Supplement

Digital Standard GPS

R&S® **SMU-K44**
1161.0566.02

R&S® **SMJ-K44**
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R&S® **SMATE-K44**
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ROHDE&SCHWARZ
Test and Measurement Division

Dear Customer,

The Signal Generator includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.
Trade names are trademarks of the owners.

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

S a f e t y   I n s t r u c t i o n s

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standard of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance with the relevant safety standards. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, 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 in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for an intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

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

Symbols and safety labels

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

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

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before putting the product into operation. It is also absolutely essential to observe the additional safety instructions on personal safety that appear in 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.

Tags and their meaning

DANGER	This tag indicates a definite hazard carrying a high risk of death or serious injury if not avoided.
WARNING	This tag indicates a possible hazard carrying a medium risk of death or (serious) injury if not avoided.
CAUTION	This tag indicates a hazard carrying a low risk of minor or moderate injury if not avoided.
ATTENTION	This tag indicates the possibility of incorrect use that can cause damage to the product.
NOTE	This tag indicates a situation where the user should pay special attention to operating the product but which does not lead to damage.

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

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).

3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.

4. If products/components are mechanically and/or 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, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.

6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.

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

8. Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.

9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.

10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.

11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.

12. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.

13. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).

14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.

15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.

16. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.

17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.

18. 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.

19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a license electrician.

20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.

21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.

22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.

23. Rohde & Schwarz products are not protected against penetration of water, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.

24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.

25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.

26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.

27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.

29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.

30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).

31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.

32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.

33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.

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

Informaciones de seguridad

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estandards 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. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los estandards técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las informaciones, 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 solamente fue elaborado para ser utilizado en la industria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado dentro de las instrucciones de la correspondiente documentación de 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 profundos y conocimientos parciales del idioma inglés. Por eso se deberá tener en cuenta de exclusivamente autorizar para el uso del producto a personas peritas o debidamente minuciosamente instruidas con los conocimientos citados. Si fuera necesaria indumentaria de seguridad para el uso de productos de R&S, encontrará la información debida en la documentación del producto en el capítulo correspondiente.

Símbolos y definiciones de seguridad

Ver documen-tación de producto	Informaciones para maquinaria con uns peso de > 18kg	Peligro de golpe de corriente	¡Advertencia! Superficie caliente	Conexión a conductor protector	Conexión a tierra	Conexión a masa conductora	¡Cuidado! Elementos de construcción con peligro de carga electroestática

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

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

Palabras de señal y su significado

PELIGRO	Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas.
ADVERTENCIA	Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas.
ATENCIÓN	Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas.
CUIDADO	Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
INFORMACIÓN	Indica una situación en la que deberían seguirse las instrucciones en el uso del producto, pero que no consecuentemente deben de llevar a un daño del mismo.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el 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 de 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 malinterpretaciones y tener por consecuencia daños en personas u objetos.

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S válido lo que sigue: como posición de funcionamiento se define principalmente la posición con el suelo de la caja para abajo , modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4.500 m sobre el nivel del mar.
A menos que se especifique otra cosa en la hoja de datos, se aplicará una tolerancia de ±10% sobre el voltaje nominal y de ±5% sobre la frecuencia nominal.

2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal perito autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Despues de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se producieran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.

4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.

5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberan ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.

6. Ciertos productos, como por ejemplo las instalaciones de radiación HF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario/usario está comprometido a valorar y señalar areas de trabajo en las que se corra un riesgo aumentado de exposición a radiaciones para evitar riesgos.

7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.

8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del prodcuto.

9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.

10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto. Puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro, que es controlado su estado técnico de seguridad.

11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (según la medida del cable de distribución, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en construciones o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

12. No utilice nunca el producto si está dañado el cable eléctrico. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.

13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A (utilización de fusibles de mayor amperaje sólo previa consulta con el grupo de empresas Rohde & Schwarz).

14. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.

15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.

16. En las mediciones en circuitos de corriente con una tensión de entrada de $U_{eff} > 30$ V se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos de la EC950/EN60950.

18. 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 heridas, fuego o daños en el producto.

19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, el circuito de suministro de corriente deberá estar protegido de manera que usuarios y productos estén suficientemente protegidos.

21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir corto circuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.

22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.

23. Los productos R&S no están protegidos contra el agua si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente para el usario o de daños en el producto lo cual también puede llevar al peligro de personas.

24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.

25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.

26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. No cortocircuitar baterías ni acumuladores. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención celulas de Litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Las baterías y acumuladores deben reutilizarse y no deben acceder a los vertederos. Las baterías y acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de evacuación y reciclaje.

28. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.

29. El producto puede poseer un peso elevado. Muévalo con cuidado para evitar lesiones en la espalda u otras partes corporales.

30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).

31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetados de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean tenidas en cuenta. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.

32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo. El fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.

33. Dado el caso de que esté integrado un producto de laser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación de producto. De otra manera pondrá en peligro su salud, ya que el rayo laser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo laser.

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Digital Standard GPS

Introduction - Digital Standard GPS

The R&S Signal Generator provides you with the ability to generate signals of up to four Global Positioning System (GPS) satellites.

The Global Positioning System consists of several satellites circling the earth in low orbits. The satellites permanently transmit information about their current position (ephimeris) and about the orbits of all satellites (almanac). An additionaly transmitted time information enables the GPS receiver to determine the runtimes of the transmitted signals. The 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.With GPS, the code is known as C/A code (f_ca = 1.023 MHz) for civilian purposes. It is used as spreading code for the navigation data which is transmitted at a rate of 50 baud. The carrier L1 (f_L1= 1.57542 GHz) is modulated by C/A-code (BPSK).

***Not**e:*
To avoid any damage to connected receivers, the user must ensure that the signal level used is not too high. A downstream attenuator pad must be connected to generate output levels below -145 dBm.

A GPS signal which allows receiver function tests to be carried out, can be generated by the vector signal generator for up to four satellites (in case of two-path instruments per baseband path).

Table 1   GPS system parameters

Carrier frequency	1.57542 GHz
Signal level, after antenna	Approx. −115 dBm, depending on receive conditions
Doppler shift	-100 kHz to +100 kHz selectable
Symbol rate (C/A code)	1.023 Mcps
C/A codes	1 to 37 selectable, 1023 chips per C/A code
Modulation	BPSK
Information data rate (navigation data)	50 Hz
Frame structure of navigation data	25 frames consisting of 5 subframes where
	1 subframe consists of 10 words,
	1 word consists of 30 data bits,
	1 data bit consists of 20460 C/A code chips.

Use of navigation data

The C/A code used is fundamental to the simulation of GPS signals. The C/A code specifies the satellites to be simulated. Real navigation data (the almanac) contains the information about the currently valid ids. When using real navigation data, only valid ids can be selected in the operating menu. When using arbitrary data, the complete range of ids, 1 to 37, is available.

In addition to this, navigation data play an extremely important role, since they are essential for calculating the positions of the four satellites, which are the minimum prerequisite for localization purposes. However, even if only one satellite is available, real navigation data can be used to check the decoding of navigation information (such as GPS time, almanac and ephemeris) in addition to the recognition of the C/A code.

Current almanac data can be downloaded via the Internet and stored on the harddisk of the R&S Signal Generator. The almanac data is also used for extracting the satellite-specific navigation information (ephemeris).

For more detailed information on the content and frame structure of navigation data, as well as C/A code generation, refer to the specifications.

GPS Menu

The menu for setting the GPS digital standard is either called from the baseband block or from the menu tree under Baseband.
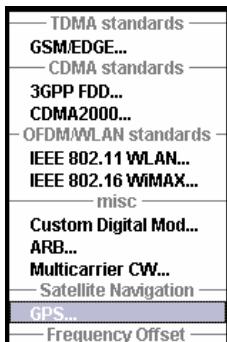
The menu is split into several sections for configuring the standard. The choice of simulation mode determines which displays and parameters are made available in the lower section.

The upper section of the menu is where the GPS digital standard is enabled and the default settings are called and the simulation mode is selected.

Buttons lead to the submenus for loading and saving the GPS configuration and for configuring the trigger and clock parameters.

The **Localization Mode** menu section is where the satellite signals are configured corresponding to a 'real' location which can be selected by the user.

The **Navigation Data** menu section is where the data source for navigation information is selected and the data indicated (in case of real navigation data).

The button in the lower section leads to the submenu for configuring the satellite signals.

Localization Mode

Geographic Location	User Defined ▾
Altitude / m	0.0
Latitude	0 ° 0 ′ 0 ″ South ▾
Longitude	0 ° 0 ′ 0 ″ East ▾

Navigation Data

Data Source	Real Navigation Data ▾
Select Almanac File...	SEM299
Almanac For GPS Week 1323:	15.05.2005 - 21.05.2005
Time Of Ephemeris (TOE):	21.05.2005 19:50:24
Date [DD.MM.YYYY]	21.05.2005
Greenwich Mean Time [HH:MM:SS (24h)]	19:50:24
Satellite Configurations...	
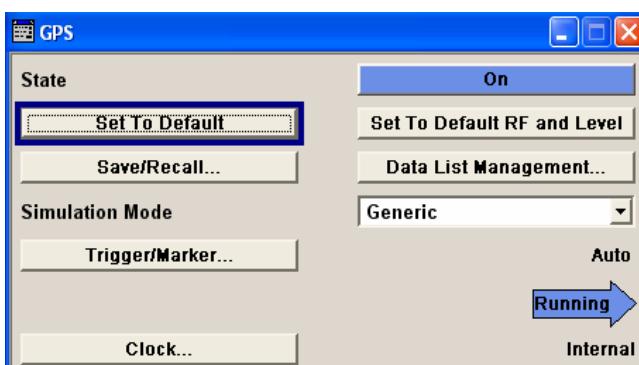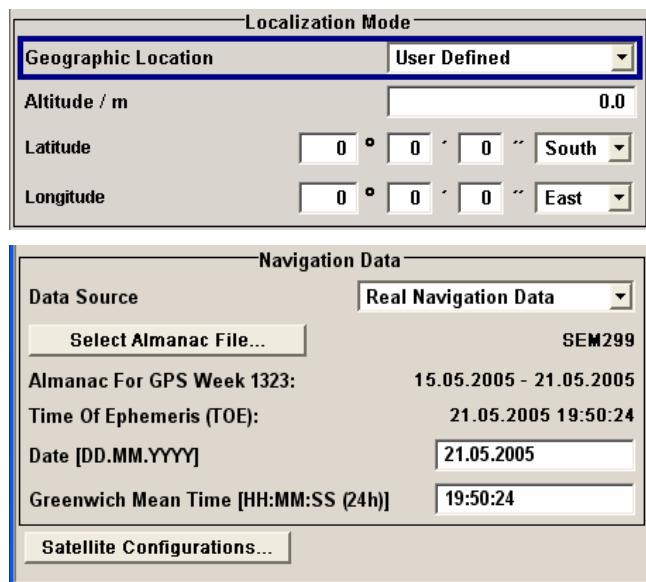
General Settings for GPS Simulation

The upper section of the menu is where the GPS digital standard is enabled, the default settings are called. Buttons lead to the submenus for loading and saving the GPS configuration and for configuring the trigger and clock parameters.

State - GPS	Enables/disables the GPS signal simulation.
	Enabling this standard disables all the other digital standards and digital modulation modes (in case of two-path instruments, this affects the same path).
	A continuous GPS signal is generated for up to four satellites in real time mode.
	The associated signal level is set in the RF level menu.
	Remote-control command: SOUR:BB:GPS:STAT ON

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

Note:
  For instruments with RF Output, the RF and level are preset with button **Set to default RF and Level***.*

Remote-control command:
SOUR:BB:GPS:PRES

Parameter	Value
State	Not affected by Set to default
Simulation Mode	Generic
Navigation Data Source	Real navigation data
Almanac	SEM299
Date	Date of TOE
Time	Time of TOE
Satellite configuration	
State satellite 1	On
State satellite 2 ... 4	Off
Space Vehicle Id (satellite 1 ... 4)	1 / 2 / 3 / 4
Ranging Code	C/A
Time Shift / CA-Chips / 40	0
Doppler Shift	0 Hz

Set to default RF and Level - GPS   **(For instruments with RF output only)**

Calls the default RF and level settings for GPS signals.

The frequency is set to the GPS carrier frequency L1 of 1.57542 GHz and the output level LEVEL is set to –115.0 dBm.

Note:
  To avoid any damage to connected receivers, the user must ensure that the signal level used is not too high. A downstream attenuator pad must be connected to generate output levels below -145 dBm.

Remote-control command:
SOUR:BB:GPS:PRFL

Save/Recall - GPS

Calls the **Save/Recall** menu.

From the **Save/Recall** menu the **File Select** windows for saving and recalling GPS configurations and the **File Manager** can be called.

Recall GPS Settings
Save GPS Settings
File Manager...

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

The complete settings in the **GPS** menu are saved and recalled.

Recall GPS setting

Opens the **File Select** window for loading a saved GPS configuration.

The configuration of the selected (highlighted) file is loaded by pressing the **Select** button.

Remote-control command:
```
MMEM:CDIR 'F:\gen_lists\gps'
```

```
SOUR:BB:GPS:SETT:CAT?
```
Response: `'gps_1',gps_2'`
```
SOUR:BB:GPS:SETT:LOAD "gps_1"
```

Save GPS setting

Opens the **File Select** window for saving the current GPS signal configuration.

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

Remote-control command:
```
MMEM:CDIR 'F:\gen_lists\gps'
```

```
SOUR:BB:GPS:SETT:STOR 'gps_3'
```

File Manager

Calls the **File Manager**.

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

Remote-control commands:
```
MMEM:CDIR 'F:\gen_lists\gps'
```

```
SOUR:BB:GPS:SETT:DEL 'gps_1'
```

Data List Management - GPS

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

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

The data lists must be selected as a data source from the submenus under the individual function, e.g. in the channel table of the base stations.

Remote-control commands:

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.

Creating and editing the data list:
```
SOUR:BB:DM:DLIS:SEL "GPS"
SOUR:BB:DM:DLIS:DATA 1,1,0,1,0,1,0,1,1,1,1,0,0,0
SOUR:BB:DM:DLIS:DATA:APP 1,1,0,1,0,1,0,1,1,1,1,0,0
```

Selecting the data list:
```
SOUR:BB:GPS:DATA DLIS
SOUR:BB:GPS:DATA:DLISt "gps_data"
```

Simulation Mode - GPS

Sets the simulation mode.

The settings of the satellite signals are provided in the submenu **Satellite Configuration** (see following section)

Generic   The satellite signals are configured by the user.

Remote-control command:
```
SOUR:BB:GPS:SMOD GEN
```

Localization   The satellite signals are configured corresponding to a 'real' location which can be selected by the user.

Remote-control command:
```
SOUR:BB:GPS:SMOD LOC
```

Trigger - Marker - GPS   Calls the menu for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal (see Section "*Trigger/Marker/Clock - GPS*", Page 16).

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

The marker signal is always related to the first active satellite.

Remote-control command: n.a.

Execute Trigger - GPS   **(This feature is only available for Trigger Source Internal.)**

Executes trigger manually.

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

Remote-control commands:
```
SOUR:BB:GPS:TRIG:SOUR INT
SOUR:BB:GPS:SEQ RETR
SOUR:BB:GPS:TRIG:EXEC
```

Clock - GPS   Calls the menu for selecting the clock source and for setting a delay (see Section "*Trigger/Marker/Clock - GPS*", Page 16").

Remote-control command: n.a.

The **Localization Mode** menu section is where the satellite signals are configured corresponding to a 'real' location which can be selected by the user.

Geographic Location - GPS   Selects the geographic location.

Remote-control commands:
```
SOUR:BB:GPS:LOC "Munich"
```

Altitude - GPS   Sets the geographic altitude.

This field is only available for user defined geographic locations. If a value other than **User Defined** is selected in the **Geographic Location** field, the **Altitude** field is read only.

Remote-control commands:
```
SOUR:BB:GPS:LOC ALT 500
```

Latitude - GPS	Sets the latitude of the user defined geographic location.
	This field is only available for user defined geographic locations. If a value other than **User Defined** is selected in the **Geographic Location** field, the **Latitude** field is read only.

Remote-control commands:
```
SOUR:BB:GPS:LOC:LAT:DEGR 48
SOUR:BB:GPS:LOC:LAT:MIN 9
SOUR:BB:GPS:LOC:LAT:SEC 0
SOUR:BB:GPS:LOC:LAT:DIR NORT
```

Longitude - GPS	Sets the longitude of the user defined geographic location.
	This field is only available for user defined geographic locations. If a value other than **User Defined** is selected in the **Geographic Location** field, the **Longitude** field is read only.

Remote-control commands:
```
SOUR:BB:GPS:LOC:LONG:DEGR 11
SOUR:BB:GPS:LOC:LONG:MIN 35
SOUR:BB:GPS:LOC:LONG:SEC 0
SOUR:BB:GPS:LOC:LONG:DIR EAST
```

The **Navigation Data** menu section is where the data source for navigation information is selected and the data indicated (in case of real navigation data).

Navigation Data Source - GPS	Selects data source for the navigation information.
	Navigation data play an extremely important role, since they are essential for calculating the positions of the four satellites, which are the minimum prerequisite for localization purposes. It also contains the information about the currently valid ids for the satellites.

Note:
> *If **Localization** is selected as simulation mode, **Real Navigation Data** is preselected and no other data source can be selected.*

Real Navigation Data	**Real Navigation Data** (almanacs) can be downloaded from the internet and stored on the harddisk of the generator.

Note:
> *Supported almanac files are SEM-files with data extension *.txt. YUMA almanac files are not supported.*

The almanac file to be used is selected in the file manager which is called with button **Select Almanac File...**. The time information of the file is indicated below the button. The simulated date and time can be set within the time interval determined by the loaded almanac (GPS week).

The satellite specific information (ephemeris) is also taken from the almanac. The time of ephemeris is indicated.

All indications and entries are made in Greenwich Mean Time.

Remote-control commands
```
SOUR:BB:GPS:NAV:DATA  RND
SOUR:BB:GPS:NAV:ALM "sem299"
```

PRBSxx
Data List
Pattern

Abitrary data can be used for basic tests on the GPS signals.

Data sources **PN9**, **PN11**, **PN15**, **PN16**, **PN20**, **PN21**, **PN23**, **ALL 0**, **ALL1**, and **Pattern** are all available.

If the **Pattern** data type is used, the bit pattern is defined in the **Pattern** input box. The length is limited to 64 bits.

Data lists are selected in the **File Select** window, which is called by means of the **Data List Management** button.

Signals generated in this way can be recognized by a GPS receiver. However, since there are no real navigation data on the C/A code, only the signal level of the simulated satellite(s) can be measured and displayed by the receiver.

A signal of this type is usually sufficient for performing simple function tests. It should be noted, however, that the receiver to be tested may have to be switched to a special test mode, since signals without correct navigation data are often not indicated (on a display, for example).

Remote-control commands
```
SOUR:BB:GPS:NAV:DATA   ZERO
SOUR:BB:GPS:NAV:DATA   PN9

SOUR:BB:GPS:NAV:DATA   PATT
SOUR:BB:GPS:NAV:DATA:PATT #H3F,8

SOUR:BB:GPS:NAV:DATA   DLIS
SOUR:BB:GPS:NAV:DATA:DSEL "gps_1"
```

Select Almanac File - GPS   Opens the file manager for selecting the almanac file.

The button is only available if data soure **Real Navigation Data** is selected.

The downloaded files can be copied to the R&S Signal Generator via USB interface or via a LAN network (see chapter 1).

Current almanacs are currently available at the following internet sites:

U.S.Coast Guard Navigation Center GPS Homepage (http://www.navcen.uscg.gov/ftp/GPS/almanacs/sem/)

The almanac file are named semxxxx.txt whereas xxxx denotes the GPS week.

http://www.celestrak.com/GPS/almanac/SEM/

The almanac file are named almanac.sem.weekXXXX.YYYYYY.txt whereas xxxx denotes the GPS week and yyyyyy the time of almanac (TOA).

Note:
Supported almanac files are SEM-files with data extension *.txt. YUMA almanac files are not supported.

Remote-control commands:
```
SOUR:BB:GPS:NAV:DATA:SOUR RND
SOUR:BB:GPS:NAV:ALM "sem299"
```

Almanac For GPS Week - GPS   Indicates the week in which the almanac was published. The simulation time (**Date**) can be set within this time interval.

The indication is only available if data source **Real Navigation Data** is selected.

Remote-control commands:
```
SOUR:BB:GPS:NAV:ALM:BEG:WNUM?
SOUR:BB:GPS:NAV:ALM:BEG:DAY?
SOUR:BB:GPS:NAV:ALM:BEG:MONT?
SOUR:BB:GPS:NAV:ALM:BEG:YEAR?
SOUR:BB:GPS:NAV:ALM:END:DAY?
SOUR:BB:GPS:NAV:ALM:END:MONT?
SOUR:BB:GPS:NAV:ALM:END:YEAR?
```

Time Of Ephemeris - GPS Indicates the time of ephemeris, i.e the exact time up to the second to which the navigation data refers. As the ephemeris is extracted from the almanac, the TOE is identical to the TOA (time of almanac).

The indication is only available if data source **Real Navigation Data** is selected.

Remote-control commands:
```
SOUR:BB:GPS:NAV:ALM:TOEP?
Response:    "589824"
```

Date - GPS Enters the date for the simulation. Only values within the almanac GPS week are valid.

The parameter is only available if data source **Real Navigation Data** is selected.

Remote-control commands:
```
SOUR:BB:GPS:NAV:SIM:BEG:DATE 2006,11,22
```

Greenwich Mean Time - GPS Enters the exact time for the simulation. The used time zone is Greenwich Mean Time.

The parameter is only available if data source **Real Navigation Data** is selected.

Remote-control commands:
```
SOUR:BB:GPS:NAV:SIM:BEG:TIME 13,45,59
```

Satellite Configuration - GPS Calls the menu for configuring the satellite data (see following section).

Remote-control command: n.a.

Satellite Configuration - GPS

In the Satellite Configuration submenu the signal simulation of up to four satellites can be activated and configured.

GPS A: Satellite Configurations					
Adjust Total Power To 0 dB		**Total Power / dB** 0.00		**Use Spreading**	☑
	Satellite 1	**Satellite 2**	**Satellite 3**	**Satellite 4**	
State	On	On	On	On	
Space Vehicle ID	5	29	2	9	
Ranging Code	C/A	C/A	C/A	C/A	
Time Shift / CA-Chips/40	1 156 907.234	1 189 124.843	1 308 090.688	1 274 475.057	
Time Shift / ms	28.272	29.060	31.967	31.146	
Power / dB	-6.02	-6.02	-6.02	-6.02	
Doppler Shift	2.429 19 kHz	1.100 19 kHz	-1.377 78 kHz	1.483 48 kHz	
Resulting Frequency / GHz	1.575 422 429 19	1.575 421 100 19	1.575 418 622 22	1.575 421 483 48	
Resulting C/A Chip Rate / MHz	1.023 001 58	1.023 000 71	1.022 999 11	1.023 000 96	
Resulting P Chip Rate / MHz	10.230 015 77	10.230 007 14	10.229 991 05	10.230 009 63	

Adjust Total Power to 0dB - GPS Sets the power level of each satellite so that the sum of all levels results in 0 dB. This will not change the power ratio among the individual satellites.

Remote-control command:
SOUR:BB:GPS:POW:ADJ

Total Power - GPS Displays the total power of all satellites.

The total power is calculated from the power ratio of the activated satellites.

After **Power Adjust**, this power corresponds to 0 dB.

If the value is not equal to 0 dB, the individual activated satellites (whilst still retaining the power ratios) are internally adapted so that the **Total Power** for achieving the set output level is 0 dB.

Remote-control command:
SOUR:BB:GPS:POW?
'Response: 0dB

Use Spreading - GPS   Activates/deactivates spreading. When spreading is deactivated the pure navigation data is modulated onto the RF carrier.

Remote-control command:
`SOUR:BB:GPS:SPR:STAT ON`

Satellite State - GPS   Activates/deactivates the generation of the satellite signal.

Remote-control command:
`SOUR:BB:GPS:SAT4:STAT ON`

Space Vehicle Id - GPS   Enters the id of the satellite to be simulated. This value is used to generate the corresponding C/A code.

37 IDs are defined whereas 32 codes are used for identifying satellites.

If **Real Navigation Data** is used, only the valid IDs which are listed in the almanac are selectable.

For arbitray data, all IDs can be selected.

Remote-control command:
`SOUR:BB:GPS:SAT4:VID 24`

Ranging Code - GPS   Selects the type of ranging code. The C/A code (f_ca = 1.023 MHz) is provided for civilian purposes. The P-code (f_p = 10.23 MHz) is provided for military purposes. They are used as spreading codes for the navigation data which is transmitted at a rate of 50 baud.

Note:
For satellite 2, 3, and 4, only C/A is available and cannot be changed.

C/A   Carrier L1 (f_L1= 1.57542 GHz) is modulated by C/A-code (BPSK).

Remote-control command:
`SOUR:BB:GPS:SAT4:RCOD CAC`
`Response: CAC`

C/A + P   **(only available for Satellite 1)**

Carrier L1 (f_L1= 1.57542 GHz) is modulated by C/A code and P-code (QPSK).

P   **(only available for Satellite 1)**

Carrier L1 (f_L1= 1.57542 GHz) is modulated by P-code (BPSK).

Time Shift / CA-Chips/40 - GPS	Sets a delay of the selected satellite relative to the other satellites.The time shift is set in oversampled CA chips (Oversamling = 40).
	Remote-control command: `SOUR:BB:GPS:SAT4:TSCH 1233`
Time Shift ms - GPS	Indicates the time shift of the code sequence in milli seconds.
	Remote-control command: `SOUR:BB:GPS:SAT4:TSS?`
Power - GPS	Sets the power offset of the satellite in dB. The offset determines the power ratio of the activated satellites.
	Remote-control command: `SOUR:BB:GPS:SAT4:POW -5`
Doppler Shift - GPS	Enters the doppler shift of the simulated signal of the satellite.
	The simulation of Doppler-shifted GPS signals can be used to check the receiver characteristics under more realistic conditions than with zero Doppler. In contrast to the real system, however, the set Doppler frequency is fixed.
	The relevant change to the chip rate of the C/A code is carried out automatically. The currently valid values for Doppler-shifted carrier frequency and chip rate are displayed under **Resulting Frequency, Resulting C/A chip rate,** and **Resulting P chip rate**.
	Remote-control command: `SOUR:BB:GPS:SAT:DSH 10.34kHz`
Resulting Frequency - GPS	Indicates the currently valid values for Doppler-shifted carrier frequency.
	The resulting frequency is calculated according to the following:
	$f_{L1resulting} = f_{L1} + f_{Doppler}$
	Remote-control command: `SOUR:BB:GPS:SAT4:FREQ?`

Resulting C/A Chip Rate - GPS

Indicates the currently valid values for the chip rate of the C/A code. The relevant change to the chip rate of the C/A code is carried out automatically if the doppler shift is changed.

The resulting C/A chip rate is calculated according to the following:

$$f_{C/Aresulting} = f_{C/A} \times \{1 + f_{Doppler} / f_{L1}\}$$

$f_{C/A}$ is fixed to 1.023 MHz.

Remote-control command:
```
SOUR:BB:GPS:SAT4:CACR?
```

Resulting P Chip Rate - GPS

Indicates the currently valid values for the chip rate of the P-code. The relevant change to the chip rate of the P-code is carried out automatically if the doppler shift is changed.

The resulting P-chip rate is calculated according to the following:

$$f_{P\text{-}resulting} = f_P \times \{1 + f_{Doppler} / f_{L1}\}$$

f_P is fixed to 10.230 MHz.

Remote-control command:
```
SOUR:BB:GPS:SAT4:PCR?
```

# Trigger/Marker/Clock - GPS

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

The Trigger/Marker/Clock menu can be reached via the GPS main menu.

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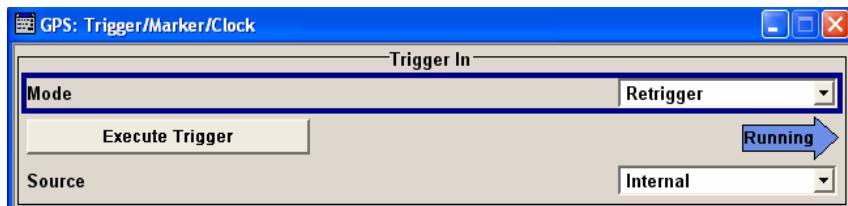


The **Marker Mode** section is where the marker signals at the MARKER output connectors are configured.
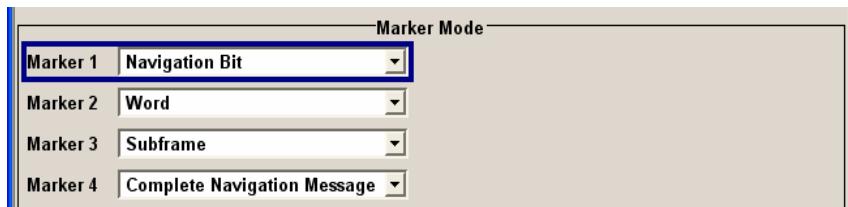


The **Marker Delay** section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.
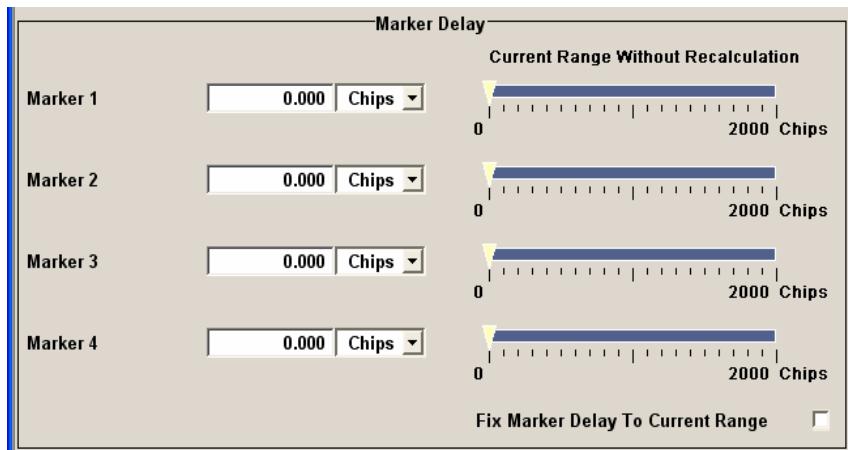


The **Clock Settings** section is where the clock source is selected and - in the case of an external source - the clock type.

The **Global Trigger/Clock Settings** button leads to a submenu for general trigger and clock settings.
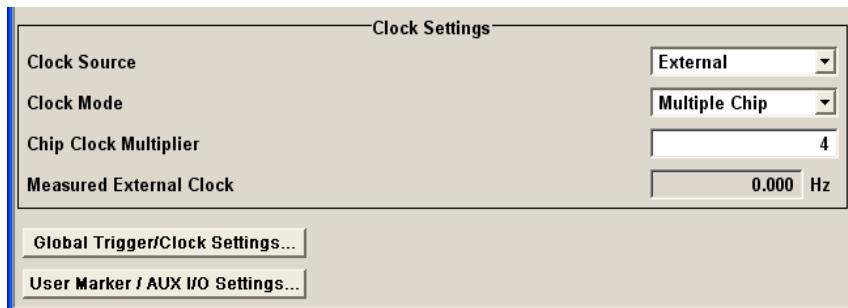
The **Trigger In** section is where the trigger for the GPS signal is set. The current status of the signal generation is displayed for all trigger modes.

| | |
|---|---|
| **Trigger Mode - GPS** | **(R&S SMx and R&S AMU instruments only)** |

Selects trigger mode.

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

**Auto**        The GPS signal is generated continuously.

Remote-control command:
`SOUR:BB:GPS:SEQ    AUTO`

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

Remote-control command:
`SOUR:BB:GPS:SEQ    RETR`

**Armed_Auto**        The GPS-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously.

Button **Arm** stops signal generation. A subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:GPS:SEQ    AAUT`

**Armed_Retrigger**        The GPS-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.

Button **Arm** stops signal generation. A subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:GPS:SEQ ARET`

| | | |
|---|---|---|
| | **Single** | The GPS signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at **Signal Duration**. Every subsequent trigger event (internal with **Execute Trigger** or external) causes a restart. |

Remote-control command:
SOUR:BB:GPS:SEQ SING

**Trigger Signal Duration Unit - GPS**

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

Defines the unit for the entry of the length of the signal sequence to be output in the **Single** trigger mode. Available units are **Subframe**, **Chip**, **Navigation Bit** or **Complete Navigation Message**.

Remote-control commands:
SOUR:BB:GPS:TRIG:SLUN CHIP

**Trigger Signal Duration - GPS**

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

Defines the length of the signal sequence to be output in the **Single** trigger mode. The unit of the entry is defined unter **Signal Duration Unit**. 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-control commands:
SOUR:BB:GPS:TRIG:SLEN 2000

**Running - Stopped - GPS**

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

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

Remote-control command:
SOUR:BB:GPS:TRIG:RMOD?
Response:    RUN or STOP

| | | |
|---|---|---|
| | **Running** | The GPS modulation signal is generated; a trigger was (internally or externally) initiated in triggered mode. |
| | | If Armed_Auto and Armed_Retrigger have been selected, generation of signals can be stopped with the Arm button. A new trigger (internally with Execute Trigger or externally) causes a restart. |
| | **Stopped** | The signal is not generated, and the instrument waits for a trigger event (internal or external). |

**Arm - GPS**              **(R&S SMx and R&S AMU instruments only)**

Stops signal generation. This button appears only with **Running** signal generation in the **Armed_Auto** and **Armed_Retrigger** trigger modes.

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

Remote-control command:
SOUR:BB:GPS:TRIG:ARM:EXEC

**Execute Trigger - GPS**       **(R&S SMx and R&S AMU instruments only)**

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

Remote-control commands:
SOUR:BB:GPS:TRIG:SOUR INT
SOUR:BB:GPS:SEQ RETR
SOUR:BB:GPS:TRIG:EXEC

**Trigger Source - GPS**       **(R&S SMx and R&S AMU instruments only)**

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

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

Remote-control command:
SOUR:BB:W3GP:TRIG:SOUR INT

**Internal**               The trigger event is executed by the trigger signal
**(Baseband A/B)**    from the second path (two-path instruments only).

Remote-control command:
SOUR:BB:W3GP:TRIG:SOUR OBAS

**External**             The trigger event is executed with the aid of the active
**(TRIGGER 1 / 2)**   edge of an external trigger signal. The trigger signal is
supplied via the TRIGGER 1 or TRIGGER 2 connector.

The polarity, the trigger threshold and the input impedance of the TRIGGER input can be set in the menu.

Remote-control command:
SOUR:BB:W3GP:TRIG:SOUR EXT | BEXT

**Trigger Delay - GPS**      **(R&S SMx and R&S AMU instruments only)**

Sets trigger signal delay in chips on external triggering (or on internal triggering via the second path for two-path instruments).

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

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

Remote-control command:
SOUR:BB:GPS:TRIG:EXT:DEL 3
SOUR:BB:GPS:TRIG:OBAS:DEL 3

**Trigger Inhibit - GPS**      **(R&S SMx and R&S AMU instruments only)**

Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in chips (only trigger source **External** or, in case of two-path instruments, trigger source **Internal Other baseband**).

In the **Retrigger** mode every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of chips.

This parameter is only available on external triggering (or on internal triggering via the second path for two-path instruments).

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

Remote-control command:
SOUR:BB:GPS:TRIG:EXT:INH 1000
SOUR:BB:GPS:TRIG:OBAS:INH 1000

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

**Marker Mode - GPS**      Selects a marker signal for the associated MARKER output. The marker signal is always related to the first active satellite.
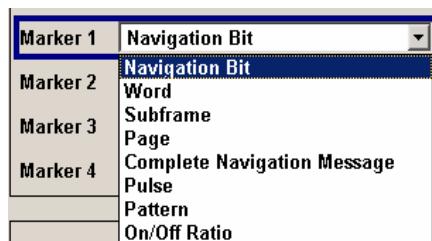


**Navigation Bit**      A marker signal is generated for every navigation data bit (20460 C/A chips)

Remote-control command:
SOUR:BB:GPS:TRIG:OUTP1:MODE  NBIT

**Word**               A marker signal is generated for every navigation data word (30 navigation bits).

Remote-control command:
```
SOUR:BB:GPS:TRIG:OUTP1:MODE WORD
```

**Subframe**       A marker signal is generated for every navigation subframe (corresponds to 10 words).

Remote-control command:
```
SOUR:BB:GPS:TRIG:OUTP1:MODE SFR
```

**Page**                A marker signal is generated for every navigation page (corresponds to 5 subframes).

Remote-control command:
```
SOUR:BB:GPS:TRIG:OUTP1:MODE PAGE
```

**Message**        A marker signal is generated for every complete navigation message (corresponds to 25 pages).

Remote-control command:
```
SOUR:BB:GPS:TRIG:OUTP1:MODE MESS
```

**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 below it.

| Divider | 8.00 | |
|---------|------|---|
| Frequency | 33.854 17 | kHz |

Remote-control commands:
```
SOUR:BB:GPS:TRIG:OUTP1:MODE PULS
SOUR:BB:GPS:TRIG:OUTP1:PULS:DIV 4
SOUR:BB:GPS:TRIG:OUTP1:PULS:FREQ?
```

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

```
0000 0000
```

Remote-control commands:
```
SOUR:BB:GPS:TRIG:OUTP1:MODE PATT
SOUR:BB:GPS:TRIG:OUTP1:PATT #B1111,4
```

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

Start of signal

ON time   OFF time   ON time   OFF time
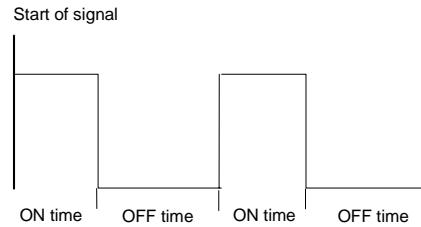
The ON time and OFF time are each expressed as a number of symbols and are set in an input field which opens when **ON/OFF ratio** is selected.

On Time	2	Sym	▼
Off Time	3	Sym	▼

Remote-control commands:
```
SOUR:BB:GPS:TRIG:OUTP1:MODE RAT
SOUR:BB:GPS:TRIG:OUTP1:OFFT 20
SOUR:BB:GPS:TRIG:OUTP1:ONT  20
```

The **Marker Delay** section can be used to set a delay for the markers.

Note:

The marker delay functions are available for R&S SMU/SMJ/SMATE and R&S AMU instruments only.

Marker x Delay - GPS   **(R&S SMx and R&S AMU instruments only)**

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

The input is expressed as a number of samples.

If the setting "**Fix Marker Delay To Current range**" is enabled, the setting range is restricted to the dynamic range. In this range the delay of the marker signals can be set without restarting the marker and signal.

The allocation of marker signals to the outputs is described in the section "*Marker Output Signals*".

Remote-control command:
```
SOUR:BB:GPS:TRIG:OUTP2:DEL 20
```

Current Range without Calculation - GPS   **(R&S SMx and R&S AMU instruments only)**

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

The delay can be defined by moving the setting mark.

Remote-control command:
```
SOUR:BB:GPS:TRIG:OUTP2:DEL:MAX?
SOUR:BB:GPS:TRIG:OUTP2:DEL:MIN?
```

Fix marker delay to current range - GPS	**(R&S SMx and R&S AMU instruments only)**
	Restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal.
	Remote-control command: `SOUR:BB:GPS:TRIG:OUTP:DEL:FIX ON`

The clock source is selected in the **Clock Settings** section.

Note:
   The clock functions are available for R&S SMU/SMJ/SMATE and R&S AMU instruments only.

Clock Source - GPS	**(R&S SMx and R&S AMU instruments only)**
	Selects the clock source (see section "*Clock Signals*").

	Intern	The internal clock reference is used to generate the chip clock.
		Remote-control command: `SOUR:BB:GPS:CLOC:SOUR INT`
	Extern	The external clock reference is fed in as the chip clock or multiple thereof via the CLOCK connector.
		The chip rate must be correctly set to an accuracy of ± 2 % (see data sheet).
		The polarity of the clock input can be changed with the aid of **Global Trigger/Clock Settings**.
		In the case of two-path instruments, this selection applies to path A.
		Remote-control command: `SOUR:BB:GPS:CLOC:SOUR EXT`

Clock Mode - GPS   **(R&S SMx and R&S AMU instruments only)**

Enters the type of externally supplied clock.

	Chip	A chip clock is supplied via the CLOCK connector.

Remote-control command:
`SOUR:BB:GPS:CLOC:MODE CHIP`

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

The **Multiplier** window provided allows the multiplication factor to be entered.

Remote-control command:
`SOUR:WIM:CLOC:MODE MCH`

Chip Clock Multiplier - GPS   Enters the multiplication factor for clock type **Multiple**.

Remote-control command:
`SOUR:BB:GPS:CLOC:MULT 4`

Measured External Clock - GPS   **(R&S SMx and R&S AMU instruments only)**

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

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

Remote-control command:

Global Trigger/Clock Settings - GPS   **(R&S SMx and R&S AMU instruments only)**

Calls the **Global Trigger/Clock/Input Settings** menu. This menu is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

In the case of two-path instruments, these settings are valid for both paths. The parameters in this menu affect all digital modulations and standards, and are described in the section "*Global Trigger/Clock/Input Settings – Setup -Environment*".

User Marker / AUX I/O Settings - GPS   **(R&S SMx and R&S AMU instruments only)**

Calls the **User Marker AUX I/O Settings** menu. This menu is used to map the connector on the rear of the instruments are described in section "*User Marker - AUX IO - Setup-Environment-Global...Settings*".

SOURce:BB:GPS Subsystem Remote-Control Commands

Introduction - GPS - General Remote-Control Commands

This subsystem contains commands for the primary and general settings of the GPS standard. These settings concern activation and deactivation of the standard, setting the filter, clock, trigger and clipping settings, defining the frame duration and the sequence length, as well as the preset setting.

The commands for defining the satellite signal are described in the next section.

The numerical suffix at SOURce distinguishes between path A and path B for two-path instruments:

SOURce<1> = path A

SOURce2 = path B

For two-path instruments, the keyword SOURce is optional with commands for path A and can be omitted. For path B, the command must include the keyword with the suffix 2.

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

Command Table - GPS

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:GPS:CLOCk:MODE	CHIP | MCHip		
[SOURce<[1]|2>:]BB:GPS:CLOCk:MULTiplier	1... 64		
[SOURce<[1]|2>:]BB:GPS:CLOCk:SOURce	EXTernal | INTernal		
[SOURce<[1]|2>:]BB:GPS:LOCation:ALTitude	-10.000 m…10.000 m	m	
[SOURce<[1]|2>:]BB:GPS:LOCation	User Defined | Munich |New York | Sydney		
[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude:DEGRees	0.0…90.0		
[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude:DIRection	NORTh | SOUTh		
[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude:MINutes	0.0…59.0		
[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude:SEConds	0.0…59.0		
[SOURce<[1]|2>:]BB:GPS:LOCation:LONGitude:DEGRees	0.0…180		
[SOURce<[1]|2>:]BB:GPS:LOCation:LONGitude:DIRection	EAST | WEST		
[SOURce<[1]|2>:]BB:GPS:LOCation:LONGitude:MINutes	0.0…59.0		
[SOURce<[1]|2>:]BB:GPS:LOCation:LONGitude:SEConds	0.0…59.0		
[SOURce<[1]|2>:]BB:GPS:POWer:ADJust			No query
[SOURce<[1]|2>:]BB:GPS:POWer[TOTal]			No query
[SOURce<[1]|2>:]BB:GPS:PRESet			No query
[SOURce<[1]|2>:]BB:GPS:PRFLevel			No query

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:GPS:SEQuence	AUTO | RETRigger | AAUTo | ARETrigger | SINGle		
[SOURce<[1]|2>:]BB:GPS:SETTing:CATalog?			Query only
[SOURce<[1]|2>:]BB:GPS:SETTing:DELete	<file_name>		
[SOURce<[1]|2>:]BB:GPS:SETTing:LOAD	<file_name>		
[SOURce<[1]|2>:]BB:GPS:SETTing:STORe	<file_name>		
[SOURce<[1]|2>:]BB:GPS:SMODe	GENeric | LOCalization		
[SOURce<[1]|2>:]BB:GPS:SPReading[:STATe]	ON | OFF		
[SOURce<[1]|2>:]BB:GPS:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:GPS:TRIGger:ARM:EXECute			No query
[SOURce<[1]|2>:]BB:GPS:TRIGger:EXECute			No query
[SOURce<[1]|2>:]BB:GPS:TRIGger[:EXTernal<[1]|2>]:DELay	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:GPS:TRIGger[:EXTernal<[1]|2>]:INHibit	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OBASeband:DELay	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OBASeband:INHibit	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:DELay	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut:DELay:FIXed	ON | OFF	Hz	
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:DELay:MAXimum			Query only
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:DELay:MINimum			Query only
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:MODE	NBIT | WORD | SFRame | PAGE | MESSage | PULSe | PATTern | RATio		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:OFFTime	2 ... (2^24 - 1) chips		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:ONTime	2 ... (2^24 - 1) chips		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:PATTern	#B0,1...#B111..1,32		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:PULSe:DIVider	2 ... 1024		
[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:PULSe:FREQuency			Query only
[SOURce<[1]|2>:]BB:GPS:TRIGger:RMODe			Query only
[SOURce<[1]|2>:]BB:GPS:TRIGger:SLENgth	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:GPS:TRIGger:SLENgth:UNIT	SFRame | CHIP | NBIT | CNMessage		
[SOURce<[1]|2>:]BB:GPS:TRIGger:SOURce	EXTernal | INTernal | BEXTernal | OBASeband		

SOURce-GPS - Primary Commands

[SOURce<[1]|2>:]BB:GPS:CLOCk:MODE CHIP | MCHip

Note:
> *This command is available for R&S SMx and R&S AMU instruments only.*

The command enters the type of externally supplied clock (:BB:GPS: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. The multiplier is entered with the command :BB:GPS:CLOCk:MULTiplier.

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

Example: "BB:GPS:CLOC:MODE CHIP"
                    'selects clock type **Chip**, i.e. the supplied clock is a chip clock.

*RST value	Resolution	SCPI
CHIP	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:CLOCk:MULTiplier 1 ... 64

Note:
> *This command is available for R&S SMx and R&S AMU instruments only.*

The command specifies the multiplier for clock type **Multiplied** (:BB:GPS:CLOCk:MODE MCHip) in the case of an external clock source.

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

Example: "BB:GPS:CLOC:SOUR EXT"
                    'selects the external clock source. The clock is supplied via the CLOCK connector.

                    "BB:GPS:CLOC:MODE MCH"
                    'selects clock type **Multiplied**, i.e. the supplied clock has a rate which is a multiple of the chip rate.

                    "BB:GPS:CLOC:MULT 12"
                    'the multiplier for the external clock rate is 12.

*RST value	Resolution	SCPI
4	1	Device-specific

[SOURce<[1]|2>:]BB:GPS:CLOCk:SOURce   INTernal | EXTernal

Note:
This command is available for R&S SMx and R&S AMU instruments only.

The command selects the clock source.

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

Parameter: **INTernal**
                     The internal clock reference is used.

                     EXTernal
                     The external clock reference is supplied to the CLOCK connector.

Example: `"BB:GPS:CLOC:SOUR EXT"`
                     'selects an external clock reference. The clock is supplied via the CLOCK connector.

                     `"BB:GPS:CLOC:MODE CHIP"`
                     'specifies that a chip clock is supplied via the CLOCK connector.

*RST value	Resolution	SCPI
INTernal	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:ALTitude   -10.000 m…10.000 m

The command sets the geographic altitude.

This field is only available for user defined geographic locations. If a value other than **User Defined** is selected in the **Geographic Location** field, the **Altitude** field is read only.

Example: `"SOUR:BB:GPS:LOC ALT 500"`
                     'sets the geographic altitude to 500 m.

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation   User Defined | Munich | New York | Sydney

The command sets the geographic location.

Example: `"SOUR:BB:GPS:LOC "Munich""`
                     'sets the geographic location to Munich.

*RST value	Resolution	SCPI
User Defined	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude:DEGRees 0.0…90.0

The command sets the latitude of the geographic location in ° (degrees).

Example: "SOUR:BB:GPS:LOC:LAT:DEGR 48"
                'sets the latitude of the geographic location to 48° (degrees).

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude:DIRection NORTh | SOUTh

The command sets the direction of the geographic location related to the latitude.

Example: "SOUR:BB:GPS:LOC:LAT:DIR NORT"
                'sets the direction of the geographic location to NORTh.

*RST value	Resolution	SCPI
NORTh	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude:MINutes 0.0…59.0

The command sets the latitude of the geographic location in ' (minutes).

Example: "SOUR:BB:GPS:LOC:LAT:MIN 9"
                'sets the latitude of the geographic location to 9'.

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude:SEConds 0.0…59.0

The command sets the latitude of the geographic location in '' (seconds).

Example: "SOUR:BB:GPS:LOC:LAT:SEC 0"
                'sets the latitude of the geographic location to 0''.

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:LONGitude:DEGRees 0.0…180.0

The command sets the longitude of the geographic location in ° (degrees).

Example: "SOUR:BB:GPS:LOC:LONG:DEGR 11"
                'sets the longitude of the geographic location to 11° (degrees).

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:LONGitude:DIRection   EAST | WEST

The command sets the direction of the geographic location related to the longitude.

Example: `"SOUR:BB:GPS:LOC:LONG:DIR EAST"`
'sets the direction of the geographic location to EAST.

*RST value	Resolution	SCPI
EAST	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:LONGitude:MINutes   0.0...59.0

The command sets the longitude of the geographic location in ' (minutes).

Example: `"SOUR:BB:GPS:LOC:LONG:MIN 35"`
'sets the longitude of the geographic location to 35'.

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:LONGitude:SEConds   0.0...59.0

The command sets the longitude of the geographic location in '' (seconds).

Example: `"SOUR:BB:GPS:LOC:LONG:SEC 0"`
'sets the latitude of the geographic location to 0''.

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:POWer[:TOTal]?

The command queries the total power of all satellites. After **Power Adjust**, this power corresponds to 0 dB.

The command is a query command and therefore does not have an *RST value.

Example: `"BB:GPS:POW?"`
'queries the total power of all satellites.

Response: `"-22.5"`
'the total power is -25 dB.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:POWer:ADJust

The command calculates the power level of each satellite so that the sum of all levels results in 0 dB.

The command triggers an action and therefore has no *RST value and no query form.

Example: `"BB:GPS:POW:ADJ"`

                      'the total power of all satellites is set to 0 dB.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:PRESet

The command produces a standardized default for all GPS settings. The settings correspond to the *RST values specified for the commands.

This command triggers an action and therefore has no *RST value and no query form.

Example: `"BB:GPS:PRES"`

                      'resets all the GPS settings to default values.

*RST value	Resolution	Dependencies	SCPI
-	-	All GPS settings are preset.	Device-specific

[SOURce<[1]|2>:]BB:GPS:PRFLevel

Note:
    This command is available for instruments with RF output only.

The command sets the RF to GPS standard L1 (1.575420 GHz) and the power level to -115.0 dBm. The affected RF path depends on the signal routing of the selected baseband.

This command triggers an action and therefore has no *RST value and no query form.

Example: `"BB:GPS:PRFL"`

                      'sets the RF level to 1.575420 GHz and the level to -115.0 dBm.

*RST value	Resolution	Dependencies	SCPI
-	-	Sets commands `SOUR:FREQ` and `SOUR:POW`	Device-specific

[SOURce<[1]|2>:]BB:GPS:SEQuence   AUTO | RETRigger | AAUTo | ARETrigger | SINGle

Note:

    This command is available for R&S SMx and R&S AMU instruments only.

The command selects the trigger mode.

Parameter: **AUTO**
    The modulation signal is generated continuously.

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

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

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

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

Example: `"BB:GPS:SEQ AAUT"`
    'sets the **Armed_auto** trigger mode; the device waits for the first trigger (e.g. with `*TRG`) and then generates the signal continuously.

*RST value	Resolution	SCPI
AUTO	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SETTing:CATalog?

This command reads out the files with IEEE 802.16 settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only files with the file extension ***.gps** will be listed.

The command is a query command and therefore has no *RST value.

Example: `"MMEM:CDIR 'D:\user\gps"`
    'sets the default directory to D:\user\gps.

    `"BB:GPS:SETT:CAT?"`
    'reads out all the files with GPS settings in the default directory.

    Response: `"'gps_generic','gps_gen2'"`
    'the files ''gps_generic' and 'gps_gen2'' are available.

*RST value	Resolution	SCPI
	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SETTing:DELete <file_name>

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

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:GPS:SETT:DEL 'gps'"`
                'deletes file 'gps'.

*RST value	Resolution	SCPI
	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SETTing:LOAD <file_name>

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

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:GPS:SETT:LOAD 'gps'"`
                'loads file 'gps'.

*RST value	Resolution	SCPI
	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SETTing:STORe <file_name>

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

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:GPS:SETT:STOR 'gps_sem299'"`
                'stores the current settings into file '`gps_sem299`'.

*RST value	Resolution	SCPI
	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SMODe   GENeric | LOCalization

The command sets the simulation mode.

Example: `"BB:GPS:SMOD GEN`
                'generic satellite signals are generated.

*RST value	Resolution	Dependencies	SCPI
GENeric	-	`BB:GPS:STAT ON` deactivates the other standards and digital modulation.	Device-specific

[SOURce<[1]|2>:]BB:GPS:SPReading[:STATe] ON | OFF

The command activates/deactivates spreading. When spreading is deactivated the pure navigation data is modulated onto the RF carrier.

Example: "BB:GPS:SPR ON"

> 'activates spreading of simulated GPS satellite signals.

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:STATe ON | OFF

The command activates the signal generation of simulated GPS satellites. Activating this standard deactivates all the other digital standards and digital modulation modes (in case of two-path instruments, this affects the same path).

Example: "BB:GPS:STAT ON"

> 'activates signal generation of simulated GPS satellites.

*RST value	Resolution	Dependencies	SCPI
OFF	-	BB:GPS:STAT ON deactivates the other standards and digital modulation.	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:ARM:EXECute

Note:

> *This command is available for R&S SMx and R&S AMU instruments only.*

The command stops signal generation for trigger modes Armed_Auto and Armed_Retrigger. A subsequent internal or external trigger event restart signal generation.

This command triggers an event and therefore has no *RST value and no query form.

Example: "BB:GPS:TRIG:SOUR INT"

> 'sets internal triggering.

> "BB:GPS:TRIG:SEQ ARET"

> 'sets Armed_Retrigger mode, i.e. every trigger event causes signal generation to restart.

> "BB:GPS:TRIG:EXEC"

> 'executes a trigger, signal generation is started.

> "BB:GPS:TRIG:ARM:EXEC"

> 'signal generation is stopped.

> "BB:GPS:TRIG:EXEC"

> 'executes a trigger, signal generation is started again.

*RST value	Resolution	SCPI
		Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:EXECute   E-2

> *Note:*
>   *This command is available for R&S SMx and R&S AMU instruments only.*

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

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:GPS:TRIG:SOUR INT"`
                        'sets internal triggering.

                        `"BB:GPS:TRIG:SEQ RETR"`
                            'sets Retrigger mode, i.e. every trigger event causes signal generation to
                            restart.

                        `"BB:GPS:TRIG:EXEC"`
                            'executes a trigger.

*RST value	Resolution	SCPI
		Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger[:EXTernal<[1]|2>]:DELay 0 ... 2^32-1

> *Note:*
>   *This command is available for R&S SMx and R&S AMU instruments only.*

The command specifies the trigger delay (expressed as a number of chips) for external triggering.
The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix
1) and TRIGGER 2 (suffix 2) connector.

Example: `"BB:GPS:TRIG:SOUR EXT"`
                        'sets an external trigger via the TRIGGER 1 connector.

                        `"BB:GPS:TRIG:DEL 50"`
                            'sets a delay of 50 chips for the trigger.

*RST value	Resolution	SCPI
0 chips	1 chip	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger[:EXTernal<[1]|2>]:INHibit 0 ... 2^32-1

Note:
  This command is available for R&S SMx and R&S AMU instruments only.

The command specifies the number of chips by which a restart is to be inhibited following a trigger event. This command applies only in the case of external triggering. The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

Example: "BB:GPS:TRIG:SOUR EXT"
                    'selects an external trigger via the TRIGGER 1 connector.

                    "BB:GPS:TRIG:INH 200"
                    'sets a restart inhibit for 200 chips following a trigger event.

*RST value	Resolution	SCPI
0 chips	1 chip	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OBASeband:DELay 0 ... 2^32-1

Note:
  This command is available for R&S SMx and R&S AMU two-path instruments only.

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

Example: "BB:GPS:TRIG:SOUR OBAS"
                    'sets for path A the internal trigger executed by the trigger signal from the second path (path B).

                    "BB:GPS:TRIG:OBAS:DEL 50"
                    'sets a delay of 50 chips for the trigger.

*RST value	Resolution	Options	SCPI
0 chips	1 chips	B9/B10/B11 and B13	Device-specific
		K44 Only with second option B13	

[SOURce<[1]|2>:]BB:GPS:TRIGger:OBASband:INHibit 0 ... 2^32-1

Note:
  This command is available for R&S SMx and R&S AMU two-path instruments only.

The command specifies the number of chips by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path (two-path instruments only).

Example: "BB:GPS:TRIG:SOUR OBAS"
                    'sets for path A the internal trigger executed by the trigger signal from the second path (path B).

                    "BB:GPS:TRIG:INH 200"
                    'sets a restart inhibit for 200 chips following a trigger event.

*RST value	Resolution	Options	SCPI
0 chips	1 chip	B9/B10/B11 and B13	Device-specific
		K44 Only with second option B13	

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:DELay 0 ... 2^32 - 1 Chips

> *Note:*
> *This command is available for R&S SMx and R&S AMU instruments only.*

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

Example: `"BB:GPS:TRIG:OUTP2:DEL 1600"`
                         'sets a delay of 1600 chips for the signal on connector MARKER 2.

*RST value	Resolution	SCPI
0	1 chip	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut:DELay:FIXed ON | OFF

> *Note:*
> *This command is available for R&S SMx and R&S AMU instruments only.*

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

Example: `"BB:GPS:TRIG:OUTP:DEL:FIX ON"`
                         'restricts the marker signal delay setting range to the dynamic range.

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:DELay:MAXimum

> *Note:*
> *This command is available for R&S SMx and R&S AMU instruments only.*

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

The command is a query only and therefore has no *RST value.

Example: `"BB:GPS:TRIG:OUTP:DEL:FIX ON"`
                         'restricts the marker signal delay setting range to the dynamic range.

                         `"BB:GPS:TRIG:OUTP:DEL:MAX?"`
                         'queries the maximum of the dynamic range.

                         Response: `"2000"`
                         'the maximum for the marker delay setting is 2000 chips.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:DELay:MINimum

Note:
This command is available for R&S SMx and R&S AMU instruments only.

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

The command is a query only and therefore has no *RST value.

Example: `"BB:GPS:TRIG:OUTP:DEL:FIX ON"`
'restricts the marker signal delay setting range to the dynamic range.

`"BB:GPS:TRIG:OUTP:DEL:MIN?"`
'queries the minimum of the dynamic range.

Response: `"0"`
'the minimum for the marker delay setting is 0 chips.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:MODE
NBIT | WORD | SFRame | PAGE | MESSage | PULSe | PATTern | RATio

The command defines the signal for the selected marker output.

Parameter: **NBIT**
A marker signal is generated for every navigation data bit (20460 C/A chips).

WORD
A marker signal is generated for every navigation data word (30 navigation bits).

SFRame
A marker signal is generated for every navigation subframe (corresponds to 10 words).

PAGE
A marker signal is generated for every navigation page (corresponds to 5 subframes).

MESSage
A marker signal is generated for every complete navigation message (corresponds to 25 pages).

PULSe
A pulsed marker signal is generated. The pulse frequency
(= symbol rate/divider) is defined with the `SOUR:BB:GPS:TRIG:OUTP:PULSe:DIVider` command and can be queried with the `SOUR:BB:GPS:TRIG:OUTP:PULSe:FREQuency?` command.

PATTern
A marker signal is generated according to the user defined pattern (command `SOURce:BB:GPS:TRIGger:OUTPut:PATTern`).

RATio
A marker signal corresponding to the Time Off / Time On specifications in the commands `SOURce:BB:GPS:TRIGger:OUTPut:OFFT` and `SOURce:BB:GPS:TRIGger:OUTPut:ONT` is generated.

Example: `"BB:GPS:TRIG:OUTP2:MODE WORD"`
'selects the word marker signal on output MARKER 2. A marker signal is generated for every navigation data word (30 navigation bits, 20460 C/A chips each).

*RST value	Resolution	SCPI
NBIT	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:OFFTime 1.. 2^24 - 1 (1..16 777 215) chips

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

Example: `"BB:GPS:TRIG:OUTP2:OFFT 200"`
'sets an OFF time of 200 chips for marker signal 2.

*RST value	Resolution	SCPI
1	1	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:ONTime 1.. 2^24 - 1 (1..16 777 215) chips

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

Example: `"BB:GPS:TRIG:OUTP2:ONT 200"`
'sets an ON time of 200 chips for marker 2.

*RST value	Resolution	SCPI
1	1	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:PATTern #B0,1 ... #B111...1, 2

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

Example: `"BB:GPS:TRIG:OUTP2:PATT #B000000011111111,15"`
'sets a bit pattern.

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

*RST value	Resolution	SCPI
#B,1	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:PULSe:DIVider 2 ... 2^10

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

Example: `"BB:GPS:TRIG:OUTP2:PULS:DIV 2"`
'sets the divider to 2 for the marker signal on output MARKER 2.

`"BB:GPS:TRIG:OUTP2:FREQ?"`
'queries the resulting pulse frequency of the marker signal.

Response: `"511511.038"`
'the resulting pulse frequency is
511.511 kHz.

*RST value	Resolution	SCPI
2	1	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:OUTPut<[1]...4>:PULSe:FREQuency?

The command queries the pulse frequency of the pulsed marker signal in the setting
`SOURce:BB:GPS:TRIGger:OUTPut:MODE PULSe`. The pulse frequency is derived by dividing the
symbol rate by the divider.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:TRIG:OUTP2:PULS:DIV 2"`
'sets the divider for the marker signal on output MARKER 2 to the value 2.

                  `"BB:GPS:TRIG:OUTP2:MODE PULS"`
'enables the pulsed marker signal.

                  `"BB:GPS:TRIG:OUTP2:PULS:FREQ?"`
'queries the pulse frequency of the marker signal.

                  Response: `"511511.038"`
'the resulting pulse frequency is
511.511 kHz.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:RMODe

Note:
    This command is available for R&S SMx and R&S AMU instruments only.

The command queries the current status of signal generation for all trigger modes with GPS
modulation on.

The command is a query command and therefore has no *RST value.

Parameter: **RUN**
the signal is generated. A trigger event occurred in the triggered mode.

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

Example: `BB:GPS:TRIG:MODE ARET"`
'selects the Armed_Retrigger mode.

                  `BB:GPS:TRIG:SOUR EXT"`
'sets external triggering via the TRIGGER 1 connector.

                  `BB:GPS:TRIG:RMOD?"`
'queries the current status of signal generation.

                  Response: `"RUN"`
'the signal is generated, an external trigger was executed.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:SLENgth   1 … Max

Note:
This command is available for R&S SMx and R&S AMU instruments only.

The command defines the length of the signal sequence to be output in the **Single** trigger mode (`SOUR:BB:GPS:SEQ SING`). The unit of the entry is defined unter **Signal Duration Unit**. The maximum value for the sequence length depends on the selected unit.

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.

Example: `BB:GPS:SEQ SING"`
                        'sets trigger mode Single.

                     `BB:GPS:TRIG:SLEN 200"`
                        'sets a sequence length of 200 chips. The first 200 chips of the current frame will be output after the next trigger event.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:SLUNit   SFRame | CHIP | NBIT | CNMessage

Note:
This command is available for R&S SMx and R&S AMU instruments only.

The command defines the unit for the entry of the length of the signal sequence (`SOUR:BB:GPS:TRIG:SLEN`) to be output in the **Single** trigger mode (`SOUR:BB:GPS:SEQ SING`).

Parameter: **SFRame**
                        Unit subframe. A single subframe is generated after a trigger event.

                     CHIP
                        Unit Chip. A single chip is generated after a trigger event.

                     NBIT
                        Unit Navigation Bit. A single Navigation Bit is generated after a trigger event.

                     CNMessage
                        Unit Complete Navigation Message. A single Complete Navigation Message is generated after a trigger event.

Example: `"BB:GPS:SEQ SING"`
                        'sets trigger mode Single.

                     `"BB:GPS:TRIG:SLUN SFR"`
                        'sets unit Subframe for the entry of signal duration.

                     `"BB:GPS:TRIG:SLEN 2"`
                        'sets a signal duration of 2 subframes. The current subframe will be output twice after the next trigger event.

*RST value	Resolution	SCPI
CHIP	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:TRIGger:SOURce INTernal | EXTernal | BEXTernal | OBASeband

Note:
    This command is available for R&S SMx and R&S AMU instruments only.

The command selects the trigger source.

Parameter: **INTernal**
                   Triggering is executed by means of the Trigger command `SOURce:BB:GPS:TRIGger:EXECute` or
                   `*TRG` in the case of remote control and by means of **Execute Trigger** in the case of manual
                   operation.

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

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

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

Example: `BB:GPS:TRIG:SING"`
                       'selects a trigger mode that requires a trigger.

                   `BB:GPS:TRIG:SOUR EXT"`
                       'sets external triggering via the TRIGGER 1 connector.

*RST value	Resolution	SCPI
INTernal	-	Device-specific

SOURce-GPS - Satellite Signal Settings

The SOURce:BB:GPS:SATellite and SOURce:BB:GPS:NAVigation systems contain commands for setting the characteristics of the satellite signals.

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac	<file name>		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:DAY	1 ... 31		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:MONTh	1 ... 12		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:WNUMber	1 ... 5		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:YEAR	-9999 ... 9999		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:DAY	1 ... 31		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:MONTh	1 ... 12		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:YEAR	-9999 ... 9999		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:TOEPhemeris			Query only
[SOURce<[1]|2>:]BB:GPS:NAVigation:DATA	ZERO | ONE | PATTern | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | RNData		
[SOURce<[1]|2>:]BB:GPS:NAVigation:DATA:DSELect	<dlist_name>		
[SOURce<[1]|2>:]BB:GPS:NAVigation:DATA:PATTern	#B0,1...B11..1,64		
[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation:[:BEGin]:DATE	<YY,MM,DD>		
[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation:[:BEGin]:TIME	<HH,MM,SS>		
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:CACRate			Query only
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:DSHift	-100.0 kHz ... 100.0 kHz	Hz	
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:FREQency			Query only
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:PCRate			Query only
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:POWer	-10.0 dB ... 10.0 dB	dB	
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:RCODe	CACode		
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:TSCHips	0 ... 10 000 000		
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:TSSeconds		s	Query only
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:VID	0 ... 37		

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac   <text file name>

The command selects the almanac providing the navigation information). Current almanac data can be downloaded via the Internet. The files are provided as text files (*.txt).

The directory applicable to the following command is defined with the command `MMEMory:CDIR`. To access the files in this directory, onlythe file name is required, without the path and the file extension.

Example: `"MMEM:CDIR 'D:\Lists\gps'"`
                      'selects the directory for the almanac files.

                      `"BB:GPS:NAV:ALM 'SEM269'"`
                      'the file '`SEM269`' is used for retrieving navigation information.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:DAY?

The command queries the start day of the week in which the almanac was published. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAVigation:DATA RND`). The almanac is loaded with command `SOURce:BB:GPS:NAVigation:ALMananc`.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:NAV:ALM:BEG:DAY?"`
                      'queries the start day of the GPS week.

                      Response: `"12"`
                      'the GPS week starts on the 12th of the month.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:MONTh?

The command queries the start month of the week in which the almanac was published. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAVigation:DATA RND`). The almanac is loaded with command `SOURce:BB:GPS:NAVigation:ALMananc`.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:NAV:ALM:BEG:MONT?"`
                      'queries the start month of the GPS week.

                      Response: `"4"`
                      'the week starts in April.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:WNUMber?

The command queries the GPS week number of the almanac. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAVigation:DATA RND`). The almanac is loaded with command `SOURce:BB:GPS:NAVigation:ALMananc`.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:NAV:ALM:BEG:WNUM?"`
                'queries the GPS week number of almanac.

                Response: `"1233"`
                'the week number is 1233.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:YEAR?

The command queries the year of the week in which the almanac was published. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAVigation:DATA RND`). The almanac is loaded with command `SOURce:BB:GPS:NAVigation:ALMananc`.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:NAV:ALM:BEG:YEAR?"`
                'queries the year of the GPS week.

                Response: `"2005"`
                'the year is 2005.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:DAY?

The command queries the final day of the week in which the almanac was published. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAVigation:DATA RND`). The almanac is loaded with command `SOURce:BB:GPS:NAVigation:ALMananc`.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:NAV:ALM:END:DAY?"`
                'queries the final day of the GPS week.

                Response: `"19"`
                'the GPS week ends on the 19th of the month.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:MONTh?

The command queries the final month of the week in which the almanac was published. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAVigation:DATA RND`). The almanac is loaded with command `SOURce:BB:GPS:NAVigation:ALMananc`.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:NAV:ALM:END:MONT?"`
                     'queries the final month of the GPS week.

                     Response: `"4"`
                     'the GPS week ends in April.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:YEAR?

The command queries the year of the week in which the almanac was published. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAVigation:DATA RND`). The almanac is loaded with command `SOURce:BB:GPS:NAVigation:ALMananc`.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:NAV:ALM:END:YEAR?"`
                     'queries the year of the GPS week.

                     Response: `"2005"`
                     'the year is 2005.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:TOEPhemeris?

The command queries the time of ephemeris, i.e the exact time in seconds to which the navigation data refers. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAVigation:DATA RND`). The almanac is loaded with command `SOURce:BB:GPS:NAVigation:ALMananc`.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:NAV:ALM:TOEP?"`
                     'queries the time of ephemeris.

                     Response: `"589824"`
                     'the value is returned in seconds. Counting starts at 0.00 a.m. on sunday of the GPS week.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:DATA RNData **|** PN9 | PN11 | PN15 | PN16 | PN20 | PN21 |
PN23 | DLISt | ZERO | ONE | PATTern

The command determines the data source for the navigation information.

Parameters: **RNData**
Real navigation data provided by an almanac file is used. The file is loaded with command
`SOURce:BB:GPS:NAVigation:ALMananc`.

DLISt
A data list is used. The data list is selected with the command
`:BB:GPS:NAVigation:DATA:DSELect`.

PNxx
The pseudo-random sequence generator is used as the data source. Different random sequence
lengths can be selected.

ZERO | ONE
Internal 0 and 1 data is used

PATTern
Internal data is used The bit pattern for the data is defined by the command
`:BB:GPS:NAVigation:DATA:PATTern`.

Example: `"BB:GPS:NAV:DATA PATT"`
'selects as the data source for the data fields of burst 0, the bit pattern defined
with the following command.

`"BB:GPS:NAV:DATA:PATT  #H3F,8"`
'defines the bit pattern.

*RST value	Resolution	SCPI
RNData	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:DATA:DSELect <data list name>

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

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

Example: `"BB:GPS:NAV:DATA DLIS"`
'selects the Data Lists data source.

`"MMEM:CDIR 'D:\Lists\DM\IqData'"`
'selects the directory for the data lists.

`"BB:GPS:NAV:DATA:DLIS 'GPS_list1'"`
'selects file `GPS_list1` as the data source. This file must be in the directory
`D:\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:DATA:PATTern #B0,1... #B111..1,64

The command determines the bit pattern for the PATTern selection. The maximum length is 64 bits.

Example: `"BB:GPS:NAV:DATA:PATT  #H3F,8"`
                'defines the bit pattern.

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:DATE <YYYY,MM,DD>

The command sets the date for the simulation. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAV:DATA RND`).

Example: `"BB:GPS:NAV:SIM:DATE 2006,12,25"`
                'sets the date for the simulation.

*RST value	Resolution	SCPI
2004,10,10	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:TIME <HH,MM,SS>

The command sets the time for the simulation in Greenwich Mean Time. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAV:DATA RND`).

Example: `"BB:GPS:NAV:SIM:TIME 12,45,59"`
                'sets the time for the simulation.

*RST value	Resolution	SCPI
0,0,0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>CACRate?

The command queries the currently valid values for the chip rate of the C/A code.The chip rate depends on the set doppler shift.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:SAT4:CACR?"`
                'queries the chip rate of the C/A code of satellite 4.

                Response: `"1023022.077"`
                'the chip rate is 1. 023022 08 MHz.

*RST value	Resolution	SCPI
-		Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:DSHift   -100 kHz ... 100 kHz

The command sets the doppler shift of the simulated signal of the selected satellite. The relevant change to the chip rate of the C/A code is carried out automatically. The currently valid values for Doppler-shifted carrier frequency and chip rates are queried with commands `SOURce:BB:GPS:SATellite:CACRate`, `SOURce:BB:GPS:SATellite:PCRate`, and `SOURce:BB:GPS:SATellite:FREQuency`.

Example: `"BB:GPS:SAT2:DSH 5 kHz"`
                       'sets a doppler shift of 5 kHz for satellite 2.

*RST value	Resolution	SCPI
0	0.01 Hz	Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>CACRate?

The command queries the resulting C/A chip rate.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:SAT4:CACR?"`
                       'queries the resulting C/A chip rate of satellite 4.

                       Response: `"1023000.0067142857"`
                       'the resulting C/A chip rate is 11.023 MHz.

*RST value	Resolution	SCPI
-		Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:FREQuency?

The command queries the currently valid value for the doppler-shifted carrier frequency.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:SAT4:FREQ?"`
                       'queries the resulting carrier frequency of satellite 4.

                       Response: `"1575421111"`
                       'the resulting carrier frequency is 1.57542 GHz.

*RST value	Resolution	SCPI
-		Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>PCRate?

The command queries the currently valid value for the resulting P-chip rate.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:SAT4:PCR?"`
                    'queries the resulting P-chip rate of satellite 4.

                    Response: `"10230007.214285715"`
                    'the resulting P-chip rate is 10.230007 MHz.

*RST value	Resolution	SCPI
-		Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:POWer -10 dB ... +10 dB

The command sets the power offset of the satellite.

Example: `"BB:GPS:SAT4:POW -2 dB"`
                    'sets a power offset of 2 dB.

*RST value	Resolution	SCPI
0 dB	0.1 dB	Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:RCODe   CACode | CAPCode | PCODe

The command selects the ranging code for satellite 1. For satellite 2, 3, and 4, only C/A is available and cannot be changed.

Parameters: **CACode**
                    Carrier L1 (f_L1= 1.57542 GHz) is modulated by C/A-code (BPSK).

                    CAPCode
                    (only available for Satellite 1)
                    Carrier L1 (f_L1= 1.57542 GHz) is modulated by C/A code and P-code (QPSK).

                    PCODe
                    (only available for Satellite 1)
                    Carrier L1 (f_L1= 1.57542 GHz) is modulated by P-code (BPSK).

Example: `"BB:GPS:SAT1:RCOD CAC"`
                    'sets the C/A ranging code for satellite 1.

*RST value	Resolution	SCPI
CACode	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:STATe ON | OFF

The command enables/disables generation of the signal of the selected satellite.

Example: `"BB:GPS:SAT4:STAT ON"`
                    'enables generation of the signal of satellite 4.

*RST value	Resolution	SCPI
SAT1: ON SAT<2|3|4>: OFF		Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:TSCHips 0 ...10 000 000

The command sets a delay of the selected satellite relative to the other satellites. The time shift is set in oversampled CA chips (Oversamling = 40).

Example: `"BB:GPS:SAT4:TSCH 100232"`
                              'sets a time shift of 100232 oversampled CA chips.

*RST value	Resolution	SCPI
0		Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:TSSeconds?

The command queries the time shift of the code sequence in seconds.

The command is a query command and therefore has no *RST value.

Example: `"BB:GPS:SAT4:TSS?"`
                              'queries the time shift in seconds.

                              Response: `"0.00979"`
                              'the time shift is 9.799 ms.

*RST value	Resolution	SCPI
		Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:VID   1 ... 37

The command sets the id of the satellite to be simulated. This value is used to generate the corresponding C/A code. If **Real Navigation Data** is used, only the valid Ids which are listed in the almanac are setable. For arbitray data, all Ids can be selected.

Example: `"BB:GPS:SAT2:VID 4"`
                              'sets id 4 for the second satellite.

*RST value	Resolution	SCPI
SAT1: 1 SAT2: 2 SAT3: 3 SAT4: 4	-	Device-specific

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