctly set to the accuracy specified in the data sheet.
  To change the polarity of the clock input, use the "Global Trigger/Clock Settings".

Remote command:
[:SOURce<hw>]:BB:GNPR:CLOCk:SOURce on page 106

Clock Mode
Enters the type of externally supplied clock.

- "Chip"
  A chip clock is supplied via the CLOCK connector.
- "Multiple"
  A multiple of the chip clock is supplied via the CLOCK connector; the symbol clock is derived internally from it.

Remote command:
[:SOURce<hw>]:BB:GNPR:CLOCk:MODE on page 106

Clock Multiplier
Enters the multiplication factor for clock type Multiple.

Remote command:
[:SOURce<hw>]:BB:GNPR:CLOCk:MULTiplier on page 106

Measured External Clock
Provided for permanent monitoring of the enabled and externally supplied clock signal.

Remote command:
CLOCk:INPut:FREQuency?

4.7.4 Global Settings

This section provides access general trigger, clock and mapping settings.

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

This dialog is to set the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

The parameters in this dialog affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the operating manual.

5 How to Generate a GNSS Signal for Receiver Tests with Varying Signal Dynamics and Modulation Control

The general workflow on Figure 5-1 shows the main configuration steps to be performed for almost all configuration tasks.

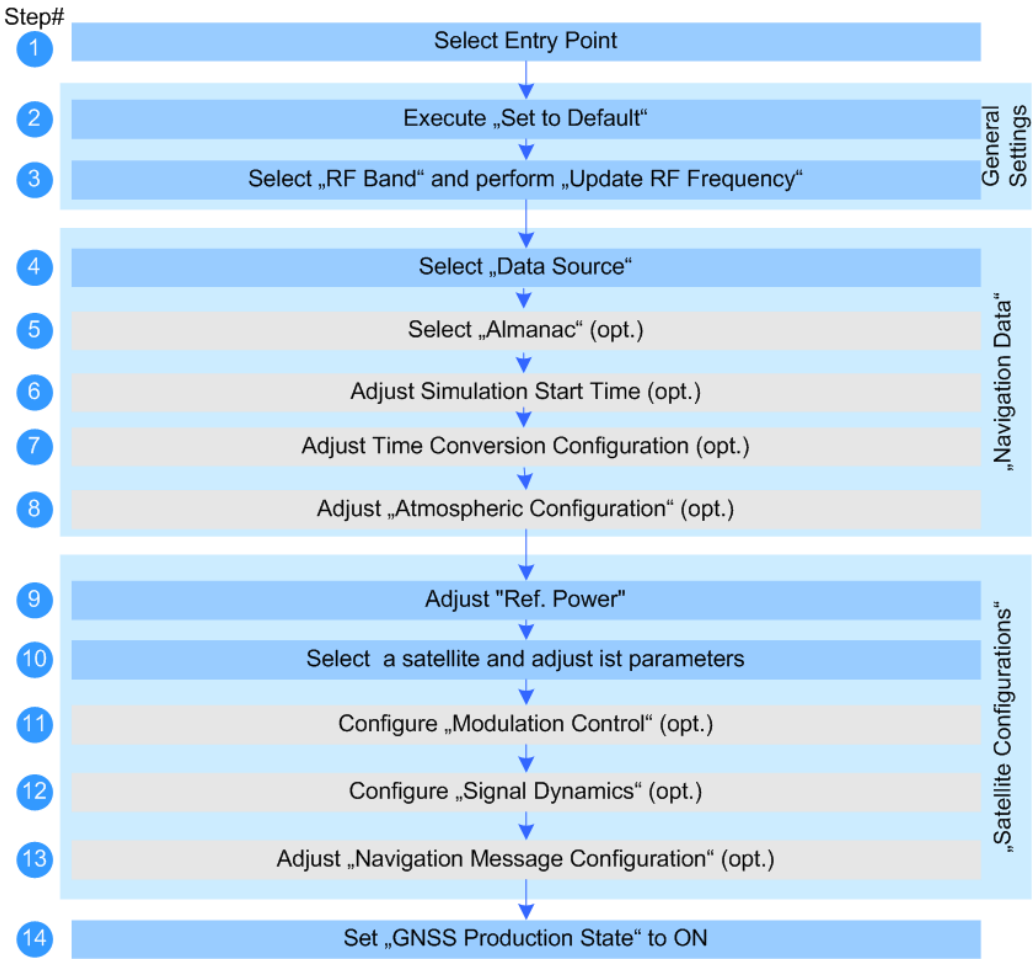


Figure 5-1: General workflow

This example describes how to configure a signal for testing the dynamic range of a receiver. It specifies a maximum dynamic range regarding speed, acceleration and jerk, and disables individual modulation components of the signal.

1. Select "Baseband > GNSS Production".
2. Select "Set to Default".
3. Select "Navigation Data > Data Source" and select e.g. **"Zero Navigation Data"**.
4. Adjust the simulation start time.

5. Select "Navigation Data > Time Conversion Configuration" and if required, change the settings.
6. Select "Navigation Data > Satellite Configuration" and:
   a) Set "Reference Power".
   b) Adjust the settings of each of the four satellites, e.g. set the "SV-ID", "Power", "State", etc.
   c) Select **"Modulation Control"** and **enable the individual modulation components of the satellites**.
   d) Select "Signal Dynamics" and configure the required dynamic Doppler profile.
7. Select "GNSS Production > State > ON".
8. If required, perform also the following:
   a) Select "Navigation Data > Data Source" and select "Real Navigation Data".
   b) Select "Navigation Data > Almanac" and if required, change the selected almanacs.
   c) Select "Navigation Data > Atmospheric Configurations" and if required, change the ionospheric navigation parameters.

   The generated GNSS signal is calculated according to the satellite configuration settings, the selected data source and the specified modulation scheme and dynamic Doppler profile.

6 Remote-Control Commands

The following commands are required to perform signal generation with the satellite navigation options in a remote environment. We assume that the R&S SMBV has already been set up for remote operation in a network as described in the R&S SMBV documentation. A knowlage about the remote control operation and the SCPI command syntax are assumed.

Conventions used in SCPI command descriptions

For a description of the conventions used in the remote command descriptions, see section "Remote Control Commands" in the R&S SMBV operating manual.

Placeholder <GNSS>

The placeholder `<GNSS>` is introduced to simplify the description of group of commands with similar syntax. Depending on the navigation standard to be controlled, replace this placeholder `<GNSS>` with `GPS`, `GALileo`, `GLONass` or `BEIDou`.

Example:

SCPI command: `[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:FILE`

- To set the almanac of a GPS satellite, replace the placeholder `<GNSS>` with `GPS`. Correct command syntax
  `SOURce:BB:GNPR:NAVigation:ALManac:GPS:FILE`.
- invalid command
  `SOURce:BB:GNPR:NAVigation:ALManac:<GNSS>:FILE`

Common Suffixes

The following common suffixes are used in remote commands:

Suffix	Value range	Description
`SOURce<hw>`	1	available baseband signals
`OUTPut<ch>`	1 .. 2	available markers
`EXTernal<ch>`	1	external trigger connector
`SVID<ch>`	1 .. 32 for GPS satellites 1 .. 50 for Galileo satellite 1 .. 24 for GLONASS satellites 1 .. 37 for BeiDou satellites	available SV IDs If almanacs are used, the SV ID must correspond to a healthy satellie!
`Satellite<st>`	1 .. 4	available satellites

The following commands specific to the satellite standards are described here:

- Primary Settings.....59
- Navigation Data.....61
- Almanac Configuration.....64

- Time Conversion Configuration....68
- Satellites Configuration and Satellites Signal Settings....71
- Modulation Control....76
- Signal Dyamics....77
- Power Settings....80
- Navigation Message Configuration....81
- Atmospheric Configuration....100
- Trigger Settings....101
- Marker Settings....103
- Clock Settings....106

6.1 Primary Settings

[:SOURce<hw>]:BB:GNPR:PRESet....59
[:SOURce<hw>]:BB:GNPR:STATe....59
[:SOURce<hw>]:BB:GNPR:RFBand....59
[:SOURce<hw>]:BB:GNPR:PRFFrequency....60
[:SOURce<hw>]:BB:GNPR:SETTing:CATalog?....60
[:SOURce<hw>]:BB:GNPR:SETTing:DELete....60
[:SOURce<hw>]:BB:GNPR:SETTing:LOAD....60
[:SOURce<hw>]:BB:GNPR:SETTing:STORe....61
[:SOURce<hw>]:BB:GNPR:SETTing:STORe:FAST....61

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

Sets the parameters of the digital standard to their default values (`*RST` values specified for the commands).

Not affected is the state set with the command `SOURce<hw>:BB:GNPR:STATe`.

Usage: Event

Manual operation: See "Set to default" on page 18

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

Enables/disables the GNSS signal simulation.

Parameters:

<State> 0 | 1 | OFF | ON

*RST: 0

Manual operation: See "State" on page 18

[:SOURce<hw>]:BB:GNPR:RFBand <RfBand>

Selects the RF band.

Parameters:
<RfBand> L1 | L2
*RST: L1

Manual operation: See "RF Band" on page 20

[:SOURce<hw>]:BB:GNPR:PRFFrequency

Sets the "Status Bar > Frequency" display to the resulting frequency.

Usage: Event

Manual operation: See "Update RF Frequency" on page 20

[:SOURce<hw>]:BB:GNPR:SETTing:CATalog?

Reads out the files with GNSS production settings in the default directory, set with the command `MMEM:CDIRectory`.

Listed are files with the file extension `*.gnss_prod`.

Usage: Query only

Manual operation: See "Save/Recall" on page 19

[:SOURce<hw>]:BB:GNPR:SETTing:DELete <Filename>

Deletes the selected file with GNSS settings.

Setting parameters:
<Filename> string

Usage: Setting only

Manual operation: See "Save/Recall" on page 19

[:SOURce<hw>]:BB:GNPR:SETTing:LOAD <Filename>

Loads the selected file with GNSS settings form the directory set with the command `MMEM:CDIRectory`. A path can also be specified, in which case files in the specified directory are read.

Loaded are files with the file extension `*.gnss_prod`.

Setting parameters:
<Filename> string

Usage: Setting only

Manual operation: See "Save/Recall" on page 19

[:SOURce<hw>]:BB:GNPR:SETTing:STORe <Filename>

Stores the current settings of the specified GNSS standard into the selected file. The directory is set using command `MMEM:CDIRectory`. Only the file name has to be entered; configurations are stored with the predefined file extensions.

Setting parameters:
<Filename> string

Usage: Setting only

Manual operation: See "Save/Recall" on page 19

[:SOURce<hw>]:BB:GNPR: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: 1

Manual operation: See "Save/Recall" on page 19

6.2 Navigation Data

[:SOURce<hw>]:BB:GNPR:NAVigation:DATA....61
[:SOURce<hw>]:BB:GNPR:NAVigation:DATA:DSELect....62
[:SOURce<hw>]:BB:GNPR:NAVigation:DATA:PATTern....62
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:DATE....62
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TBASis....63
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TIME....63
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TOWeek....63
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:WNUMber....64
[:SOURce<hw>]:BB:GNPR:LIST:SVID:BEIDou?....64
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GALileo?....64
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GLONass?....64
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GPS?....64

[:SOURce<hw>]:BB:GNPR:NAVigation:DATA <Data>

Determines the data source for the navigation information.

Parameters:

<Data> ZERO | ONE | PATTern | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | RNData | ZNData

*RST: RNData

Example: see `[:SOURce<hw>]:BB:GNPR:SATellite<st>:SVID`

Manual operation: See "Data Source" on page 21

[:SOURce<hw>]:BB:GNPR:NAVigation:DATA:DSELect <DSelect>

Selects a data list as data source.

Data lists are files with file extensions `*.dm_iqd` that are stored in a directory of the user's choice.

To set the default directory, use 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

Manual operation: See "Data Source" on page 21

[:SOURce<hw>]:BB:GNPR:NAVigation:DATA:PATTern <Pattern>

Determines the bit pattern for [:SOURce<hw>]:BB:GNPR:NAVigation:DATA PATTern.

Parameters:

<Pattern> 64 bit pattern

Example:
```
SOURce1:BB:GNPR:NAVigation:DATA PATTern
SOURce1:BB:GNPR:NAVigation:DATA:PATTern #H3F,8
```

Manual operation: See "Data Source" on page 21

[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:DATE <Year>, <Month>, <Day>

Defines the date for the simulation in `DD.MM.YYYY` format of the Gregorian calendar.

This setting is available for `[:SOURce<hw>]:BB:GNPR:NAVigation:DATA RNData|ZNData` and `[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TBASisUTC`.

Parameters:

<Year> integer

Range: 1980 to 9999

<Month> integer

Range: 1 to 12

<Day> integer

Range: 1 to 31

Manual operation: See "Simulation Start Time" on page 22

[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TBASis <SystemTime>

Determines the time basis used to enter the simulation start time.

Parameters:

<SystemTime> UTC | GPS

*RST: UTC

Manual operation: See "Simulation Start Time" on page 22

[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TIME <Hour>, <Minute>, <Second>

Defines the exact simulation start time in UTC time format.

This setting is available for `[:SOURce<hw>]:BB:GNPR:NAVigation:DATA RNData|ZNData` and `[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TBASisUTC`.

Parameters:

<Hour> integer

Range: 0 to 23

<Minute> integer

Range: 0 to 59

<Second> float

Range: 0 to 59.999
Increment: 0.001

Manual operation: See "Simulation Start Time" on page 22

[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TOWeek <TOW>

Defines the simulation start time within the defined week (see `[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:WNUMber`).

This setting is available for `[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TBASisGPS`.

Parameters:

<TOW> float

Range: 0 to 604799.999
Increment: 0.001
*RST: 0

Manual operation: See "Simulation Start Time" on page 22

[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:WNUMber <Week>

Enters the week number (WN) the navigation signal is generated for.

This setting is available for `[:SOURce<hw>]:BB:GNPR:NAVigation:DATA RNData|ZNData` and `[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TBASisGPS`.

Parameters:

<Week> integer

Range: 0 to 9999*53
*RST: 0

Manual operation: See "Simulation Start Time" on page 22

[:SOURce<hw>]:BB:GNPR:LIST:SVID:BEIDou?
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GALileo?
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GLONass?
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GPS?

Queries the list of valid satellites (SV IDs) of the selected almanac file for the navigation standard.

To select the file, use the command `[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:FILE`.

Example: see `[:SOURce<hw>]:BB:GNPR:SATellite<st>:SVID`

Usage: Query only

6.3 Almanac Configuration

[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:FILE....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:FILE....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:FILE....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GLONass:FILE....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:FILE....65
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:SPAN?....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:SPAN?....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:SPAN?....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:SPAN?....65
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:DATE:BEGIn....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:DATE:BEGin?....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:DATE:BEGin?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:DATE:BEGin?....66
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:DATE:END....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:DATE:END?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:DATE:END?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:DATE:END?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GLONass:TOAPplicability:DATE?....66

[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GLONass:TOAPplicability:TIME?..... 67
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:TOAPplicability:TOAWeek..... 67
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:TOAPplicability:TOWeek?..... 67
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:TOAPplicability:TOWeek?..... 67
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:TOAPplicability:TOWeek?..... 67
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:TOAPplicability:WNUMber..... 68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:TOAPplicability:WNUMber?..... 68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:TOAPplicability:WNUMber?..... 68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:TOAPplicability:WNUMber?..... 68
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:WNUMber..... 68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:WNUMber?..... 68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:WNUMber?..... 68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:WNUMber?..... 68

[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:FILE
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:FILE <Almanac>
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:FILE <Almanac>
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GLONass:FILE <Almanac>
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:FILE <Almanac>

Defines the almanac file for the navigation standard.

Parameters:

<Almanac> string

The file name is sufficient to select a predefined almanac file or almanacs in the default directory.
The complete file path with file name and extension is required to select almanac files stored elsewhere.

[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:SPAN?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:SPAN?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:SPAN?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:SPAN?

Queries the time span of the selected almanac file.

Return values:

<Span> <Start date and time> - <End date and time>

Almanac file span, where the start and end date and time strings follow the syntax `<DD.MM.YYYY HH:MM:SS>`

Example:

```
SOURce1:BB:GNPR:NAVigation:ALManac:GPS:SPAN?
// "16.02.2014 00:00:00 - 23.02.2014 23:59:59"
```

Usage: Query only

[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:DATE:BEGIn
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:DATE:BEGin?

[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:DATE:BEGin?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:DATE:BEGin?

Queries the start date of the week span of the selected almanac file for the navigation standard.

To select the file, use the command `[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:FILE`.

Return values:

<Year> integer
Range: 1980 to 9999

<Month> integer
Range: 1 to 12

<Day> integer
Range: 1 to 31

Usage: Query only

[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:DATE:END
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:DATE:END?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:DATE:END?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:DATE:END?

Queries the end date of the week span of the selected almanac file for the navigation standard.

To select the file, use the command `[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:FILE`.

Return values:

<Year> integer
Range: 1980 to 9999

<Month> integer
Range: 1 to 12

<Day> integer
Range: 1 to 31

Usage: Query only

[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GLONass:TOAPplicability:DATE?

Queries the date of applicability of the selected almanac file.

Return values:

<Year> integer
Range: 1996 to 9999

<Month> integer
Range: 1 to 12

<Day> integer
Range: 1 to 31

Usage: Query only

Manual operation: See "Almanac Configuration" on page 24

[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GLONass:TOAPplicability:TIME?

Queries the start time of applicability of the selected almanac file.

Return values:

<Hour> integer
Range: 0 to 23

<Minute> integer
Range: 0 to 59

<Second> float
Range: 0 to 59.999
Increment: 0.001

Usage: Query only

Manual operation: See "Almanac Configuration" on page 24

[SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:<GNSS>:TOAPplicability:TOAWeek
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:TOAPplicability:TOWeek?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:TOAPplicability:TOWeek?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:TOAPplicability:TOWeek?

Determines the Time of Week (TOW) the selected almanac is used for (time of applicability).

Return values:

<Tow> float
Range: 0 to 604799.999
Increment: 0.001
*RST: 0

Usage: Query only

[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:TOAPplicability:WNUMber
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:TOAPplicability:WNUMber?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:TOAPplicability:WNUMber?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:TOAPplicability:WNUMber?

Determines the Week Number for which the selected almanac is used for (time of applicability).

Return values:

<WN> integer

Range: 0 to 9999.0*53
*RST: 1488

Usage: Query only

[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:WNUMber
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:BEIDou:WNUMber?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GALileo:WNUMber?
[:SOURce<hw>]:BB:GNPR:NAVigation:ALManac:GPS:WNUMber?

Queries the week number of the selected almanac file for the navigation standard.

To select the file, use the command `[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:FILE`.

Return values:

<WeekNumber> integer

Range: 0 to 529947
*RST: 1488

Usage: Query only

6.4 Time Conversion Configuration

[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:DATE? 69
[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:AONE 69
[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:AZERo 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:AZERo 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:AZERo 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:AZERo 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:AZERo 70

[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:AZERo....70
[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:TOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:TOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:TOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:TOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:TOT....70
[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:WNOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:WNOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:WNOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:WNOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:WNOT....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:LEAP:SEConds....70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:LEAP:SYNC....71

[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:DATE?

Enters the date for the UTC-UTC(SU) data in DMS format.

Return values:

<Year> integer
Range: 1996 to 9999

<Month> integer
Range: 1 to 12

<Day> integer
Range: 1 to 31

Usage: Query only

Manual operation: See "UTC-UTC(SU)" on page 26

[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:AONE
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:AONE <A_1>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:AONE <AOne>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:AONE <AOne>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:AONE <AOne>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:AONE <AOne>

Sets the 1st order term of polynomial, A_1.

Parameters:

<AOne> integer
Range: -8388608 to 8388607
*RST: 0

[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:AZERo
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:AZERo <A_0>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:AZERo <AZero>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:AZERo <AZero>

[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:AZERo <AZero>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:AZERo <AZero>

Sets the constant term of polynomial, A_0.

Parameters:

<AZero> integer

Range: -2147483648 to 2147483647
*RST: 0

[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:TOT
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:TOT <Tot>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:TOT <Tot>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:TOT <Tot>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:TOT <Tot>

Sets the UTC data reference time of week, t_{ot}.

Parameters:

<Tot> integer

Range: 0 to 255
*RST: 0

[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:WNOT
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:WNOT <Wnot>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:WNOT <Wnot>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:WNOT <Wnot>
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:WNOT <Wnot>

Sets the UTC data reference week number, WN_t.

Parameters:

<Wnot> integer

Range: 0 to 255
*RST: 0

[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:LEAP:SEConds
<LeapSeconds>

Sets the currently used leap second.

Parameters:

<LeapSeconds> integer

Range: 0 to 50
*RST: 16

Manual operation: See "Leap Second Configuration" on page 26

[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:LEAP:SYNC

Synchronizes the leap second according to the simulation time.

Usage: Event

Manual operation: See "Leap Second Configuration" on page 26

6.5 Satellites Configuration and Satellites Signal Settings

[:SOURce<hw>]:BB:GNPR:SATellite:COUNt? 71
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SVID 71
[:SOURce<hw>]:BB:GNPR:SATellite<st>:CACRate? 72
[:SOURce<hw>]:BB:GNPR:SATellite<st>:DSHift 72
[:SOURce<hw>]:BB:GNPR:SATellite<st>:FNUMber 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:FREQuency? 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:CPHase 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:ICPHase 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MODulation? 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:ORBit? 74
[:SOURce<hw>]:BB:GNPR:SATellite<st>:POWer 74
[:SOURce<hw>]:BB:GNPR:SATellite<st>:PRANge 74
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SCRate? 74
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SIGNal? 75
[:SOURce<hw>]:BB:GNPR:SATellite<st>:STANdard? 75
[:SOURce<hw>]:BB:GNPR:SATellite<st>:STATe 75
[:SOURce<hw>]:BB:GNPR:SATellite<st>:TSHift 75

[:SOURce<hw>]:BB:GNPR:SATellite:COUNt?

Queries the number of satellites that can be simulated.

Return values:

<SatCount> integer

Range: 4 to 4
*RST: 4

Usage: Query only

Manual operation: See "Maximum Number of Satellites" on page 28

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SVID <Svid>

Defines the Space Vehicle ID of the satellite to be simulated. This value is used to generate the corresponding spreading code.

Parameters:

<Svid> integer

The available SV IDs depend on the data source:
for [:SOURce<hw>]:BB:GNPR:NAVigation:DATAZNData or arbitrary data, any ID can be selected, see "Common Suffixes" on page 58
for [:SOURce<hw>]:BB:GNPR:NAVigation:DATARNData, available are the valid IDs, as listed in the almanac;
use the command [:SOURce<hw>]:BB:GNPR:LIST:SVID:GPS? to query the list of the valid IDs.

Range: 1 to depends on the navigation standard
*RST: 1

Example:

```
SOURce1:BB:GNPR:NAVigation:DATA RNData
// SOURce1:BB:GNPR:NAVigation:ALManac:GPS:FILE?
SOURce1:BB:GNPR:LIST:SVID:GPS?
// 1,2,3,4,5,6,7,8,9,10, ... ,30,31,32
SOURce1:BB:GNPR:LIST:SVID:GALileo?
// 1,2,3,4,5,6,7,8,9,10, ...,28,29,30

SOURce1:BB:GNPR:NAVigation:DATA ZNData
SOURce1:BB:GNPR:LIST:SVID:GALileo?
// 1,2,3,4,5,6,7,8,9,10,...,46,47,48,49,50
```

Manual operation: See "SV-ID/PRN" on page 29

[:SOURce<hw>]:BB:GNPR:SATellite<st>:CACRate?

Queries the currently valid values for the chip rate.

Return values:

<CACRate> float

Usage: Query only

Manual operation: See "Resulting Start Chip Rate" on page 32

[:SOURce<hw>]:BB:GNPR:SATellite<st>:DSHift <DopplerShift>

Defines the Doppler shift of the simulated signal of the satellite.

Parameters:

<DopplerShift> float

Range: -100E3 to 100E3
Increment: 0.01
*RST: 0

Manual operation: See "Initial Doppler Shift" on page 31

[:SOURce<hw>]:BB:GNPR:SATellite<st>:FNUMber <FrequencyNumber>

Sets or queries the frequency number, depending on the used data source.

The parameter corresponds to the sub-carrier used to modulate the GLONASS satellite.

Parameters:

<FrequencyNumber> integer

Range: -7 to 24
*RST: 0

Manual operation: See "Frequency Number" on page 30

[:SOURce<hw>]:BB:GNPR:SATellite<st>:FREQuency?

Queries the currently valid values for Doppler-shifted carrier frequency.

Return values:

<Frequency> float

Usage: Query only

Manual operation: See "Resulting Start Frequency" on page 32

[:SOURce<hw>]:BB:GNPR:SATellite<st>:CPHase <Code>

Sets the initial code phase in chips while using arbitary navigation data source.

Parameters:

<Code> float

Range: 0 to 20459.99
Increment: 0.01
*RST: 0

Manual operation: See "Initial Code Phase" on page 31

[:SOURce<hw>]:BB:GNPR:SATellite<st>:ICPHase <ICPhase>

Sets the initial carrier phase.

Parameters:

<ICPhase> float

Range: 0 to 6.28
Increment: 0.01
*RST: 0

Manual operation: See "Initial Carrier Phase " on page 31

[:SOURce<hw>]:BB:GNPR:SATellite<st>:MODulation?

Defines the modulation used for modulating the carrier signal.

Return values:
<Modulation> BPSK | CBOC
*RST: BPSK

Usage: Query only

Manual operation: See "Modulation" on page 30

[:SOURce<hw>]:BB:GNPR:SATellite<st>:ORBit?

For BeiDou satellites, queries the orbit type the corresponding satellite is using.

Return values:
<OrbitType> MEO | IGSO | GEO
*RST: GEO

Usage: Query only

Manual operation: See "Orbit Type" on page 30

[:SOURce<hw>]:BB:GNPR:SATellite<st>:POWer <Power>

Sets the power offset of the satellite in dB. The offset determines the power ratio of the activated satellites.

See Chapter 4.4.1, "Power Configuration", on page 27 for information about the power calculation.

Parameters:
<Power> float
Range: -36 to 0
Increment: 0.01
*RST: 0

Manual operation: See "Power" on page 29

[:SOURce<hw>]:BB:GNPR:SATellite<st>:PRANge <Pseudorange>

Sets the propagation delay from satellite to receiver in meters.

Parameters:
<Pseudorange> float
Range: 0 to $2.499*10^6/1.023*10^6*c$
Increment: 0.001
*RST: 0

Manual operation: See "Pseudorange" on page 31

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SCRate?

Queries the standard chip rate.

Return values:
<ChipRate> float

Usage: Query only

Manual operation: See "Standard Chip Rate" on page 30

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SIGNal?

Selects the type of signal the corresponding satellite is using.

Return values:
<Signal> CACode | E1Def | RCA | B1CA
*RST: CACode

Usage: Query only

Manual operation: See "Signals" on page 29

[:SOURce<hw>]:BB:GNPR:SATellite<st>:STANdard?

Querries the navigation standard the corresponding satellite belongs to.

Return values:
<Standard> GPS | GALileo | GLONass | BEIDou
*RST: GPS

Usage: Query only

Manual operation: See "Standard" on page 29

[:SOURce<hw>]:BB:GNPR:SATellite<st>:STATe <State>

Activates/deactivates the satellite.

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

Manual operation: See "Satellite State" on page 29

[:SOURce<hw>]:BB:GNPR:SATellite<st>:TSHift <TimeShift>

Defines the propagation delay from satellite to receiver.

Parameters:
<TimeShift> float
Range: 0 to 2499999.999
Increment: 0.001
*RST: 0

Manual operation: See "Time Shift/ chips" on page 31

6.6 Modulation Control

[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:DATA<ch>[:STATe] 76
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:DRATe 76
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:MEANdering[:STATe] 76
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:SECondary<ch>[:STATe] 76
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:SPReading<ch>[:STATe] 77
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:TSEQuence[:STATe] 77

[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:DATA<ch>[:STATe]
<DataSourceState>

Disables/enables the data signal component of a satellite navigation signal.

Parameters:
<DataSourceState> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "Modulation Control" on page 33

[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:DRATe <DataRate>

Sets the data rate of the satellite navigation signal.

Parameters:
<DataRate> D50HZ | D100HZ | D250HZ | D1000HZ

Manual operation: See "Modulation Control" on page 33

[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:MEANdering[:STATe]
<MeanderingState>

Disables/enables meandering, i.e. doubling the data rate of a GLONASS satellite navigation signal.

Parameters:
<MeanderingState> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "Modulation Control" on page 33

[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:SECondary<ch>[:STATe]
<SecondaryCode>

Disables/enables the data signal component in the pilot channel of a GLONASS signal.

Parameters:
<SecondaryCode> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "Modulation Control" on page 33

[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:SPReading<ch>[:STATe]
<SpreadingState>

Disables/enables the spreading signal component of a satellite navigation signal.

Suffix:
<ch> [1]|2
for GLONASS satellites, sets the data or the pilot channel

Parameters:
<SpreadingState> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "Modulation Control" on page 33

[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:TSEQuence[:STATe]
<TimeSequence>

Disables/enables the time signal component of GLONASS signals.

Parameters:
<TimeSequence> 0 | 1 | OFF | ON
*RST: 1

Manual operation: See "Modulation Control" on page 33

6.7 Signal Dyamics

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:ACCel:MAX....77
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CAPeriod....78
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CVPeriod....78
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CONFig....78
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:DSHift....78
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:DSHift:UNIT....79
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:IDSHift....79
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:JERK:MAX....79
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:PROFile....79
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:RPERiod?....80
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:TOFFset....80

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:ACCel:MAX <MaxAccel>

Sets the maximum acceleration.

Parameters:
<MaxAccel> float
Range: 0.01 to 1000
Increment: 0.0001
*RST: 0.5

Manual operation: See "Max. Acceleration" on page 36

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CAPeriod <Period>

Sets the constant acceleration period.

Parameters:

<Period> float

Range: 0.1 to 10800
Increment: 0.1
*RST: 45

Manual operation: See "Const. Acc. Period" on page 36

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CVPeriod <Period>

Sets the constant velocity period.

Parameters:

<Period> float

Range: 0.1 to 10800
Increment: 0.1
*RST: 5

Manual operation: See "Const. Vel. Period" on page 36

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CONFig <PredefinedConfi>

Selects a Doppler profile.

Parameters:

<PredefinedConfi> USER | VEL1 | VEL2

VEL1|VEL2
Predefined Doppler profiles with firmly set parameters.

USER
Enables the edit mode to define a user-specific Doppler profile.

*RST: VEL1

Manual operation: See "Predefined Config." on page 35

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:DSHift <DopplerShift>

Sets the Doppler shift for a constant signal profile.

Parameters:

<DopplerShift> float

Range: -100E3 to 100E3
Increment: 0.01
*RST: 0

Manual operation: See "Doppler Shift (Constant)" on page 35

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:DSHift:UNIT <DopplerShiftUni>

Selects the units of the parameter Doppler shift.

Parameters:

<DopplerShiftUni> HZ | MPS

*RST: HZ

Manual operation: See "Doppler Shift Unit" on page 35

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:IDSHift <InitDopplShift>

Sets the doppler shift of the high order profile.

Parameters:

<InitDopplShift> float

Range: -19042 to 19042
Increment: 0.0001
*RST: 5

Manual operation: See "Initial Doppler Shift" on page 36

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:JERK:MAX <MaxJerk>

Sets the maximum jerk.

Parameters:

<MaxJerk> float

Range: 0.1 to 7E4
Increment: 0.0001
*RST: 1

Manual operation: See "Max. Jerk" on page 36

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:PROFile <Profile>

Selects a signal dynamics profile.

Parameters:

<Profile> CONStant | HIGH

CONStant
Constant signal with definable Doppler shift.

HIGH
Mode for using Doppler profiles with higher dynamics.

*RST: CONStant

Manual operation: See "Dynamics Profile" on page 34

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:RPERiod?

Queries the time that elapses until the Doppler signal of a high order velocity profile repeats.

Return values:

<Period> float

Range: 0 to 90000
Increment: 0.1
*RST: 0

Usage: Query only

Manual operation: See "Repetition Period" on page 36

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:TOFFset <StartTimeOffset>

Sets a time delay for the Doppler signal.

Parameters:

<StartTimeOffset> float

Range: 0 to 90000
Increment: 0.1
*RST: 0

Manual operation: See "Start Time Offset" on page 35

6.8 Power Settings

[:SOURce<hw>]:BB:GNPR:POWer:MODE 80
[:SOURce<hw>]:BB:GNPR:POWer:REFerence[:POWer] 80
[:SOURce<hw>]:BB:GNPR:POWer:TOTal? 81

[:SOURce<hw>]:BB:GNPR:POWer:MODE <Mode>

Queries the calculation basis of the power.

Parameters:

<Mode> USER

USER
Manual power configuration per satellite

*RST: USER

Manual operation: See "Power Mode" on page 28

[:SOURce<hw>]:BB:GNPR:POWer:REFerence[:POWer] <ReferencePower>

Sets the power level that is used as a reference for the calculation of the power level of the satellites.

Parameters:

<ReferencePower> float

Range: -145 to 20
Increment: 0.01
*RST: -30

Manual operation: See "Reference Power" on page 28

[:SOURce<hw>]:BB:GNPR:POWer:TOTal?

Queries the total power of the GNSS signal.

Return values:

<Power> float

Range: -145 to 30
Increment: 0.01
*RST: 0

Usage: Query only

Manual operation: See "Total Power" on page 28

6.9 Navigation Message Configuration

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:PRESet....84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:PRESet....84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:PRESet....84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:PRESet....84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:PRESet....84
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:AF<gr0>....84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:AF<gr0>....84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:AF<gr0>....84
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:TGD....85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:TGD<gr>....85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:TGD....85
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:TOC....85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:TOC....85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:TOC....85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:AODO....85
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CIC....85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CIC....85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CIC....85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CIC....86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CIC....86
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CIS....86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CIS....86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CIS....86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CIS....86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CIS....86

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CLTMode 86
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CRC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CRC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CRC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CRC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CRC 86
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CRS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CRS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CRS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CRS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CRS 87
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CUC 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CUC 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CUC 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CUC 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CUC 87
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CUS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CUS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CUS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CUS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CUS 87
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:FIFLag 88
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:HEALth 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:HEALth 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:HEALth 88
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[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IDOT 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IDOT 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IDOT 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:IDOT 89
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[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IODC 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IODC 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IODC 89
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IODE 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IODE 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IODE 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IODNav 89
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:LTPData 90

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:MZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:MZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:MZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:MZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:MZERo 90
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:NDELta 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:NDELta 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:NDELta 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:NDELta 91
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[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:ODOT 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:ODOT 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ODOT 91
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[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:OMEGa 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:OMEGa 91
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[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:OZERo 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:OZERo 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:OZERo 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:OZERo 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SF1Reserved<gr> 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:SISA 92
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:SQRA 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:SQRA 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:SQRA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:SQRA 93
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[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SVConfig 93
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:TOE 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:TOE 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:TOE 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TOE 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:TOE 93
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:URA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:URA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:URA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:URA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:AF<gr0> 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:AF<gr0> 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:BGD 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:BGD 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:TOC 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:TOC 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:E5ADVS 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:E5AHS 95

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:K 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E1BDVS 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E1BHS 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E5BDVS 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E5BHS 96
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:DTAU 96
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:EN 96
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:GAMN 96
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:TAUN 97
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:AOEP 97
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:HEALth 97
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:P 97
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:SEType 98
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TALignment 98
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TINDex 98
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TINTerval? 98
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TOE? 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XDDN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YDDN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZDDN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XDN 100
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YDN 100
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZDN 100

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:PRESet
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:PRESet
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:PRESet
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:PRESet
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:PRESet

The navigation message's parameters are calculated according to the selected almanac.

Usage: Event

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:AF<gr0>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:AF<gr0>
<Af>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:AF<gr0>
<Af>

Defines the clock correction parameters a_f2, a_f1, a_f0.

Parameters:

<Af> integer

Value range (GPS parameters):
a_f2 = -2^7 to 2^7-1; a_f1 = -2^{15} to $2^{15}-1$; a_f0 = -2^{21} to $2^{21}-1$
Value range (BeiDou parameters):
a_f2 = -2^{10} to $2^{10}-1$; a_f1 = -2^{21} to $2^{21}-1$; a_f0 = -2^{23} to $2^{23}-1$

*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:TGD
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:TGD<gr> <Tgd>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:TGD <Tgd>

Defines the L1-L2 correction term.

Parameters:

<Tgd> integer

Range: -128 to 127
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:TOC
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:TOC <Toc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:TOC <Toc>

Defines the Clock Correction Parameter.

Parameters:

<Toc> integer

Range: 0 to 65535
*RST: 0

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:AODO <Aodo>

Age of Data Offset

Parameters:

<Aodo> integer

Range: 0 to 31
*RST: 0

Manual operation: See "GPS Ephemeris Parameters" on page 41

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CIC
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CIC <Cic>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CIC <Cic>

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CIC <Cic>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CIC <Cic>

Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination

Parameters:

<Cic> integer

Range: -32768 to 32767
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CIS
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CIS <Cis>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CIS <Cis>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CIS <Cis>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CIS <Cis>

Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination

Parameters:

<Cis> integer

Range: -32768 to 32767
*RST: 0

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CLTMode
<CltMode>

Type of code for L2; This value does not have any impact on the actual used ranging code of the generated satellite.

Parameters:

<CltMode> REServed | PCODe | CACode

REServed
Reserved for future use.

PCODe
Carrier L2 (f_L2= 1.2276 GHz) is modulated by P-code (BPSK).

CACode
Carrier L2 (f_L2= 1.2276 GHz) is modulated by C/A-code (BPSK).

*RST: PCODe

Manual operation: See "GPS Ephemeris Parameters" on page 41

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CRC
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CRC <Crc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CRC <Crc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CRC
<Crc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CRC <Crc>

Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius

Parameters:

<Crc> integer

Range: -32768 to 32767
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CRS
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CRS <Crs>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CRS <Crs>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CRS <Crs>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CRS <Crs>

Amplitude of the Sine Harmonic Correction Term to the Orbit Radius

Parameters:

<Crs> integer

Range: -32768 to 32767
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CUC
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CUC <Cuc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CUC <Cuc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CUC <Cuc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CUC <Cuc>

Amplitude of the Cosine Harmonic Correction Term to the Argument of Latitude

Parameters:

<Cuc> integer

Range: -32768 to 32767
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CUS
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CUS <Cus>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CUS <Cus>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CUS <Cus>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CUS <Cus>

Amplitude of the Sine Harmonic Correction Term to the Argument of Latitude

Parameters:

<Cus> integer

Range: -32768 to 32767
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:ECCentricity
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:ECCentricity <Eccentricity>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:ECCentricity <Eccentricity>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ECCentricity <Eccentricity>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:ECCentricity <Eccentricity>

Eccentricity

Parameters:

<Eccentricity> integer
Range: 0 to 4294967295
*RST: 0

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:FIFLag <FiFlag>

Indicates the curve-fit interval used by the CS (Control Segment) in determining the ephemeris parameters

Parameters:

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

Manual operation: See "GPS Ephemeris Parameters" on page 41

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:HEALth
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:HEALth <Health>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:HEALth <Health>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:HEALth <Health>

This value does not have an impact on the actual health status of the generated satellite.

Parameters:

<Health> integer
Range: 0 to 31
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IDOT
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IDOT <Idot>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IDOT <Idot>

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:IDOT <Idot>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IDOT <Idot>

Rate of Inclination Angle

Parameters:

<Idot> integer

Range: -8192 to 8191
*RST: 0

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IODA <Ioda>

Issue Of Data (Almanacs)

Parameters:

<Ioda> integer

Range: 0 to 15
*RST: 0

Manual operation: See "Galileo Ephemeris Parameters" on page 41

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IODC
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IODC <Iodc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IODC <Iodc>

Issue of Data, Clock

Parameters:

<Iodc> integer

Range: 0 to 1023
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IODE
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IODE <Iode>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IODE <Iode>

Issue of Data, Ephemeris

Parameters:

<Iode> integer

Range: 0 to 255
*RST: 0

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IODNav <IodNav>

Issue Of Data (Ephemeris and Clock correction)

Parameters:

<IodNav> integer

Range: 0 to 1023
*RST: 0

Manual operation: See "Galileo Ephemeris Parameters" on page 41

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IZERo
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IZERo
<Izero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IZERo
<Izero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:IZERo
<Izero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IZERo <Izero>

Inclination Angle at Reference Time

Parameters:

<Izero> integer

Range: -2147483648 to 2147483647
*RST: 0

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:LTPData
<LtpData>

Use of carrier L2 P data flag

This value does not have an impact on whether data is really transmitted on the satellite's carrier L2 or not.

Parameters:

<LtpData> 0 | 1 | OFF | ON

*RST: 0

Manual operation: See "GPS Ephemeris Parameters" on page 41

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:MZERo
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:MZERo
<MZero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:MZERo
<MZero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:MZERo
<MZero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:MZERo
<MZero>

Mean Anomaly at Reference Time

Parameters:

<MZero> integer

Range: -2147483648 to 2147483647
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:NDELta
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:NDELta
<NDelta>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:NDELta
<NDelta>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:NDELta
<NDelta>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:NDELta
<NDelta>

Mean Motion Difference From Computed Value

Parameters:

<NDelta> integer

Range: -32768 to 32767
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:ODOT
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:ODOT
<ODot>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:ODOT
<ODot>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ODOT
<ODot>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:ODOT <ODot>

Rate of Right Ascension

Parameters:

<ODot> integer

Range: -8388608 to 8388607
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:OMEGa
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:OMEGa
<Omega>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:OMEGa
<Omega>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:OMEGa
<Omega>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:OMEGa
<Omega>

Argument of Perigee

Parameters:

<Omega> integer

Range: -2147483648 to 2147483647
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:OZERo
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:OZERo
<OZero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:OZERo
<OZero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:OZERo
<OZero>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:OZERo
<OZero>

Longitude of Ascending Node of Orbit Plane at Weekly Epoch

Parameters:

<OZero> integer

Range: -2147483648 to 2147483647
*RST: 0

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:
SF1Reserved<gr> <Reserved>

SF1 Reserved 1/2/3/4

Parameters:

<Reserved> integer

Range: 0 to 67108864
*RST: 0

Manual operation: See "GPS Ephemeris Parameters" on page 41

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:SISA
<Sisa>

Signal In Space Accuracy

Parameters:

<Sisa> integer

Range: 0 to 255
*RST: 0

Manual operation: See "Galileo Ephemeris Parameters" on page 41

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:SQRA
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:SQRA
<SqrA>

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:SQRA <SqrA>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:SQRA <SqrA>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SQRA <SqrA>

Square Root of the Semi-Major Axis

Parameters:

<SqrA> integer

Range: 100000 to 4294967295
*RST: 100000

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SVConfig <SvConfig>

SV Configurations

Parameters:

<SvConfig> integer

Range: 0 to 15
*RST: 0

Manual operation: See "GPS Ephemeris Parameters" on page 41

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:TOE
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:TOE <ToE>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:TOE <ToE>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TOE <ToE>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:TOE <ToE>

Time Of Ephemeris

Parameters:

<ToE> integer

Range: 0 to 65535
*RST: 0

[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:URA
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:URA <Ura>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:URA <Ura>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:URA <Ura>

SV accuracy / URA Index

Parameters:

<Ura> integer

Range: 0 to 15
*RST: 0

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:AF<gr0> <Af>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:AF<gr0> <Af>

Sets the SV clock drift rate correction coefficients a_{f0}, a_{f1}, a_{f2}.

Suffix:
<gr0> 0 = a_f2, 1 = a_f1, 2 = a_f0
Correction parameter name

Parameters:
<Af> integer

Value range for af2: -2^5 ... 2^5-1
Value range for af1: -2^20 ... 2^20-1
Value range for af0: -2^30 ... 2^30-1

*RST: 0

Manual operation: See "Galileo INAV Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:BGD <B_GD>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:BGD <B_GD>

Sets the Broadcast Group Delay parameter.

Parameters:
<B_GD> integer

Range: -512 to 511
*RST: 0

Manual operation: See "Galileo INAV Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:TOC <Toc>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:TOC <Toc>

Sets the Clock correction data reference Time of Week parameter.

Parameters:
<Toc> integer

Range: 0 to 16383
*RST: 0

Manual operation: See "Galileo INAV Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:E5ADVS <Dvs>

Defines the Data Validity Satellite Status.

Parameters:
<Dvs> integer

Range: 0 to 1
*RST: 0

Manual operation: See "Galileo FNAV Parameters" on page 46

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:E5AHS <Hs>

Defines the Signal Health Status parameter.

Parameters:

<Hs> integer

Range: 0 to 3
*RST: 0

Manual operation: See "Galileo FNAV Parameters" on page 46

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:K <K>

Sets the F-NAV Almanac Scheduling start index.

Parameters:

<K> integer

Range: 0 to 3
*RST: 0

Manual operation: See "Galileo FNAV Parameters" on page 46

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E1BDVS <Dvs>

Defines the Data Validity Satellite Status parameter.

Parameters:

<Dvs> integer

Range: 0 to 1
*RST: 0

Manual operation: See "Galileo INAV Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E1BHS <HS>

Defines the Signal Health Status parameter.

Parameters:

<HS> integer

Range: 0 to 3
*RST: 0

Manual operation: See "Galileo INAV Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E5BDVS <Dvs>

Defines the Data Validity Satellite Status parameter.

Parameters:

<Dvs> integer

Range: 0 to 1
*RST: 0

Manual operation: See "Galileo INAV Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E5BHS <Hs>

Defines the Signal Health Status parameter.

Parameters:

<Hs> integer

Range: 0 to 3
*RST: 0

Manual operation: See "Galileo INAV Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:DTAU <Delta_TAU_n>

Defines the time difference between navigation RF signal transmitted in L2 and navigation RF signal transmitted in L1 band.

Parameters:

<Delta_TAU_n> integer

Range: -16 to 15
*RST: 0

Manual operation: See "GLONASS Clock Correction Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:EN <E_n>

Sets the age of operation information.

Parameters:

<E_n> integer

Range: 0 to 31
*RST: 0

Manual operation: See "GLONASS Clock Correction Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:GAMN <GAMMA_n>

Defines the SV Clock drift correction coefficient.

Parameters:

<GAMMA_n> integer

Range: -1024 to 1023
*RST: 0

Manual operation: See "GLONASS Clock Correction Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:TAUN <TAU_n>

Defines the SV Clock bias correction coefficient.

Parameters:

<TAU_n> integer

Range: -2097152 to 2097151
*RST: 0

Manual operation: See "GLONASS Clock Correction Parameters" on page 45

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:AOEP <AgeOfEph>

Sets the time interval between 2 adjacent values of TOE. It defines hence the age of the current GLONASS Ephemeris page.

Parameters:

<AgeOfEph> A30M | A45M | A60M

*RST: A30M

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:HEALth <Health>

A health value. The user navigation equipment analyzes only the MSB of this word.

Parameters:

<Health> integer

Range: 0 to 7
*RST: 0

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:P <P>

Reliability measure of system time conversion parameters.

Parameters:

<P> integer

Range: 0 to 3
*RST: 0

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:SEType <Type>

Selects the satellite ephemeris type.

Parameters:

<Type> GLO | GLOM

*RST: GLOM

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris: TALignment <TbAlign>

Sets TOE to be aligned to an even or odd scale of 15 min for Age of Ephemeris = 30 or 60 min.

Parameters:

<TbAlign> EVEN | ODD

*RST: ODD

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TINDex <TbIndex>

Defines the index of the Tb-time interval.

To define the duration of the Tb-time interval, use the command `[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:AOEP`.

Parameters:

<TbIndex> integer

Range: 1 to 95

*RST: 1

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris: TINTerval?

Queries the Tb-Interval in the current day where the Ephemeris set page is valid.

Return values:

<TbInterval> string

Usage: Query only

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TOE?

Queries the time of Ephemeris in the current day.

Return values:

<Hour> integer
Range: 0 to 23

<Minute> integer
Range: 0 to 59

<Second> float
Range: 0 to 59
Increment: 1

Usage: Query only

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XN <X_n>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YN <Y_n>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZN <Z_n>

Sets the OX | OY | OZ position coordinates of the current satellite at TOE(tb), i.e. the middle of Tb-Interval.

Parameters:

<Z_n> integer
Range: -67108864 to 67108863
*RST: 0

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XDDN <XDDOT_n>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YDDN <YDDOT_N>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZDDN <ZDDOT_n>

The OX | OY | OZ acceleration coordinate of the current satellite due to solar and lunar gravitational effects at TOE(tb), i.e. the middle of Tb-Interval.

Parameters:

<ZDDOT_n> integer
Range: -16 to 15
*RST: 0

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XDN <XDOT_n>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YDN <YDOT_n>
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZDN <ZDOT_n>

Sets the OX | OY | OZ velocity coordinate of the current satellite at TOE(tb), i.e. the middle of Tb-Interval(1).

Parameters:

<ZDOT_n> integer

Range: -8388608 to 8388607
*RST: 0

Manual operation: See "GLONASS Ephemeris Parameters" on page 42

6.10 Atmospheric Configuration

[:SOURce<hw>]:BB:GNPR:ATMospheric:BEIDou:IONospheric:ALPHa<ch0> 100
[:SOURce<hw>]:BB:GNPR:ATMospheric:GPS:IONospheric:ALPHa<ch0> 100
[:SOURce<hw>]:BB:GNPR:ATMospheric:BEIDou:IONospheric:BETA<ch0> 100
[:SOURce<hw>]:BB:GNPR:ATMospheric:GPS:IONospheric:BETA<ch0> 100
[:SOURce<hw>]:BB:GNPR:ATMospheric:GALileo:IONospheric:AI<ch0> 101
[:SOURce<hw>]:BB:GNPR:ATMospheric:GALileo:IONospheric:SF<ch> 101

[:SOURce<hw>]:BB:GNPR:ATMospheric:BEIDou:IONospheric:ALPHa<ch0> <Alpha>
[:SOURce<hw>]:BB:GNPR:ATMospheric:GPS:IONospheric:ALPHa<ch0> <Alpha>

Sets the parameter alpha_0 .. alpha_3 of the satellite's navigation message.

Parameters:

<Alpha> float

Range: -128 to 127
Increment: 1
*RST: 0

[:SOURce<hw>]:BB:GNPR:ATMospheric:BEIDou:IONospheric:BETA<ch0> <Beta>
[:SOURce<hw>]:BB:GNPR:ATMospheric:GPS:IONospheric:BETA<ch0> <Beta>

Sets the parameter beta_0 .. beta_3 of the satellite's navigation message.

Parameters:

<Beta> integer

Range: -128 to 127
*RST: 0

[:SOURce<hw>]:BB:GNPR:ATMospheric:GALileo:IONospheric:AI<ch0> <A_i>

Sets the parameters effective Ionization level 1st .. 3rd order of the satellite's navigation message.

Parameters:

<A_i> integer

Range: dynamic to dynamic
*RST: 0

Manual operation: See "GALILEO Ionospheric Navigation Parameters" on page 48

[:SOURce<hw>]:BB:GNPR:ATMospheric:GALileo:IONospheric:SF<ch> <SF>

Sets the parameters ionospheric disturbance flag for region 1 to 5 of the satellite's navigation message.

Parameters:

<SF> integer

Range: 0 to 1
*RST: 0

Manual operation: See "GALILEO Ionospheric Navigation Parameters" on page 48

6.11 Trigger Settings

[:SOURce<hw>]:BB:GNPR:TRIGger:ARM:EXECute....101
[:SOURce<hw>]:BB:GNPR:TRIGger:EXECute....101
[:SOURce<hw>]:BB:GNPR:TRIGger:EXTernal:SYNChronize:OUTPut....102
[:SOURce<hw>]:BB:GNPR:TRIGger:RMODe?....102
[:SOURce<hw>]:BB:GNPR:TRIGger:SLENgth....102
[:SOURce<hw>]:BB:GNPR:TRIGger:SOURce....102
[:SOURce<hw>]:BB:GNPR:TRIGger[:EXTernal<ch>]:DELay....102
[:SOURce<hw>]:BB:GNPR:TRIGger[:EXTernal<ch>]:INHibit....103
[:SOURce<hw>]:BB:GNPR[:TRIGger]:SEQuence....103

[:SOURce<hw>]:BB:GNPR:TRIGger:ARM:EXECute

Stops the signal generation until subsequent trigger event occurs.

Usage: Event

Manual operation: See "Arm" on page 20

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

Executes an internal trigger manually.

Usage: Event

Manual operation: See "Execute Trigger" on page 21

[:SOURce<hw>]:BB:GNPR:TRIGger:EXTernal:SYNChronize:OUTPut <Output>

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

Parameters:

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

Manual operation: See "Sync. Output to External Trigger" on page 51

[:SOURce<hw>]:BB:GNPR:TRIGger:RMODe?

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

Return values:

<RMode> STOP | RUN
*RST: STOP

Usage: Query only

Manual operation: See "Running/Stopped" on page 50

[:SOURce<hw>]:BB:GNPR:TRIGger:SLENgth <SLength>

Enters the length of the signal sequence to be output in the single trigger mode.

Parameters:

<SLength> integer
Range: 1 to 4294967295
*RST: 1023

Manual operation: See "Signal Duration" on page 50

[:SOURce<hw>]:BB:GNPR:TRIGger:SOURce <Source>

Selects the trigger source.

Parameters:

<Source> INTernal | OBASeband | BEXTernal | EXTernal

Manual operation: See "Trigger Source" on page 51

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

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

Parameters:

<Delay> float

Range: 0 to 65535
Increment: 0.01
*RST: 0

Manual operation: See "External Delay" on page 52

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

Sets the duration a new trigger event subsequent to triggering is suppressed

Parameters:

<Inhibit> integer

Range: 0 to 67108863
*RST: 0

Manual operation: See "External Inhibit" on page 52

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

Selects the trigger mode.

Parameters:

<Sequence> AUTO | RETRigger | AAUTo | ARETrigger | SINGle

*RST: AUTO

Manual operation: See "Trigger Mode" on page 49

6.12 Marker Settings

[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:MODE....103
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:ONTime....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:OFFTime....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PATTern....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:DIVider....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:FREQuency?....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:WIDTh....105
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut:DELay:FIXed....105
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay....105
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay:MINimum?....105
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay:MAXimum?....105

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

Defines the signal for the selected marker output.

Parameters:
<Mode> PULSe | PATTern | RATio | PPS | PP2S | TRIGger | DISabled | PPS10
*RST: PPS

Manual operation: See "Marker Mode" on page 52

[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:ONTime <OnTime>
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:OFFTime <OffTime>

Sets the number of chips in a period (ON time + OFF time).

Parameters:
<OffTime> integer
Range: 1 to max
*RST: 1

Manual operation: See "Marker Mode" on page 52

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

Defines the bit pattern used to generate the marker signal.

Parameters:
<Pattern> integer

Manual operation: See "Marker Mode" on page 52

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

Sets the divider for Pulse marker mode.

Parameters:
<Divider> integer
Range: 2 to 1024
*RST: 2

Manual operation: See "Marker Mode" on page 52

[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:FREQuency?

Queries the pulse frequency of the pulsed marker signal.

Return values:
<Frequency> float

Usage: Query only

Manual operation: See "Marker Mode" on page 52

[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:WIDTh <Width>

Sets the Pulse Width for 1PPS, 1PP2S and PPS10 markers.

Parameters:

<Width> integer

Range: 1 to 800
*RST: 1

Manual operation: See "Marker Mode" on page 52

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

Restricts the marker delay setting range to the dynamic range.

Parameters:

<Fixed> 0 | 1 | OFF | ON

*RST: 0

Manual operation: See "Marker x Delay" on page 53

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

Sets the marker delay.

Parameters:

<Delay> float

Range: 0 to max
*RST: 0

Manual operation: See "Marker x Delay" on page 53

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

Queries the minimum/maximum marker delay.

Return values:

<Maximum> float

Range: 0 to max

Usage: Query only

Manual operation: See "Marker x Delay" on page 53

6.13 Clock Settings

[:SOURce<hw>]:BB:GNPR:CLOCk:MODE 106
[:SOURce<hw>]:BB:GNPR:CLOCk:MULTiplier 106
[:SOURce<hw>]:BB:GNPR:CLOCk:SOURce 106
[:SOURce<hw>]:BB:GNPR:CLOCk:SYNChronization:EXECute 106
[:SOURce<hw>]:BB:GNPR:CLOCk:SYNChronization:MODE 107

[:SOURce<hw>]:BB:GNPR:CLOCk:MODE <Mode>

Enters the type of externally supplied clock (`[:SOURce<hw>]:BB:GNPR:CLOCk:SOURce EXTernal`).

When `MCHip` is used, a multiple of the chip clock is supplied via the clock connector and the chip clock is derived internally from this.

Use the command `[:SOURce<hw>]:BB:GNPR:CLOCk:MULTiplier` to set the multiplier.

Parameters:

<Mode> CHIP | MCHip

*RST: CHIP

Manual operation: See "Clock Mode" on page 55

[:SOURce<hw>]:BB:GNPR:CLOCk:MULTiplier <Multiplier>

Specifies the multiplier for clock type "Multiplied" (`[:SOURce<hw>]:BB:GNPR:CLOCk:MODE MCHip`) in the case of an external clock source.

Parameters:

<Multiplier> integer

Range: 1 to 64

*RST: 4

Manual operation: See "Clock Multiplier" on page 55

[:SOURce<hw>]:BB:GNPR:CLOCk:SOURce <Source>

Selects the clock source.

Parameters:

<Source> INTernal | EXTernal

*RST: INTernal

Manual operation: See "Clock Source" on page 55

[:SOURce<hw>]:BB:GNPR:CLOCk:SYNChronization:EXECute

Performs automatically adjustment of the instrument's settings required for the selected synchronization mode.

Usage: Event

Manual operation: See "Set Synchronization Settings" on page 54

[:SOURce<hw>]:BB:GNPR:CLOCk:SYNChronization:MODE <Mode>

Selects the synchronization mode.

Parameters:

<Mode> NONE | MASTer | SLAVe

*RST: NONE

Manual operation: See "Sync. Mode" on page 54

List of Commands

[:SOURce<hw>]:BB:GNPR:ATMospheric:BEIDou:IONospheric:ALPHa<ch0>....100
[:SOURce<hw>]:BB:GNPR:ATMospheric:BEIDou:IONospheric:BETA<ch0>....100
[:SOURce<hw>]:BB:GNPR:ATMospheric:GALileo:IONospheric:AI<ch0>....101
[:SOURce<hw>]:BB:GNPR:ATMospheric:GALileo:IONospheric:SF<ch>....101
[:SOURce<hw>]:BB:GNPR:ATMospheric:GPS:IONospheric:ALPHa<ch0>....100
[:SOURce<hw>]:BB:GNPR:ATMospheric:GPS:IONospheric:BETA<ch0>....100
[:SOURce<hw>]:BB:GNPR:CLOCk:MODE....106
[:SOURce<hw>]:BB:GNPR:CLOCk:MULTiplier....106
[:SOURce<hw>]:BB:GNPR:CLOCk:SOURce....106
[:SOURce<hw>]:BB:GNPR:CLOCk:SYNChronization:EXECute....106
[:SOURce<hw>]:BB:GNPR:CLOCk:SYNChronization:MODE....107
[:SOURce<hw>]:BB:GNPR:LIST:SVID:BEIDou?....64
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GALileo?....64
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GLONass?....64
[:SOURce<hw>]:BB:GNPR:LIST:SVID:GPS?....64
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:DATE:BEGin?....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:DATE:END?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:FILE....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:SPAN?....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:TOAPplicability:TOWeek?....67
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:TOAPplicability:WNUMber?....68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:BEIDou:WNUMber?....68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:DATE:BEGin?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:DATE:END?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:FILE....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:SPAN?....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:TOAPplicability:TOWeek?....67
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:TOAPplicability:WNUMber?....68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GALileo:WNUMber?....68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GLONass:FILE....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GLONass:TOAPplicability:DATE?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GLONass:TOAPplicability:TIME?....67
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:DATE:BEGin?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:DATE:END?....66
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:FILE....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:SPAN?....65
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:TOAPplicability:TOWeek?....67
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:TOAPplicability:WNUMber?....68
[:SOURce<hw>]:BB:GNPR:NAVigation:ALMAnac:GPS:WNUMber?....68
[:SOURce<hw>]:BB:GNPR:NAVigation:DATA....61
[:SOURce<hw>]:BB:GNPR:NAVigation:DATA:DSELect....62
[:SOURce<hw>]:BB:GNPR:NAVigation:DATA:PATTern....62
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:DATE....62
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TBASis....63
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TIME....63
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:TOWeek....63
[:SOURce<hw>]:BB:GNPR:NAVigation:SIMulation:WNUMber....64

[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:AZERo 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:TOT 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:BEIDou:WNOT 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:AZERo 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:TOT 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GALileo:WNOT 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:AZERo 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:TOT 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GLONass:WNOT 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:AZERo 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:TOT 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:GPS:WNOT 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:LEAP:SECond 70
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:LEAP:SYNC 71
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:AONE 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:AZERo 69
[:SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:UTCSu:DATE? 69
[:SOURce<hw>]:BB:GNPR:POWer:MODE 80
[:SOURce<hw>]:BB:GNPR:POWer:REFerence[:POWer] 80
[:SOURce<hw>]:BB:GNPR:POWer:TOTal? 81
[:SOURce<hw>]:BB:GNPR:PRESet 59
[:SOURce<hw>]:BB:GNPR:PRFFrequency 60
[:SOURce<hw>]:BB:GNPR:RFBand 59
[:SOURce<hw>]:BB:GNPR:SATellite:COUNt? 71
[:SOURce<hw>]:BB:GNPR:SATellite<st>:CACRate? 72
[:SOURce<hw>]:BB:GNPR:SATellite<st>:CPHase 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:DSHift 72
[:SOURce<hw>]:BB:GNPR:SATellite<st>:FNUMber 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:FREQuency? 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:ICPHase 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:DATA<ch>[:STATe] 76
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:DRATe 76
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:MEANdering[:STATe] 76
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:SECondary<ch>[:STATe] 76
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:SPReading<ch>[:STATe] 77
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MCONtrol:TSEQuence[:STATe] 77
[:SOURce<hw>]:BB:GNPR:SATellite<st>:MODulation? 73
[:SOURce<hw>]:BB:GNPR:SATellite<st>:ORBit? 74
[:SOURce<hw>]:BB:GNPR:SATellite<st>:POWer 74
[:SOURce<hw>]:BB:GNPR:SATellite<st>:PRANge 74
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SCRate? 74
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:ACCel:MAX 77
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CAPeriod 78
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CONFig 78
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:CVPeriod 78
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:DSHift 78

[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:DSHift:UNIT 79
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:IDSHift 79
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:JERK:MAX 79
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:PROFile 79
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:RPERiod? 80
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SDYNamics:TOFFset 80
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SIGNal? 75
[:SOURce<hw>]:BB:GNPR:SATellite<st>:STANdard? 75
[:SOURce<hw>]:BB:GNPR:SATellite<st>:STATe 75
[:SOURce<hw>]:BB:GNPR:SATellite<st>:SVID 71
[:SOURce<hw>]:BB:GNPR:SATellite<st>:TSHift 75
[:SOURce<hw>]:BB:GNPR:SETTing:CATalog? 60
[:SOURce<hw>]:BB:GNPR:SETTing:DELete 60
[:SOURce<hw>]:BB:GNPR:SETTing:LOAD 60
[:SOURce<hw>]:BB:GNPR:SETTing:STORe 61
[:SOURce<hw>]:BB:GNPR:SETTing:STORe:FAST 61
[:SOURce<hw>]:BB:GNPR:STATe 59
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:AF<gr0> 84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:TGD<gr> 85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:CCORrection:TOC 85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CIC 85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CIS 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CRC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CRS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CUC 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:CUS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:HEALth 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IDOT 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IODC 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IODE 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:MZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:NDELta 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:ODOT 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:OMEGa 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:OZERo 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:SQRA 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:TOE 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:EPHemeris:URA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:BEIDou:NMESsage:PRESet 84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CIC 85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CIS 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CRC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CRS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CUC 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:CUS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IDOT 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IODA 89

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IODNav 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:MZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:NDELta 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:ODOT 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:OMEGa 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:OZERo 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:SISA 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:SQRA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:EPHemeris:TOE 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:AF<gr0> 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:BGD 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:E5ADVS 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:E5AHS 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:K 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:FNAV:TOC 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:AF<gr0> 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:BGD 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E1BDVS 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E1BHS 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E5BDVS 95
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:E5BHS 96
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:INAV:TOC 94
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GALileo:NMESsage:PRESet 84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:DTAU 96
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:EN 96
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:GAMN 96
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:CCORrection:TAUN 97
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:AOEP 97
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CIC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CIS 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CRC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CRS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CUC 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:CUS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:HEALth 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:HEALth 97
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:IDOT 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:MZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:NDELta 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ODOT 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:OMEGa 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:OZERo 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:P 97
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:SEType 98
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:SQRA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TALignment 98
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TINDex 98

[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TINTerval? 98
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TOE 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:TOE? 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:URA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XDDN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XDN 100
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:XN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YDDN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YDN 100
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:YN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZDDN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZDN 100
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:EPHemeris:ZN 99
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GLONass:NMESsage:PRESet 84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:AF<gr0> 84
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:TGD 85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:CCORrection:TOC 85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:AODO 85
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CIC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CIS 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CLTMode 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CRC 86
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CRS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CUC 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:CUS 87
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:ECCentricity 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:FIFLag 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:HEALth 88
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IDOT 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IODC 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IODE 89
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:IZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:LTPData 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:MZERo 90
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:NDELta 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:ODOT 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:OMEGa 91
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:OZERo 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SF1Reserved<gr> 92
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SQRA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:SVConfig 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:TOE 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:EPHemeris:URA 93
[:SOURce<hw>]:BB:GNPR:SVID<ch>:GPS:NMESsage:PRESet 84
[:SOURce<hw>]:BB:GNPR:TRIGger:ARM:EXECute 101
[:SOURce<hw>]:BB:GNPR:TRIGger:EXECute 101
[:SOURce<hw>]:BB:GNPR:TRIGger:EXTernal:SYNChronize:OUTPut 102
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut:DELay:FIXed 105
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay 105
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay:MAXimum? 105

[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:DELay:MINimum?....105
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:MODE....103
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:OFFTime....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:ONTime....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PATTern....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:DIVider....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:FREQuency?....104
[:SOURce<hw>]:BB:GNPR:TRIGger:OUTPut<ch>:PULSe:WIDTh....105
[:SOURce<hw>]:BB:GNPR:TRIGger:RMODe?....102
[:SOURce<hw>]:BB:GNPR:TRIGger:SLENgth....102
[:SOURce<hw>]:BB:GNPR:TRIGger:SOURce....102
[:SOURce<hw>]:BB:GNPR:TRIGger[:EXTernal<ch>]:DELay....102
[:SOURce<hw>]:BB:GNPR:TRIGger[:EXTernal<ch>]:INHibit....103
[:SOURce<hw>]:BB:GNPR[:TRIGger]:SEQuence....103
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:DATE:BEGIn....65
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:DATE:END....66
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:FILE....65
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:SPAN?....65
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:TOAPplicability:TOAWeek....67
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:TOAPplicability:WNUMber....68
[SOURce<hw>]:BB:GNPR:NAVigation:ALManac:<GNSS>:WNUMber....68
[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:AONE....69
[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:AZERo....69
[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:TOT....70
[SOURce<hw>]:BB:GNPR:NAVigation:TCONversion:<GNSS>:WNOT....70
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:AF<gr0>....84
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:TGD....85
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:CCORection:TOC....85
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CIC....85
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CIS....86
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CRC....86
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CRS....87
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CUC....87
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:CUS....87
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:ECCentricity....88
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:HEALth....88
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IDOT....88
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IODC....89
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IODE....89
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:IZERo....90
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:MZERo....90
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:NDELta....91
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:ODOT....91
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:OMEGa....91
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:OZERo....92
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:SQRA....92
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:TOE....93
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:EPHemeris:URA....93
[SOURce<hw>]:BB:GNPR:SVID<ch>:<GNSS>:NMESsage:PRESet....84

Index

A

a_f0 42
a_f1 42
a_f2 42
a_i0 to a_i2 48
Age of Ephemeris Page (P1) 42
Almanac 23
    Conflict 24
    Data span 24
alpha_0 to alpha_3 47
Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination 39
Amplitude of the Cosine Harmonic Correction Term to the Argument of Latitude 39
Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius 39
Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination 39
Amplitude of the Sine Harmonic Correction Term to the Argument of Latitude 39
Amplitude of the Sine Harmonic Correction Term to the Orbit Radius 39
Application cards 9
Application notes 9
Argument of Perigee 39

B

beta_0 to beta_3 47
Brochures 9

C

C_ic 39
C_is 39
C_rc 39
C_rs 39
C_uc 39
C_us 39
Carrier frequencies 20
Clock Correction
    Galileo 42
    GLONASS 45
    GPS 42
Clock Mode 55
Clock Multiplier 55
Clock parameters 21
Clock Source 55
Constant acceleration period
    Signal dynamics 36
Constant velocity period
    Signal dynamics 36
Constellation Table 28
Conventions
    SCPI commands 58

D

Data sheets 9
Data source 21
Data span
    Almanac 24
Date 22
Default settings 18
Delete GPS settings 19
delta_N 39
Delta_TAU_n 45
Documentation overview 8
Doppler shift
    Signal dynamics 35
Doppler Shift 31
Dynamics profile
    Signal dynamics 34

E

e 39
E_n 45
Eccentricity 39

F

Frequency number
    GLONASS satellite 30

G

GAMMA_n (a_f1) 45
Global trigger/clock settings 55
GLONASS specific ephemeris parameters 42
Greenwich Mean Time 22

H

Help 8

I

i_0 39
IDOT 39
Inclination Angle at reference Time 39
Initial Carrier Phase 31
Initial Doppler shift
    Signal dynamics 36
Instrument help 8
Instrument security procedures 9
IODa 41
IODC 40
IODE 40
IODnav 41
Ionospheric model
    Overview 16

L

Leap second simulation
    Overview 16
Load GPS settings 19
Longitude of Ascending Node of Orbit Plane at Weekly Epoch 39

M

M_0 39
Marker Mode 52
Marker Period 52
Marker x Delay 53

Maximum acceleration
Signal dynamics ... 36
Maximum jerk
Signal dynamics ... 36
Maximum Number of Satellites ... 28
Mean Anomaly at Reference Time ... 39
Mean Motion difference From Computed Value ... 39
Measured external clock ... 55
Modulation control ... 32
Multi-satellite GNSS signal ... 14

O

omega ... 39
OMEGA_0 ... 39
OMEGA_DOT ... 39
ON/OFF Ratio Marker ... 52
Open source acknowledgment ... 9
Orbit type
BeiDou satellite ... 30
OSA ... 9

P

P ... 42
Parameters unit
Signal dynamics ... 35
Power
Mode ... 28
Total ... 28
Power/dB ... 29
Predefined configuration
Signal dynamics ... 35

Q

Quick start guide ... 8

R

Rate of Inclination Angle ... 39
Rate of Right Ascension ... 39
Real-time generation ... 14
Recall GPS settings ... 19
Reference
Power ... 28
Release notes ... 9
Repetition period
Signal dynamics ... 36
Resulting Frequency ... 32
Resulting Start Chip Rate ... 32
RF band ... 20
Running ... 50

S

Safety instructions ... 9
Satellite Ephemeris Type (M) ... 42
Satellite signal ... 29
Satellite Standard ... 29
Satellite State ... 29
Satellites Constellation ... 28
Save GPS settings ... 19
Save/Recall ... 19
Service manual ... 8
Set Synchronization Settings ... 54
Set to Almanac ... 39
Set to default ... 18
SF_1 ... 48
SF1 Reserved 1 .. 4 ... 41
Signal Duration ... 50
Signal dynamics ... 34
Constant acceleration period ... 36
Constant velocity period ... 36
Doppler shift ... 31, 35
Dynamics profile ... 34
Initial Doppler shift ... 36
Maximum acceleration ... 36
Maximum jerk ... 36
Parameters unit ... 35
Predefined configuration ... 35
Repetition period ... 36
Start time offset ... 35
Simulation start time ... 22
SISA ... 41
SQRT(A) ... 39
Square Root of the Semi-Major Axis ... 39
Standard settings ... 18
Start time offset
Signal dynamics ... 35
State
GNSS ... 18
Stopped ... 50
Supported signals ... 29
SV Accuracy ... 40
SV accuracy / URA Index (F_T) ... 42
SV Health ... 40
SV Health (B_n,1_n) ... 42
Sync. Output to External Trigger ... 51
Synchronization mode ... 54
System Time ... 22

T

T_GD ... 42
t_OC ... 42
TAU_n (-a_f0) ... 45
Tb-Index ... 42
Tb-Interval ... 42
Time conversion
Overview ... 16
Time of Ephemeris ... 39
Time of Week (TOW) ... 22
Time Shift (Chips) ... 31
TOE ... 39
TOE (tb) ... 42
Total power ... 28
Trigger
Arm ... 20, 50
Execute ... 21, 50
Manual ... 21, 50
Trigger Delay ... 52
Trigger Inhibit ... 52
Trigger Mode ... 49
Armed ... 49
Auto ... 49
Retrigger ... 49
Single ... 49
Trigger parameters ... 20
Trigger Source ... 51

U

Update RF Frequency ... 20

URA Index 40
User manual 8
User Period 52

W

Week Number 22
White papers 9

X

X_n 42
XDDOT_n 42
XDOT_n 42

Y

Y_n 42
YDDOT_n 42
YDOT_n 42

Z

Z_n 42
ZDDOT_n 42
ZDOT_n 42