Supplement

Digital Standard GPS and Assisted GPS

R&S® AMU-K44
1402.6406.02

R&S® AMU-K65
1403.0101.02

R&S® SMATE-K44
1404.5407.02

R&S® SMATE-K65
1415.1372.02

R&S® SMJ-K44
1404.1401.02

R&S® SMU-K65
1415.0053.02

R&S® SMU-K44
1161.0566.02

ROHDE&SCHWARZ

Test and Measurement

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.

Grouped Safety Messages

Make sure to read through and observe the following safety instructions!

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, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for 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 only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

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

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

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

NOTICE   NOTICE indicates a property damage message.

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

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

34. Prior to cleaning, disconnect the product from the AC supply. Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluent for cellulose lacquers.

Informaciones elementales de seguridad

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

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. 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 estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda sufrir daño. El uso del producto fuera de sus fines definidos o 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 básicas del idioma inglés. Por eso se debe tener en cuenta que el producto sólo pueda ser operado por personal especializado o personas minuciosamente instruidas con las capacidades correspondientes. 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. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto y entréguela a usuarios posteriores.

Símbolos y definiciones de seguridad

Ver documentación de producto	Informaciones para maquinaria con un 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.
AVISO	Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
	En la documentación del producto se emplea de forma sinónima el término CUIDADO.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación 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 por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4.500 m sobre el nivel del mar.
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 especializado 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. Después 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 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, deberán ser tenidas en cuenta las prescipciones 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 radiocomunicación RF, 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/usuario está comprometido a valorar y señalar áreas 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 producto.

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 bastidores 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 del estándar IEC950/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 cortocircuitos 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 líquidos 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 usuario 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 células 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 observadas. 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 láser 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 láser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo láser.

34. Antes de proceder a la limpieza, desconecte el producto de la red. Realice la limpieza con un paño suave, que no se deshilache. No utilice de ninguna manera agentes limpiadores químicos como, por ejemplo, alcohol, acetona o nitrodiluyente.

Contents – Digital Standard GPS

Digital Standard GPS/A-GPS

SOURce:BB:GPS Subsystem Remote-Control Commands

Digital Standard GPS/A-GPS

The R&S Signal Generator provides you with the ability to generate signals of up to four Global Positioning System (GPS) satellites per baseband path, i.e. eight GPS satellites in case of two path instrument. Signal generation is done in real-time and thus it is not limited to a certain time period.

Introduction - Digital Standard GPS/A-GPS

The Global Positioning System consists of several satellites circling the earth in low orbits. The satellites permanently transmit information about their current position (ephemeris) and about the orbits of all satellites (almanac). Additionally 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 folloing two ranging codes are defined:
◆ the Coarse/Acquisition code (C/A code)
   The C/A code (f_ca = 1.023 MHz) is freely availlable and used for civilian purposes.
◆ the Precise code (P-Code).
   The P-Code (f_p = 10.23 MHz) is restricted and used for military applications.
Both ranging codes are used as spreading code for the navigation message which is transmitted at a rate of 50 baud.
There are two carriers available:
◆ L1 (f_L1 = 1.57542 GHz), which is modulated by both C/A code and P-code (QPSK)
◆ L2 (f_L2 = 1.2276 GHz), modulated only with P-Code (BPSK).

Assisted GPS

Assisted-GPS was introduced to different mobile communication standards to significantly reduce the Time To First Fix (TTFF) of a UE containing a GPS receiver. This is achieved by transmitting information about the satellites directly from the base station to the UE.

In order to obtain a valid position fix, a stand-alone GPS receiver performs the following steps:
1. Find visible satellites by searching different C/A codes over different Doppler shifts. (This process is also called acquisition.)
2. Read out ephemeris data from the satellite's signal in order to get the satellite's current position.
3. Read out the complete navigation message from the satellite's signal in order to get the ionospheric model and the positions of all satellites (almanac).
4. Perform measurements to get runtimes of the different satellite signals.
5. Calculate exact location based on the satellite's positions and the measurements taken. (This process is also called navigation.)
Depending on previous knowledge a stand-alone GPS receiver needs about 30-60 seconds for a first fix and up to 12.5 minutes to get all information (almanac).

In A-GPS "UE based mode", the base station assists the UE by providing the complete navigation message along with a list of visible satellites and ephemeris data. In addition to this information, the UE gets the location and the current time at the Base Station and that speeds up both acquisition and navigation processes of the GPS receiver and hence reduces TTFF to a few seconds.

In A-GPS "UE assisted mode", the base station is even responsible for the calculation of the UE's exact location, i.e. the base station performs the navigation based on the raw measurements provided by the UE. Since the Acquisition Assistance Data provided by the Base Station already serves speeding up the Doppler and Code Phase correlation, i.e. the acquisition process, the UE only has to perform the measurements for getting the runtimes of the different satellite signals. Complexity of the UE's GPS module is hence reduced which leads to lower power consumption.

GPS system parameters

The table below gives an overview of the GPS system parameters.

Carrier frequency	L1=1.57542 GHz
	L2=1.2276 GHz
Signal level, after antenna	Approx. –115 dBm, depending on receive conditions
Doppler shift	-100 kHz to +100 kHz selectable (individually for each satellite)
Symbol rate	1.023 Mcps (C/A code)
	10.23 Mcps (P-code)
C/A codes	1 to 37 selectable, 1023 chips per C/A code
Modulation	BPSK (C/A code, P-code)
	QPSK (C/A code and P-code)
Information data rate (navigation message)	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.

Tab. 1   GPS system parameters

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).

Almanacs are currently available at the following internet sites:

◆ U.S.Coast Guard Navigation Center GPS Homepage
   http://www.navcen.uscg.gov/GPS/almanacs.htm
   The almanac files are named xxx.alm (for YUMA files) or xxx.al3 (for SEM files) whereas xxx denotes the day of a year.

◆ http://www.celestrak.com/GPS/almanac/
   The naming convention of the almanac file is: almanac.sem/yuma.weekXXXX.YYYYYY.txt whereas xxxx denotes the GPS week and yyyyyy the time of almanac (TOA).

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

Functional Overview Option GPS (R&S-K44)

With the option GPS (R&S-K44), up to four satellites per baseband can be simulated in real-time. In **Generic mode,** static satellites with constant Doppler shifts are provided for simple receiver test. However forcing the connected GPS-receiver to obtain a valid 3D fix at a user-defined location is only possible in **Localization mode** set to **Auto SV Selection**. An R&S Signal Generator equipped with option GPS (R&S-K44) does the whole configuration of visible satellites and the generation of the ephemeris out of the uploaded almanac. The user only needs to specify time and location; all other configurations are done automatically by the the R&S Signal Generator in order to get a realistic scenario with an optimal 4-satellite constellation i.e. minimum Position Dilution of Precision (PDOP). In case of a 2-path instrument equipped with two options GPS (R&S-K44), up to 8 satellites can be simulated and controlled within one dialog.

Enhancements of Option Assisted GPS (R&S-K65)

The option Assisted GPS (R&S-K65) is only available for 2-path instruments equipped with two options GPS (R&S-K44). It enhances the option GPS (R&S-K44) with functionalities required for A-GPS test scenarios for 3GPP FDD and GSM.

The following predefined A-GPS test scenarios are currently supported:

◆ GSM Signaling Test Scenario (3GPP TS 51.010-1 v.7.7.0)
◆ GSM Performance Test Scenario#1 (3GPP TS 51.010-1 v.7.7.0)
◆ GSM Performance Test Scenario#2 (3GPP TS 51.010-1 v.7.7.0)
◆ GSM Performance Test Scenario#3 (3GPP TS 51.010-1 v.7.7.0)
◆ 3GPP FDD Signaling Test Scenario (3GPP 34.108 v.8.0.0, 3GPP TS 34.123-3 v.6.4.0)
◆ 3GPP FDD Performance Test Scenario#1 (3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)
◆ 3GPP FDD Performance Test Scenario#2 (3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)
◆ 3GPP FDD Performance Test Scenario#3 (3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)

It is also possible to define user-specific test scenarios.

Besides generating the satellite signals for an A-GPS test scenario, the option Assisted GPS (R&S-K65) is also able to provide all kinds of assistance data in line with the simulated scenario which can be provided to the UE by a protocol tester, like e.g. R&S CMU/CRTU family. Certainly, this also applies to user-defined A-GPS test scenarios.

However, the option Assisted GPS (R&S-K65) is not limited to be used in A-GPS testing exclusively. For testing of stand-alone GPS receivers the option Assisted GPS (R&S-K65) is useful as it offers full flexibility on the simulated satellites including definition of the satellite's orbit and the complete navigation message.
The Localization mode Auto SV Selection can be used to get a reasonable GPS scenario, changing to **Full Configuration** however enables the user to adjust the scenario to his exact requirements. For example, a detailed configuration of the ionospheric model for each satellite is possible.

Moving Scenarios

As it is part of the A-GPS test scenarios for 3GPP FDD and GSM (Performance Test Scenario#3), the option Assisted GPS (R&S-K65) enhances the option GPS (R&S-K44) by user-definable moving scenarios, which can also be used for testing stand-alone GPS-receivers. The user has the possibility to define a movement by means of a so-called "waypoint" file, which will lead to a "moving" of the connected GPS-receiver.

Waypoint file's formats

Two ".txt" formats can be used for the waypoint file:
- The first format is a list of coordinates (longitude, latitude, altitude) and a respective resolution in milliseconds, as shown for the case of 3GPP Performance Test Scenario#3 "Melbourne" (WGS 84 geodetic coordinates)

```
RESOLUTION: 50
144.966666334601,-37.8166633061788,100.000000009313
144.966662392613,-37.8166632247233,100.000000039116
144.966658453002,-37.8166630889914,100.00000008475
144.966654516955,-37.8166628990241,100.000000149943
144.966650585658,-37.8166626548785,100.000000235625
144.966646660296,-37.8166623566284,100.000000339001
144.966642742053,-37.8166620043635,100.000000461936
144.966638832109,-37.81666159819,100.000000603497
144.966634931642,-37.8166611382304,100.000000762753
144.96663104183,-37.8166606246233,100.000000941567
144.966627163843,-37.8166600575235,100.000001138076
144.96662329885,-37.8166594371019,100.000001354143
144.966619448018,-37.8166587635456,100.000001588836
144.966615612505,-37.8166580370574,100.000001840293
144.966611793469,-37.8166572578565,100.00000211224
144.96660799206,-37.8166564261776,100.00000240095
144.966574759635,-37.8166466260761,100.00000580959
etc.
```

The resolution command at the beginning of the format specifies the sampling rate to be used for the WGS-84 geodetic coordinates list.

◆ The second format uses a script containing the commands defined in the following table:

Command	Description
REFERENCE: lon, Lat, alt	Specifies the Cartesian Reference of the ENU coordinates system. Given as a geodetic WGS-84 point (longitude, Latitude, Altitude).
START: E ,N, U, Velocity	Start location i.e., initial "current location" in the ENU Cartesian coordinate of center "REFERENCE". East, North and UP (ENU) coordinates are then provided (m). The last argument is the start velocity in (m/s).
ARC: E, N, Angle	Specifies a 2-Dimensional ARC (East, North) with the first two arguments representing the center of the ARC (m) in the Cartesian basis. The last argument specifies the angle in degrees (°) of the Arc Starting the "current location". Angle sign is significant since it indicates positive direction (against clock movement) or negative direction (same as clock movement). The end edge of the arc represents the new "current location". Velocity doesn't change when using an ARC command.
LINE: ΔE, ΔN, Acceleration	Specifies a 2-Dimensional Line starting the "current location" as the first edge and (Current loc E + ΔE, Current loc N + ΔN) as the second edge (m). Constant acceleration/deceleration can be specified in the last argument e.g., (0 means constant velocity). Unit for acceleration is (m/s^2). The second edge is again used as the "current location" for the next command. The speed at this second edge is also used as the start speed for the next command.
STAY: Time	Stay at the current location for Time period (ms).

Example of Waypoint File

This example explains a waypoint file in the second format for the case of 3GPP Performance Test Scenario#3 "Melbourne", as described in 3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1.
The GPS signals simulate the GPS-receiver moving on a rectangular trajectory of 940m by 1 440m with rounded corners defined in Fig. 1 and Tab. 2.
The initial reference is first defined followed by acceleration to final speed of 100 km/h in 250 m.
The UE then maintains the speed for 400 m. This is followed by deceleration to final speed of 25 km/h in 250 m. The UE then turn 90 degrees with turning radius of 20 m at 25 km/h. This is followed by acceleration to final speed of 100 km/h in 250 m.
The sequence is repeated to complete the rectangle.

Parameter	Distance (m)	Speed (km/h)
I_{11}, I_{15}, I_{21}, I_{25}	20	25
I_{12}, I_{14}, I_{22}, I_{24}	250	25 to 100 and 100 to 25
I_{13}	400	100
I_{23}	900	100

Tab. 2   Trajectory Parameters for Moving Scenario and Periodic Update Performance test case

Fig. 1   Moving Scenario

Movement Description

```
****************************** MOVEMENT FILE ******************************
%%!! All empty lines or statements starting with %% will be ignored
%%This file format is used to load a continuous movement File into the SMU
%% Enter the WGS-84 Reference Point's Coordinates S
REFERENCE: 144.96667027777777777777777777777777,-7.81666333333333333333333333333,100
%%From here on, we work in an ENU (EAST-NORTH-UPPER) basis centered around the ENU reference
point S.
%%And more specifically the movement description will start from "START"
%%"START", "EAST COORDINATE E0 relative to S", "NORTH COORDINATE N0 relative to S", "UPPER
COORDINATE N0 relative to S", "SPEED in (m/s)"
START: 0, 0, 0, 6.94444444444444444
%%Each movement segment is described in one line command in the file and the segments are to be
read sequentially.
%%It can be either a line description or an arc description... for a line, we start by the
syntax: "LINE" and for an arc
%%we start with the syntax "ARC"
%%In the current version, we will provide only EAST-NORTH Movement segments
%%"ARC", "Center EAST Coordinate", "Center NORTH Coordinate", "ARC in degrees (pos or neg is
necessary for orientation)"
ARC: 0, 20, -90
%%"LINE", "Second Edge EAST Coordinate, first edge is the current point or last point of
previous segment", "Second Edge NORTH Coordinate", "Acceleration/Deceleration"
%%Acceleration is to be taken as the projection following the movement segment

LINE: 0, 250, 1.44675925925925925926
LINE: 0, 400, 0
LINE: 0, 250, -1.44675925925925925926
ARC: 0, 920, -90
LINE: 250, 0, 1.44675925925925925926
LINE: 900, 0, 0
LINE: 250, 0, -1.44675925925925925926
ARC: 1400, 920, -90
LINE: 0, -250, 1.44675925925925925926
LINE: 0, -400, 0
LINE: 0, -250, -1.44675925925925925926
ARC: 1400, 20, -90
LINE: -250, 0, 1.44675925925925925926
LINE: -900, 0, 0
LINE: -250, 0, -1.44675925925925925926
%%End of Trajectory description
```

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, 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.

GPS A

State	On

Set To Default	Save/Recall...
Data List Management...	Set To Default RF And Level

RF Band	L1
Filter	Gauss
AGPS Test Scenario	User Defined
Use Baseband A+B	☐
Simulation Mode	Localization
Localization Mode	Full Configuration

Trigger/Marker...		Retrig / Int
Execute Trigger		**Running** ➤
Clock...		Internal

Localization Data

Geographic Location	Waypoints
Select Waypoint File...	INTERPOLATION_IMB_A
Read Out Mode	One Way
Position Format	DEG:MIN:SEC
Altitude	0.9 m
Latitude	0 ° 52 ′ 30.639 ′′ North
Longitude	0 ° 52 ′ 30.639 ′′ 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 Almanac (TOA):	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...	Assistance Data Generation...

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 the same path.

Note:
> *For two path instruments and enabled parameter **Use of Baseband A+B**, enabling the GPS signal simulation will disable all other digital standards and digital modulation modes even in the path B.*

A continuous GPS signal is generated for up to four satellites per path 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
Filter	Gauss
RF Band	L1
AGPS Test Scenario	User Defined
Use Baseband A+B	Off
Simulation Mode	Generic
Navigation Data Source	Real navigation data
Select Almanac File	SEM299
Almanac for GPS Week	Week of Almanac
Date	Date of TOE
Time	Time of TOE
Greenwich Mean Time	Time
Satellite configuration	
Use Spreading	On
State satellite 1	On

Parameter	Value
State satellite 2 ... 4	Off
Ranging Code	C/A
Space Vehicle Id (satellite 1 ... 4)	1 / 2 / 3 / 4
Time Shift / CA-Chips / 40	0
Time Shift /ms	0
Power /dB	0
Doppler Shift	0 Hz
Trigger/Marker/Clock	
Trigger/Marker	Auto
Clock	Internal

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.

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.

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"
```

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 selected by parameter **RF Band** (L1 of 1.57542 GHz respectively L2 of 1.2276 GHz) and the output 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
```

RF Band - GPS	Selects the GPS carrier frequency used for Doppler calculation.

Remote-control command:
```
SOUR:BB:GPS:RFB L2
```

L1	Selects GPS carrier frequency L1 = 1.57542 GHz.
L2	Selects GPS carrier frequency L2 = 1.2276 GHz.

Filter - GPS   Sets the filter to GPS compliant rectangular mode or to Gauss mode.

Remote-control command:
```
SOUR:BB:GPS:FILT:TYPE RECT
```

AGPS Test Scenario - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Selects a predefined A-GPS test scenario.

Remote-control command:
```
SOUR:BB:GPS:ATSC W3GPER2
```

       User Defined   No predefined test scenario is selected. The parameters can be set by the user.

       GSM   One of the following predefined A-GPS GSM test scenarios can be selected:

- GSM Signalling Scenario
  (3GPP TS 51.010-1 v.7.7.0)
- GSM Performance Test Scenario 1
  (3GPP TS 51.010-1 v.7.7.0)
- GSM Performance Test Scenario 2
  (3GPP TS 51.010-1 v.7.7.0)
- GSM Performance Test Scenario 3
  (3GPP TS 51.010-1 v.7.7.0)

All parameter will be set according to the selected test scenario.

       3GPP FDD   One of the following predefined A-GPS 3GPP FDD test scenarios can be selected:

- 3GPP FDD Signalling Scenarion
  (3GPP 34.108 v.8.0.0, 3GPP TS 34.123-3 v.6.4.0)
- 3GPP FDD Performance Test Scenario 1
  (3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)
- 3GPP FDD Performance Test Scenario 2
  (3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)
- 3GPP FDD Performance Test Scenario 3
  (3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)

All parameter will be set according to the selected test scenario.

Use Baseband A+B - GPS　　**(The parameter is available only in path A of two-path instruments)**

Enables/disables control of both paths via the GPS menu.

If this parameter is enabled, a total number of eight satellites can be configured.

If this parameter is enabled, both baseband are automatically set to trigger mode **Armed Retrigger** and a trigger event has to be performed to start the signal generation.

Remote-control command:
SOUR:BB:GPS:BAB:STAT ON

Simulation Mode - GPS　　Sets the simulation mode.

The settings of the satellite signals are provided in the submenu **Satellite Configuration** (see "Satellite Configuration - GPS")

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

Localization Mode - GPS　　Sets the localization mode.

Auto SV Selection　　Eight satellites will be selected depending on the selected almanac. However, only four satellites per baseband can be generated.
The ephemerides are read out of the almanac and displayed in the **Navigation Message Configuration** menu.

Note:
　The ephemerides are not automatically updated. There should be less than two hours between the simulation and the TOA (Time of Almanac).

Remote-control command:
SOUR:BB:GPS:LMOD AUTO

	Full Configuration	**(enabled with option Assisted GPS (R&S-K65) only)**

Selection Full Configuration as Localization mode enables the user to configure all parameter of the navigation message (see "Navigation Message Configuration - GPS").

This mode is used for A-GPS simulation.

Remote-control command:
`SOUR:BB:GPS:LMOD FULL`

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 *"Trigger/Marker/Clock - GPS"*).

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

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 *"Trigger/Marker/Clock - GPS"*).

Remote-control command: n.a.

Localization Data

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 of the GPS receiver.

User Defined	Enables the definition of the **Latitude**, **Longitude** and **Altitude** of the GPS receiver.
	Remote-control command: `SOUR:BB:GPS:LOC "User Defined"`
Waypoints	**(enabled with option Assisted GPS (R&S-K65) only)**
	Enables defining a moving scenario. The parameters **Latitude**, **Longitude** and **Altitude** are set according to the first position of the Waypoint-File (see *"Moving Scenarios"*).
	Remote-control command: `SOUR:BB:GPS:LOC "Waypoints"`
\<List of Predefined Positions\>	Selects one of the predefined positions (e.g. Munich). The parameters **Latitude**, **Longitude** and **Altitude** are set according to the selected position.
	Remote-control command: `SOUR:BB:GPS:LOC "Munich"`

Select Waypoint File … - GPS   This selection is available only for **Geographic Location** set to Waypoints.

Call the **Select Waypoint File** menu. This menu is used to select predefined waypoint files.
A waypoint file is description of a moving scenario in form of a sequence of positions.
A waypoint file must have the extension .txt. See *"Waypoint file's formats"* for detailed description of the waypoint file's format.

Remote-control commands:
`SOUR:BB:GPS:LOC:WAYP 'd:\waypoints.txt'`

Read Out Mode - GPS   This selection is available only for **Geographic Location** set to Waypoints.

Defines the way the waypoint file is to be read.

Cyclic	The waypoint file is read out cyclic. Using this read out mode is only recommended for waypoint files that describe a circle moving scenario or moving scenario in which the start and the end point are close to each other.
	Remote-control command: `SOUR:BB:GPS:LOC:ROM CYC`

<table>
<tr><td>One Way</td><td>The file is read out only once.
By reaching the end of the file, the last described position is assumed to be a static one.</td></tr>
</table>

Remote-control command:
```
SOUR:BB:GPS:LOC:ROM OWAY
```

<table>
<tr><td>Round Trip</td><td>By reaching the end of the file, the file is read out backwards.</td></tr>
</table>

Remote-control command:
```
SOUR:BB:GPS:LOC:ROM RTR
```

Position Format - GPS   Sets the format in which the Latitude and Longitude are displayed.

Remote-control commands:
```
SOUR:BB:GPS:LOC:PFOR DEC
```

<table>
<tr><td>DEG:MIN:SEC</td><td>The display format is Degree:Minute:Second and Direction, i.e.
XX°XX'XX.XX" Direction,
where Direction can be North/South and East/West.</td></tr>
<tr><td>Decimal Degree</td><td>The display format is decimal degree, i.e.
+/-XX.XXXXX°,
where "+" indicates North and East and
"-" indicates South and West</td></tr>
</table>

Altitude - GPS   Sets the geographic altitude.

This field is only configurable 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 configurable 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:PFOR DMS
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

SOUR:BB:GPS:LOC:PFOR DEC
SOUR:BB:GPS:LOC:LAT 48.15
```

Longitude - GPS   Sets the longitude of the user defined geographic location.

This field is only configurable 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:PFOR DMS
SOUR:BB:GPS:LOC:LONG:DEGR 11
SOUR:BB:GPS:LOC:LONG:MIN 30
SOUR:BB:GPS:LOC:LONG:SEC 0
SOUR:BB:GPS:LOC:LONG:DIR WEST

SOUR:BB:GPS:LOC:PFOR DEC
SOUR:BB:GPS:LOC:LONG -11.5
```

Navigation Data

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).

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 pre-selected and no other data source can be selected.*

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

Note:
   Supported almanac files are SEM-files with data extension *.txt and YUMA almanac files.

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**

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

> *Note:*
> *Arbitrary data are supported only in **Generic** mode.*

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 source **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.

Almanacs are currently available at the following internet sites:

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

The almanac files are named xxx.alm (for YUMA files) or xxx.al3 (for SEM files) whereas xxx denotes the day of a year.

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

The naming convention of the almanac file is:
almanac.sem/yuma.weekXXXX.YYYYYY.txt
whereas xxxx denotes the GPS week and
yyyyyy the time of almanac (TOA).

Note:
   *Supported almanac files are SEM-files with data extension *.txt
   and YUMA almanac files.*

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**) must be set within this time interval.

In **Full Configuration** mode, however, the simulation time is not limited to the almanac week.

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 Almanac (TOA) - GPS   Indicates the time of almanac, i.e. the exact time up to the second to which the navigation data refers.

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

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

Date - GPS

Enters the date for the simulation.
In **Auto SV Selection** mode, only values within the almanac GPS week are valid.
In **Full Configuration** mode, however, the simulation time is not limited to the almanac week.

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

The date format is: DD.MM.YYYY

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 "Satellite Configuration - GPS").

Remote-control command: n.a.

Assistance Data Generation - GPS

(enabled with option Assisted GPS (R&S-K65) only)

This button is available only for **Localization Mode** set to **Full Configuration**.

Calls the menu for generation of assistance data (see *"Assistance Data Generation - GPS"*).

Remote-control command: `n.a.`

Satellite Configuration - GPS

In the Satellite Configuration menu the signal simulation of up to four satellites per path can be activated and configured, i.e. four satellites for one path instrument and eight satellites for two path instruments.

Note:
Configuration of eight satellites is only possible for two path instruments and enabled by parameter
Use Baseband A+B *(see "*Use Baseband A+B - GPS*").*

	Satellite 1	Satellite 2	Satellite 3	Satellite 4	Satellite 5	S:
State	On	On	On	On	On	
Range Code	C/A	C/A	C/A	C/A	C/A	
Space Vehicle ID	18	14	5	26	9	
Navigation Message	Configure...	Configure...	Configure...	Configure...	Configure...	
Time Shift /CA-Chips/40	2 773 178.347	3 123 984.257	3 310 393.089	3 288 064.109	2 775 514.464	
Time Shift /ms	67.771	76.344	80.899	80.353	67.828	
Power /dB	-6.02	-6.02	-6.02	-6.02	-6.02	
Doppler Shift /Hz	222.62	2 453.10	2 864.69	-3 316.98	-399.36	
Duration (Elevation > 10°) /hh:mm:ss	02:57:15	05:50:29	03:37:05	00:18:06	02:18:21	
Additional Time Shift /CA-Chips/40	0.000	0.000	0.000	0.000	0.000	
Additional Power /dB	0.00	0.00	0.00	0.00	0.00	
Additional Doppler Shift /Hz	0.00	0.00	0.00	0.00	0.00	
Initial Carrier Phase /rad	0.00	0.00	0.00	0.00	0.00	
Resulting Frequency /GHz	1.575 420 222 62	1.575 422 453 10	1.575 422 864 69	1.575 416 683 02	1.575 419 600 64	1.
Resulting C/A Chip Rate /MHz	1.023 000 14	1.023 001 59	1.023 001 86	1.022 997 85	1.022 999 74	
Resulting P Chip Rate /MHz	10.230 001 45	10.230 015 93	10.230 018 60	10.229 978 46	10.229 997 41	

Adjust Total Power to 0dB - GPS   Sets the power level of each satellite so that the sum of all levels results in 0 dB relative to the global level setting of the instrument. 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.

> *Note:*
> *This parameter is enabled only for **Generic** mode.*

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

Initial HDOP - GPS   Displays the HDOP (Horizontal Dilution of Precision) of the selected satellite constellation at the beginning of the simulation.

The HDOP can be used as an indication of 2D positioning quality. The general rule here is that the smaller the HDOP the better the precision of the position fix will be.

At least four different satellites have to be configured to get a reasonable value; otherwise -1 will be displayed.

> *Note:*
> *This parameter is enabled only for **Localization** mode.*

Remote-control command:
```
SOUR:BB:GPS:HDOP?
```

Initial PDOP - GPS   Displays the PDOP (Position Dilution of Precision) of the selected satellite constellation at the beginning of the simulation.

The PDOP can be used as an indication of 3D positioning quality. The general rule hire is, that the smaller the PDOP the better the precision of the position fix will be.

At least four different satellites need to be configured to get a reasonable value; otherwise -1 will be displayed.

> *Note:*
> *This parameter is enabled only for **Localization** mode.*

Remote-control command:
```
SOUR:BB:GPS:PDOP?
```

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

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

Ranging Code - GPS   Selects the type of ranging code.

> *Note:*
> *Selecting the ranging code is only enabled for **Generic** simulation mode; for Localization mode this parameter is read-only.*

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

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

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

                                  Carrier L1 respectivelly carrier L2 is modulated by C/A code and P-code (QPSK).

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

                                  Carrier L2 respectivelly carrier L2 is modulated by P-code (BPSK).

Space Vehicle ID - GPS   Enters the ID of the satellite to be simulated. This value is used to generate the corresponding C/A respectivelly P-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 arbitrary data, all IDs can be selected.

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

Configure Navigation Message - GPS   Call the **Navigation Message Configurations** menu.

> *Note:*
> *This parameter is enabled only for **Localization** mode.*

Remote-control command: `n.a.`

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).
	In Localization mode, this parameter is not configurable and is set automatically depending on the simulated Geographic Location and on the satellite's orbit.

Note:
The value displayed is the initial time shift at the beginning of the simulation. This value will be updated internally to implement moving satellites and receivers. However the value displayed is not updated.

Remote-control command:
`SOUR:BB:GPS:SVID2:TSCH 1233`

Time Shift ms - GPS	Indicates the time shift of the code sequence in milliseconds.

Remote-control command:
`SOUR:BB:GPS:SVID2:TSS?`

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

After **Adjust Total Power to 0dB** has been performed, the resulting level of a certain satellite is calculated according to the following:

Resulting Level = Global Level + Satellite Power + Additional Power

Remote-control command:
`SOUR:BB:GPS:SVID2: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, in Generic mode the set Doppler frequency is fixed.

In Localization mode, this parameter is not configurable and is set automatically depending on the simulated Geographic Location and on the satellite's orbit.

Note:
> *The value displayed is the initial doppler shift at the beginning of the simulation. This value will be updated internally to implement moving satellites and receivers. However the value displayed is not updated.*

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:SVID2:DSH 10.34kHz`

**Duration
(Elevation > 10°) - GPS**

Displays the time the satellite's elevation will be higher than 10°.

Note:
> *This parameter is enabled only for **Localization** mode.*

The value is displayed in format hh:mm:ss.
The value can be used to get an impression of how long the connected GPS receiver will use this certain satellite for its position fix.

Remote-control command:
`SOUR:BB:GPS:SVID2:DUR?`

**Additional Time
Shift / CA-Chips/40 - GPS**

Sets an additional delay of the selected satellite.
Additionally, the parameter can be used to simulate multipath conditions.
To simulate multipath, assign the same space vehicle (SV ID) to more than one configuration columns (simulated satellites) and select different **Additional Time Shift**.

Remote-control command:
`SOUR:BB:GPS:SAT4:ATSC 1000`

Additional Power - GPS   Sets the additional power of the satellite in dB.
Additionally, the parameter can be used to simulate multipath conditions.
To simulate multipath, assign the same space vehicle (SV ID) to more than one configuration columns (simulated satellites) and select different **Additional Power**.

After **Adjust Total Power to 0dB** has been performed, the resulting level of a certain satellite is calculated according to the following:

Resulting Level = Global Level + Satellite Power + Additional Power

Remote-control command:
`SOUR:BB:GPS:SAT4:APOW -5`

Additional Doppler Shift - GPS   Enters the additional Doppler shift of the simulated signal of the satellite.
Additionally, the parameter can be used to simulate multipath conditions.
To simulate multipath, assign the same space vehicle (SV ID) to more than one configuration columns (simulated satellites) and select different **Additional Doppler Shift**.

Remote-control command:
`SOUR:BB:GPS:SAT4:ADSH 10.5kHz`

Initial Carrier Phase /rad - GPS   Sets the initial carrier phase.

Additionally, the parameter is used in case of multipath simulation.

Remote-control command:
`SOUR:BB:GPS:SAT4:ICPH 3.14`

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

The resulting frequency is calculated according to the following:

$f_{L1/L2resulting} = f_{L1/L2} + f_{Doppler}$

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:

$f_{C/Aresulting} = f_{C/A} \times \{1 + f_{Doppler} / f_{L1/L2}\}$

$f_{C/A}$ 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:

$$f_{P\text{-resulting}} = f_P \times \{1 + f_{Doppler} / f_{L1/L2}\}$$

f_P is fixed to 10.230 MHz.

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

Navigation Message Configuration - GPS

Note:
>   *The **Navigation Message Configuration** menu is enabled only for **Localization** mode.*

In the **Navigation Message Configuration** submenu, the navigation message of each satellite is displayed.

The menu comprises the sections **Ephemeris and Clock Correction Parameters**, **UTC Parameters**, **Ionospheric Parameters** and some **Miscellaneous Parameters,** where the corresponding parameters are displayed. The various parameters in these sections are only configurable in case of instrument equipped with option Assisted GPS (R&S-K65) and Localization mode set to Full Configuration.

Note:
>   *The parameters of the Navigation Message are only configurable for instrument equipped with option Assisted GPS (R&S K65).*

For instruments equipped with option Assisted GPS (R&S-K65) the navigation messages are fully configurable. However, it is recommended to use the almanac's parameter as basis for further configurations (see *"Set To Almanac - GPS"*).

For better readability of the parameters in the **Navigation Message Configuration** menu, the corresponding values are input as integer in the same way as they are included in the satellite's navigation message, but the scaled values are displayed right beside the parameter.

GPS A Space Vehicle ID 5: Navigation Message Configurati...

Set To Almanac

Ephemeris and Clock Correction Parameters

<<< Hide Details

Code On L2	Reserved
L2 P Data Flag	☐
Fit Interval Flag	☐
SV Accuracy / URA Index	0
SV Health	0
IODC	0
IODE	0
T_GD	0	x 2e-31 = 0.000000e+00
t_OC	9 728	x 2e4 = 1.556480e+05
a_f2	0	x 2e-55 = 0.000000e+00
a_f1	0	x 2e-43 = 0.000000e+00
a_f0	0	x 2e-31 = 0.000000e+00
M_0	-437 939 712	x 2e-31 = -2.039316e-01
Delta_N	0	x 2e-43 = 0.000000e+00
e	0	x 2e-33 = 0.000000e+00
SQRT(A)	2 702 023 424	x 2e-19 = 5.153701e+03
OMEGA_0	-662 873 856	x 2e-31 = -3.086747e-01
i_0	656 176 742	x 2e-31 = 3.055561e-01
omega	0	x 2e-31 = 0.000000e+00
OMEGA_DOT	0	x 2e-43 = 0.000000e+00
IDOT	0	x 2e-43 = 0.000000e+00
C_uc	0	x 2e-29 = 0.000000e+00
C_us	0	x 2e-29 = 0.000000e+00
C_rc	0	x 2e-5 = 0.000000e+00
C_rs	0	x 2e-5 = 0.000000e+00
C_ic	0	x 2e-29 = 0.000000e+00
C_is	0	x 2e-29 = 0.000000e+00
TOE	9 728	x 2e4 = 1.556480e+05
SF1 Reserved 1	0
SF1 Reserved 2	0
SF1 Reserved 3	0
SF1 Reserved 4	0

Set To Almanac - GPS   This button is only enabled for Localization mode **Full Configuration**.

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

Using this option as basis for further reconfigurations is recommended.

Remote-control command:
SOUR:BB:GPS:SVID:NMES:PRESet

Ephemeris and Clock Correction Parameters

Code On L2 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter type of code for L2 of the satellite's navigation message.

This value does not have any impact on the actual used ranging code of the generated satellite.
The used ranging code is set in the **Satellite Configuration** menu (see *"*Ranging Code - GPS*"*). ***Note:***
*This parameter is only configurable in Localization mode **Full Configuration**.*

Reserved	Reserved for future use.
	Remote-control command: SOUR:BB:GPS:SVID:NMES:CLTM RES
P Code ON	Carrier L2 (f_L2= 1.2276 GHz) is modulated by P-code (BPSK).
	Remote-control command: SOUR:BB:GPS:SVID:NMES:CLTM PCOD
C/A Code ON	Carrier L2 (f_L2= 1.2276 GHz) is modulated by C/A-code (BPSK).
	Remote-control command: SOUR:BB:GPS:SVID:NMES:CLTM CAC

L2 P Data Flag - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter use of carrier L2 P data flag of the satellite's navigation message.

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

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:LTPD ON

Fit Interval Flag - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter curve-fit interval flag of the satellite's navigation message.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:FIFL ON

SV Accuracy /
URA Index - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter SV accuracy/ URA index of the satellite's navigation message.

Note:
 *This parameter is only configurable in Localization mode **Full***
 ***Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:URA

SV Health - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter SV health of the satellite's navigation message.

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

Note:
 *This parameter is only configurable in Localization mode **Full***
 ***Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:HEAL

IODC - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter Issue of Data, Clock of the satellite's navigation message.

Note:
 *This parameter is only configurable in Localization mode **Full***
 ***Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:IDOC

IODE - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter Issue of Data, Ephemeris of the satellite's navigation message.

Note:
 *This parameter is only configurable in Localization mode **Full***
 ***Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:IODE

T_GD - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter L1-L2 Correction Term of the satellite's navigation message.

As this parameter affects the satellite's clock correction, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
This parameter is only configurable in Localization mode **Full Configuration***.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:TGD`

t_OC - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the clock correction parameter t_OC of the satellite's navigation message.

As this parameter affects the satellite's clock correction, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
This parameter is only configurable in Localization mode **Full Configuration***.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:TOC`

a_f2 - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the clock correction parameter a_f2of the satellite's navigation message.

As this parameter affects the satellite's clock correction, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
This parameter is only configurable in Localization mode **Full Configuration***.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:AFTW`

a_f1 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the clock correction parameter a_f1 of the satellite's
navigation message.

As this parameter affects the satellite's clock correction, the value
selected here also has an impact on the satellite's parameters **Time
Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
   *This parameter is only configurable in Localization mode **Full
   Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:AFON`

a_f0 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the clock correction parameter a_f0 of the satellite's
navigation message.

As this parameter affects the satellite's clock correction, the value
selected here also has an impact on the satellite's parameters **Time
Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
   *This parameter is only configurable in Localization mode **Full
   Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:AFZ`

M_0 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Mean Anomaly at Reference Time of the
satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here
also has an impact on the satellite's parameters **Time Shift**, **Doppler
Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
   *This parameter is only configurable in Localization mode **Full
   Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:MZER`

Delta_N - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter Mean Motion difference From Computed Value of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
    *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:NDEL`

e - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter Eccentricity of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
    *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:ECC`

SQRT(A) - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter Square Root of the Semi-Major Axis of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
    *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:SQRA`

OMEGA_0 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Longitude of Ascending Node of Orbit Plane at Weekly Epoch of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:OZER

i_0 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Inclination Angle at reference Time of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:IZER

omega - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Argument of Perigee of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:OMEG

OMEGA_DOT - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Rate of Right Ascension of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
   *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:ODOT

IDOT - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Rate of Inclination Angle of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
   *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:IDOT

C_uc - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Amplitude of the Cosine Harmonic Correction Term to the Argument of Latitude of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
   *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID2:NMES:CUC

C_us - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Amplitude of the Sine Harmonic Correction Term to the Argument of Latitude of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
> *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:CUS`

C_rc - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
> *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:CRC`

C_rs - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Amplitude of the Sine Harmonic Correction Term to the Orbit Radius of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
> *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:CRS`

C_ic - GPS **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
    *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:CIC`

C_is - GPS **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
    *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:CIS`

TOE - GPS **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter Time of Ephemeris of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
    *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:TOE`

SF1 Reserved 1 to 4 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the parameter SF1 Reserved 1 .. 4 of the satellite's navigation message.

Note:
  *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:RES1

UTC Parameters

A_0 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the UTC parameter A_0 of the satellite's navigation message.

Note:
  *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID2:NMES:AZER

A_1 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the UTC parameter A_1 of the satellite's navigation message.

Note:
  *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID2:NMES:AONE

delta t_LS - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the UTC parameter Δt_{LS} of the satellite's navigation message.

Note:
  *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
SOUR:BB:GPS:SVID:NMES:TLS

t_ot - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the UTC parameter t_{0t} of the satellite's navigation message.

Note:
   *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:TOT`

WN_t - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the UTC parameter WN_t of the satellite's navigation message.

Note:
   *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:WNT`

WN_LSF - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the UTC parameter WN_{LSF} of the satellite's navigation message.

Note:
   *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:WLSF`

DN - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Displays the UTC parameter DN of the satellite's navigation message.

Note:
   *This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:DN`

Delta t_LSF - GPS　　　　**(enabled with option Assisted GPS (R&S-K65) only)**

Displays the UTC parameter Δt_{LSF} of the satellite's navigation message.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:TLSF`

Ionospheric Parameters

alpha_0 .. alpha_3 - GPS　　　　**(enabled with option Assisted GPS (R&S-K65) only)**

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

As this parameter affects the ionospheric model used, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:ALPH0`

beta_0 .. beta_3 - GPS　　　　**(enabled with option Assisted GPS (R&S-K65) only)**

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

As this parameter affects the ionospheric model used, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:BETA0`

Miscellaneous Parameters

AODO - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter Age of Data Offset of the satellite's navigation message.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID2:NMES:AODO`

(A-S) Flags and SV Config - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Displays the parameter (A-S) Flags and SV Config of the satellite's navigation message.

Note:
*This parameter is only configurable in Localization mode **Full Configuration**.*

Remote-control command:
`SOUR:BB:GPS:SVID:NMES:SVC`

Assistance Data Generation - GPS

Note:
*The **Assistance Data Generation** menu is only available for instrument equipped with option Assisted GPS (R&S-K65).*

The **Assistance Data Generation** menu is used to generate assistance data files for Assisted-GPS testing. These files can be formatted into mobile communication's message formats and passed by the protocol tester to the DUT in order to speed up Time To First Fix (TTFF).

The generic workflow for generation of assistance data files for A-GPS test scenarios is as follow:
1. Synchronize the Assistance Data (Satellite Configurations and Reference Location Configuration) with the settings that are already made.
2. Reconfigure the Satellites IDs for which assistance data is to be generated, if necessary.
3. Reconfigure the reference location (i.e. BS location instead of receiver location).
4. Enter the time, duration and resolution of assistance data.
5. Generate the required assistance data.

Note:
***Assistance Data Generation** menu can be accessed only for Localization mode set to **Full Configuration**.*

The upper part of the **Assistance Data Generation** menu is where the **Satellites Configuration** is set. A maximum of 9 satellites can be selected at one time for assistance data generation.
The middle part of the menu is where the parameters of the **Reference Location** and **Time Configuration** are set.
The lower part of the menu offers assistance in the generation of the **Almanac**, **Ionospheric**, **Navigation**, **UTC** and **Acquisition** files.
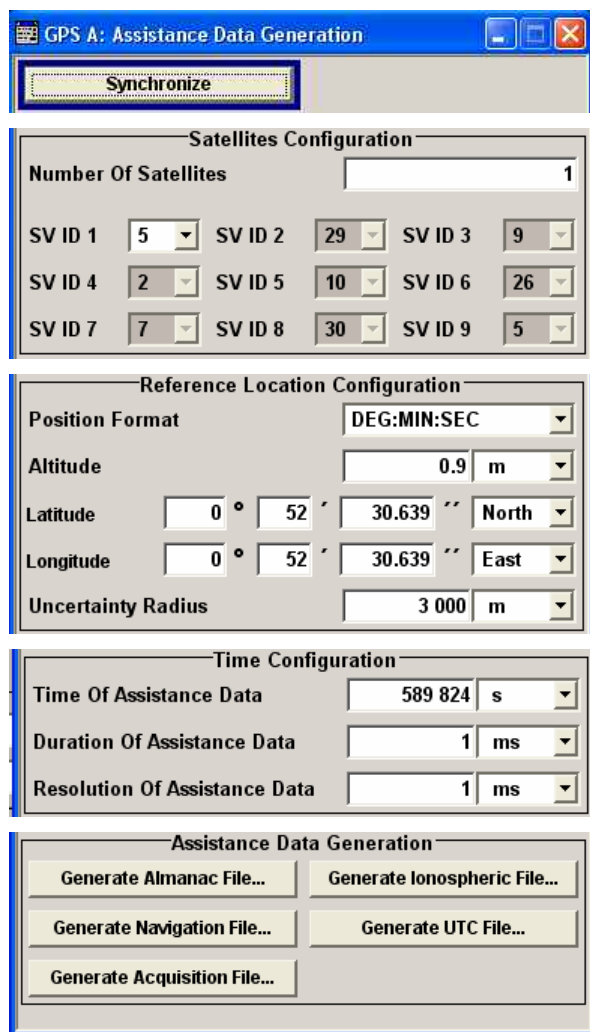
Synchronize - GPS (enabled with option Assisted GPS (R&S-K65) only)

Synchronizes the parameters of the satellites configuration and of the reference location configuration blocks as well as the parameter **Time of Assistance Data** with the settings made in the **Satellite Configuration** menu and in the main menu (see *"Satellite Configuration - GPS"* and *"Localization Data"*).

Remote-control command:
SOUR:BB:GPS:ADG:SYNC

Number Of Satellites - GPS (enabled with option Assisted GPS (R&S-K65) only)

Sets the Number of satellites for which the assistance data will be generate.

Remote-control command:
SOUR:BB:GPS:ADG:SCO 8

SV ID 1 .. 9 - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the ID for the corresponding satellite (space vehicle) for which the assistance data will be generate.

Remote-control command:
`SOUR:BB:GPS:ADG:SAT8:SVID 20`

Position Format (Assistance Data Generation) - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the format in which the Latitude and Longitude are displayed.

Remote-control commands:
`SOUR:BB:GPS:ADG:LOC:PFOR DMS`

DEG:MIN:SEC	The display format is Degree:Minute:Second and Direction, i.e. XX°XX'XX.XX" Direction, where direction can be North/South and East/West.
Decimal Degree	The display format is decimal degree, i.e. +/-XX.XXXXX°, where "+" indicates North and East and "-" indicates South and West

Altitude (Assistance Data Generation) - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the geographic altitude of the reference location in meters above sea level.

Remote-control commands:
`SOUR:BB:GPS:ADG:LOC:ALT 5000`

Latitude (Assistance Data Generation) - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the latitude of the reference location.

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

`SOUR:BB:GPS:ADG:LOC:PFOR DEC`
`SOUR:BB:GPS:ADG:LOC:LAT 45`

Longitude (Assistance Data Generation) - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the longitude of the reference location.

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

SOUR:BB:GPS:ADG:LOC:PFOR DEC
SOUR:BB:GPS:ADG:LONG:LAT 100
```

Uncertainty Radius - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the Uncertainty Radius.

The uncertainty radius determines the required sensitivity of the DUT.

Remote-control commands:
```
SOUR:BB:GPS:ADG:LOC:URAD 2500
```

Time of Assistance Data - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the starting time and date of the assistance data as GPS TOW (Time of Week).

Remote-control commands:
```
SOUR:BB:GPS:ADG:TIME 1500
```

Duration of Assistance Data - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the duration (in seconds) of the GPS Assistance Data.

Remote-control commands:
```
SOUR:BB:GPS:ADG:DUR 100
```

Resolution of Assistance Data - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Sets the resolution (in seconds) of the GPS Assistance Data.
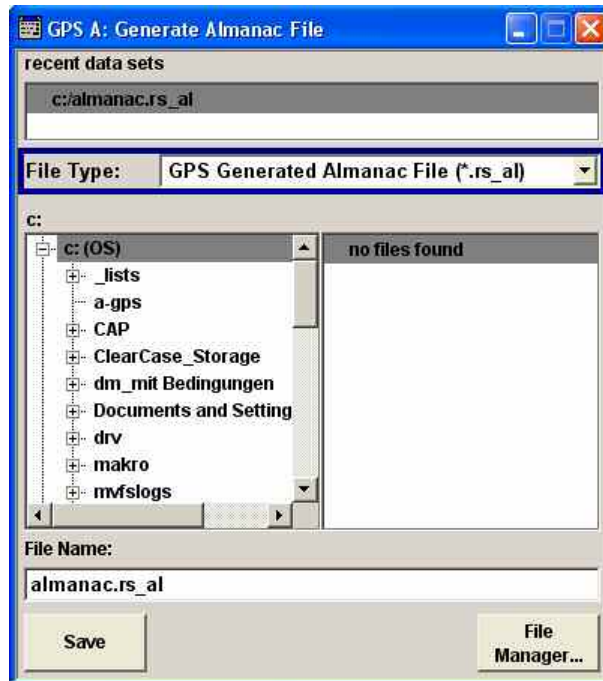
Remote-control commands:
```
SOUR:BB:GPS:ADG:DUR 100
SOUR:BB:GPS:ADG:RES 0.025
```

Generate Almanac File … - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Note:
> *See section "Assistance Data Generation - GPS" for description of the workflow for generation of assistance data.*

Opens the **Generate Almanac File** window for saving the generated Almanac File.

The name of the file is specified in the **File name** entry field. To save the file, press the **Save** button.

The almanac file is generated either in a GPS standard almanac file ".rs_al" format (see table below) or as standard Yuma formatted file ".rs_yuma" and can be therefore used as the main almanac source for GPS.

Parameter	Unit
SatID	-
e	dimensionless
toa	sec
delta_i	semi-circles
OMEGADOT	semi-circles/sec
SV Health	boolean
SQRT(A)	meters
OMEGA0	semi-circles
M0	semi-circles
w	semi-circles
af0	seconds
af1	sec/sec

The generated almanac file is conformed to the format appended to standards 3GPP 34.108 v.8.0.0 and 3GPP TS 51.010-1v.7.7.0.

The file lists all possible satellites, available from the source **Almanac File** (see *"Select Almanac File - GPS"*).

Remote-control command:
```
MMEM:CDIR 'F:\almanac_files'
SOUR:BB:GPS:ADG:ALM:CRE 'almanac'
```

Generate Ionospheric File ... - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Note:
See section "[Assistance Data Generation - GPS](#)" for description of the workflow for generation of assistance data.

Opens the **Select Ionospheric File** window for saving the generated ionospheric model.
The name of the file is specified in the **File name** entry field. To save the file, press the **Save** button.

The generated ionospheric file is file with extension ".rs_ion".
The parameters listed in this file (see table below) are according to the parameters used for describing the near satellite ionospheric model "Klobuchar".

Parameter	Unit
SatID	-
alpha_0	seconds
alpha_1	sec/semi-circles
alpha_2	sec/(semi-circles)^2
alpha_3	sec/(semi-circles)^3
beta_0	seconds
beta_1	sec/semi-circles
beta_2	sec/(semi-circles)^2
beta_3	sec/(semi-circles)^3

The generated ionospheric file contains one row per satellite (maximum 9) that was assigned in the **Assistance Data Generation** menu.

Remote-control command:
```
MMEM:CDIR 'F:\ionospheric_files'
SOUR:BB:GPS:ADG:ION:CRE 'ionospheric'
```

Generate Navigation File …   **(enabled with option Assisted GPS (R&S-K65) only)**
- GPS

Note:
See section "[Assistance Data Generation - GPS](#)" for description of the workflow for generation of assistance data.

Opens the **Select Navigation File** window for saving the generated navigation model (ephemeris).
The name of the file is specified in the **File name** entry field. To save the file, press the **Save** button.

The generated navigation file is a file with extension ".rs_nav".
The generated navigation file comprises the GPS standard ephemeris parameters of the Navigation Model (see table bellow).

Parameter	Unit
SatID	-
Sat Status	-
C/A or P on L2	boolean
URA Index	boolean
SV Health	boolean
IODC	-
L2 P Data Flag	boolean
SF 1 Reserved	-
T_{GD}	sec
t_{oc}	sec
af2	sec/sec^2
af1	sec/sec
af0	sec
Crs	meters
delta_n	semi-circles/sec
M_0	semi-circles
C_{UC}	radians
e	-
C_{US}	radians
$(A)^{1/2}$	meters$^{1/2}$
T_{oe}	sec
Fit Interval Flag	boolean
AODO	sec
C_{Is}	radians
I_0	semi-circles
C_{rc}	meters
omega	semi-circles
OMEGAdot	semi-circles/sec
Idot	semi-circles/sec

The generated navigation file is conformed to the format appended to standards 3GPP 34.108 v.8.0.0 and 3GPP TS 51.010-1v.7.7.0.

The file contains one row per satellite (maximum 9) that was assigned in the **Assistance Data Generation** menu.

Remote-control command:
```
MMEM:CDIR 'F:\navigation_files'
SOUR:BB:GPS:ADG:NAV:CRE 'navigation'
```

Generate UTC File … - GPS   **(enabled with option Assisted GPS (R&S-K65) only)**

Note:
    See section "[Assistance Data Generation - GPS](#)" for description of the workflow for generation of assistance data.

Opens the **Select UTC File** window for saving the generated UTC file. The name of the file is specified in the **File name** entry field. To save the file, press the **Save** button.
The generated UTC file is a file with extension ".rs_utc".
The file contains all standard UTC parameters ($SatID$, A_0, A_1, $delta\_t\_LS$, t_ot, WN_t, WN_LSF, DN, and $Delta\_t\_LSF$) that are necessary to transform GPS time to the normal UTC time.

The generated UTC file contains one row per satellite (maximum 9) that was assigned in the **Assistance Data Generation** menu.

Remote-control command:
```
MMEM:CDIR 'F:\utc_files'
SOUR:BB:GPS:ADG:UTC:CRE 'utc'
```

Generate Acquisition File … - GPS

(enabled with option Assisted GPS (R&S-K65) only)

Note:
See section "[Assistance Data Generation - GPS](#)" for description of the workflow for generation of assistance data.

Opens the **Select Acquisition File** window for saving the generated acquisition file.
The name of the file is specified in the **File name** entry field. To save the file, press the **Save** button.

The generated Acquisition file is a file with extension ".rs_acq".
This file consists of one ore more rows, each corresponding to the Receiver Referenced GPS Time of Week (GPS TOW). The number of generated rows depends on the settings made for in the **Assistance Data Generation** dialog and is calculated as follow:

Number Of Generated Rows = **Duration Of Assistance Data** / **Resolution of Assistance Data**

Each row includes several sequential Acquisition Blocks, each comprising the parameters listed in table below.
The number of the acquisition blocks depends on the N**umber Of Satellites** (maximum 9) that was assigned in the **Assistance Data Generation** menu.

The generated navigation file is conformed to the format appended to standards 3GPP 34.108 v.8.0.0 and 3GPP TS 51.010-1v.7.7.0.

Parameter	Unit
SatID	-
Doppler (0th order term)	Hz
Doppler (1st order term)	Hz/sec
Doppler Uncertainty	Hz
Code Phase	chips
Integer Code Phase	-
GPS Bit Number	-
Code Phase Search Window	chips
Azimuth	deg
Elevation	deg

Remote-control command:
```
MMEM:CDIR 'F:\acq_files'
SOUR:BB:GPS:ADG:TIME 1500
SOUR:BB:GPS:ADG:ACQ:CRE 'acquisition'
SOUR:BB:GPS:ADG:ACQ:BLOC? 2,0.1
Response:
589925,5,3733.3371910282908,0,0,599,18,1,11,225.328
01752395233,11.17712126071662
```

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.
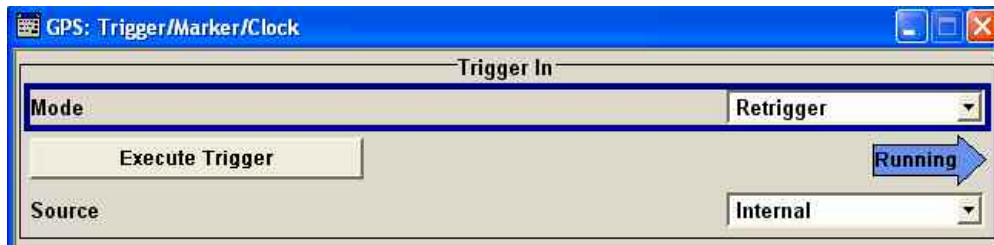
The **Marker Mode** section is where the marker signals at the MARKER output connectors are configured.
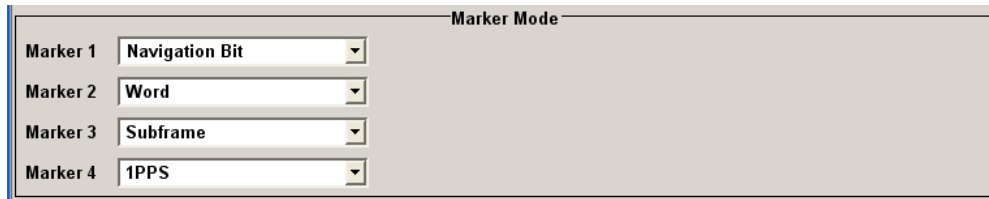
The **Marker Delay** section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.
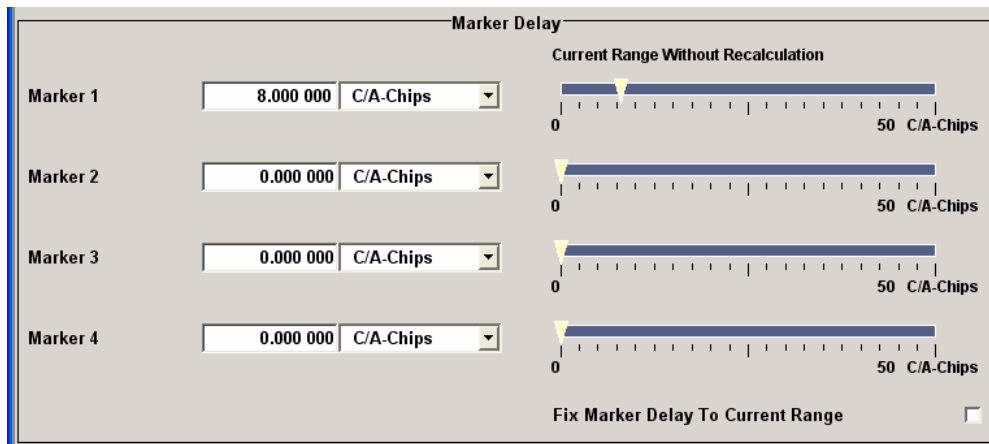
The **Clock Settings** section is where the clock source is selected and - in the case of an external source - the clock type.

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.
		This trigger mode is not allowed, if parameter **Use Baseband A+B** is enabled.
		Remote-control command: `SOUR:BB:GPS:SEQ AUTO`
	Retrigger	The GPS signal is generated continuously. A trigger event (internal or external) causes a restart.
		This trigger mode is not allowed, if parameter **Use Baseband A+B** is enabled.
		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.

This trigger mode is not allowed, if parameter **Use Baseband A+B** is enabled.

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** and **Navigation Bit**.

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 under **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 (Baseband A/B)	The trigger event is executed by the trigger signal from the second path (two-path instruments only).
	This trigger source is not allowed, if parameter **Use Baseband A+B** is enabled.
	Remote-control command: `SOUR:BB:W3GP:TRIG:SOUR OBAS`

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

1PPS   A marker signal is generated for every start of second (GPS time).

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

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 (1.023 MHz) by the divider. The input box for the divider opens when **Pulse** is selected, and the resulting pulse frequency is displayed below it.

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.
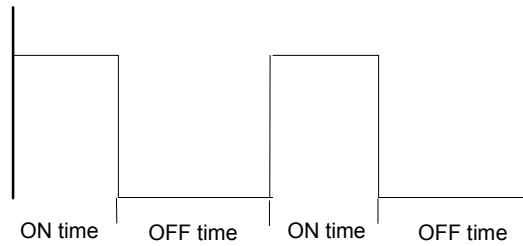

Remote-control commands:
`SOUR:BB:GPS:TRIG:OUTP1:MODE PATT`
`SOUR:BB:GPS:TRIG:OUTP1:PATT #B1111,4`

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 (1.023 MHz).
		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 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

SOURce <2> = 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<HW>:]BB:GPS:ADGeneration:ACQuisition:BLOCk SVID,Time Offset			
[SOURce<[1]|2>:]BB:GPS:ADGeneration:ACQuisition:CREate	<file name>		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:ALManac:CREate	<file name>		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:DURation	1.0e-3 .. 5.0e3	s	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:IONospheric:CREate	<file name>		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:ALTitude	-10000.0 .. 10000.0	m	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LATitude	-90.0 .. 90.0		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LATitude:DEGRees	0 .. 90.0	°	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LATitude:DIRection	NORTh	SOUTh		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LATitude:MINutes	0 .. 59.0	'	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LATitude:SEConds	0 .. 59.999	"	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude	-180.0 .. 180.0		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude:DEGRees	0 .. 180	°	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude:DIRection	EAST	WEST		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude:MINutes	0 .. 59	'	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude:SEConds	0 .. 59.999	"	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:PFORmat	DMS	DECimal		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:URADius	0 .. 1000000	m	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:NAVigation:CREate	<file name>		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:RESolution	1.0e-3 .. 5.0e3	s	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:SATellite<ST>:SVID	1 .. 37		

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:GPS:ADGeneration:SCOunt	1 .. 9		
[SOURce<[1]|2>:]BB:GPS:ADGeneration:SYNChronize			
[SOURce<[1]|2>:]BB:GPS:ADGeneration:TIME	-604800 .. 604800	s	
[SOURce<[1]|2>:]BB:GPS:ADGeneration:UTC:CREate	<file name>		
[SOURce<[1]|2>:]BB:GPS:ATSCenario	USER | GSMSIG | GSMPER1 | GSMPER2 | GSMPER3 | W3GSIG | W3GPER1 | W3GPER2 | W3GPER3		
[SOURce<[1]|2>:]BB:GPS:BAB[:STATe]	ON | OFF		
[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 | AINTernal		
[SOURce<[1]|2>:]BB:GPS:FILTer:TYPE	RECTangle | GAUSs		
[SOURce<[1]|2>:]BB:GPS:HDOP			Query only
[SOURce<[1]|2>:]BB:GPS:LMODe	AUTO | FULL		
[SOURce<[1]|2>:]BB:GPS:LOCation	User Defined | Munich | New York | Sydney | Waypoints		
[SOURce<[1]|2>:]BB:GPS:LOCation:ALTitude	-10.000…10.000	m	
[SOURce<[1]|2>:]BB:GPS:LOCation:LATitude	-90.0 .. 90.0		
[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…59.999		
[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…59.999		
[SOURce<[1]|2>:]BB:GPS:LOCation:PFORmat	DMS | DECimal		
[SOURce<[1]|2>:]BB:GPS:LOCation:ROMode	CYCLic | RTRip | OWAY		
[SOURce<[1]|2>:]BB:GPS:LOCation:WAYPoints	<file name>		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac	<file name>		
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:DAY	1 ... 31		Query only
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:MONTh	1 ... 12		Query only
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:WNUMber	1 ... 5		Query only
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:BEGin:YEAR	-9999 ... 9999		Query only
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:DAY	1 ... 31		Query only
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:MONTh	1 ... 12		Query only
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:END:YEAR	-9999 ... 9999		Query only
[SOURce<[1]|2>:]BB:GPS:NAVigation:ALManac:TOALmanac		s	Query only

Command	Parameters	Default unit	Comments
[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]:DAY	1 ... 31		
[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:HOUR	0 .. 23		
[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:MINute	0 .. 59		
[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:MONTh	1 ... 12		
[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:SECond	0…59		
[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation:[:BEGin]:TIME	<HH,MM,SS>		
[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:YEAR	-9999 ... 9999		
[SOURce<[1]|2>:]BB:GPS:PDOP			Query only
[SOURce<[1]|2>:]BB:GPS:POWer:ADJust			No query
[SOURce<[1]|2>:]BB:GPS:POWer[TOTal]		dB	No query
[SOURce<[1]|2>:]BB:GPS:PRESet			No query
[SOURce<[1]|2>:]BB:GPS:PRFLevel			No query
[SOURce<[1]|2>:]BB:GPS:RFBand	L1 | L2		
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:ADSHift	-100.0 kHz ... 100.0 kHz	Hz	
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:APOWer	-10.0 dB ... 10.0 dB	dB	
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:ATSChips	0 ... 10 000 000		
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:CACRate			Query only
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:FREQency			Query only
[SOURce<[1]|2>:]BB:GPS:SATellite<ST>:ICPHase	0 .. 6.28	radians	
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:PCRate			Query only
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:RCODe	CACode | CAPCode | PCODe		
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:SVID	0 ... 37		
[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:SVID<ST>:DSHift	-100.0kHz .. 100.0kHz	Hz	

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:DURation		s	
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:AFONe			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:AFTWo			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:AFZero			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:ALPHa<CH0>			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:AODO			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:AONE			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:AZERo			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:BETA<CH0>			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:CIC			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:CIS			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:CLTMode			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:CRC			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:CRS			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:CUC			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:CUS			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:DN			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:ECCentricity			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:FIFLag			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:HEALth			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:IDOT			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:IODC			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:IODE			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:IZERo			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:LTPData			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:MZERo			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:NDELta			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:ODOT			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:OMEGa			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:OZERo			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:PRESet			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:REServed<CH>			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:SQRA			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:SVConfig			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:TGD			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:TLS			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:TLSF			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:TOC			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:TOE			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:TOT			

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:URA			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:WLSF			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:NMESsage:WNT			
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:POWer	-50.0 .. 10.0	dB	
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:TSCHips	0 .. 10.0e6		
[SOURce<[1]|2>:]BB:GPS:SVID<ST>:TSSeconds			
[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 Settings

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

[SOURce<[1]|2>:]BB:GPS:ATSCenario User | GSMSIG | GSMPER1 | GSMPER2 | GSMPER3 | W3GSIG | W3GPER1 | W3GPER1 | W3GPER2 | W3GPER3

Selects the file with the predefined A-GPS test scenario.

Parameter:	**User**
	No predefined test scenario is selected.
	GSMSIG
	Predefined A-GPS GSM Signalling Scenario
	(3GPP TS 51.010-1 v.7.7.0)
	GSMPER1
	Predefined A-GPS GSM Performance Test Scenario 1
	(3GPP TS 51.010-1 v.7.7.0)
	GSMPER2
	Predefined A-GPS GSM Performance Test Scenario 2
	(3GPP TS 51.010-1 v.7.7.0)
	GSMPER3
	Predefined A-GPS 3GPP FDD Performance Test Scenario 3
	(3GPP TS 51.010-1 v.7.7.0)
	W3GSIG
	Predefined A-GPS 3GPP FDD Signalling Scenario
	(3GPP 34.108 v.8.0.0, 3GPP TS 34.123-3 v.6.4.0)
	W3GPER1
	Predefined A-GPS 3GPP FDD Performance Test Scenario 1
	(3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)
	W3GPER2
	Predefined A-GPS 3GPP FDD Performance Test Scenario 2
	(3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)
	W3GPER3
	Predefined A-GPS 3GPP FDD Performance Test Scenario 3
	(3GPP 34.108 v.8.0.0, 3GPP 34.171 v.7.0.1)
Example:	`BB:GPS:ATSC W3GPER2`
	'selects the predefined A-GPS test scenario 3GPP FDD Performance Test Scenario 2

*RST value	Resolution	SCPI
USER	-	Device-specific

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

Note:
> *This parameter is available only in path A of two path instruments.*

Enables/disables control of both paths via the GPS A menu.

If this parameter is enabled, a total number of eight satellites can be configured.

Note:
> *Configuration of eight satellites is only possible for two path instruments.*

Example: `BB:GPS:BAB:STAT ON`
'Enables control of both paths via the GPS A menu. 8 Satellites can be configured.

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LMODe   AUTO | FULL

Sets the localization mode.

Parameter: **AUTO**
Eight satellites will be selected depending on the selected almanac. The ephemerides are read out of the almanac and displayed in the Navigation Message Configuration menu.

Note:
> *The ephemerides are not automatically updated. There should be less than two hours between the simulation and the TOA (Time of Almanac).*

FULL
All parameter of the navigation message are enabled for configuration.

Note:
> *Full Configuration is only available for instruments equipped with option Assisted GPS (R&S-K65).*

This mode is used for A-GPS simulation.

Example: `BB:GPS:LMOD FULL`
'sets the localization mode to full configuration

*RST value	Resolution	SCPI
AUTO	-	Device-specific

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

Sets the geographic location of the GPS receiver.

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

*RST value	Resolution	SCPI
User Defined	-	Device-specific

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

Sets the geographic altitude.

This parameter is configurable only for user defined geographic locations. If a value other than **User Defined** is set for the **Geographic Location**, the parameter **Altitude** is read only.

Example: 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:LATitude   -90…90

Sets the latitude of the geographic location expressed as decimal degree. The value will be automatically converted into DEG:MIN:SEC format.

Example: BB:GPS:LOC:LAT 12.12505
                      'sets the latitude to 12.12505

*RST value	Resolution	SCPI
0.0	0.000001	Device-specific

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

Sets the latitude of the geographic location in ° (degrees).

Example: 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

Sets the direction of the geographic location related to the latitude.

Example: 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…59

Sets the latitude of the geographic location in ’ (minutes).

Example: 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

Sets the latitude of the geographic location in ’’ (seconds).

Example: 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   **-**180…180

Sets the longitude of the geographic location expressed as decimal degree. The value will be automatically converted into DEG:MIN:SEC format.

Example: BB:GPS:LOC:LONG -18.05
                      'sets the longitude to -18.05

*RST value	Resolution	SCPI
0.0	0.000001	Device-specific

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

Sets the longitude of the geographic location in ° (degrees).

Example:　　　　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

Sets the direction of the geographic location related to the longitude.

Example:　　　　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…59

Sets the longitude of the geographic location in ' (minutes).

Example:　　　　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

Sets the longitude of the geographic location in '' (seconds).

Example:　　　　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:LOCation:PFORmat   DMS | DECimal

Sets the format in which the Latitude and Longitude are displayed. According to this parameter, the position can be specified in "DEG:MIN:SEC" or in "Decimal Degree" format.

Parameter: **DMS**
The position is specified in DEG:MIN:SEC.

DECimal
The position is specified in decimal degree, i.e. +/-XX.XXXXX°,
where "+" indicates North and East and "-" indicates South and West.

Example: BB:GPS:LOC:PFOR DMS
'position is specified in format DEG:MIN:SEC

*RST value	Resolution	SCPI
DMS	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:ROMode   CYCLic | RTRip | OWAY

Defines the way the waypoint file is to be read.

Parameter: **CYCLic**
The waypoint file is read out cyclic.
Using this read out mode is recommended only for waypoint files that describe a circle moving scenario or moving scenario in which the start and the end point are close to each other.

OWAY
The file is read out only once.
By reaching the end of the file, the last described position is assumed to be a static one.

RTRip
By reaching the end of the file, the file is read out backwards.

Example: BB:GPS:LOC:ROM CYCL
'the waypoint file will be read out cyclic.

*RST value	Resolution	SCPI
OWAY	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:LOCation:WAYPoints   <file name>

Selects the waypoint file. A waypoint file must have the extension .txt.

See "Waypoint file's format" for detailed description of the waypoint file's format.

Example: BB:GPS:LOC:WAYP "d:\waypoints.txt"
'selects the waypoint file

*RST value	Resolution	SCPI
-	-	Device-specific

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

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.

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:RFBand   L1 | L2

Sets the GPS frequency.

Parameter: **L1**
              GPS carrier frequency L1 = 1.57542 GHz

              L2
              GPS carrier frequency L2 = 1.2276 GHz

Example: BB:GPS:RFB L2
            'sets the carrier frequency to 1.2276 GHz

*RST value	Resolution	SCPI
L1	-	Device-specific

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

Reads out the files with GPS settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. 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>

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>

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>

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

Sets the simulation mode.

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

*RST value	Resolution	SCPI
GENeric	-	Device-specific

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

Activates the signal generation of simulated GPS satellites.

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

Note:
*For two path instruments and enabled parameter **Use of Baseband A+B**, enabling the GPS signal simulation will disable all other digital standards and digital modulation modes even in the path B.*

A continuous GPS signal is generated for up to four satellites per path in real time mode.

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-GPS - Satellites Configuration and Satellites Signal Settings

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

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

Note:
> *This parameter is enabled only for **Localization** mode.*

Queries the HDOP (Horizontal Dilution of Precision) of the selected satellite constellation at the beginning of the simulation.

The HDOP can be used as an indication of 2D positioning quality. The general rule here is, that the smaller the HDOP the better the precision of the position fix will be. At least three different satellites have to be configured to get a reasonable value, otherwise -1 will be set.

Example: `BB:GPS:HDOP?`
'queries the initial HDOP

`Response: -1`
'less than 3 different satellites are configured. The Initial HDOP can not be calculated

*RST value	Resolution	SCPI
-	-	Device-specific

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

Selects the almanac providing the navigation information.

Current almanac data can be downloaded via the Internet. The files are provided as text files (*.txt) or YUMA files.

The directory applicable to the following command is defined with the command `MMEMory:CDIR`. To access the files in this directory, only the 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 'SEM299'`
'the file '`SEM299`' is used for retrieving navigation information.

*RST value	Resolution	SCPI
-	-	Device-specific

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

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?

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?

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?

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: `2007`
                  'the year is 2007.

*RST value	Resolution	SCPI
-	-	Device-specific

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

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?

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?

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: `2007`
                  'the year is 2007.

*RST value	Resolution	SCPI
-	-	Device-specific

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

Queries the time of almanac, 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:TOAL?`
                  'queries the time of almanac.

                  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

Determines the data source for the navigation information.

Note:
    *Arbitrary data are supported only in **Generic** mode.*

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>

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

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>

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]:DAY 1 .. 31

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

Example: `BB:GPS:NAV:SIM:DAY 10`
                      'sets the simulation start day.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:HOUR 0 .. 23

Sets the hour of the simulation start. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAV:DATA RND`).

Example: `BB:GPS:NAV:SIM:HOUR 10`
                      'sets the simulation start hour.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:MINute 0 .. 59

Sets the minute of the simulation start. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAV:DATA RND`).

Example: `BB:GPS:NAV:SIM:MIN 10`
                 'sets the simulation start minute.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:MONth 1 .. 12

Sets the month of the simulation start. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAV:DATA RND`).

Example: `BB:GPS:NAV:SIM:MON 10`
                 'sets the simulation start month.

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:NAVigation:SIMulation[:BEGin]:SECond 0 .. 59

Sets the second of the simulation start. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAV:DATA RND`).

Example: `BB:GPS:NAV:SIM:SEC 10`
                 'sets the simulation start second.

*RST value	Resolution	SCPI
-	-	Device-specific

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

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:NAVigation:SIMulation[:BEGin]:YEAR -9999 .. 9999

Sets the year of the simulation start. The command is only available if data source Real Navigation Data is selected (`SOURce:BB:GPS:NAV:DATA RND`).

Example: `BB:GPS:NAV:SIM:YEAR 10`
                    'sets the simulation start year.

*RST value	Resolution	SCPI
-	-	Device-specific

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

Queries the PDOP (Position Dilution of Precision) of the selected satellite constellation at the beginning of the simulation.

The PDOP can be used as an indication of 3D positioning quality.
The general rule here is, that the smaller the PDOP the better the precision of the position fix will be.

At least three different satellites need to be configured to get a reasonable value, otherwise -1 will be set.

Note:
    *This parameter is enabled only for **Localization** Mode.*

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

Example: `BB:GPS:SMOD LOC`
                    'satellite signals are generated corresponding to a 'real' location.

                    `BB:GPS:PDOP?`
                    'queries the PDOP of the selected satellite constellation.

                    Response: '2.80'

*RST value	Resolution	SCPI
-		Device-specific

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

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:POWer[:TOTal]?

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:SATellite<1 ... 37>:ADSHift   -100.0kHz … 100.0kHz

Sets the additional Doppler shift of the simulated signal of the satellite.
Additionally, the parameter can be used to simulate multipath conditions.
To simulate multipath, assign the same space vehicle (SV ID) to more than one simulated satellites
and set different **Additional Doppler Shift**.

Example: `BB:GPS:SAT1:VID 4`
'sets space vehicle 4 for the first satellite.

`BB:GPS:SAT2:VID 4`
'sets space vehicle 4 for the second satellite.

`BB:GPS:SAT1:ADSH 10.5kHz`
'sets the additional Doppler shift of satellite 1 to 10.5 KHz

`BB:GPS:SAT2:ADSH 1kHz`
'sets the additional Doppler shift of satellite 2 to 1 KHz

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1..37>:APOWer   -50.0 … 10.0

Sets the additional power of the satellite in dB.
Additionally, the parameter can be used to simulate multipath conditions.
To simulate multipath, assign the same space vehicle (SV ID) to more than one configuration
columns (simulated satellites) and set different **Additional Power**.

Example: `BB:GPS:SAT1:VID 4`
'sets space vehicle 4 for the first satellite.

`BB:GPS:SAT2:VID 4`
'sets space vehicle 4 for the second satellite.

`BB:GPS:SAT1:APOW -10.0`
'sets the additional power of satellite 1 to -10dB

`BB:GPS:SAT2:APOW -5.0`
'sets the additional power of satellite 2 to -5dB

*RST value	Resolution	SCPI
0.0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1..37>:ATSChips   0 … 10.0e6

Sets an additional delay of the selected satellite.

Additionally, the parameter can be used to simulate multipath conditions.
To simulate multipath, assign the same space vehicle (SV ID) to more than one simulated satellites and set different **Additional Time Shift**.

Example:	BB:GPS:SAT1:VID 4
	'sets space vehicle 4 for the first satellite.
	BB:GPS:SAT2:VID 4
	'sets space vehicle 4 for the second satellite.
	BB:GPS:SAT1:ATSC 10000
	'sets the additional time shift of satellite 1 to 10000
	BB:GPS:SAT2:ATSC 20000
	'sets the additional time shift of satellite 2 to 20000

*RST value	Resolution	SCPI
0.0	-	Device-specific

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

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 resulting C/A chip rate 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>:FREQuency?

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 1.575421111 GHz.

*RST value	Resolution	SCPI
-		Device-specific

[SOURce<[1]|2>:]BB:GPS:SATellite<1|2|3|4>:ICPHase 0 .. 6.28

Sets the initial carrier phase in radians.
Additionally, the parameter can be used to simulate multipath conditions.

Example: `BB:GPS:SAT4:ICPH 3.14`
                    '**sets the initial carrier phase of satellite 4.**

*RST value	Resolution	SCPI
-	0.01	Device-specific

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

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>:RCODe CACode | CAPCode | PCODe

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

Note:
*Selecting the ranging code is only enabled for **Generic** simulation mode; for Localization mode this parameter is read-only.*

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:SMOD GEN`
                    'generic satellite signals are generated.

                    `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

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>:SVID   1 ... 37

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 settable. For arbitrary 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

[SOURce<[1]|2>:]BB:GPS:SVID<1 .. 8>:DSHift   -100 kHz ... 100 kHz

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>:DURation?

Queries the time (in hh:mm:ss format) the satellite is visible (the satellite's elevation will be higher than 10°).

This value can be used to get an impression of how long the connected GPS receiver will use this certain satellite for its position fix.

Note:
    *This parameter is enabled only for **Localization** Mode.*

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

Example: `BB:GPS:SMOD LOC`
                'satellite signals are generated corresponding to a 'real' location.

                `BB:GPS:SAT2:DUR?`
                'queries the time the satellite's elevation will be higher then 10°.

*RST value	Resolution	SCPI
-	0.01 Hz	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.

Note:
    *This parameter is enabled only for **Generic** mode.*

Example: `BB:GPS:SMOD GEN`
                'selects generic mode

                `BB:GPS:SPR ON`
                'activates spreading of simulated GPS satellite signals.

*RST value	Resolution	SCPI
ON	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:AFONe -32768 .. 32767

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to ***Full Configuration***.

Sets the clock correction parameter a_f1 of the satellite's navigation message.

As this parameter affects the satellite's clock correction, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                   'sets the Localization mode to Full Configuration

                   `BB:GPS:SVID5:NMES:AFON 10000`
                   'sets the value of the clock correction parameter a_f1

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:AFTWo -128 .. 127

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to ***Full Configuration***.

Sets the clock correction parameter a_f2 of the satellite's navigation message.

As this parameter affects the satellite's clock correction, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                   'sets the Localization mode to Full Configuration

                   `BB:GPS:SVID5:NMES:AFTW 100`
                   'sets the value of the clock correction parameter a_f2

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:AFZero -2097152 .. 2097151

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the clock correction parameter a_f0 of the satellite's navigation message.

As this parameter affects the satellite's clock correction, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: BB:GPS:LMOD FULL
                 'sets the Localization mode to Full Configuration

                 BB:GPS:SVID5:NMES:AFZ 10000
                 'sets the value of the clock correction parameter a_f0

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:ALPHa<0|1|2|3> -128 .. 127

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the ionospheric parameters alpha_0, alpha_1, alpha_2 and alpha_3 of the satellite's navigation message.

As this parameter affects the ionospheric model, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: BB:GPS:LMOD FULL
                 'sets the Localization mode to Full Configuration

                 BB:GPS:SVID5:NMES:ALPH0 100
                 'sets the value of the ionospheric parameter alpha_0

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:AODO 0 .. 31

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Age of Data Offset of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
                    'sets the Localization mode to Full Configuration

                    BB:GPS:SVID5:NMES:AODO 20
                    'sets the value of the parameter age of data offset

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:AONE -8388608 .. 8388607

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the UTC parameter A_1 of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
                    'sets the Localization mode to Full Configuration

                    BB:GPS:SVID5:NMES:AONE 10000
                    'sets the value of the UTC parameter A_1

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:AZERo -2147483648 .. 2147483648

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the UTC parameter A_0 of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
                    'sets the Localization mode to Full Configuration

                    BB:GPS:SVID5:NMES:AZER 10000
                    'sets the value of the UTC parameter A_0

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:BETA<0|1|2|3> -128 .. 127

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter beta_0, beta_1, beta_2 and beta_3 of the satellite's navigation message.

As this parameter affects the ionospheric model used, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: BB:GPS:LMOD FULL
                   'sets the Localization mode to Full Configuration

                   BB:GPS:SVID5:NMES:BETA1 100
                   'sets the value of the ionospheric parameter beta_1

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:CIC -32768 .. 32767

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: BB:GPS:LMOD FULL
                   'sets the Localization mode to Full Configuration

                   BB:GPS:SVID5:NMES:CIC 100
                   'sets the value of the parameter C_ic

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:CIS   -32768 .. 32767

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                    'sets the Localization mode to Full Configuration

                    `BB:GPS:SVID5:NMES:CIS 100`
                    'sets the value of the parameter C_is

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:CLTMode   REServed | PCODe | CACode

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter type of code for L2 of the satellite's navigation message.

This value does not have any impact on the actual used ranging code of the generated satellite.
The used ranging code is set in the **Satellite Configuration** menu (see "Raging Code -GPS").

Parameter: **REServed**
                    Reserved for future use

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

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

Example: `BB:GPS:LMOD FULL`
                    'sets the Localization mode to Full Configuration

                    `BB:GPS:SVID5:NMES:CLTM PCOD`
                    'sets the type of raging code for L2 to P-Code

*RST value	Resolution	SCPI
REServed	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:CRC -32768 .. 32767

Note:
    *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                'sets the Localization mode to Full Configuration

                `BB:GPS:SVID5:NMES:CRC 100`
                'sets the value of the parameter C_rc

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:CRS -32768 .. 32767

Note:
    *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Amplitude of the Sine Harmonic Correction Term to the Orbit Radius of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                'sets the Localization mode to Full Configuration

                `BB:GPS:SVID5:NMES:CRS 100`
                'sets the value of the parameter C_rs

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:CUC -32768 .. 32767

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Amplitude of the Cosine Harmonic Correction Term to the Argument of Latitude of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of these parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                      'sets the Localization mode to Full Configuration

                      `BB:GPS:SVID5:NMES:CUC 100`
                      'sets the value of the parameter C_{uc}

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:CUS -32768 .. 32767

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Amplitude of the Sine Harmonic Correction Term to the Argument of Latitude of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                      'sets the Localization mode to Full Configuration

                      `BB:GPS:SVID5:NMES:CUS 100`
                      'sets the value of the parameter C_{us}

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:DN 0 .. 7

Note:
  *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the UTC parameter DN of the satellite's navigation message.

Example: `BB:GPS:LMOD FULL`
                  'sets the Localization mode to Full Configuration

                  `BB:GPS:SVID5:NMES:DN 5`
                  'sets the value of the parameter DN

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:ECCentricity 0 .. 4294967295

Note:
  *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Eccentricity of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                  'sets the Localization mode to Full Configuration

                  `BB:GPS:SVID5:NMES:ECC 1000000`
                  'sets the value of the parameter e (Eccentricity)

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:FIFLag ON | OFF

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter curve-fit interval flag of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
                    'sets the Localization mode to Full Configuration

                    BB:GPS:SVID5:NMES:FIFL ON
                    'enables the curve-fit interval flag

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:HEALth 0 .. 31

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter SV health of the satellite's navigation message.

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

Example: BB:GPS:LMOD FULL
                    'sets the Localization mode to Full Configuration

                    BB:GPS:SVID5:NMES:HEAL 10
                    'sets the SV health to 10

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:IDOT   -8192 .. 8191

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Rate of Inclination Angle of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: BB:GPS:LMOD FULL
               'sets the Localization mode to Full Configuration

               BB:GPS:SVID5:NMES:IDOT 1000
               'sets the parameter IDOT

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:IODC   0 .. 1023

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Issue of Data, Clock of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
               'sets the Localization mode to Full Configuration

               BB:GPS:SVID5:NMES:IDOC 1000
               'sets the parameter IDOC

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:IODE 0 .. 255

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration***.*

Sets the parameter Issue of Data, Ephemeris of the satellite's navigation message.

Example: `BB:GPS:LMOD FULL`
                   'sets the Localization mode to Full Configuration

                   `BB:GPS:SVID5:NMES:IDOE 100`
                   'sets the parameter IDOE

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:IZERo -2147483648 .. 2147483647

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration***.*

Sets the parameter Inclination Angle at reference Time of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                   'sets the Localization mode to Full Configuration

                   `BB:GPS:SVID5:NMES:IZER 100000`
                   'sets the parameter i_0

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:LTPData   ON |OFF

Note:
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter use of carrier L2 P data flag of the satellite's navigation message.

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

Example: `BB:GPS:LMOD FULL`
                     'sets the Localization mode to Full Configuration

                     `BB:GPS:SVID5:NMES:LTPD ON`
                     'enables the L2 P data Flag

*RST value	Resolution	SCPI
OFF	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:MZERo   -2147483648 .. 2147483647

Note:
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Mean Anomaly at Reference Time of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                     'sets the Localization mode to Full Configuration

                     `BB:GPS:SVID5:NMES:MZER 100000`
                     'sets the parameter M_0

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:NDELta   -32768 .. 32767

Note:

*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Mean Motion difference From Computed Value of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                      'sets the Localization mode to Full Configuration

                      `BB:GPS:SVID5:NMES:NDEL 100`
                      'sets the parameter Delta_N

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:ODOT   -8388608 .. 8388607

Note:

*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Rate of Right Ascension of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                      'sets the Localization mode to Full Configuration

                      `BB:GPS:SVID5:NMES:ODOT 100000`
                      'sets the parameter OMEGA_DOT

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:OMEGa   -2147483648 .. 2147483647

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to Full Configuration.

Sets the parameter Argument of Perigee of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                      'sets the Localization mode to Full Configuration

                      `BB:GPS:SVID5:NMES:OMEG 100000`
                      'sets the parameter omega

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:OZERo   -2147483648 .. 2147483647

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to Full Configuration.

Sets the parameter Longitude of Ascending Node of Orbit Plane at Weekly Epoch of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                      'sets the Localization mode to Full Configuration

                      `BB:GPS:SVID5:NMES:OZER 100000`
                      'sets the parameter OMEGA_0

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:PREset

Note:
   *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Set navigation message parameters to values defined in almanac file.

Presetting the parameters of the navigation message is recommended as basis for further reconfigurations.

Example: `BB:GPS:LMOD FULL`
                      'sets the Localization mode to Full Configuration

                      `BB:GPS:SVID5:NMES:PRS`
                      'set navigation message parameters to values defined in almanac file

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:REServed<1|2|3|4> 0 .. 8388608

Note:
   *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter SF1 Reserved 1 .. 4 of the satellite's navigation message.

Example: `BB:GPS:LMOD FULL`
                      'sets the Localization mode to Full Configuration

                      `BB:GPS:SVID5:NMES:RES3 100000`
                      'sets parameter SF1 Reserved 3 to 1000000

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:SQRA 0 .. 4294967295

Note:
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Square Root of the Semi-Major Axis of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                    'sets the Localization mode to Full Configuration

                    `BB:GPS:SVID5:NMES:SQRA 100000`
                    'sets parameter SQRT(A) to 1000000

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:SVConfig 0 .. 15

Note:
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter (A-S) Flags and SV Config of the satellite's navigation message.

Example: `BB:GPS:LMOD FULL`
                    'sets the Localization mode to Full Configuration

                    `BB:GPS:SVID5:NMES:SVC 10`
                    'sets parameter A-S Flag and SV Config to 10

*RST value	Resolution	SCPI
9	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:TGD   -128 .. 127

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter L1-L2 Correction Term of the satellite's navigation message.

As this parameter affects the satellite's clock correction, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: BB:GPS:LMOD FULL
                    'sets the Localization mode to Full Configuration

                    BB:GPS:SVID5:NMES:TGD 100
                    'sets parameter T_GD

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:TLS   -128 .. 127

Note:
*This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the UTC parameter Δt_{LS} of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
                    'sets the Localization mode to Full Configuration

                    BB:GPS:SVID5:NMES:TLS 100
                    'sets parameter Δt_{LS}

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:TLSF -128 .. 127

Note:
   *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the UTC parameter Δt_{LSF} of the satellite's navigation message.

Example: `BB:GPS:LMOD FULL`
                'sets the Localization mode to Full Configuration

                `BB:GPS:SVID5:NMES:TLSF 100`
                'sets parameter Δt_{LSf}

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:TOC 0 .. 65535

Note:
   *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the clock correction parameter t_OC of the satellite's navigation message.

As this parameter affects the satellite's clock correction, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                'sets the Localization mode to Full Configuration

                `BB:GPS:SVID5:NMES:TOC 100`
                'sets parameter t_OC

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:TOE   0 .. 65535

Note:
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter Time of Ephemeris of the satellite's navigation message.

As this parameter affects the satellite's orbit, the value selected here also has an impact on the satellite's parameters **Time Shift**, **Doppler Shift** and **Duration (Elevation>10°)**.
The value of this parameters will be updated automatically.

Example: `BB:GPS:LMOD FULL`
                'sets the Localization mode to Full Configuration

                    `BB:GPS:SVID5:NMES:TOE 100`
                'sets parameter TOE

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:TOT   0 .. 602112

Note:
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the UTC parameter t_{0t} of the satellite's navigation message.

Example: `BB:GPS:LMOD FULL`
                'sets the Localization mode to Full Configuration

                    `BB:GPS:SVID5:NMES:TOT 1000`
                'sets parameter t_ot

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:URA 0 .. 15

Note:
   *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the parameter SV accuracy/ URA index of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
                      'sets the Localization mode to Full Configuration

                      BB:GPS:SVID5:NMES:URA 10
                      'sets parameter SV accuracy/ URA index

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:WLSF 0 .. 255

Note:
   *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the UTC parameter WN_{LSF} of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
                      'sets the Localization mode to Full Configuration

                      BB:GPS:SVID5:NMES:WLSF 10
                      'sets parameter WN_{LSF}

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1..37>:NMESsage:WNT 0 .. 255

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65) and Localization mode set to **Full Configuration**.*

Sets the UTC parameter WN_t of the satellite's navigation message.

Example: BB:GPS:LMOD FULL
                 'sets the Localization mode to Full Configuration

                 BB:GPS:SVID5:NMES:WNT 100
                 'sets parameter WNt

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1 .. 8>:POWer -50 dB ... +10 dB

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

After **Adjust Total Power to 0dB** has been performed, the resulting level of a certain satellite is calculated according to the following:

Resulting Level = Global Level + Satellite Power + Additional Power

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:SVID<1 .. 8>:TSCHips 0 ...10 000 000

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	0.0001	Device-specific

[SOURce<[1]|2>:]BB:GPS:SVID<1 .. 8>:TSSeconds?   E-7

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-GPS - Assistance Data Settings

The SOURce:BB:GPS:ADGeneration contains commands for setting the assistance data settings.

[SOURce<[1]|2>:]BB:GPS:ADGeneration:ACQuisition:BLOCk? <SV ID>,<Time Offset>

Note:
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Queries part of the current assistance data settings.
This command has two mandatory arguments, the SV ID and the Time Offset. The SV ID is the ID of the space vehicle for which the assistance data is queried; Time Offset is the offset of time to the beginning of the acquisition data generation set with the parameter `BB:GPS:ADGeneration:TIME`.

The returned value is exactly one row of the acquisition assistance data file (2G, 3G) that can be generated by the command `SOUR:BB:GPS:ADG:ACQ:CRE` and has following elements:

```
Rx Time of Week,
Satellite ID that corresponds to the record,
Zero Order Doppler Term,
1st order Doppler Term,
Uncertainty Doppler,
Code Phase (or half-Chip index at epoch Time of Transmission (GPS Sat
Time)),
Integer Code Phase (or ms unit index at epoch Time of Transmission (GPS
Sat Time)),
Corresponding Bit number (modulo 4) at epoch Time of Transmission (GPS Sat
Time),
Correlator Code phase Search Radius,
Azimuth Angle of the Satellite in ENU orthonormal coordinate System
centered at reference point,
Elevation Angle of the Satellite in ENU orthonormal coordinate System
centered at reference point.
```

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

Example: `BB:GPS:ADG:TIME 1500`
                    'sets the time of assistance data.

          `BB:GPS:ADG:ACQ:BLOC? 2,0.1`
                    'queries the acquisition data for SV ID 2 and time offset of 0.1s, i.e. at GPS Time 1500 + 0.1 s.

          Response:
                    `589925,5,3733.3371910282908,0,0,599,18,1,11,225.328017523 95233,11.17712126071662`

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:ACQuisition:CREate   <file_name>

> *Note:*
>   *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Stores the current assistance data settings into the selected acquisition 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. Assistance data settings are stored as acquisition file with the specific file extensions ***.rs_acq**.

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

Example: MMEM:CDIR 'd:\acq_files'
                'sets the default directory to d:\acq_files

                BB:GPS:ADG:ACQ:CRE 'acquisition'
                'stores the current settings into file 'acquisition'

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:ALManac:CREate   <file_name>

> *Note:*
>   *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Stores the current assistance data settings into the selected almanac 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. Assistance data settings are stored as almanac file with the specific file extensions ***.rs_al** or ***.rs_yuma**.
The default extension is ***.rs_al** and can be omitted in the file name.
To save an almanac file as file with extension ***.rs_yuma**, however, this extension has to be specified in the file name.

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

Example: MMEM:CDIR 'D:\almanac_files'
                'sets the default directory to D:\almanac_files

                BB:GPS:ADG:ALM:CRE 'almanac_yuma.rs_yuma'
                'stores the current settings into file 'almanac_yuma.rs_yuma'

                BB:GPS:ADG:ALM:CRE 'almanac'
                'stores the current settings into file 'almanac.rs_al'

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:DURation   1.0e-3...5.0e3

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Sets the duration (in seconds) of the GPS Assistance Data.

Example: BB:GPS:ADG:DUR 150
                    'sets the duration of assistance data to 150s

*RST value	Resolution	SCPI
1ms	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:IONospheric:CREate   <file_name>

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Stores the current assistance data settings into the selected ionospheric 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. Assistance data settings are stored as ionospheric file with the specific file extensions ***.rs_ion**.

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

Example: MMEM:CDIR 'D:\ionospheric_files'
                    'sets the default directory to D:\ionospheric_files

                    BB:GPS:ADG:ALM:CRE 'ionospheric'
                    'stores the current settings into file 'ionospheric'

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:ALTitude   -10000.0 … 10000.0

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Sets the geographic altitude of the reference location in meters above sea level.

Example: BB:GPS:ADG:LOC:ALT 250
                    'sets the altitude of the reference location

*RST value	Resolution	SCPI
0	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LATitude -90.0 … 90.0

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the latitude (expressed as decimal degree) of the reference location. The decimal value is automatically converted into DEG:MIN:SEC format.

Example: `BB:GPS:ADG:LOC:LAT 12.05`
                'sets the latitude of the reference location

*RST value	Resolution	SCPI
0	0.000001	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LATitude:DEGRees 0 … 90.0

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the latitude of the reference location in ° (degrees).

Example: `BB:GPS:ADG:LOC:LAT:DEGR 12`
                'sets the latitude of the geographic location to 12°

*RST value	Resolution	SCPI
0	-	Device-specific

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

Note:
This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the direction of the geographic location related to the latitude.

Example: `BB:GPS:ADG:LOC:LAT:DIR SOUT`
                'sets the direction of the reference location to south

*RST value	Resolution	SCPI
-	-	Device-specific

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

Note:
 This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the latitude of the geographic location in ' (minutes).

Example: `BB:GPS:ADG:LOC:LAT:MIN 15`
                     'sets the latitude of the geographic location to 15'

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LATitude:SEConds 0.0 … 59.999

Note:
 This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the latitude of the geographic location in " (seconds).

Example: `BB:GPS:ADG:LOC:LAT:SEC 30.123`
                     'sets the latitude of the geographic location to 30.123"

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude -180.0 … 180.0

Note:
 This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the longitude (expressed as decimal degree) of the reference location. The decimal value is automatically converted into DEG:MIN:SEC format.

Example: `BB:GPS:ADG:LOC:LONG 25.123456`
                     'sets the longitude to `25.123456`

*RST value	Resolution	SCPI
0.0	0.000001	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude:DEGRees 0 … 180

Note:
  This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the longitude (expressed as decimal degree) of the reference location. The decimal value is automatically converted into DEG:MIN:SEC format.

Example: `BB:GPS:ADG:LOC:LONG:DEGR 25`
                      'sets the longitude of the geographic location to 25°

*RST value	Resolution	SCPI
-	-	Device-specific

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

Note:
  This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the direction of the geographic location related to the longitude.

Example: `BB:GPS:ADG:LOC:LONG:DIR WEST`
                      'sets the direction of the reference location west

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude:MINutes 0 … 59

Note:
  This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the longitude of the geographic location in ' (minutes).

Example: `BB:GPS:ADG:LOC:LONG:MIN 15`
                      'sets the longitude of the geographic location to 15'

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:LONGitude:SEConds 0.0 … 59.999

Note:
  This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the longitude of the geographic location in " (seconds).

Example: `BB:GPS:ADG:LOC:LONG:SEC 15.123`
  'sets the longitude of the geographic location to 30.123"

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:PFORmat DMS | DECimal

Note:
  This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the format in which the Latitude and Longitude are displayed. According to this parameter, the position can be specified in "DEG:MIN:SEC" or in "Decimal Degree" format.

Parameter: **DMS**
  The position is specified in DEG:MIN:SEC.

  DECimal
  The position is specified in decimal degree, i.e.+/-XX.XXXXX°,
  where "+" indicates North and East and "-" indicates South and West.

Example: `BB:GPS:ADG:LOC:PFOR DMS`
  'position is specified in format DEG:MIN:SEC

*RST value	Resolution	SCPI
CHIP	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:LOCation:URADius 0 … 1000000

Note:
  This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Sets the Uncertainty Radius.

Example: `BB:GPS:ADG:LOC:URAD 2.5KM`
  'sets the uncertainty radius to 2500m

*RST value	Resolution	SCPI
3000	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:NAVigation:CREate　<file_name>

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Stores the current assistance data settings into the selected navigation 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. Assistance data settings are stored as navigation file with the specific file extensions ***.rs_nav.**

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

Example:　　　　`MMEM:CDIR 'D:\navigation_files'`
　　　　　　　　　　'sets the default directory to D:\navigation_files

　　　　　　　　　　`BB:GPS:ADG:ALM:CRE 'navigation'`
　　　　　　　　　　'stores the current settings into file 'navigation'

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:RESolution　1.0e-3 … Duration

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Sets the resolution (in seconds) of the GPS Assistance Data.

Example:　　　　`BB:GPS:ADG:DUR 100`
　　　　　　　　　　'sets the duration of the assistance data to 100s

　　　　　　　　　　`BB:GPS:ADG:RES 25MS`
　　　　　　　　　　'sets the resolution of assistance data to 25ms

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:SATellite<1..37>:SVID　1 … 37

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Sets the ID for the corresponding satellite (space vehicle) for which the assistance data will be generate.

Example:　　　　`BB:GPS:ADG:SAT4:SVID 16`
　　　　　　　　　　'sets the satellite with SV ID 16 to be simulated from satellite 4

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:SCOunt   1 … 9

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Sets the Number of satellites for which the assistance data will be generate.

> *Note:*
> *Configuration of eight satellites is only possible for two path instruments.*

Example: `BB:GPS:BAB:STAT ON`
         'enables configuration of 8 satellites

                 `BB:GPS:ADG:SCO 7`
         'sets the number of satellites for which assistance data will be generate to 7

*RST value	Resolution	SCPI
1	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:SYNChronize

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Synchronies the "assisted" satellites with GPS satellites.

Example: `BB:GPS:ADG:SYNC`
         'synchronies the "assisted" satellites with GPS satellites

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:TIME   -604800 … 604800

> *Note:*
> *This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).*

Sets the starting time and date of the assistance data as GPS TOW (Time of Week).

Example: `BB:GPS:ADG:TIME 1500`
         'sets the time of assistance data

*RST value	Resolution	SCPI
-	-	Device-specific

[SOURce<[1]|2>:]BB:GPS:ADGeneration:UTC:CREate <file_name>

Note:
   This parameter is only configurable for instruments equipped with option Assisted GPS (R&S-K65).

Stores the current assistance data settings into the selected UTC 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. Assistance data settings are stored as UTC file with the specific file extensions ***.rs_utc.**

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

Example: `MMEM:CDIR 'D:\utc_files'`
                   'sets the default directory to D:\utc_files

                   `BB:GPS:ADG:ALM:CRE 'utc'`
                   'stores the current settings into file 'utc'

*RST value	Resolution	SCPI
-	-	Device-specific

SOURce-GPS - Trigger/Marker/Clock

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

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

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.

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 | AINTernal

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

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 to generate the chip clock (1.023 MHz).
	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:FILTer:TYPE   RECTangle | GAUSs

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

Sets the filter to GPS compliant rectangular mode or to Gauss mode.

Example:	BB:GPS:FILTer:TYPE RECT
	'sets the filter to rectangular mode.

*RST value	Resolution	SCPI
GAUSs		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.

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:TRIGger:ARM:EXECute

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

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

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

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.*

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.*

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

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	SCPI
0 chips	1 chips	Device-specific

[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.

Specifies the number of chips by which a restart is to be inhibited following a trigger event. 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	SCPI
0 chips	1 chip	Device-specific

[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.

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.

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.

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.

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 | PPS | PULSe | PATTern | RATio

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).

　　　　　　　　　　PPS
　　　　　　　　　　　A marker signal is generated for every start of second (GPS time).

　　　　　　　　　　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

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

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

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

Sets the divider for Pulse marker mode (`SOUR:BB:GPS:TRIG:OUTP:MODE PULSe`). The resulting
pulse frequency is derived by dividing the chip rate (1.023 MHz) 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?

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.

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.

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 under **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

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

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.
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.

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

Alphabetical List of Commands

Index