

Bluetooth® Enhanced Data Rate Digital Standard for R&S® Signal Generators Operating Manual



1171.6496.12 – 06

This document describes the following software options:

- R&S®AMU-K60/-K260
1403.0353.02, 1403.0401.02
- R&S®SMATE-K60
1404.8412.02
- R&S®SMBV-K60/-K260
1415.8477.xx, 1415.8483.xx
- R&S®SMJ-K60/-K260
1409.2858.02, 1409.2906.02
- R&S®SMU-K60/-K260
1408.7962.02, 1408.8017.02
- R&S®AFQ-K260
1401.5758.02
- R&S®SFU-K260
2115.2389.02

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The following abbreviations are used throughout this manual: R&S®AMU is abbreviated as R&S AMU, R&S®SMATE is abbreviated as R&S SMATE, R&S®SMBV is abbreviated as R&S SMBV, R&S®SMJ is abbreviated as R&S SMJ, R&S®SMU is abbreviated as R&S SMU, R&S®WinIQSIM2 is abbreviated as R&S WinIQSIM2

Basic Safety Instructions

Always read through and comply with the following safety instructions!

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the attached EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

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

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories.





Symbols and safety labels

							
Notice, general danger location Observe product documentation	Caution when handling heavy equipment	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Be careful when handling electrostatic sensitive devices

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

Tags and their meaning

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

	indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	indicates the possibility of incorrect operation which can result in damage to the product. In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of $\pm 10\%$ shall apply to the nominal voltage and $\pm 5\%$ to the nominal frequency.
2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or death.
3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

Electrical safety

If the information on electrical safety is not observed either at all to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.
3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
6. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages $V_{\text{rms}} > 30 \text{ V}$, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

Basic Safety Instructions

14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.

1. Cells must not be taken apart or crushed.
2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.
3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.
4. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.
5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
6. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.
7. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.
8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.

2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

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

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestro sistema de garantía de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el certificado de conformidad adjunto de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

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







Informaciones elementales de seguridad

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

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

Símbolos y definiciones de seguridad

							
Aviso: punto de peligro general Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Advertencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)

					
Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Palabras de señal y su significado

En la documentación del producto se utilizan las siguientes palabras de señal con el fin de advertir contra riesgos y peligros.



PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.



ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.



ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.



AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.

En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

Estados operativos y posiciones de funcionamiento

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

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de $\pm 10\%$ sobre el voltaje nominal y de $\pm 5\%$ sobre la frecuencia nominal.
2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, pueden causarse lesiones o incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

Si no se siguen (o se siguen de modo insuficiente) las indicaciones del fabricante en cuanto a seguridad eléctrica, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión $U_{\text{eff}} > 30 \text{ V}$ se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

Informaciones elementales de seguridad

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

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

Eliminación

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

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1 Preface

1.1 Documentation Overview

The user documentation for the R&S Signal Generator consists of the following parts:

- Online Help system on the instrument,
- "Quick Start Guide" printed manual,
- Documentation CD-ROM with:
 - Online help system (*.chm) as a standalone help,
 - Operating Manuals for base unit and options,
 - Service Manual,
 - Data sheet and specifications,
 - Links to useful sites on the R&S internet.

Online Help

The Online Help is embedded in the instrument's firmware. It offers quick, context-sensitive access to the complete information needed for operation and programming. The online help contains help on operating the R&S Signal Generator and all available options.

Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the Documentation CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and an example of setup are described. The manual includes also general information, e.g., Safety Instructions.

Operating Manuals

The Operating Manuals are a supplement to the Quick Start Guide. Operating Manuals are provided for the base unit and each additional (software) option.

These manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In the Operating Manual for the base unit, all instrument functions are described in detail. Furthermore, it provides an introduction to remote control and a complete description of the remote control commands with programming examples. Information on maintenance, instrument interfaces and error messages is also given.

In the individual option manuals, the specific instrument functions of the option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S Signal Generator is not included in the option manuals.

These manuals can also be ordered in printed form (see ordering information in the data sheet).

Service Manual

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

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

Release Notes

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

1.2 Typographical Conventions

The following text markers are used throughout this documentation:

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

2 Introduction

The R&S Signal Generator provides you with ability to generate signals in accordance with Bluetooth Specification 2.1+EDR. The basic documents for this specification are regulations for Europe, Japan and North America. The frequency band defined for Bluetooth devices is the unlicensed 2.4 GHz ISM (Industrial Scientific medical) frequency band.

Two modulation modes are used for Bluetooth: a mandatory mode, called the Basic Rate and an optional one, called the Enhanced Data Rate. The Basic Rate mode uses binary FM modulation and has data rate of 1 Mbps. The Enhanced Data Rate uses two types of PSK modulation, the $\pi/4$ -DQPSK or 8DPSK, and achieves data rates of 2 Mbps and 3 Mbps, respectively. All modulations schemes have the symbol rate equal to 1Ms/s.

A Time Division Duplex (TDD) scheme for full duplex transmission is defined for both modes.

The latest Bluetooth Low Energy specification is supported as well. See [chapter 3.4, "Bluetooth Low Energy"](#), on page 25 for a detailed description on Bluetooth Low Energy support.

The following list gives an overview of the options provided by the R&S Signal Generator for generating of signals according to the Bluetooth specification:

- Support for three transport modes, the ACL+EDR, SCO, eSCO+EDR transport modes
- Support of all packet types for both the Basic Rate and the Enhanced Data Rate modes
- Generation of signals with up to 5238 frames sequence length
- Configuration of the packet contents with a convenient packet editor or all data packets, both with optional data whitening
- Generation of signals in accordance to the Dirty Transmitter Test specification for both the basic and Enhanced Data Rates and with possibilities to change the start phase, the frequency drift rate and the frequency drift deviation
- Power Ramp Control with possibilities to choose ramp time, rise and fall offset
- Configuration of the clipping, filter and modulation settings

2.1 Bluetooth Transport Modes

There are three different transport modes defined in the Bluetooth specification, each of them with special applications:

- Synchronous Connection-Oriented (SCO)
The SCO transport mode is used for a symmetric point-to-point link establishment between a master and a specific slave in the piconet.
- Extended Synchronous Connection-Oriented (eSCO)
The eSCO transport mode is used for a symmetric or asymmetric, point-to-point link establishment between the master and a specific slave.

- Asynchronous Connection-Less (ACL)
 - The ACL transport mode is used for a point-to-multipoint link establishment between the master and all slaves participating on the piconet.

There are some common transmitted packets used by all transport modes and some specific packets defined for each transport mode.

2.2 Bluetooth Packet Types

2.2.1 ACL packets

The ACL packets are used for asymmetric links and they contain user data or control data. The table and the figures below give an overview of the ACL packets and their structure.

Table 2-1: ACL packet - Basic Rate

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot Number
DM1	1	0-17	2/3	Yes, 16-bit	1
DH1		0-27	no		
DM3	2	0-121	2/3		3
DH3		0-183	no		
DM5		0-224	2/3		
DH5		0-339	no		
AUX1	1	0-29		no	5

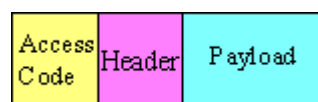


Fig. 2-1: Packet Structure of ACL packets - Basic Rate

Table 2-2: ACL packets - Enhanced Rate

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot Number
2-DH1	2	0-54	no	Yes, 16-bit	1
2-DH3		0-367			3
2-DH5		0-679			5
3-DH1		0-83			1
3-DH3		0-552			3
2-DH5		0-1021			5



Fig. 2-2: Packet Structure of ACL packets - Enhanced Rate

2.2.2 SCO and eSCO packets

The SCO and eSCO packets are used for symmetric links. The SCO packets are used for 64 kb/s speech transmission and for transparent synchronous data. The eSCO packets are also used for 64kb/s speech transmission and transparent data at 64 kb/s but also at other rates.

The tables and the figures below give an overview of the SCO and eSCO packets and their structure.

Table 2-3: SCO packets

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot Number
HV1	n.a.	10	1/3	no	n.a.
HV2		20			
HV3		30	2/3		
DV	1 (Data only)	10+(0-9)	2/3 (Data only)	Yes, 16-bit (Data only)	

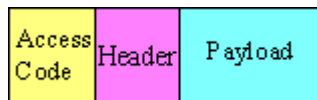


Fig. 2-3: Packet Structure SCO packets

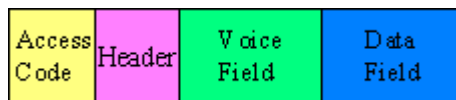


Fig. 2-4: Packet Structure SCO packets (data only)

Table 2-4: eSCO packets - Basic Rate

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot Number
EV3	n.a.	1-30	no	Yes, 16-bit (Data only)	1
EV4		1-120	2/3		3
EV5		1-180	no		3

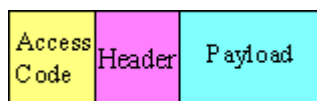


Fig. 2-5: Packet Structure eSCO packets - Basic Rate

Table 2-5: eSCO packets - Basic Rate

Type	Payload Header (bytes)	User Payload (bytes)	FEC	CRC	Slot Number
2-EV3	n.a.	1-60	no	Yes, 16-bit	1
2-EV5		1-360			3
3-EV3		1-90			1
3-EV5		1-540			3

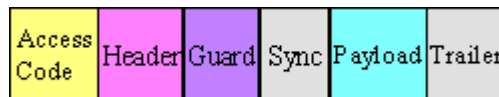


Fig. 2-6: Packet Structure eSCO packets - Enhanced Rate

2.2.3 Link control packets for ACL, SCO, eSCO transport modes

There are some common kinds of packet types. An overview of these packet types is given in the table below.

Table 2-6: Common link control packets

Transport modes	Type	Payload Header (bytes)	FEC	CRC	Application
SCO,eSCO,ACL	ID	n.a.	n.a.	n.a.	Paging, inquiry, response
SCO,eSCO,ACL	NULL				Carries Link information to the source, e.g. about successfully received signal (ARQN) or the state of the receiving buffer (FLOW)
SCO,eSCO,ACL	POLL				Similar to NULL packet, used by master to poll the slaves, must be confirmed
SCO,ACL	FHS	18	2/3	Yes	Page master response, inquiry response, in roll switch

Table 2-7: Common link control packets: packet structure

Packet Type ID	Packet Types NULL and POLL	Packet Types FHS
Access Code (DAK or IAC)	Access Code Header	Access Code Header Payload

2.3 Packet Structure and Fields

Allmost all Bluetooth transmitted packets have standard format and consist of the access code, the header and the payload with useful information. The exceptions are the ID

packet which consists of the access code only and NULL and POLL packets which carry only the access code and the header.

2.3.1 Access code

The access code is used for synchronisation, DC offset compensation and identification. The fields of the access code are shown in the figure below and their meaning is explained in the table below.

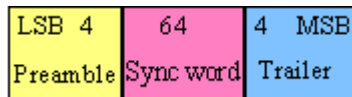


Table 2-8: The access code fields

Field	Description	Packets
Preamble	A fixed zero-one pattern of 4 symbols, used to facilitate DC compensation	All packets
Sync Word	A 64-bit code word derived from a 24 bit address, improves timing acquisition	All packets
Trailer	A fixed zero-one pattern of four symbols, extended DC compensation	All packets, except ID

2.3.2 Header

The Header contains link control information. The fields of the header are shown in the figure and their meaning is explained in the table below.

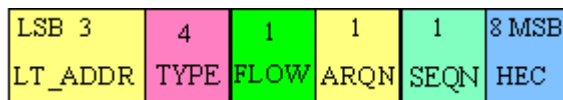


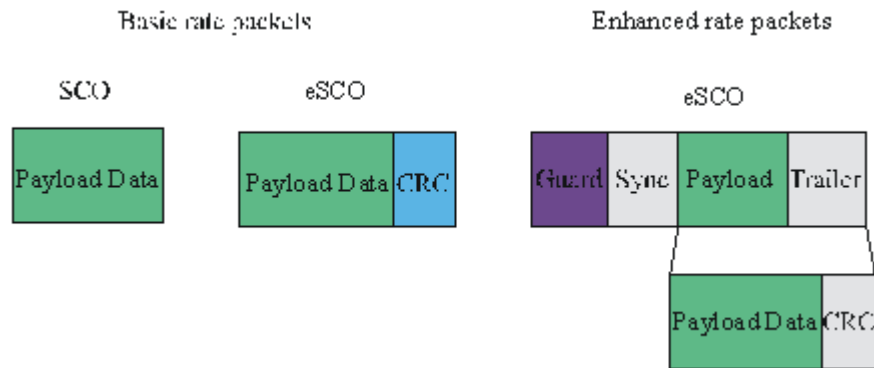
Table 2-9: The header fields

Field	Description	Packets
LT_ADDR	Logical transport address, indicates the destination slave for a packet in a master-to-slave transmission slot and the source slave for a slave-to-master transmission slot	
TYPE	Type code, specifies which packet type is used	
FLOW	Flow control, used for flow control of packets over the ACL logical transport. When the RX buffer in the recipient is full, a STOP indication shall be returned. When the RX buffer can accept data, a Go indication shall be returned.	All packets, except ID
ARQN	Automatic Repeat Request Number, acknowledgement indication, used to inform the source of a successful transfer of payload data with CRC can be positive acknowledged ACK or negative acknowledged NAK,	
SEQN	Sequential numbering scheme to order the data packet stream	
HEC	Header-error-check to check the header integrity	

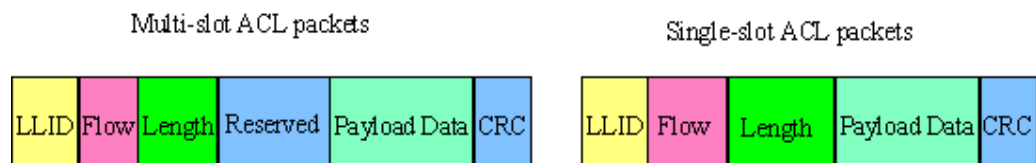
2.3.3 Payload format

The payload structure depends on the type of the data field and the data rate. Two fields are defined in the payload: the synchronous data field and the asynchronous data field. The ACL packets only have the asynchronous data field and the SCO and eSCO packets only have the synchronous data field. The exception is DV of SCO transport mode which has both data fields, synchronous and asynchronous.

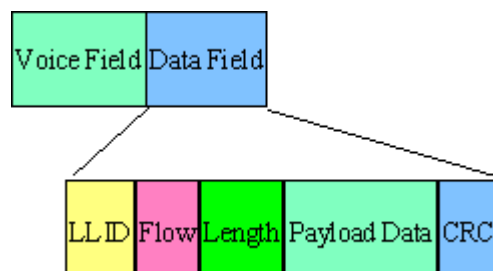
Synchronous data fields



Asynchronous data fields



Synchronous and Asynchronous data fields



The meaning of some payload fields is given in the table below.

Table 2-10: The payload fields

Field	Description
CRC	The cyclic redundancy error check
Guard, Sync	The guard time and synchronization sequence, used for physical layer change of modulation scheme
LLID	The logical link identifier, specifies the logical link
Flow	Field which controls the flow on the logical channels

The payload format and content of the FHS packet are different from other packets. The fields of the FHS packet are shown in the figure below and their meaning is explained in the table below.

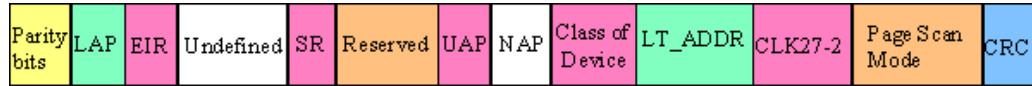


Table 2-11: The payload fields for the FHS packet

Field	Description
Parity bits	Form the first part of the sync word of the access code of the device that sends the FHS packet
LAP	Contains the lower address part of the device that sends the FHS packet
EIR	An extended inquiry response, provides miscellaneous information during the inquiry response procedure
Undefined	Reserved for future use and shall be set to zero
SR	The scan repetition field, indicates the interval between two consecutive page scan windows
Reserved	Shall be set to 10
UAP	Contains the upper address part of the device that sends the FHS packet
NAP	Contains the non-significant address part of the device that sends the FHS packet
Class of device	Contains the class of device of the device that sends the FHS packet. This field is defined in Bluetooth Assigned Numbers.
LT_ADDR	Contains the logical transport address
CLK27-2	Contains the value of the native clock of the device that sends the FHS packet, sampled at the beginning of the transmission of the access code of this FHS packet
Page scan mode	Indicates which scan mode is used by default by the sender of the FHS packet

2.4 Bluetooth Modulation Schemes

The modulation used for the basic data rate packets is GFSK (Gaussian Frequency Shift Keying) with a bandwidth bit period product $BT=0.5$. The modulation index is between 0.28 and 0.35.

The modulation scheme used for enhanced data rate packets changes within the packet. The access code and packet header has GFSK modulation scheme and are transmitted with the Basic Rate 1Mbps, while the subsequent synchronisation sequence, payload and trailer sequence have a PSK type of modulation and are transmitted with a data rate of 2 Mbps or optionally 3 Mbps.

The PSK modulation, namely $\pi/4$ rotated differential encoded quaternary phase shift keying ($\pi/4$ -DQPSK) is defined for for the 2 Mbps transmission.

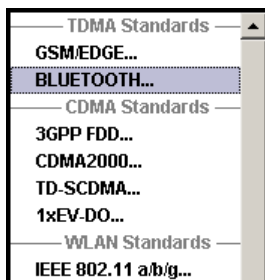
The PSK modulation, namely differential encoded 8-ary phase shift keying (8DPSK), is defined for the 3Mbps transmission.

The modulation types and corresponding packet types are given in the table below.

Table 2-12: The modulation types and corresponding packet types

Modulation type	Packet types
GFSK	ID, NULL, POLL, FHS, DM1, DH1, DM3, DH3, DM5, DH5, AUX1, HV1, HV2, HV3, DV, EV3, EV4, EV5
GFSK + $\pi/4$ -DQPSK	2-DH1, 2-DH3, 2-DH5, 2-EV3, 2-EV5
GFSK + 8DPSK	3-DH1, 3-DH3, 3-DH5, 3-EV3, 3-EV5

3 User Interface



The menu for setting the Bluetooth 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.

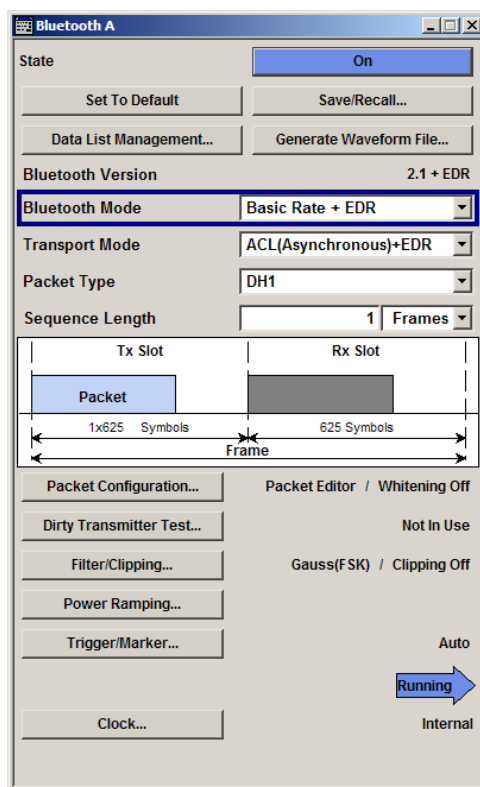
The upper section of the menu is where the Bluetooth digital standard is enabled, the default settings are called, and the transport mode, the packet type and the sequence length are selected.

The valid Bluetooth version in use is displayed.

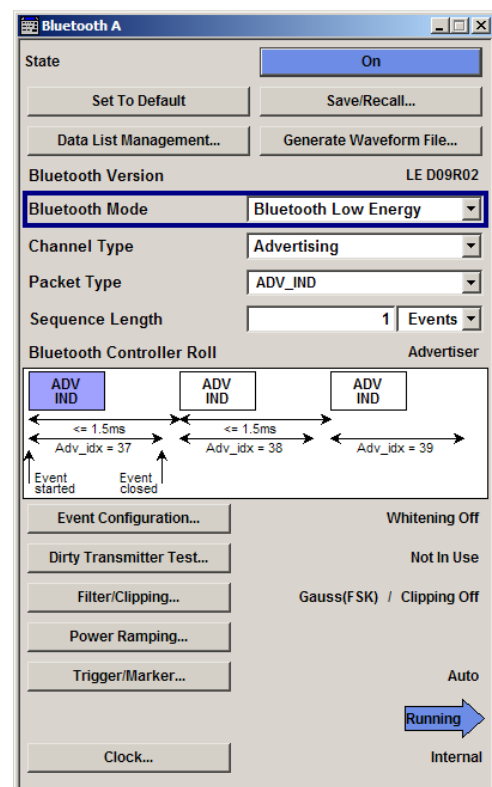
Between an upper part of menu and a lower part of menu Transmission/Reception TX/ RX timing is shown. Transmitted packet has duration $N \times 625 \mu s$ where N is an odd integer larger than 0. N depends on the type of the transmitted packet. For Bluetooth Low Energy modes, various packet durations apply depending on the type of channel and packet selected.

Many of the buttons lead to submenus for loading and saving the Bluetooth configuration and for setting the filter, trigger, and clock parameters.

Specific settings of the Bluetooth modes EDR are described in separate chapters. Refer to [chapter 3.2, "Bluetooth Basic Rate + EDR"](#), on page 18, and [chapter 3.4, "Bluetooth Low Energy"](#), on page 25.



Bluetooth Basic Rate + EDR



Bluetooth Low Energy

3.1 General Settings for Bluetooth Signals

The upper menu section is where the Bluetooth digital standard is enabled and reset and where the transport mode, packet type and sequence length are selected.

State

Activates or deactivates the Bluetooth standard.

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

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

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:STATe` on page 65

Set To Default

Calls the default settings.

Parameter	Value
Bluetooth Version	2.1 + EDR (2.1 = current version number)
Bluetooth Mode	Basic Rate + EDR
Transport mode	ACL (Asynchronous) + EDR
Packet type	DH1
Sequence length	1 Frames
Packet configuration	Packet Editor/ Whitening off
Dirty Transmitter Test	Not in Use
Filter/Clipping	Gauss (FSK) / Clipping off
Power ramping	Cosine / 1 Symbols
Trigger/Marker	Auto
Clock	Internal

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:PRESet` on page 63

Save/Recall...

Calls the "Save/Recall" menu.

From the "Save/Recall" menu, the "File Select" windows for saving and recalling Bluetooth configurations and the "File Manager" are called.



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

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

- "Recall Bluetooth Setting" Opens the "File Select" window for loading a saved Bluetooth configuration. The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.
- "Save Bluetooth Setting" Opens the "File Select" window for saving the current Bluetooth signal configuration. The name of the file is specified in the "File name" entry field, the directory selected in the "Save Into" field. The file is saved by pressing the "Save" button.
- "File Manager" Calls the "File Manager". The "File Manager" is used to copy, delete, and rename files and to create new directories.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT00th:SETTing:CATalog](#) on page 63

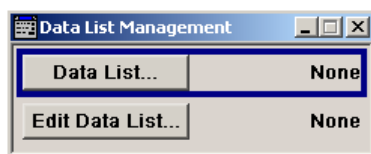
[\[:SOURCE<hw>\]:BB:BT00th:SETTing:LOAD](#) on page 64

[\[:SOURCE<hw>\]:BB:BT00th:SETTing:STORe](#) on page 65

[\[:SOURCE<hw>\]:BB:BT00th:SETTing:DELeTe](#) on page 64

Data List Management...

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



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

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

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

Example: Creating and editing the data list

```
SOUR:BB:DM:DLIS:SEL 'd_list1'
```

```
SOUR:BB:DM:DLIS:DATA #B1111010101000001111....
```

```
SOUR:BB:DM:DLIS:DATA:APP #B1111010101000001111....
```

SCPI command:

[\[:SOURCE<hw>\]:BB:BT00th:PCONfiguration:DATA](#) on page 90

[\[:SOURCE<hw>\]:BB:BT00th:PCONfiguration:DATA:DSELection](#) on page 90

Generate Waveform File...

Calls the "Generate Waveform" menu. This menu is used to store the current Bluetooth signal as ARB signal in a waveform file.

This file can be loaded in the "ARB" menu and processed as multicarrier or multisegment signal.

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

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:WAVEform:CREate](#) on page 66

Bluetooth Version

Displays the current version of the Bluetooth / Bluetooth LE standard.

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

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:VERSion](#) on page 66

Bluetooth Mode

Determines the digital Bluetooth standard. Basic Rate + EDR or Bluetooth Low Energy are available.

"Basic Rate +EDR" Selects the Bluetooth mode Basic Rate + EDR. Specific settings of the basic mode are described in [chapter 3.2, "Bluetooth Basic Rate + EDR"](#), on page 18c.

"Bluetooth Low Energy" Selects the Bluetooth mode Low Energy. The settings concerning Bluetooth Low Energy mode are described in [chapter 3.4, "Bluetooth Low Energy"](#), on page 25.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:BMODE](#) on page 103

3.2 Bluetooth Basic Rate + EDR

Transport Mode

Selects the transport mode.

"ACL+EDR" The transport mode selected is used for a point-to-multipoint link establishment between the master and all the slaves participating on the piconet.

"SCO" The transport mode selected is used for a point-to-point link establishment between a master and a single slave in the piconet.

"eSCO+EDR" The transport mode selected is used for a symmetric or asymmetric point-to-point link establishment between a master and a specific slave.

SCPI command:

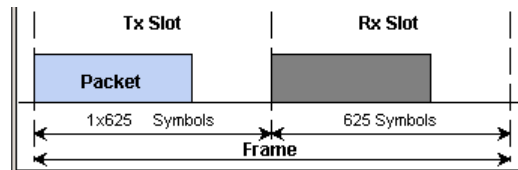
[\[:SOURCE<hw>\]:BB:BT0oth:TMODE](#) on page 65

Packet Type

Selects the packet type.

The available packets depend on the selected transport mode.

The graphic in the main menu shows the frame structure of the selected packet type.



The transmitted packet has a duration of $N \times 625 \mu\text{s}$ where N is an odd integer larger than 0. N depends on the type of the transmitted packet.

"ID / NULL / All packet types as defined in the Bluetooth specification are supported.
 POLL / FHS / For an overview of the supported packets, see [chapter 2.2, "Bluetooth Packet Types"](#), on page 8.

DMx / DHx /
 AUX1 / 2-DHx /
 3-DHx / HVx /
 DV / EVx / 2-
 EVx / 3-EVx"

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:PTYPE` on page 63

Sequence Length

Selects the sequence length in frames of the generated signal. The signal repeats after the specified number of frames.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:SLENgth` on page 65

Packet Configuration...

Calls the menu for setting a packet configuration.

The current data source for packet and the data whitening state are displayed next to the button.

The menu is described in [chapter 3.3, "Packet Configuration - Bluetooth Basic Rate + EDR"](#), on page 20.

SCPI command:

n.a.

Dirty Transmitter Test...

Calls the menu for configuring parameters of the Dirty Transmitter Test.

The current state of the Dirty Transmitter Test is displayed next to the button.

The menu is described in [chapter 3.7, "Dirty Transmitter Test"](#), on page 44

SCPI command:

n.a.

Filter/Clipping...

Calls the menu for setting baseband filter and clipping of the generated signal. The current filter and the clipping state are displayed next to the button.

The menu is described in [chapter 3.8, "Filter/Clipping Settings"](#), on page 47.

SCPI command:

n.a.

Power Ramping...

Calls the menu for setting the power ramping.

The menu is described in [chapter 3.9, "Power Ramping"](#), on page 50.

SCPI command:

n.a.

Trigger/Marker

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

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

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

The menu is described in [chapter 3.10, "Trigger/Marker/Clock Settings"](#), on page 51.

SCPI command:

n.a.

Execute Trigger

Executes a trigger manually.

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

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGger:EXECute](#) on page 74

Arm

Stops signal generation manually.

The "Arm" button is displayed only if the trigger modes "Armed Retrigger" or "Armed Auto" have been selected.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGger:ARM:EXECute](#) on page 74

Clock

Calls the menu for selecting the clock source and for setting a delay, see [chapter 3.10, "Trigger/Marker/Clock Settings"](#), on page 51.

SCPI command:

n.a.

3.3 Packet Configuration - Bluetooth Basic Rate + EDR

The "Packet Configuration" menu is reached via the "Bluetooth" main menu.

The available settings in the lower part of the menu depend on the selected data source for packet and the selected packet type. Header configurations are selected in the Header Settings section.

Data Source for Packet

The data sent for each packet can be comfortably edited with the Packet Editor, or filled with a predefined ALL Data sequence.

"Packet Editor" Enables the Packet Editor. All packet fields can be configured individually.

"All Data" Fills the generated packets with the selected data source. Useful if predefined data contents are loaded with a data list file or the data contents of the packet are not of interest.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DSFPacket](#) on page 92

Data Whitening

Activates or deactivates the Data Whitening.

Evenly distributed white noise is ideal for the transmission and real data can be forced to look similar to white noise with different methods called Data Whitening.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DWhitening](#) on page 92

Bluetooth Device Address (BD_ADDR)

Enters Bluetooth Device Address. Each Bluetooth device shall be allocated a unique 48-bit Bluetooth device address (BD_ADDR).

ACDE	48	0000 80
NAP	UAP	LAP

The BD_ADDR may take any values except the 64 reserved LAP values. : 0x9E8B00 – 0x9E8B3F.

- "NAP" Selects non-significant address part.
The length of NAP is 16 bits or 4 hexadecimal figures.
- "UAP" Selects upper address part.
The length of UAP is 8 bits or 2 hexadecimal figures.
- "LAP" Selects lower address part.
The length of LAP is 24 bits or 6 hexadecimal figures.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:BDANap](#) on page 89

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:BDAUap](#) on page 89

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:BDALap](#) on page 88

Logical Transport Address

(Available for all packet types except ID)

Enters the logical transport address for the header.

Each slave active in a piconet is assigned a primary logical transport address (LT_ADDR). The all-zero LT_ADDR is reserved for broadcast messages.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:LTAddress](#) on page 93

Flow Control (Header)

(Available for all packet types except ID)

Sets the FLOW bit in the header. This bit indicates start or stop of transmission of packets over the ACL logical transport.

- "Go" Allows the other devices to transmit new data.
- "Stop" Stops the other devices from transmitting data temporarily.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:HFControl](#) on page 93

Acknowledgement

(Available for all packet types except ID)

Sets the ARQN bit of the packet header.

- "NAK" Request to retransmit the previous payload.
- "ACK" Previous payload has been received successfully.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:ACKnowledgement](#) on page 88

SEQN Start Value

(Available for all packet types except ID)

Sets the start value of the header SEQN bit.

The SEQN bit is present in the header to filter out retransmissions in the destination. The signal generator is altering this bit automatically on consecutive frames, if a sequence length of at least 2 frames is set.

"0" The SEQN bit starts with 0.

"1" The SEQN bit starts with 1.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:SNValue](#) on page 95

Data Source

(Available for all packet types except ID, POLL, NULL and FHS packets)

Selects the data source used for the payload.

"All 0 / All 1" 0 data and 1 data is generated internally.

"Pattern" Pattern is user definable.
The bit pattern is defined in the "Pattern" entry field.

"PN xx" Pseudo-random noise sequence. XX can be equal to 9, 11, 15, 16, 20, 21, 23.

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

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA](#) on page 90

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA:DPATtern](#) on page 90

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DATA:DSElection](#) on page 90

Data Length

(Available all packet types except ID, POLL, NULL and FHS packets)

Enters the payload data length in bytes.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:DLENgth](#) on page 91

Flow Control (Payload)

(Available for all packets types except ID, POLL, NULL, FHS, HV1, HV2, HV3, EV3, EV4, EV5, 2-EV3, 2-EV5, 3-EV3, 3-EV5 packets.)

Sets the FLOW bit in the payload (flow control per logical link)

"Go" Indicates start of transmission of ACL packets after a new connection has been established.

"Stop" Indicates stop of transmission of ACL packets before an additional amount of payload data is sent.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:PFControl](#) on page 94

Packet Length

(Available in All Data mode only and for all packet types except ID packet)

Enters the packet length in symbols.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:PLENgtH](#) on page 94

EIR packet follows

(Available for FHS packets)

Indicates that an extended inquiry response packet may follow.

"Yes" Indicates that an EIR packet follows.

"No" Indicates that EIR does not follow.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:EIRPacketfollows](#)
on page 92

Scan Repetition Mode

(Available for FHS packets)

The 2-bit scan repetition field indicates the interval between two consecutive page scan windows, determines the behavior of the paging device.

"R0" The scan interval is equal to the scan window T_w page scan (continuous scan) and maximal 1.28s.

"R1" The scan interval is maximal 1.28s.

"R2" The scan interval is maximal 2.56s.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:SRMode](#) on page 95

Class of Device

(Available for FHS packets)

A parameter received during the device discovery procedure, indicates the type of device and which types of service that are supported.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PCONfiguration:CODevice](#) on page 89

Data Source (Voice Field)

(Available for DV packets)

Selects the Data Source for the voice field.

"All 0 / All 1" 0 data and 1 data is generated internally

"Pattern" Pattern is user definable.
The bit pattern is defined in the "Pattern" entry field.

"PN xx" Pseudo-random noise sequence. XX can be equal to 9, 11, 15, 16, 20, 21, 23.

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

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:PCONfiguration:VDATa` on page 95

`[:SOURce<hw>] :BB:BT0oth:PCONfiguration:DATA:VDPAttern` on page 91

`[:SOURce<hw>] :BB:BT0oth:PCONfiguration:DATA:VDSElection`
on page 91

3.4 Bluetooth Low Energy

The R&S Signal Generator provides you with ability to generate signals in accordance with Bluetooth Low Energy Specification (LE). Bluetooth Low Energy makes it possible to transfer data from low power devices running on the smallest of batteries to a larger device, such as a PC, a mobile phone, or a PDA. For the first time, a Bluetooth connection to a wristwatch, or a heart rate sensor, or a data transfer from a digital camera, is possible. The Bluetooth low energy chips will offer capabilities that do not replace or supersede the existing Bluetooth 2.x standards. Data rates are comparable to Bluetooth 1.1, and are data-only (no audio content).

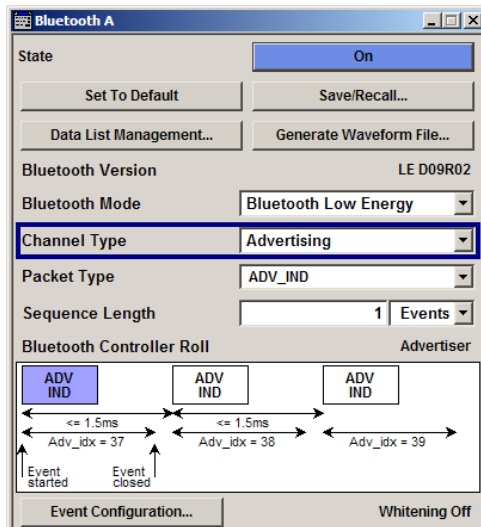
Bluetooth LE mode only uses the Basic Rate. The Basic Rate mode uses binary FM modulation and has a data rate of 1 MBps. The modulation scheme has the symbol rate equal to 1Ms/s.

For full duplex transmission, a Time Division Duplex (TDD) scheme is used.

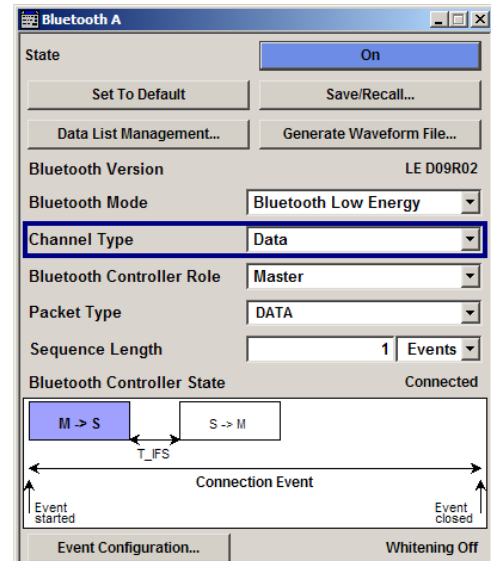
The following list gives an overview of the options provided by the R&S Signal Generator for Bluetooth LE compliant signal generation:

- Support for two channel types, the Advertising and Data channel types.
- Support of all Bluetooth LE packet types.
- Sequence Length unit can be set to Event or Frame.
- Convenient packet editor for all supported packet types including optional data whitening.
- Dirty Transmitter Test compliant to RF test specification, with options to change start phase, frequency drift rate and frequency drift deviation.
- Power Ramp Control with configurable ramp time, rise and fall offsets.
- Clipping, filter and modulation settings supported.

In the following description Bluetooth Low Energy is abbreviated as Bluetooth LE.



Bluetooth LE Channel Type Advertising



Bluetooth LE Channel Type Data

Channel Type

Determines the channel type. Advertising and data are available. Refer to [chapter 3.5, "Event / Frame Configuration - Bluetooth LE"](#), on page 29 for setting the respective parameters.

"Advertising" Selects channel type Advertising.

"Data" Selects channel type Data.
Devices in a connected state transmit data channel packets in connection events with a start point and an interval.

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:CTYPe on page 62
```

Bluetooth Controller Role

Determines the controller role. Depending on the selected channel type different roles are assigned to the controller.

For channel type "Data", master or slave can be assigned.

If channel type "Advertising" is selected, the parameter is read only and displayed directly above the graph. The possible roles are described in ["Bluetooth Controller State/Roll"](#) on page 28.

Note: The available packet types for the selected channel types and the controller roles are described in ["Packet Type"](#) on page 27. This parameter is relevant for data channel type.

"Master" Assigns master role to the controller.

"Slave" Selects slave as controller role.

SCPI command:

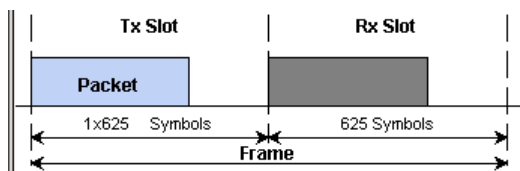
```
[ :SOURce<hw> ] :BB:BT0oth:BCRole on page 102
```

Packet Type

Selects the packet type.

The available packets depend on the selected channel type.

The graphic in the main menu shows the frame structure of the selected packet type.



"ADV_IND/
ADV_DIRECT_
IND/
ADV_NON-
CONN_IND/
ADV_DIS-
COVER_IND/
SCAN_REQ/
SCAN_RSP/
CON-
NECT_REQ/
TEST
PACKET"

"Channel type Advertising"

- Advertising
- ADV_IND
- ADV_IND
- ADV_DIRECT_IND
- ADV_NONCONN_IND
- ADV_DISCOVER_IND
- SCAN_REQ
- SCAN_RSP
- CONNECT_REQ
- DATA
- CONTROL_DATA ▶
- TEST PACKET

"DATA/ CON-
NEC-
TION_UPDATE
_REQ/ CHAN-
NEL_MAP_RE
Q/ TERMI-
NATE_IND/
LL_ENC_REQ/
LL_START_EN
C_RSP/ FEA-
TURE_REQ/
TEST PACKET
"

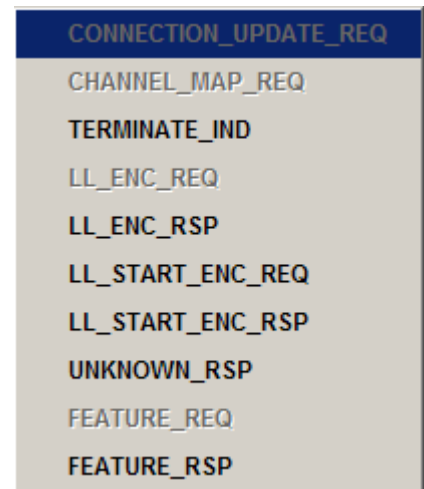
"Channel type Data and Controller role Master"

- Data
- Master
- DATA
- ADV_IND
- ADV_DIRECT_IND
- ADV_NONCONN_IND
- ADV_DISCOVER_IND
- SCAN_REQ
- SCAN_RSP
- CONNECT_REQ
- DATA
- CONTROL_DATA ▶
- TEST PACKET

- CONNECTION_UPDATE_REQ
- CHANNEL_MAP_REQ
- TERMINATE_IND
- LL_ENC_REQ
- LL_ENC_RSP
- LL_START_ENC_REQ
- LL_START_ENC_RSP
- UNKNOWN_RSP
- FEATURE_REQ
- FEATURE_RSP

"DATA/ TERMIN-Channel type Data and Controller role Slave

NATE_IND/
 LL_ENC_RSP/
 LL_START_EN
 C_REQ/
 LL_START_EN
 C_RSP/
 UNKNOWN_R
 SP/ FEA-
 TURE_RSP/
 TEST PACKET
 "



SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:UPTYPE](#) on page 121

Sequence Length

Selects the number of frames or events depending on the packet type. The signal repeats after the specified number of frames/events.

For SCAN_REQ and CONNECT_REQ packet, the sequence length is expressed in "Frames".

For TERMINATE_IND packets, a default value according to the specification is given:

- Master: 'SlaveLatency + 6'
- Slave: '6'

For all other packet types the sequence length is expressed in "Events".

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:USLength](#) on page 122

Bluetooth Controller State/Roll

Shows that the state is Connected.

Note: This parameter is relevant for data channel type.

If channel type Advertising is selected, this field displays the current bluetooth Controller Role, depending on the selected packet type:

- "Advertiser" for all ADV-xxx packet types and SCAN_RSP
- "Scanner" for SCAN_REQ packet type
- "Initiator" for CONNECT_REQ packet type

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:BCText](#) on page 62

Event / Frame Configuration

Calls a submenu for setting Event Configuration, depending on the packet type. In case the sequence length of the packet type is expressed in frames, the button calls the menu for setting the Frame Configuration

These submenus are described in [chapter 3.5, "Event / Frame Configuration - Bluetooth LE"](#), on page 29.

The data whitening state is displayed next to the button.

SCPI command:
n.a.

3.5 Event / Frame Configuration - Bluetooth LE

The "Event/ Frame Configuration" menus are reached via the "Bluetooth "main menu.

The upper area of the menus changes, as a function of the used channel type. For channel type "Data", the section provides "Connection Settings", and for channel type "Advertising" the "Advertising Settings" are given with regard to this channel type. The "Packet Configuration" submenu can be opened, and a graph represents the physical channel mapping and the channel indices. The table in the lower section gives an overview of the used channels and their parameters.

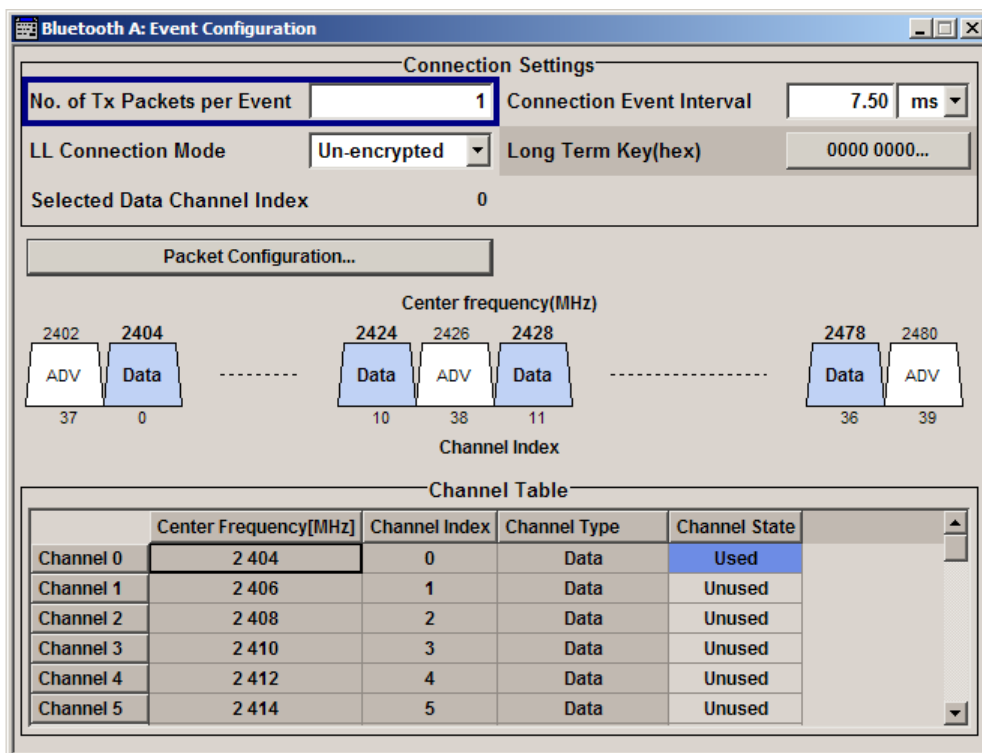


Fig. 3-1: Event Configuration Dialog of channel type Data

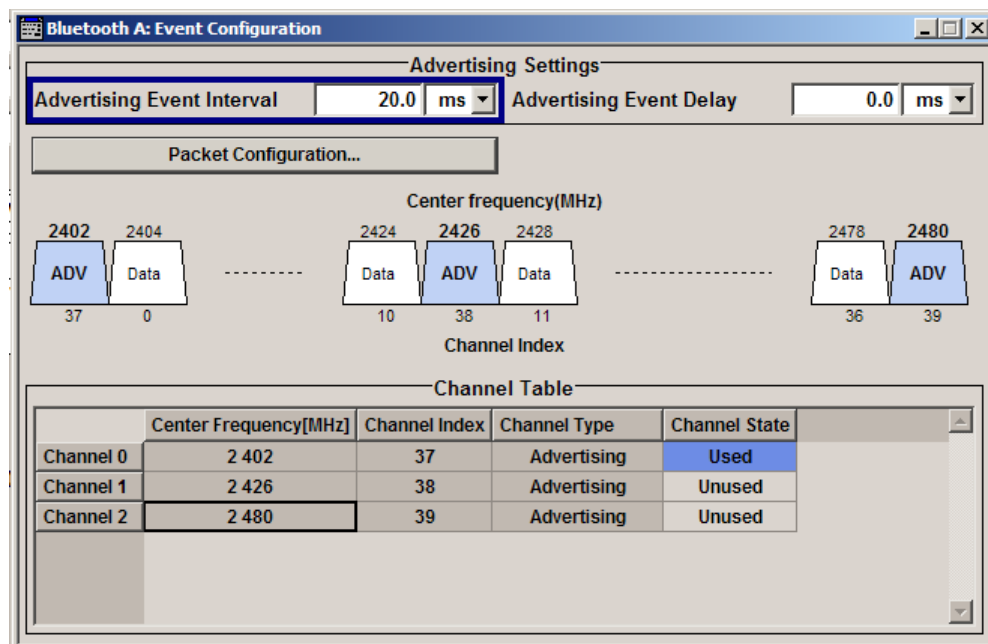


Fig. 3-2: Event Configuration Dialog of channel type Advertising

3.5.1 Configuration

No. of Tx Packets per Event

Sets the number of Tx packets per event. Each connection contains at least one data channel packet. The maximum number of packets per event is determined by the duration of the connection event interval.

Note: This parameter is relevant for data event connection settings.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PNUMBER` on page 119

Connection Event Interval

Sets the time interval between the start points of two consecutive connection events.

Subsequent transmissions within an event are separated by this parameter in order to separate connecting event starting points in time.

Note: This parameter is relevant for data event connection settings.

SCPI command:

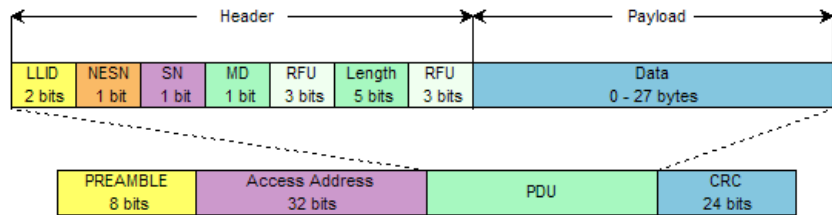
`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CINTERval` on page 109

LL Connection Mode

Select the link layer connection mode. In order to provide safe transmission of payload data, the data in the packet can be encrypted. If activated, the payload data follows MIC (Message authentication Code).

Note: This parameter is relevant for data event connection settings.

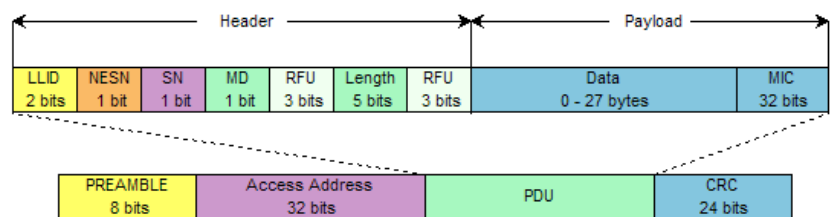
"Unencrypted" Payload data is transmitted without encoding.



Note: The packet types DATA, CONNECTION_UPDATE_REQ, CHANNEL_MAP_REQ, TERMINATE_IND, LL_ENC_REQ, LL_ENC_RSP, LL_START_ENC_REQ, FEATURE_REQ, FEATURE_RSP and UNKNOWN_RSP can be transmitted unencrypted. The packet type LL_ENC_REQ, LL_ENC_RSP and LL_START_ENC_REQ, are transmitted only unencrypted.

"Encrypted" The link layer connection runs in encrypted mode.

Note: The packet types DATA, CONNECTION_UPDATE_REQ, CHANNEL_MAP_REQ, TERMINATE_IND, LL_START_ENC_RSP, FEATURE_REQ, FEATURE_RSP and UNKNOWN_RSP can be transmitted encrypted. The packet type LL_START_ENC_RSP is transmitted only encrypted.



SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:LCMode` on page 107

Long Term key (hex)

Indicates the time the controller needs to receive the long term key from the host. After this time, the controller is ready to enter into the last phase of encryption mode setup.

Note: This parameter is relevant for data event connection settings. In encrypted mode, the code can be edited.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:LTKey` on page 107

Selected Data Channel Index

Indicates the number of the first active data channel.

The data channel is selected for each connection event. The master and slave determine the used data channel by selecting from the list of used channels (see "Data Channel Map Table" on page 42).

Note: This parameter is relevant for data event connection settings.

Displays the data channel index currently selected.

SCPI command:

n.a.

3.5.2 Advertising Configuration - Event

Advertising Event Interval

Sets the time interval between two consecutive advertising events, with regard to the starting points.

Note: This parameter is relevant for advertising event configuration and for the packet types ADV-IND, ADV_DIRECT_IND, ADV_NONCONN_IND and ADV_DISCOVER_IND.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECONfiguration:AEInterval](#) on page 106

Advertising Event Delay

Sets a time delay between the start times of two consecutive advertising events. The value is added to the advertising event interval.

Note: This parameter is relevant for advertising event configuration and for the packet types ADV-IND, ADV_NONCONN_IND and ADV_DISCOVER_IND.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECONfiguration:AEDelay](#) on page 106

Scan Window

Sets the length of the window during which the scanner is operating in the advertising channel.

Note that the scan window is less or equal to the value of the scan interval.

Note: This parameter is relevant for advertising frame configuration and for the packet type SCAN_REQ.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECONfiguration:SWINDOW](#) on page 120

Scan Interval

Sets the time interval between the starting points of two consecutive windows during which the scanner is operating in an advertising channel.

Note: This parameter is relevant for advertising frame configuration and for the packet type SCAN_REQ.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECONfiguration:SINTERVAL](#) on page 120

Advertising Packet Interval

Sets the time interval between packets starting points of two consecutive packets in the advertising channel.

Note: This parameter is relevant for advertising frame configuration and for the packet type SCAN_RSP.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:APInterval](#) on page 106

Transmit Window Offset

Displays the start point of the transmit window.

Note: This parameter is relevant for advertising frame configuration and for the packet type CONNECT_REQ.

This parameter is set in the Packet Configuration, see "[Transmit Window Offset](#)" on page 41.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:WOINfo](#) on page 120

Transmit Window Size

Indicates the size of the transmit window, regarding to the start point.

Note that the scan window size is less or equal to the value of the connection interval.

Note: This parameter is relevant for advertising frame configuration and for the packet type CONNECT_REQ.

The parameter is set in the "Packet Configuration" dialog, see "[Transmit Window Size](#)" on page 40.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:ECOnfiguration:WSINfo](#) on page 121

Packet Configuration

Calls the menu for setting a packet configuration.

The menu is described in [chapter 3.6, "Packet Configuration - Bluetooth LE"](#), on page 33.

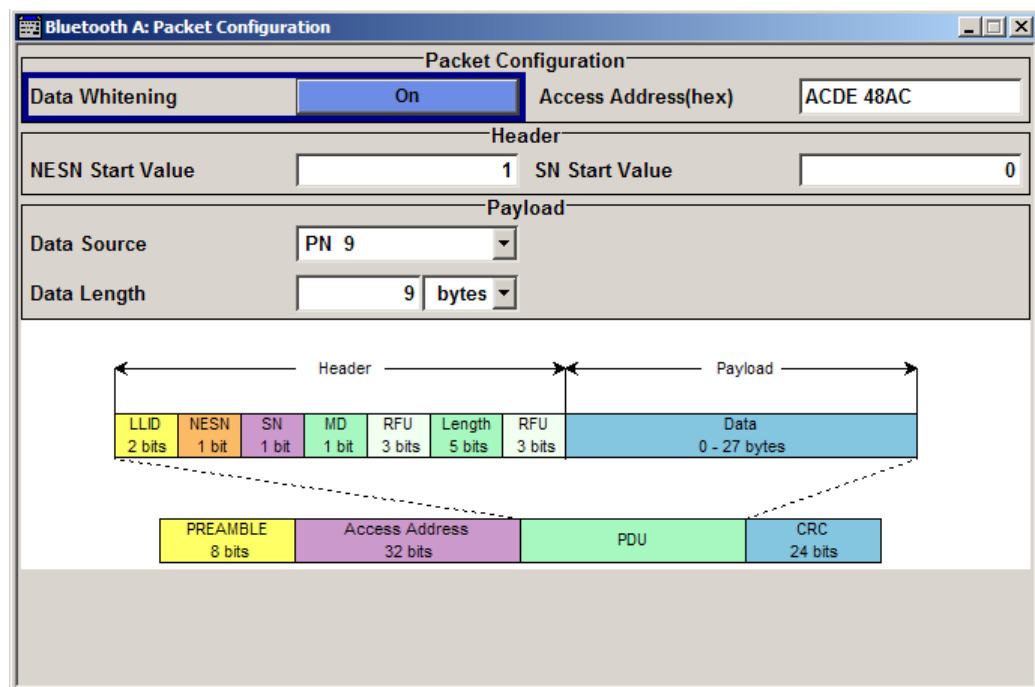
SCPI command:

n.a.

3.6 Packet Configuration - Bluetooth LE

The "Packet Configuration" menu is reached via the "Event Configuration" menu or the "Frame Configuration" menu, respectively.

The available settings in the menu depend on the selected channel type and the packet type. Header configurations are selected in the "Header" section. Data and control parameters are set in the "Payload" section. The figure shows the packet structure of the currently selected configuration.



3.6.1 Packet Configuration Section

Data Whitening

Activates or deactivates the Data Whitening.

Evenly distributed white noise is ideal for the transmission and real data can be forced to look similar to white noise with different methods called Data Whitening. Applied to the PDU and CRC fields of all packet types, whitening is used to avoid long equal sequences in the data bit stream.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DWHitening`
on page 111

Access Address

Sets the access address of the link layer connection.

Bluetooth Low Energy transmissions are based on an interface packet format, that consists of a preamble (8 bits), the access address (32 bits), the PDU and CRC (24 bits).

The access address' structure depends on the packet type:

- Data channel packets
The access address is a pseudo-random LL connection address, generated by the initiator of the LL connection. The address has to follow some specific rules, which are described in the "Bluetooth Low Energy Technology Specification".
- Advertising channel packets
The address is fixed to 0110101101111011001000101110001 with the left most bit sent first and being the LSB.

Note: This parameter is relevant for data event and advertising frame configuration and the packet types DATA, CONNECTION_UPDATE_REQ, CHANNEL_MAP_REQ, TERMINATE_IND, LLENC_REQ, LL_START_ENC_:RSP, FEATURE_REQ, CONNECT_REQ.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:AADdress`
on page 107

3.6.2 Header Section - Data Event Configuration & Advertising Event / Frame Configuration

NESN Start Value

Sets the start value of the next expected packet from the same device in the LL connection (NextExpected SequenceNumber). This parameter can be set in the first event. From the second event this field is not indicated.

Note: This parameter is relevant for data event configuration and all data channel packet types except TEST_PACKET.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NSValue`
on page 115

SN Start Value

Sets the sequence number of the packet. This parameter can be set in the first event. From the second event this field is not indicated.

Note: This parameter is relevant for data event configuration and all data channel packet types except TEST_PACKET.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SSValue`
on page 117

Device's Addr Type

Selects the address type of the controller device. Depending on the Bluetooth controller role either the Tx or Rx or both address types are assigned.

Subdivided into private and random, a Bluetooth LE device address consists of 48 bits. The format of the device address differs depending on the selected address type.

Note: This parameter is relevant for advertising event or frame configuration.

The bluetooth "Controller Role" and the packet type determine the available entries:

- **Tx** in conjunction with the packet types ADV_IND, ADV_DIRECT_IND, ADV_NONCONN_IND, ADV_DISCOVER_IND, SCAN_REQ, SCAN_RSP and CONNECT_REQ
- **Rx** for the packet types ADV_DIRECT_IND, SCAN_REQ and CONNECT_REQ

"Public" Allocates a unique 48 bit address to each bluetooth LE device. The public address is given from the registration authority IEEE.

"Random" Allocates a 48 bit address to each bluetooth LE device. A random address is optional.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:TAType`

on page 116

3.6.3 Payload section - Data Event Configuration

Data Source

Selects the data source used for the payload.

Note: This parameter is relevant for event configuration and packet types DATA, ADV_IND, ADV_NONCONN_IND and ADV_DISCOVER_IND.

"All 0 / All 1" 0 data and 1 data is generated internally.

"Pattern" Pattern is user definable.
The bit pattern is defined in the "Pattern" entry field.

"PN xx" Pseudo-random noise sequence. XX can be equal to 9, 11, 15, 16, 20, 21, 23.

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

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA`

on page 110

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:DPATtern` on page 110

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:DSElection` on page 110

Data Length

Enters the payload data length in bytes.

Note: This parameter is relevant for event configuration with packet types ADV_IND, ADV_NONCONN_IND and ADV_DISCOVER_IND.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DLENgth`

on page 111

Select Data List

Calls the "Bluetooth Data List" menu.

From this menu, the "File Select" windows for selecting Bluetooth data files and the "File Manager" are called. For description of data list handling refer to the operating manual of your R&S instrument.

Note: This button is available for event configuration with packet types DATA, ADV_IND, ADV_NONCONN_IND and ADV_DISCOVER_IND.

SCPI command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:DATA:
```

DSElection on page 110

Connection Event Interval

Set the time interval between the start points of two consecutive connection events.

Note: This parameter is relevant for data event and advertising frame configuration with the packet types CONNECTION_UPDATE_REQ and CONNECT_REQ.

SCPI command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CINterval
```

on page 109

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NCINterval
```

on page 114

Slave Latency

Sets a number of consecutive connection events the slave can ignore for asymmetric link layer connections.

Note: This parameter is relevant for data event and advertising frame configuration with the packet types CONNECTION_UPDATE_REQ and CONNECT_REQ.

SCPI command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SLATency
```

on page 117

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NSLatency
```

on page 115

LL Connection Timeout

Defines the maximum time between two correctly received Bluetooth Low Energy packets in the LL connection before the connection is considered lost.

Note: This parameter is relevant for data event and advertising frame configuration with the packet types CONNECTION_UPDATE_REQ and CONNECT_REQ.

SCPI command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:LCTimeout
```

on page 113

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NLCTimeout
```

on page 114

Connection Instant

Sets a connection instant for indicating the connection event at which the new connection parameters are taken in use.

Both the master and the slave have a 32-bit connection event counter per LL connection. It is reset to zero on the first connection event of the LL connection and incremented by one on every elapsed connection event interval of the LL connection.

Note: This parameter is relevant for data event configuration with the packet types CONNECTION_UPDATE_REQ and CHANNEL_MAP_REQ.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CINStant`

on page 109

Show / Hide Data Channel (Mapping) Table

Calls / Hides the channel map table that displays the used channels and their parameters.

The channel table is described in "Data Channel Map Table" on page 42.

Note: This parameter is relevant for data event and advertising frame configuration with the packet types CHANNEL_MAP_REQ and CONNECT_REQ.

SCPI command:

n.a.

Hop Length

Sets the difference from the current channel to the next channel. The master and slave devices determine the data channel in use for every connection event from the channel map. Hop_length is set for the LL connection and communicated in the CONNECT_REQ packets.

Note: This parameter is relevant for data event and advertising frame configuration with the packet type CONNECT_REQ.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:HLEngth`

on page 112

Random Vector (hex)

Sets the random vector of the master for device identification.

The parameter is an initialization vector provided by the Host in the HCI_ULP_Start_Encryption command.

Note: This parameter is relevant for data event configuration with the packet type LLENC_REQ.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:RVEctor`

on page 116

Encrypted Diversifier (hex)

Sets the encrypted diversifier of the master for device identification. The parameter is an initialization vector provided by the Host in the HCI_ULP_Start_Encryption command.

Note: This parameter is relevant for data event configuration with the packet type LLENC_REQ.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:`

`EDIVersifier` on page 112

Session Key ID (hex)

Sets the master's or the slave's portion of the session key diversifier (SKDm/SKDs).

Note: This parameter is relevant for data event configuration with the packet types LL_ENC_REQ (Master) and LL_ENC_RSP (Slave).

SCPI command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MSKD
```

on page 113

Initialization Vector (hex)

Sets the master's or the slave's portion of the initialization vector(IVm/IVs).

Note: This parameter is relevant for data event configuration with the packet types LL_ENC_REQ (Master) and LL_ENC_RSP (Slave).

SCPI command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:MIVector
```

on page 113

Feature Set Length

Enables that the feature set length is indicated.

FeatureSet indicates whether the Controller features are used or not. All the data in FeatureSet is RFU(zero).

Note: This parameter is relevant for data event configuration with the packet types FEATURE_REQ (Master) and FEATURE_RSP (Slave).

SCPI command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:FSLength
```

on page 112

Unknown Type (hex)

Enables that an invalid control packet is indicated.

The CtrType field indicates the value of the LL control packet that caused the transmission of this packet.

This parameter is relevant for data event configuration with the packet type UNKNOWN_RSP (Slave).

SCPI command:

```
[ :SOURCE<hw> ] :BB:BT0oth:ECOnfiguration:PCOnfiguration:UTYPE
```

on page 118

3.6.4 Payload Section - Advertising Event / Frame Configuration

Controller's Device Addr

Sets the advertiser's device address.

In bluetooth low energy systems all the transmissions start with an 8 bit preamble followed by an access address. The access address is composed of a the parts "Company_Id" (LSB) and the "Company_assigned" (MSB). Beside the address fields the notation is given.

For advertising channel packets the format of the device address differs, depending on the selected address type.

Note: This parameter is relevant for advertising event or frame configuration. Refer to [Tx/Rx Address Type - Bluetooth LE Device's Addr Type](#) for information about the available package types for the respective "Controller Roles".

- "Public Address Types"
 - The public address is given from the registration authority IEEE and is composed of:
 - LSB: 24 bits = company_assigned
 - MSB: 24 bits = company_id
- "Private Address Type"
 - A private address is optional and composed of:
 - LSB: 24 bits = hash
 - MSB: 24 bits = random

SCPI command:

Company_Assigned and Company_Id in Advertiser's Device Address

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ACID`

on page 107

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ACASsigned`

on page 107

Company_Assigned and Company_Id in Scanner's Device Address

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SCASsigned`

on page 108

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SCID`

on page 108

Company_Assigned and Company_Id in Initiator's Device Address

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ICASsigned`

on page 108

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ICID`

on page 108

CRC Initial

Sets the initialization value for the CRC (Cyclic Redundary Check, 24 bits) calculation. A packet has been received correctly, when it has passed the CRC check.

Note: This parameter is relevant for advertising frame configuration and the packet type CONNECT_REQ.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CIValue`

on page 109

Transmit Window Size

Sets the size of the transmit window, regarding to the start point.

Note that the scan window size is less or equal to the value of the connection interval, see ["Connection Event Interval"](#) on page 37.

Note: This parameter is relevant for advertising frame configuration and for the packet types CONNECT_REQ and CONNECTION_UPDATE_REQ.

This parameter is also indicated in the Frame Configuration Dialog.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:WSize`
on page 119

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NWSize`
on page 116

Transmit Window Offset

Sets the start point of the transmit window.

Note: This parameter is relevant for advertising frame configuration and for the packet types CONNECT_REQ and CONNECTION_UPDATE_REQ.

This parameter is also indicated in the Frame Configuration Dialog.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:WOffset`
on page 119

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:NWOffset`
on page 115

Sleep Clock Accuracy

Defines the master's clock accuracy with specified encoding. This parameter is used by the slave to determine required listening windows in the LL connection. It is a controller design parameter known by the Controller.

Note: This parameter is relevant for advertising frame configuration and the packet type CONNECT_REQ.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:SCACcuracy`
on page 117

Error Code

Sets the error code value to inform the remote device why the connection is about to be terminated in case of LL_TERMINATE_IND packet. On the other hand, this parameter for LL_REJECT_IND packet is used for the reason a request was rejected. A 8 bit value is set.

Note: This parameter is relevant for data frame configuration and the packet type LL_TERMINATE_IND and LL_REJECT_IND.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ECODE`
on page 111

Company ID

Sets the company identifier of the manufacturer of the Bluetooth Controller. A 16 bit value is set.

Note: This parameter is relevant for data frame configuration and for the packet type LL_VERSION_IND.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:CID`

on page 108

Version Number

Sets the version of the Bluetooth Controller specification (8 bits).

Note: This parameter is relevant for data frame configuration and the packet type LL_VERSION_IND

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:VNumber`

on page 118

Sub Version Number

Sets a unique value for each implementation or revision of an implementation of the Bluetooth Controller.

A 16 bit value is set.

Note: This parameter is relevant for data frame configuration and for the packet type LL_VERSION_IND.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:ECOnfiguration:PCOnfiguration:ECODE`

on page 111

3.6.5 Data Channel Map Table - Advertising CONNECT_REQ / Channel Table - Data

Data Channel Map Table

The data channel map table indicates the entire data set of the channels in a table.

Every channel is represented with bit positioned as per the data channel index. LSB represents data channel index 0 and the bit in position 36 represents data channel index 36.

If the channel is used channel its bit is to be set to '1'. Bit value '0' indicates that the channel is unused.

The bits in positions 37, 38 and 39 shall be set to zero upon transmission and ignored upon receipt.

Note: This parameter is relevant for data event and advertising frame configuration with the packet types CHANNEL_MAP_REQ and CONNECT_REQ.

"Center Frequency" Indicates the center frequency of a channel.

"Channel Index" Indicates the channel index.

"Channel Type" Indicates the channel type.

"Channel State" Indicates used and unused data channels.

SCPI command:

State in Advertising Channel Table: `[:SOURCE<hw>] :BB:BT0oth: ECONFfiguration:ACTable:SET<ch>:STATE` on page 105

State in Data Channel Table: `[:SOURCE<hw>] :BB:BT0oth: ECONFfiguration: DCTable:SET<ch>:STATE` on page 105

State in Data Channel Mapping Table: `[:SOURCE<hw>] :BB:BT0oth: ECONFfiguration: PCONFfiguration:DCMTable:SET<ch>:STATE` on page 105

SCPI command:

Entire data set for Advertising Channel Table: `[:SOURCE<hw>] :BB:BT0oth: ECONFfiguration:ACTable` on page 105

Entire data set for Data Channel Table: `[:SOURCE<hw>] :BB:BT0oth: ECONFfiguration: DCTable` on page 105

Entire data set for Channel Map Table: `[:SOURCE<hw>] :BB:BT0oth: ECONFfiguration: PCONFfiguration:DCMTable` on page 105

Graph

The figure in the packet configuration dialog shows the packet structure of the currently selected packet type.

SCPI command:

n.a.

3.6.6 Test Packet Configuration

Packet Interval

Sets the time interval between two consecutive test packets, with regard to the starting points.

Test Packet Interval

Note: This parameter is relevant for test packet types only.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TPCONFfiguration:TPINTERval` on page 104

Payload Type

Selects the data source used for the payload test packets.

Note: This parameter is relevant for test packet types only.

"PRBS 9, 15" Select a PRBS-modulated data sequence (PRBS = pseudo random binary sequence) for testing.

"Pattern 1, 2, 3, Pattern is predefined.
4, 5, 6"

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TPCONFfiguration:UPSource` on page 104

Payload Length

Sets the payload length.

Note: This parameter is relevant for test packet types only.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:DTTest:TPConfiguration:UPLength`

on page 104

3.7 Dirty Transmitter Test

The Dirty Transmitter settings contain parameters which can be changed for the master signal in order to test the connection under 'dirty transmitter' conditions and define the influence on the receiver quality (bit error rate tests).

Dirty transmitter parameters according to the Bluetooth test specification (Basic Rate) are given in the table below.

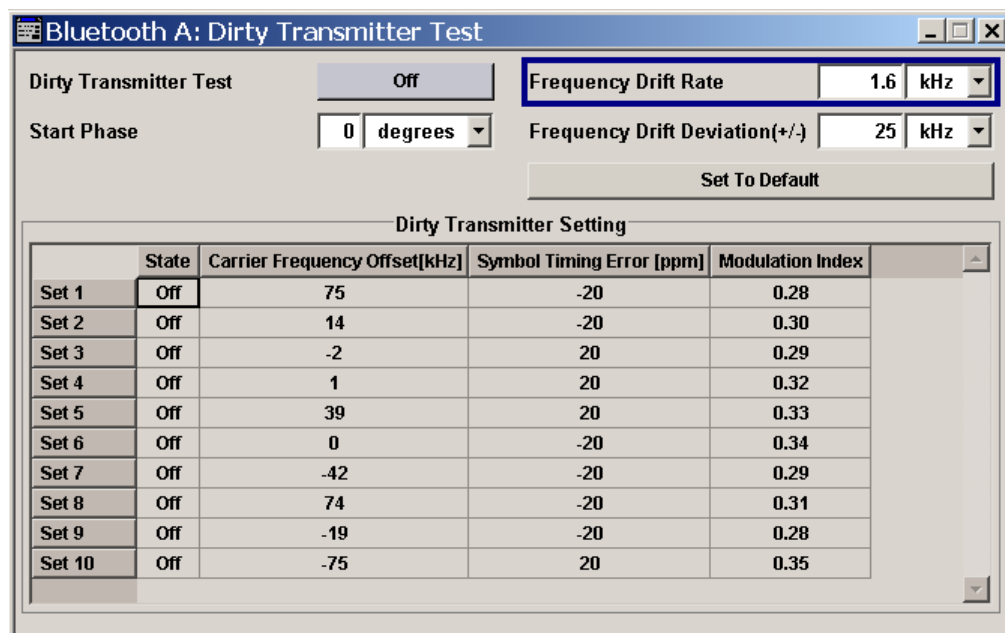
Table 3-1: Dirty transmitter parameters according to the Bluetooth test specification (Basic Rate)

Set	Carrier Frequency Offset	Symbol Timing Error	Modulation Index
1	75	-20	0.28
2	14	-20	0.30
3	-2	+20	0.29
4	1	+20	0.32
5	39	+20	0.33
6	0	-20	0.34
7	-42	-20	0.29
8	74	-20	0.31
9	-19	-20	0.28
10	-75	+20	0.35

Dirty transmitter parameters according to the Bluetooth test specification (EDR) are given in the table below.

Table 3-2: Dirty transmitter parameters according to the Bluetooth test specification (EDR)

Set	Carrier Frequency Offset	Symbol Timing Error
1	0	0
2	+65	-20
3	-65	+20



Dirty Transmitter Test

(Available only for packet types DH1, DH3, DH5, 2-DH1, 2-DH3, 2 - DH5, 3-DH1, 3-DH3, 3-DH5, 2-EV3, 2-EV5, 3-EV3, 3-EV5.)

Activates or deactivates the Dirty Transmitter Test.

For Basic Rate packets, each set of parameters in the Dirty Transmitter Setting table below is used for a duration of 20 ms. After 20 ms, the following set is used, continuing with the first set after the sequence is completed.

For EDR packets, the parameter sets apply for 20 packets each.

SCPI command:

[\[:SOURce<hw>\]:BB:BT0oth:DTTest:DTTState](#) on page 96

Frequency Drift Rate

Enters a frequency drift rate.

A sine wave is used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset with the set frequency drift rate.

SCPI command:

[\[:SOURce<hw>\]:BB:BT0oth:DTTest:FDRate](#) on page 97

Start Phase

Enters a start phase.

The start phase of the sine wave used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset is set here.

SCPI command:

[\[:SOURce<hw>\]:BB:BT0oth:DTTest:SPHase](#) on page 97

Frequency Drift Deviation (+/-)

Enters a frequency drift deviation.

A sine wave is used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset. The maximum deviation reached during the drift equals the set frequency drift deviation.

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:FDDeviation on page 96
```

Set to Default - Dirty Transmitter Test

Calls the default settings for the Dirty Transmitter Test.

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:STDefault on page 97
```

State (Table)

Activates or deactivates the corresponding parameter set.

If a set deactivated, its parameters are skipped in the sequence. Instead, the next active set is used.

For Basic Rate packets, each set applies to 20ms of signal. For EDR packets, each set applies to 20 packets.

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:TABLE:LONG:SET<ch>:STATE  
on page 99
```

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:TABLE:SHORT:SET<ch>:STATE  
on page 100
```

Carrier Frequency Offset kHz – Dirty Transmitter Test

Enters a carrier frequency offset.

The center frequency of the modulated RF carrier is offset by the specified value.

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:TABLE:LONG:SET<ch>:CFOffset  
on page 98
```

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:TABLE:SHORT:SET<ch>:CFOffset  
on page 100
```

Symbol Timing Error – Dirty Transmitter Test

Enters the symbol timing error in ppm.

The Symbol Timing Error modifies the symbol clock frequency by the set amount.

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:TABLE:LONG:SET<ch>:STError  
on page 99
```

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:TABLE:SHORT:SET<ch>:STError  
on page 101
```

Modulation Index – Dirty Transmitter Test

(Only for Basic Rate Packets)

Enter the modulation index.

The modulation index specifies the frequency deviation.

The modulation index h is defined as:

$$h = \frac{2\Delta f}{f_{symbol}}$$

where f_{symbol} is the "symbol rate" and Δf is the "frequency deviation".

According to the Bluetooth standard, the modulation index is allowed to vary between 0.28 and 0.35.

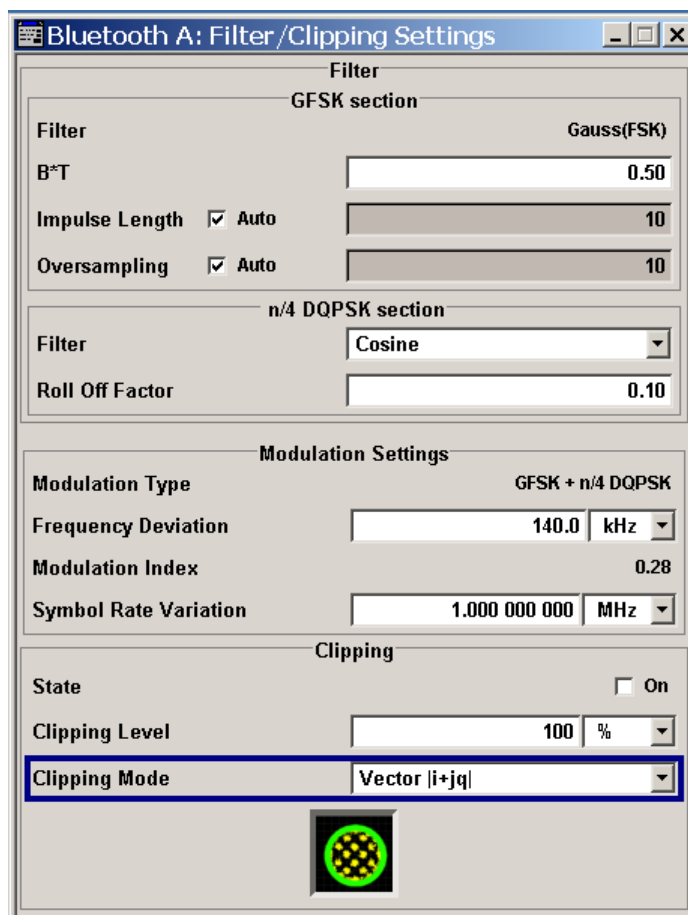
SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:DTTest:TABLE:LONG:SET<ch>:MINdex
on page 98
```

3.8 Filter/Clipping Settings

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

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



In the "Filter" section, the settings are made for the baseband filter. The settings for modulation are collected in the "Modulation Settings" section. The settings for clipping are collected in the "Clipping" section.

3.8.1 Filter Settings

Filter

Sets the baseband filter.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:FILTer:TYPE` on page 68

Roll Off Factor / BxT

Sets the filter parameter.

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

The filter parameter offered can be expressed by a normalised bandwidth B^*T , where B is the 3 dB bandwidth of the filter and T the duration of a symbol period. The normalised bandwidth B^*T can be selected in the range from 0.1 to 2.50 with 0.01 resolution in the B^*T field of the Filter window. The Bluetooth standard prescribes a value 0.5.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:APCO25` on page 70

`[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:COSSine` on page 71

`[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:FGAUSS` on page 71

`[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:GAUSS` on page 71

`[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:PGAUSS` on page 72

`[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:RCOSSine` on page 72

`[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:SPHase` on page 72

Cut Off Frequency Factor

(available for filter parameter Lowpass only)

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

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:FILTer:PARAmeter:LPASS` on page 72

Impulse Length

Displays the number of filter tabs. If the check box is activated, the most sensible parameter values are selected. The value depends on the coherence check. If the check box is deactivated, the values can be changed manually.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:FILTer:ILENgtH:AUTO [:STATe]` on page 69

`[:SOURce<hw>] :BB:BT0oth:FILTer:ILENgtH` on page 68

Oversampling

Determines the upsampling factor. If the check box is activated, the most sensible parameter values are selected. The value depends on the coherence check. If the check box is deactivated, the values can be changed manually.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:FILTer:OSAMpling:AUTO [:STATe]` on page 69

`[:SOURce<hw>] :BB:BT0oth:FILTer:OSAMpling` on page 69

3.8.2 Modulation Settings

Modulation type

Displays the modulation type used for the current packet selection.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:FILTer:MTYPe` on page 70

Frequency deviation

Enter the frequency deviation of the frequency modulated part.

The frequency deviation can be varied in a range from 100.0 kHz to 200.0 kHz according to Bluetooth specification.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:MSETtings:FDEVIation` on page 70

Modulation index

Displays the modulation index resulting from the entered frequency deviation value.

Modulation index is calculated from the given frequency deviation and symbol rate values.

The modulation index **h** is defined as:

$$h = \frac{2\Delta f}{f_{symbol}}$$

where f_{symbol} is the "symbol rate" and Δf is the "frequency deviation".

According to the Bluetooth standard, the modulation index is allowed to vary between 0.28 and 0.35.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:FILTer:MINDEX` on page 70

Symbol Rate Variation

Enter the symbol rate.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:SRATe:VARiation` on page 73

3.8.3 Clipping Settings

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

Clipping State

Switches baseband clipping on and off.

Baseband clipping is a very simple and effective way of reducing the crest factor of the signal.

With baseband clipping, the signal level is limited to a settable value ("Clipping Level"). This level is specified as a percentage of the highest peak value. Since clipping is done prior to filtering, the procedure does not influence the spectrum. The EVM however increases.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:CLIPping:STATe](#) on page 68

Clipping Level

Sets the limit for clipping.

This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:CLIPping:LEVel](#) on page 67

Clipping Mode

Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the menu.

"Vector $|i + q|$ " The limit is related to the amplitude $|i + q|$. The I and Q components are mapped together, the angle is retained.



"Scalar $|i| + |q|$ " The limit is related to the absolute maximum of all the I and Q values $|i| + |q|$.



The I and Q components are mapped separately, the angle changes.

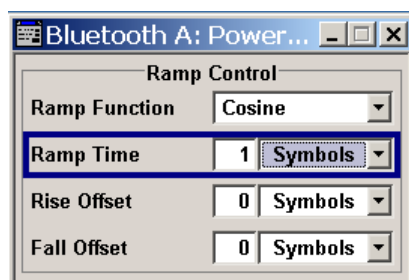
SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:CLIPping:MODE](#) on page 67

3.9 Power Ramping

The "Power Ramping Settings" menu is reached via the "Bluetooth" main menu.

The menu is used to set the power ramping.



Ramp Function

Selects the form of the transmitted power, i.e. the shape of the rising and falling edges during power ramp control.

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

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

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PRAMping:RFUNction](#) on page 87

Ramp Time

Sets the power ramping rise time and fall time for a burst.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PRAMping:RTIME](#) on page 87

Rise Offset

Sets the offset in the rising edge of the envelope at the start of a burst. A positive value moves the ramp into the beginning of a transmitted packet and a negative value introduces an additional guard period before the start of the packet.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PRAMping:ROFFset](#) on page 87

Fall Offset

Sets the offset of the falling edge of the envelope at the end of a burst. A positive value introduces a guard period after the end of the packet and a negative value moves the ramp into the end part of the transmitted packet.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:PRAMping:FOFFset](#) on page 86

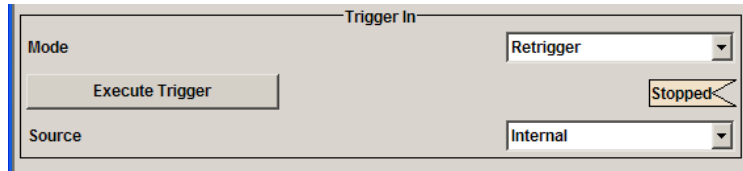
3.10 Trigger/Marker/Clock Settings



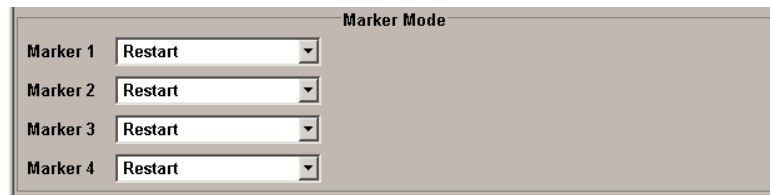
The trigger, clock, and marker delay functions are available for R&S SMx and R&S AMU instruments only.

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

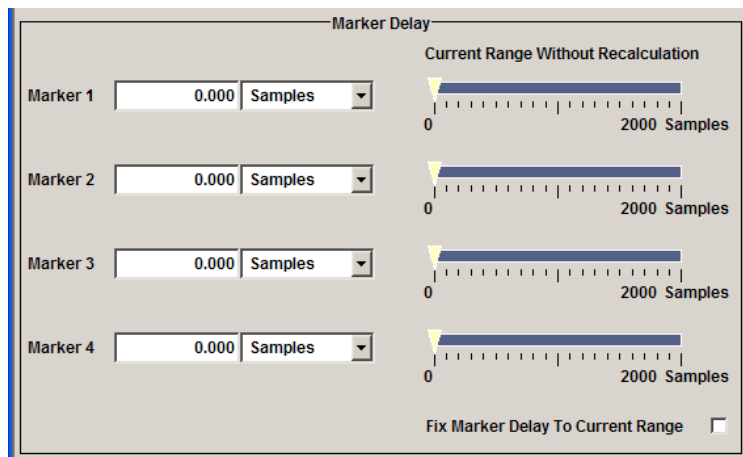
The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.



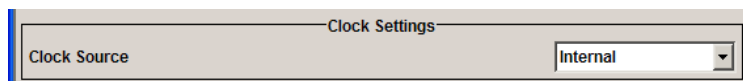
The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.



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



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



The buttons in the last section lead to submenu for general trigger, clock and mapping settings.



3.10.1 Trigger In



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

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

Trigger Mode

Selects trigger mode.

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

"Auto"	The signal is generated continuously.
"Retrigger"	The signal is generated continuously. A trigger event (internal or external) causes a restart.
"Armed_Auto"	The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Button "Arm" stops signal generation. A subsequent trigger event (internal with "Execute Trigger" or external) causes a restart.
"Armed_Retrigger"	The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart. Button "Arm" stops signal generation. A subsequent trigger event (internal with "Execute Trigger" or external) causes a restart.
"Single"	The signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at "Signal Duration". Every subsequent trigger event (internal with "Execute Trigger" or external) causes a restart.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth\[:TRIGGER\]:SEQUENCE](#) on page 78

Signal Duration Unit

Selects the unit for the entry of the length of the signal sequence to be output in the Single trigger mode. Available units are sequence length (SL) or frames.

"Sequence Length"	The selected unit for the entry of the length of the signal sequence at the output in the Single trigger mode is sequence length .
"Frames"	The selected unit for the entry of the length of the signal sequence at the output in the Single trigger mode is frame.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGGER:SLUNIT](#) on page 76

Signal Duration

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

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

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:TRIGger:SLENgth` on page 76

Running/Stopped

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

"Running" The modulation signal is generated; a trigger was (internally or externally) initiated in triggered mode.
If "Armed_Auto" and "Armed_Retrigger" have been selected, generation of signals can be stopped with the "Arm" button. A new trigger (internally with "Execute Trigger" or externally) causes a restart.

"Stopped" The signal is not generated, and the instrument waits for a trigger event (internal or external).

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:TRIGger:RMODe` on page 75

Arm

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

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

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:TRIGger:ARM:EXECute` on page 74

Execute Trigger

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

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:TRIGger:EXECute` on page 74

Trigger Source

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

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

"Internal (Base-

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

"External The trigger event is executed with the aid of the active edge of an external (TRIGGER 1 /

2)" The trigger signal is supplied via the TRIGGER connector.

The polarity, the trigger threshold and the input impedance of the TRIGGER input can be set in the "Global Trigger/Clock Settings" dialog.

SCPI command:

`[:SOURCE<hw>] :BB:BT0oth:TRIGger:SOURce` on page 77

Sync. Output to External Trigger

(enabled for Trigger Source External)

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

For R&S SMBV instruments:

For or two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, configure this parameter depending on the provided system trigger event and the properties of the output signal. See the table below for an overview of the required settings.

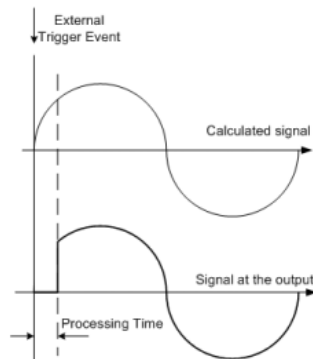
Table 3-3: Typical Applications

System Trigger	Application	"Sync. Output to External Trigger"
Common External Trigger event for the master and the slave instruments	All instruments are synchronous to the external trigger event	ON
	All instruments are synchronous among themselves but starting the signal from first symbol is more important than synchronicity with external trigger event	OFF
Internal trigger signal of the master R&S SMBV for the slave instruments	All instruments are synchronous among themselves	OFF

"On"

Corresponds to the default state of this parameter.

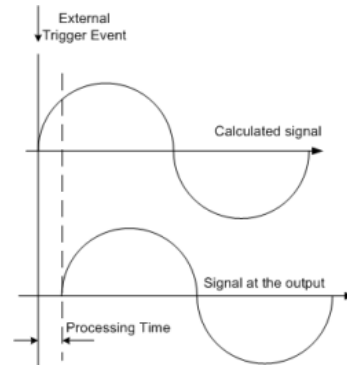
The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is outputted. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.



"Off"

The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is outputted.

This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.



SCPI command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger [:EXTernal<ch>] :SYNChronize:OUTPut` on page 74

Trigger Delay

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

Sets the trigger signal delay in samples on external triggering.

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

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

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger [:EXTernal<ch>] :DELay` on page 77

`[:SOURce<hw>] :BB:BT0oth:TRIGger:OBASeband:DELay` on page 75

Trigger Inhibit

Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in samples.

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

This parameter is only available on external triggering or on internal triggering via the second path.

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

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:TRIGger [:EXTernal<ch>] :INHibit` on page 78

`[:SOURce<hw>] :BB:BT0oth:TRIGger:OBASeband:INHibit` on page 75

3.10.2 Marker Mode

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

The R&S SMBV supports only two markers.

Marker Mode

Selects a marker signal for the associated MARKER output.

- "Restart" A marker signal is generated at the start of each signal sequence.
- "Frame Start" A marker signal is generated at the start of each frame.
- "Frame Active Part" The marker masks the active part of the frame. At the start of each burst, the marker signal changes to high. It changes back to low after the end of each burst.
- "Pulse" A regular marker signal is generated. The pulse frequency is defined by entering a divider. The frequency is derived by dividing the sample rate by the divider. The input box for the divider opens when "Pulse" is selected, and the resulting pulse frequency is displayed below it.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:DIVider](#)

on page 83

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:FREQuency](#)

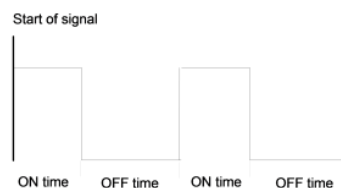
on page 83

- "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.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGger:OUTPut<ch>:PATTern](#) on page 83

- "ON/OFF Period" A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle. The "ON Time" and "OFF Time" are each expressed as a number of samples and are set in an input field which opens when ON/OFF ratio is selected.



SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGger:OUTPut<ch>:ONTime](#) on page 82

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGger:OUTPut<ch>:OFFTime](#) on page 82

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:TRIGger:OUTPut<ch>:MODE](#) on page 81

3.10.3 Marker Delay

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



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

The R&S SMBV supports only two markers.

Marker x Delay

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

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

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:TRIGger:OUTPut<ch>:DELay on page 80
```

Current Range without Recalculation

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

The delay can be defined by moving the setting mark.

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:TRIGger:OUTPut<ch>:DELay:MINimum  
on page 81
```

```
[ :SOURce<hw> ] :BB:BT0oth:TRIGger:OUTPut<ch>:DELay:MAXimum  
on page 81
```

Fix marker delay to current range

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

SCPI command:

```
[ :SOURce<hw> ] :BB:BT0oth:TRIGger:OUTPut:DELay:FIXed on page 80
```

3.10.4 Clock Settings

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



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

Sync. Mode

(for R&S SMBV only)

Selects the synchronization mode.

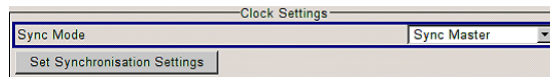
This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

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

Avoid unnecessary cable length and branching points.

"None" The instrument is working in stand-alone mode.

"Sync. Master" The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.



"Sync. Slave" The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:CLOCK:SYNChronization:MODE](#) on page 86

Set Synchronization Settings

(for R&S SMBV only)

Performs automatically adjustment of the instrument's settings required for the synchronization mode, selected with the parameter "Synchronization Mode".

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:CLOCK:SYNChronization:EXECute](#) on page 85

Clock Source

Selects the clock source.

"Internal" The internal clock reference is used to generate the symbol clock.

"External" The external clock reference is fed in as the symbol clock or multiple thereof via the CLOCK connector.
The symbol rate must be correctly set to an accuracy of +/-2 % (see data sheet).
The polarity of the clock input can be changed with the aid of "Global Trigger/Clock Settings".
In the case of two-path instruments this selection applies to path A.

SCPI command:

[\[:SOURCE<hw>\]:BB:BT0oth:CLOCK:SOURCE](#) on page 85

Clock Mode

(This feature is available for the external clock source only.)

Selects the type of externally supplied clock.

"Sample" A sample clock is supplied via the CLOCK connector.

"Multiple Sample" A multiple of the sample clock is supplied via the CLOCK connector. The sample clock is derived internally from this. The value range is 1 to 64. The "Clock Multiplier" field provided allows the multiplication factor to be entered.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:CLOCK:MODE` on page 84

Clock Multiplier

(This feature is available for the external clock source only.)

Enters the multiplication factor for clock type Multiple Sample.

SCPI command:

`[:SOURce<hw>] :BB:BT0oth:CLOCK:MULTIplier` on page 84

Measured External Clock

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

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

SCPI command:

`CLOCK:INP:FREQ?`

3.10.5 Global Settings

The buttons in this section lead to submenu for general trigger, clock and mapping settings.

This settings are available for R&S SMx and R&S AMU instruments only.

Global Trigger/Clock Settings

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

This dialog is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

In the case of two-path instruments, these settings are valid for both paths.

The parameters in this menu affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the Operating Manual.

User Marker / AUX I/O Settings

Calls the "User Marker AUX I/O Settings" menu, used used to map the connector on the rear of the instruments.

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

4 Remote-Control Commands

The commands in the `SOURce:BB:BT00th` subsystem are described in three sections, separated into general remote commands, commands for Packet Configuration settings and commands for Dirty Transmitter Test settings.

This subsystem contains commands for the primary and general settings of the Bluetooth standard. These settings concern activation and deactivation of the standard, setting filter, clock, trigger and clipping settings, defining the symbol rate variation and the sequence length, as well as the preset and power adjust setting.

SOURce<hw>

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

The numeric suffix to `SOURce` distinguishes between signal generation for path A and path B in the case of two-path instruments:

- `SOURce[1]` = path A
The keyword `SOURce` is optional and can be omitted
- `SOURce2` = path B
The keyword `SOURce` is mandatory, i.e. the command must contain the keyword with suffix 2.

OUTPut<ch>

The numeric suffix to `OUTPut` distinguishes between the available markers.

Only two markers are available for the R&S SMBV, i.e. the allowed values for the suffix are 1 or 2.

Placeholder <root>

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

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

4.1 General Commands

<code>[SOURce<hw>]:BB:BT00th:BCText</code>	62
<code>[SOURce<hw>]:BB:BT00th:CTYPe</code>	62
<code>[SOURce<hw>]:BB:BT00th:PRESet</code>	63
<code>[SOURce<hw>]:BB:BT00th:PTYPe</code>	63

<code>[:SOURce<hw>]:BB:BT0oth:SETTing:CATalog</code>	63
<code>[:SOURce<hw>]:BB:BT0oth:SETTing:DELeTe</code>	64
<code>[:SOURce<hw>]:BB:BT0oth:SETTing:LOAD</code>	64
<code>[:SOURce<hw>]:BB:BT0oth:SETTing:STORe</code>	65
<code>[:SOURce<hw>]:BB:BT0oth:SLENgth</code>	65
<code>[:SOURce<hw>]:BB:BT0oth:STATe</code>	65
<code>[:SOURce<hw>]:BB:BT0oth:TMODe</code>	65
<code>[:SOURce<hw>]:BB:BT0oth:VERSiOn</code>	66
<code>[:SOURce<hw>]:BB:BT0oth:WAVeform:CREAtE</code>	66

`[:SOURce<hw>]:BB:BT0oth:BCText?`

Queries the state/roll of the controller.

Return values:

<code><BcText></code>	string
	Connected (for data channel type) Shows that the state is Connected.
	Advertiser (for advertising channel type) the current bluetooth Controller Role is Advertiser for all ADV-xxx packet types and SCAN_RSP.
	Scanner (for advertising channel type) the current bluetooth Controller Role is Scanner for SCAN_REQ packet type
	Initiator (for advertising channel type) the current bluetooth Controller Role is Initiator for CONNECT_REQ packet type

Example: `SOUR:BB:BT0:BCT?`
Queries the state/roll of the controller.

Usage: Query only

`[:SOURce<hw>]:BB:BT0oth:CTYPe <CType>`

Determines the channel type. Advertising and data are available.

Parameters:

<CType>

ADvertising|DATA

ADvertising

Selects channel type Advertising.

DATA

Selects channel type Data. Devices in a connected state transmit data channel packets in connection events with a start point and an interval.

*RST: ADvertising

Example:

SOUR:BB:BTO:CTYP ADV

channel type Advertising.

SOUR:BB:BTO:CTYP DATA

channel type Data.

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

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

All Bluetooth settings are preset.

Example:

BB:BTO:PRES

resets all the Bluetooth settings to default values.

Usage:

Event

[:SOURce<hw>]:BB:BTOoth:PTYPe <PType>

The available packets depend on the selected transport mode. All packet types as defined in the Bluetooth specifications are supported.

Parameters:

<PType>

ID|NULL|POLL|FHS|DM1|DH1|DM3|DH3|DM5|DH5|AUX1|ADH1|ADH3|ADH5|AEDH1|AEDH3|AEDH5|HV1|HV2|HV3|DV|EV3|EV4|EV5|EEV3|EEV5|EEEV3|EEEV5

*RST: DH1

Example:

BB:BTO:PTYP NULL

sets the packet type.

[:SOURce<hw>]:BB:BTOoth:SETTING:CATalog?

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

Return values:

<Catalog> string

Example:

```
MEM:CDIR '<root>\user\bluetooth'
```

sets the default directory to <root>\user\bluetooth.

```
BB:BTO:SETT:CAT?
```

reads out all the files with Bluetooth settings in the default directory.

Response: 'Bluetooth_EDR', 'Bluetooth_SCO'

the files Bluetooth_EDR and Bluetooth_SCO are available.

Usage:

Query only

[[:SOURce<hw>]:BB:BTOoth:SETTING:DELeTe <Filename>

This command deletes the selected file with Bluetooth settings. The directory is set using command `MEM: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 `*.bto` will be deleted.

Parameters:

<Filename> string

Example:

```
BB:BTO:SETT:DEL '<root>\user\bluetooth'
```

deletes the specified file with Bluetooth settings.

Usage:

Setting only

[[:SOURce<hw>]:BB:BTOoth:SETTING:LOAD <Filename>

This command loads the selected file with Bluetooth settings. The directory is set using command `MEM: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 `*.bto` will be loaded.

Parameters:

<Filename> string

Example:

```
BB:BTO:SETT:LOAD 'bluetooth_1'
```

loads file bluetooth_1.

Usage:

Setting only

[[:SOURce<hw>]:BB:BTOoth:SETTING:STORE <Filename>

This command stores the current Bluetooth 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. Bluetooth settings are stored as files with the specific file extensions `*.bto`.

Setting parameters:

<Filename> string

Example: `BB:BTO:SETT:STOR 'bluetooth_1'`
stores the current Bluetooth settings into file `bluetooth_1`.

Usage: Setting only

[[:SOURce<hw>]:BB:BTOoth:SLENGTH <SLength>

The command sets the sequence length of the Bluetooth signal in number of frames. This signal is calculated in advance and output in the arbitrary waveform generator.

Parameters:

<SLength> float

Range: 1 to 53687

*RST: 1

Example: `BB:BTO:SLEN 10`
sets the sequence length to 10 frames.

[[:SOURce<hw>]:BB:BTOoth:STATE <State>

The command activates modulation in accordance with the Bluetooth standard. Activating this standard deactivates all the other digital standards and digital modulation modes (in case of two-path instruments, this affects the same path).

`BB:BTO:STAT ON` deactivates the other standards and digital modulation.

Parameters:

<State> 0|1|OFF|ON

*RST: OFF

Example: `BB:BTO:STAT ON`
activates modulation in accordance with the Bluetooth standard.

[[:SOURce<hw>]:BB:BTOoth:TMODE <TMode>

The command selects the transport mode.

Parameters:

<TMode> ACL|SCO|ESCO

ACL

The selected transport mode is used for a point-to-point multipoint link establishment between the master and all the slaves participating on the piconet.

SCO

The selected transport mode is used for a point-to-point link establishment between a master and a single slave in the piconet.

ESCO

The selected transport mode is used for a symmetric or asymmetric point-to-point link establishment between a master and a specific slave.

*RST: ACL

Example:

```
BB:BTO:TMOD ACL
selects transport mode ACL.
```

[[:SOURce<hw>]:BB:BT0oth:VERSion?

The command queries the version of the Bluetooth standard underlying the definitions.

Return values:

<Version> string

Example:

```
BB:BTO:VERS?
queries the Bluetooth version.
Response: Version 2.1+EDR
```

Usage:

Query only

[[:SOURce<hw>]:BB:BT0oth:WAVeform:CREate <Filename>

This command creates a waveform using the current settings of the "Bluetooth" menu. The file name is entered with the command. The file is stored with the predefined file extension *.wv. The file name and the directory it is stored in are user-definable.

Setting parameters:

<Filename> string

Example:

```
MMEM:CDIR '<root>\user\waveform'
sets the default directory to <root>\user\waveform.
BB:BTO:WAV:CRE 'bluetooth_1'
creates the waveform file bluetooth.wv in the default directory.
```

Usage:

Setting only

4.2 Filter/Clipping Settings

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<code>[:SOURce<hw>]:BB:BT0oth:CLIPping:MODE</code>	67
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<code>[:SOURce<hw>]:BB:BT0oth:FILTer:ILENght</code>	68
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`[:SOURce<hw>]:BB:BT0oth:CLIPping:LEVel <Level>`

The command sets the limit for level clipping (Clipping). This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Parameters:

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

Example:

```
BB:BT0:CLIP:LEV 80
sets the limit for level clipping to 80% of the maximum level.
BB:BT0:CLIP:STAT ON
activates level clipping.
```

`[:SOURce<hw>]:BB:BT0oth:CLIPping:MODE <Mode>`

The command sets the method for level clipping (Clipping).

Parameters:

<Mode> VECTor|SCALar

VECTorThe reference level is the amplitude $|i+jq|$.**SCALar**

The reference level is the absolute maximum of the I and Q values.

*RST: VECTor

Example:

```
BB:BTO:CLIP:MODE VECT
sets the amplitude as reference level.
```

[[:SOURce<hw>]:BB:BTOoth:CLIPping:STATe <State>

The command activates level clipping (Clipping). The value is defined with the command `BB:BTO:CLIPping:LEVel`, the mode of calculation with the command `BB:BTO:CLIPping:MODE`.

Parameters:

<State> 0|1|OFF|ON

*RST: OFF

Example:

```
BB:BTO:CLIP:STAT ON
activates level clipping.
```

[[:SOURce<hw>]:BB:BTOoth:FILTer:TYPE <Type>

The command selects the filters used for GFSK, $\pi/4$ DQPSK and 8DPSK modulations. This opens a selection window containing all the filters available to the instrument.

Parameters:

<Type> RCOSine|COSine|GAUSSs|LGAuss|CONE|COF705|
COEqualizer|COFequalizer|C2K3x|APCO25|SPHase|
RECTangle|PGAuss|LPASs|DIRac|ENPSHape|EWPSHape

*RST: RCOS

Example:

```
BB:BTO:FILT:TYPE RCOS
sets the filter type RCOSine.
```

[[:SOURce<hw>]:BB:BTOoth:FILTer:ILENgtH <ILength>

The command sets the impulse length (the number of filter taps).

Parameters:

<Length> float
 Range: 1 to 128
 Increment: 1
 *RST: 10

Example:

BB:BTO:FILT:ILEN 10
 sets the number of filter tabs to 10.

[[:SOURce<hw>]:BB:BTOoth:FILT:ILENth:AUTO[:STATe] <State>

The command activates/deactivates the impulse length state. If activated, the most sensible parameter values are selected. The value depends on the coherence check.

Parameters:

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

Example:

BB:BTO:FILT:ILEN:AUTO ON
 the most sensible parameters are selected automatically.

[[:SOURce<hw>]:BB:BTOoth:FILT:OSAMpling <OSampling>

The command sets the upsampling factor.

Parameters:

<OSampling> integer
 Range: 1 to 32
 *RST: 10

Example:

BB:BTO:FILT:OSAM 10
 sets the upsampling factor to 10.

[[:SOURce<hw>]:BB:BTOoth:FILT:OSAMpling:AUTO[:STATe] <State>

The command activates/deactivates the upsampling factor state. If activated, the most sensible parameter values are selected. The value depends on the coherence check. If deactivated, the values can be changed manually.

Parameters:

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

Example:

BB:BTO:FILT:OSAM:AUTO ON
 the most sensible parameters are selected automatically.

[:SOURce<hw>]:BB:BTOoth:FILTer:MINdex?

Queries the modulation index resulting from the entered frequency deviation value.

Return values:

<MIndex> string

Example:

BB:BTO:FILT:MIND
Queries the modulation index
Response: 0.5

Usage: Query only

[:SOURce<hw>]:BB:BTOoth:FILTer:MTYPE?

Queries the modulation type used for the current packet selection.

Return values:

<MType> string

Example:

BB:BTO:FILT:MTYP?
Queries the modulation type

Usage: Query only

[:SOURce<hw>]:BB:BTOoth:MSETtings:FDEVIation <FDeviation>

The frequency deviation can be varied in a range from 100.0 kHz to 200.0 kHz.

Parameters:

<FDeviation> float

Range: 100 kHz to 200 kHz
Increment: 0.1 kHz
*RST: 160 kHz

Example:

BB:BTO:MSET:FDEV 160
sets a frequency deviation.

[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:APCO25 <Apco25>

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

Parameters:

<Apco25> float

Range: 0.05 to 0.99
Increment: 0.01
*RST: 0.2

Example: `BB:BTO:FILT:PAR:APCO25 0.2`
sets the roll-off factor to 0.2 for filter type APCO25.

[[:SOURce<hw>]:BB:BT0oth:FILTer:PARAmeter:COsine <Cosine>

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

Parameters:

<Cosine> float
Range: 0 to 0.99
Increment: 0.01
*RST: 0.1

Example: `BB:BTO:FILT:PAR:COS 0.35`
sets the roll-off factor to 0.35 for filter type Cosine.

[[:SOURce<hw>]:BB:BT0oth:FILTer:PARAmeter:FGAuss <FGauss>

The command sets the B x T for the Gauss filter type.

Parameters:

<FGauss> float
Range: 0.15 to 2.5
Increment: 0.01
*RST: 0.5

Example: `BB:BTO:FILT:PAR:FGA 0.5`
sets B x T to 0.5 for the Gauss filter type for the GFSK section of the packet.

[[:SOURce<hw>]:BB:BT0oth:FILTer:PARAmeter:GAUSs <Gauss>

The command sets the B x T for the Gauss filter type.

Parameters:

<Gauss> float
Range: 0.15 to 2.5
Increment: 0.01
*RST: 0.5

Example: `BB:BTO:FILT:PAR:GAUS 0.5`
sets B x T to 0.5 for the Gauss filter type for $\pi/4$ DQPSK or 8DPSK sections.

[[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:LPASs <LPass>

The command sets the cut off frequency factor for a lowpass filter (ACP Opt.).

Parameters:

<LPass> float

Range: 0.05 to 2.00
 Increment: 0.01
 *RST: 0.50

Example:

BB:BTO:FILT:PAR:LPAS 1
 sets the cut off frequency factor for a lowpass filter

[[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:PGAuss <PGauss>

The command sets the B x T for the Pure Gauss filter type.

Parameters:

<PGauss> float

Range: 0.15 to 2.5
 *RST: 0.5
 Default unit: 0.01

Example:

BB:BTO:FILT:PAR:PGA 0.5
 sets B x T to 0.5 for the Pure Gauss filter type.

[[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:RCOSine <RCosine>

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

Parameters:

<RCosine> float

Range: 0 to 0.99
 Increment: 0.01
 *RST: 0.4

Example:

BB:BTO:FILT:PAR:RCOS 0.22
 sets the roll-off factor to 0.22 for filter type Root Cosine.

[[:SOURce<hw>]:BB:BTOoth:FILTer:PARAmeter:SPHase <SPhase>

The command sets the B x T for the Split Phase filter type.

Parameters:

<SPhase> float
 Range: 0.15 to 2.5
 Increment: 0.01
 *RST: 2

Example:

BB:BTO:FILT:PAR:SPH 0.5
 sets B x T to 0.5 for the Split Phase filter type.

[:SOURce<hw>]:BB:BTOoth:SRATe:VARiation <Variation>

The command enters the symbol rate.

Parameters:

<Variation> float
 Range: 400 to 15E6
 Increment: 1 Hz
 *RST: 1E6
 Default unit: Hz

Example:

BB:BTO:SRAT:VAR 1
 sets the symbol rate variation to 1 MHz.

4.3 Trigger Settings



The trigger settings are available for R&S SMx and R&S AMU instruments only.

EXTernal<ch>

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

[:SOURce<hw>]:BB:BTOoth:TRIGger:ARM:EXECute.....	74
[:SOURce<hw>]:BB:BTOoth:TRIGger:EXECute.....	74
[:SOURce<hw>]:BB:BTOoth:TRIGger[:EXTernal<ch>]:SYNChronize:OUTPut.....	74
[:SOURce<hw>]:BB:BTOoth:TRIGger:OBASeband:DELay.....	75
[:SOURce<hw>]:BB:BTOoth:TRIGger:OBASeband:INHibit.....	75
[:SOURce<hw>]:BB:BTOoth:TRIGger:RMODE.....	75
[:SOURce<hw>]:BB:BTOoth:TRIGger:SLENGth.....	76
[:SOURce<hw>]:BB:BTOoth:TRIGger:SLUNit.....	76
[:SOURce<hw>]:BB:BTOoth:TRIGger:SOURce.....	77
[:SOURce<hw>]:BB:BTOoth:TRIGger[:EXTernal<ch>]:DELay.....	77
[:SOURce<hw>]:BB:BTOoth:TRIGger[:EXTernal<ch>]:INHibit.....	78
[:SOURce<hw>]:BB:BTOoth[:TRIGger]:SEQUence.....	78

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

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

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

Usage: Event

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

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

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

Usage: Event

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

(enabled for "Trigger Source" External)

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

For R&S SMBV instruments:

See also "[Sync. Output to External Trigger](#)" on page 55 for a detailed description of the applications of this setting.

Parameters:

<Output> 0|1|OFF|ON

ON

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

OFF

The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is outputted.

*RST: ON

Example: `BB:BTO:TRIG:SOUR EXT`
 sets external triggering.
 `BB:BTO:TRIG:EXT:SYNC:OUTP ON`
 enables synchronous output to external trigger

[:SOURce<hw>]:BB:BT0oth:TRIGger:OBASeband:DELay <Delay>

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

Parameters:

<Delay> float

 Range: 0 samples to (1<<16)-1u samples
 Increment: 0.01 samples
 *RST: 0 samples

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

[:SOURce<hw>]:BB:BT0oth:TRIGger:OBASeband:INHibit <Inhibit>

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

Parameters:

<Inhibit> integer

 Range: 0 samples to (1<<26)-1u samples
 Increment: 1 sample
 *RST: 0 samples

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

[:SOURce<hw>]:BB:BT0oth:TRIGger:RMODe <RMode>

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

Parameters:

<RMode>

RUN|STOP

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:BTO:TRIG:ARM:EXECute` (armed trigger modes only).

Example:

```
BB:BTO:SEQ ARET
```

selects the Armed_Retrigger mode.

```
BB:BTO:TRIG:RMOD?
```

queries the current status of signal generation.

```
Response: RUN
```

the signal is generated, an external trigger was executed.

[[:SOURce<hw>]:BB:BTOoth:TRIGger:SEnGth <SLength>

The command defines the length of the signal sequence to be output in the Single trigger mode (`SOUR:BB:BTO:SEQ SING`). The unit is defined with command `SOUR:BB:BTO:TRIG:SLUNit`.

Parameters:

<SLength>

float

Range: 1 to 7000

*RST: 1 sequence length

Example:

```
BB:BTO:SEQ SING
```

sets trigger mode Single.

```
BB:BTO:TRIG:SLUN FRAM
```

sets unit frames for the entry of sequence length.

```
BB:BTO:TRIG:SEn 200
```

sets a sequence length of 200 frames.

[[:SOURce<hw>]:BB:BTOoth:TRIGger:SLUNit <SIUnit>

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

Parameters:

<SIUnit>

FRAMe|SEQuence|EVENT

*RST: SEQuence

Example:

```
BB:BTO:SEQ SING
sets trigger mode Single.
BB:BTO:TRIG:SLUN FRAM
sets unit frames for the entry of sequence length.
BB:BTO:TRIG:SLEN 2
sets a sequence length of 2 frames. The current frame will be out-
put twice after the next trigger event.
```

[:SOURCE<hw>]:BB:BT0oth:TRIGger:SOURCE <Source>

The command selects the trigger source.

Parameters:

<Source> INTernal|EXTernal|BEXTernal|OBASeband

INTernal

Triggering is executed by means of the Trigger command [: SOURCE<hw>]:BB:BT0oth:TRIGger:EXECute or *TRG in the case of remote control and by means of "Execute Trigger" in the case of manual operation.

EXTernal

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

BEXTernal

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

OBASeband

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

*RST: INTernal

Example:

```
BB:BTO:TRIG:SOUR EXT
executes triggering by means of the signal on the TRIGGER 1
connector.
```

[:SOURCE<hw>]:BB:BT0oth:TRIGger[:EXTernal<ch>]:DELay <Delay>

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

Parameters:

<Delay> float

Range: 0 samples to 65535 samples

Increment: 0.01 samples

*RST: 0 samples

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

[:SOURce<hw>]:BB:BT0oth:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>

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

Parameters:

<Inhibit> float
 Range: 0 samples to (1<<26)-1u samples
 Increment: 1 sample
 *RST: 0 samples

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

[:SOURce<hw>]:BB:BT0oth[:TRIGger]:SEQuence <Sequence>

The command selects the trigger mode.

Parameters:

<Sequence>

AUTO|RETRigger|AAUTo|ARETrigger|SINGle

AUTO

The modulation signal is generated continuously.

RETRigger

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

AAUTo

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

SINGle

The modulation signal is generated only when a trigger) event occurs. After the trigger event, the signal is generated once to the set sequence length (`SOUR:BB:BTO:TRIG:SLen`). Every subsequent trigger event causes a restart.

*RST: AUTO

Example:

```
BB:BTO: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.

4.4 Marker Settings

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



The marker delay settings are available for R&S SMx and R&S AMU instruments only.

OUTput<ch>

The numeric suffix to `OUTPut` distinguishes between the available markers.

Only two markers are available for the R&S SMBV, i.e. the allowed values for the suffix are 1 or 2.

<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut:DElay:FIXed</code>	80
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:DElay</code>	80
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:DElay:MAXimum</code>	81
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:DElay:MINimum</code>	81
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:MODE</code>	81
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:ONTime</code>	82
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:OFFTime</code>	82
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PATTern</code>	83
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:DIVider</code>	83
<code>[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:PULSe:FREQuency</code>	83

`[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut:DElay:FIXed` <Fixed>

The command restricts the marker delay setting range to the current 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.

The numeric suffix in OUTPut has no significance for this command, since the setting always affects every marker.

Parameters:

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

Example:

`BB:BT0:TRIG:OUTP:DEL:FIX ON`
 restricts the marker signal delay setting range to the current range.

`[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:DElay` <Delay>

The command defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of samples. Command

`BB:BT0:TRIGger:OUTPut:DElay:FIXed` can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

Parameters:

<Delay> float
 Range: 0 samples to ((1<<24)-1u) samples
 Increment: 0.001 samples
 *RST: 0 samples

Example:

`BB:BT0:TRIG:OUTP2:DEL 16000`
 sets a delay of 16000 samples for the signal on connector
 MARKER 2.

[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:DELay:MAXimum?

The command queries the maximum marker delay for setting :BB:BT0:TRIG:OUTP:DEL:FIX ON.

Return values:

<Maximum> float

Example:

BB:BT0:TRIG:OUTP:DEL:FIX ON

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

BB:BT0:TRIG:OUTP:DEL:MAX?

queries the maximum of the dynamic range.

Response: 2000

the maximum for the marker delay setting is 2000 samples.

Usage: Query only

[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:DELay:MINimum?

The command queries the minimum marker delay for setting :BB:BT0:TRIGger:OUTPut:DELay:FIXed ON.

Return values:

<Minimum> float

Example:

BB:BT0:TRIG:OUTP:DEL:FIX ON

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

BB:BT0:TRIG:OUTP:DEL:MIN?

queries the minimum of the dynamic range.

Response: 0

the minimum for the marker delay setting is 0 samples.

Usage: Query only

[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:MODE <Mode>

The command defines the signal for the selected marker output.

Parameters:

<Mode>

REStart|STARt|ACTive|PULSe|PATTern|RATio

REStart

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

STARt

A marker signal is generated at the start of each frame

ACTive

The marker masks the active part of the frame. At the start of each burst, the marker signal changes to high. It changes back to low after the end of each burst.

PULSe

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

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.

RATio

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

SOURce:BB:BTO:TRIGger:OUTPut:OFFTime and

SOURce:BB:BTO:TRIGger:OUTPut:ONTime is generated.

*RST: REStart

Example:

BB:BTO:TRIG:OUTP2:MODE REST

selects the marker generation at the start of each signal sequence

[[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:ONTime <OnTime>**[[:SOURce<hw>]:BB:BT0oth:TRIGger:OUTPut<ch>:OFFTime <OffTime>**

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

Parameters:

<OffTime>

float

Range: 1 sample to (1<<24)-1u samples

Increment: 1 sample

*RST: 1 sample

Example:

BB:BTO:TRIG:OUTP2:OFFT 2000

sets an OFF time of 2000 samples for marker signal 2.

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

The command selects the data for a pattern.

Parameters:

<Pattern> integer

Example:

```
BB:BTO:TRIG:OUTP2:MODE PATT
sets the marker mode pattern
BB:BTO:TRIG:OUTP2:PATT #B010101,6
sets the pattern
```

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

The clock frequency is defined by entering a divider. The frequency is derived by dividing the symbol rate by the divider. The input box for divider opens when Pulse is selected, and the resulting pulse frequency is displayed below it.

Parameters:

<Divider> float

Range: 2 to 1024

Increment: 1

*RST: 2

Example:

```
BB:BTO:TRIG:OUTP2:MODE:PULS
selects marker mode Pulse
BB:BTO:TRIG:OUTP2:PULS:DIV 2
sets a divider for the clock frequency.
```

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

The clock frequency is defined by entering a divider. The frequency is derived by dividing the symbol rate by the divider. The input box for divider opens when Pulse is selected, and the resulting pulse frequency is displayed below it.

Return values:

<Frequency> float

Example:

```
BB:BTO:TRIG:OUTP2:MODE:PULS
selects marker mode Pulse
BB:BTO:TRIG:OUTP2:PULS:DIV 2
sets a divider for the clock frequency
BB:BTO:TRIG:OUTP2:PULS:FREQ
displays resulting pulse frequency
```

Usage: Query only

4.5 Clock Settings

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



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

<code>[:SOURce<hw>]:BB:BT0oth:CLOCK:MODE</code>	84
<code>[:SOURce<hw>]:BB:BT0oth:CLOCK:MULTIPLIER</code>	84
<code>[:SOURce<hw>]:BB:BT0oth:CLOCK:SOURce</code>	85
<code>[:SOURce<hw>]:BB:BT0oth:CLOCK:SYNChronization:EXECute</code>	85
<code>[:SOURce<hw>]:BB:BT0oth:CLOCK:SYNChronization:MODE</code>	86

`[:SOURce<hw>]:BB:BT0oth:CLOCK:MODE <Mode>`

The command enters the type of externally supplied clock (`BB:BT0:CLOCK:SOURce EXTERNAL`). When `MSAMple` is used, a multiple of the clock is supplied via the `CLOCK` connector and the clock is derived internally from this. The multiplier is entered with the command `[:SOURce<hw>]:BB:BT0oth: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.

Parameters:

<Mode> SAMPLE|MSAMple
*RST: SAMP

Example:

`BB:BT0:CLOC:MODE MSAM`
sets the type of externally supplied clock.

`[:SOURce<hw>]:BB:BT0oth:CLOCK:MULTIPLIER <Multiplier>`

The command specifies the multiplication factor for clock type "Multiple Sample" (`BB:BT0:CLOCK:MODE MSAMple`) in the case of an external clock source.

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

Parameters:

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

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

`BB:BTO:CLOC:MODE MSAM`
 selects clock type "Multiple Sample", i.e. the supplied clock has a rate which is a multiple of samples.

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

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

The command selects the clock source.

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

Parameters:

<Source> INTERNAL|EXTERNAL

INTERNAL

The internal clock reference is used.

EXTERNAL

The external clock reference is supplied to the CLOCK connector.

Commands :BB:BTO:CLOCK:MODE and :MULTIPLIER are used to enter the type of the external clock.

*RST: INTERNAL

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

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

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

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

Performs automatic adjustment of the instrument's settings required for the synchronization mode, set with the command `BB:BTO:CLOC:SYNC:MODE`.

Example: `BB:BTO:CLOC:SYNC:MODE MAST`
 the instrument is configured to work as a master one.

`BB:BTO:CLOC:SYNC:EXEC`
 all synchronizations settings are adjusted accordingly.

Usage: Event

```
[:SOURce<hw>]:BB:BT0oth:CLOCK:SYNChronization:MODE <Mode>
```

Selects the synchronization mode.

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

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

Parameters:

<Mode> NONE|MASTer|SLAVe

NONE

The instrument is working in stand-alone mode.

MASTer

The instrument provides all connected instrument with its synchronization (including the trigger signal) and reference clock signal.

SLAVe

The instrument receives the synchronization and reference clock signal from another instrument working in a master mode.

*RST: NONE

Example:

```
BB:BT0:CLOC:SYN:MODE MAST
```

the instrument is configured to work as a master one.

4.6 Power Ramping

[:SOURce<hw>]:BB:BT0oth:PRAMPing:FOFFset.....	.86
[:SOURce<hw>]:BB:BT0oth:PRAMPing:RFUNction.....	.87
[:SOURce<hw>]:BB:BT0oth:PRAMPing:ROFFset.....	.87
[:SOURce<hw>]:BB:BT0oth:PRAMPing:RTIME.....	.87

```
[:SOURce<hw>]:BB:BT0oth:PRAMPing:FOFFset <FOffset>
```

The command sets the offset of the falling edge of the envelope at the end of a burst. A positive value introduces a guard period after the end of the packet and negative value moves the ramp into the end part of the transmitted packet.

Parameters:

<FOffset> integer

Range: -32 to 32

Increment: 1

*RST: 0

Default unit: symbols

Example: `BB:BTO:PRAM:FOFF 8.0`
sets the offset in the falling edge of the envelope to 8.0 symbols.

[:SOURce<hw>]:BB:BTOoth:PRAMping:RFUNction <RFunction>

The command selects the form of the transmitted power, i.e. the shape of the rising and falling edges during power ramp control.

Parameters:
<RFunction> LINear|COSine

*RST: COSine

Example: `BB:BTO:PRAM:RFUN LIN`
sets linear shape for the rising and falling edges during power ramp control.

[:SOURce<hw>]:BB:BTOoth:PRAMping:ROFFset <ROffset>

The command sets the offset in the rising edge of the envelope at the start of a burst. A positive value moves the ramp into beginning of a transmitted packet and a negative value introduce an additional guard period after the end of the packet.

Parameters:
<ROffset> integer

Range: -32 symbols to 32 symbols
Increment: 1 symbol
*RST: 0 symbols

Example: `BB:BTO:PRAM:ROFF 8.0`
sets the offset in the rising edge of the envelope to 8.0 symbols.

[:SOURce<hw>]:BB:BTOoth:PRAMping:RTIME <RTime>

The command sets the power ramping rise time and fall time for a burst.

Parameters:
<RTime> integer

Range: 1 symbol to 32 symbols
Increment: 1 symbol
*RST: 1 symbol

Example: `BB:BTO:PRAM:TIME 2.0`
sets the power ramping rise time and fall time for a burst to 2 samples.

4.7 Packet Configuration Setting

<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:ACKnowledgement</code>	88
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:BDALap</code>	88
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:BDANap</code>	89
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:BDUap</code>	89
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:CODevice</code>	89
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA</code>	90
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA:DPATtern</code>	90
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA:DSELection</code>	90
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA:VDPAttern</code>	91
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA:VDSElection</code>	91
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DLEngth</code>	91
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DSFPacket</code>	92
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<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:EIRPacketfollows</code>	92
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:HFControl</code>	93
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:LTADdress</code>	93
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:PFControl</code>	94
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:PLEngth</code>	94
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:SNSValue</code>	95
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:SRMode</code>	95
<code>[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:VDATA</code>	95

`[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:ACKnowledgement` <Acknowledgement>

This command sets the ARQN bit of the packet header..

Parameters:

<Acknowledgement> NAK|ACK

NAK

Request to retransmit the previous payload.

ACK

Previous payload has been received successfully.

*RST: ACK

Example:

```
BB: BTO: PTYP DH1
selects the packet type DH1.
BB: BTO: PCON: DSFP PED
enable packet editor under data source for packet
BB: BTO: PCON: ACKN ACK
sets positive acknowledgement
```

`[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:BDALap` <BdaLap>

Enters the lower address part of Bluetooth Device Address. The length of LAP is 24 bits or 6 hexadecimal figures.

Parameters:

<BdaLap> integer

Range: #H000000 to #HFFFFFFF
 *RST: 80

Example:

BB:BTO:PCON:BDAL #H000000, 24
 sets the lower address part

[[:SOURce<hw>]:BB:BT0oth:PCONfiguration:BDANap <BdaNap>

Enters the non-significant address part of Bluetooth Device Address. The length of NAP is 16 bits or 4 hexadecimal figures.

Parameters:

<BdaNap> integer

Range: #H0000 to #HFFFF
 *RST: ABCD

Example:

BB:BTO:PCON:BDAN #H0000, 16
 sets the non-significant address part

[[:SOURce<hw>]:BB:BT0oth:PCONfiguration:BDAUap <BdaUap>

Enters the upper address part of Bluetooth Device Address. The length of UAP is 8 bits or 2 hexadecimal figures.

Parameters:

<BdaUap> integer

Range: #H00 to #HFF
 Increment: 1
 *RST: 48

Example:

BB:BTO:PCON:BDAN #H00, 8
 sets the non-significant address part

[[:SOURce<hw>]:BB:BT0oth:PCONfiguration:CODevice <CoDevice>

A parameter received during the device discovery procedure, indicates the type of device and which types of service that are supported.

Parameters:

<CoDevice> integer

Range: #H000000 to #HFFFFFFF

Example:

```
BB:BTO:PTYP FHS
sets the packet type
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet
BB:BTO:PCON:COD '020104'
sets the class of device
```

[:SOURCE<hw>]:BB:BTObth:PCONfiguration:DATA <Data>

Selects the data source used for the payload.

Parameters:

<Data> ALL0|ALL1|PATTERN|PN09|PN11|PN15|PN16|PN20|PN21|
PN23|DLIST

*RST: PN09

Example:

```
BB:BTO:PTYP FHS
sets the packet type
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet
BB:BTO:PCON:DATA ALL1
sets the data type.
```

[:SOURCE<hw>]:BB:BTObth:PCONfiguration:DATA:DPATTERN <DPattern>

The command selects the data for a pattern.

Parameters:

<DPattern> integer

Increment: 1

*RST: 0

Example:

```
BB:BTO:PCON:DATA PATT
sets the data type.
BB:BTO:PCON:DATA:DPAT #B010101, 6
selects the data for a pattern
```

[:SOURCE<hw>]:BB:BTObth:PCONfiguration:DATA:DSELECTION <DSelection>

The command selects data list file.

Parameters:

<DSelection> string

Increment: 1

Example: BB:BTO:PCON:DATA DLIS
selects the data type.
BB:BTO:PCON:DSEL bluetooth_1
selects the file for the data.

[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA:VDPattern <VdPattern>

The command selects the bit pattern for the voice data.

Parameters:

<VdPattern> integer
Increment: 1
*RST: 0

Example: BB:BTO:PCON:DATA:PATT
selects the data type.
BB:BTO:PCON:DATA:VDPA #B010101, 6
selects the bit pattern for the voice data.

[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DATA:VDSElection <VdSelection>

The command selects the data list for voice data.

Parameters:

<VdSelection> string
Increment: 1

Example: BB:BTO:PCON:VDAT DLIS
selects the data type.
BB:BTO:PCON:VDSE bluetooth_1
selects the file for the data.

[:SOURCE<hw>]:BB:BT0oth:PCONfiguration:DLENgth <DLength>

The command enters the payload data length in bytes.

Parameters:

<DLength> float
Range: 0 to 1021
Increment: 1
*RST: 0

Example:

```
BB:BTO:PTYP DH1
sets the packet type.
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet
BB:BTO:PCON:DLEN 25
sets the data length.
```

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:DSFPacket <DsfPacket>

The command selects the data source for the selected packet type.

Parameters:

<DsfPacket> PEDit|ADATa

PED

Enables Packet Editor. All packet fields can be configured individually.

ADAT

Fills the generated packets with the selected data source. Useful if predefined data contents are loaded with a data list file or the data contents of the packet are not of interest.

*RST: PEDit

Example:

```
BB:BTO:PCON:DSFP PED
enables packet editor under data source for packet.
```

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:DWhitening <DWhitening>

The command activates or deactivates the Data Whitening.

Parameters:

<DWhitening> 0|1|OFF|ON

*RST: OFF

Example:

```
BB:BTO:PCON:DWH ON
activates data whitening.
```

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:EIRPacketfollows <EirPacketFollow>

The command indicates that an extended inquiry response packet may follow.

Parameters:

<EirPacketFollow> YES|NO
YES
 Indicates that EIR packet follows.
NO
 Indicates that EIR packet does not follow.
 *RST: NO

Example:

```
BB:BTO:PCON:PTYP FHS
sets the packet type.
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet
BB:BTO:PCON:EIRP YES
the EIR packet follows.
```

[[:SOURce<hw>]:BB:BT0oth:PCONfiguration:HFControl <HfControl>

The command sets the FLOW bit in the header. This bit indicates start or stop of transmission of packets over the ACL logical transport.

Parameters:

<HfControl> GO|STOP
GO
 Allows the other devices to transmit new data.
STOP
 Stops the other devices from transmitting data temporarily.
 *RST: GO

Example:

```
BB:BTO:PCON:PTYP DH1
sets the packet type.
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet.
BB:BTO:PCON:HFC GO
allows the other devices to transmit new data.
```

[[:SOURce<hw>]:BB:BT0oth:PCONfiguration:LTAddress <LtAddress>

The command enters the logical transport address for the header. Each slave active in a piconet is assigned a primary logical transport address (LT_ADDR). The all-zero LT_ADDR is reserved for broadcast messages.

Parameters:

<LtAddress> integer
 Range: 0 to 7
 Increment: 1
 *RST: 0

Example:

```
BB:BTO:PCON:PTYP DH1
sets the packet type.
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet
BB:BTO:PCON:LTAD 0
sets the logical transport address equal zero.
```

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:PFControl <PfControl>

The command sets the FLOW bit in the payload (flow control per logical link).

Parameters:

<PfControl> GO|STOP

GO
Indicates the start of transmission of ACL packets after a new connection has been established.

STOP
Indicates the stop of transmission of ACL packets before an additional amount of payload data is sent.

*RST: GO

Example:

```
BB:BTO:PCON:PTYP DH1
sets the packet type.
BB:BTO:PCON:DSFP PED
enable packet editor under data source for packet
BB:BTO:PCON:PFC GO
allows the flow per logical link.
```

[:SOURCE<hw>]:BB:BTOoth:PCONfiguration:PLENght <PLength>

The command enters the packet length in symbols.

Parameters:

<PLength> float

Range: 1 to 2873
Increment: 1
*RST: 0

Example:

```
BB:BTO:PCON:DSFP ADAT
fills the all data under data source for packet.
BB:BTO:PCON:PLEN 1
sets the packet length.
```

[[:SOURce<hw>]:BB:BTOoth:PCONfiguration:SNSValue <SnSvalue>

The command sets the start value of the header SEQN bit. The SEQN bit is present in the header to filter out retransmissions in the destination. The signal generator is altering this bit automatically on consecutive frames, if a sequence length of at least 2 frames is set.

Parameters:

<SnSvalue> integer
 Range: 0 to 1
 Increment: 1
 *RST: 1

Example:

```
BB:BTO:PCON:PTYP DH1
sets the packet type.
BB:BTO:PCON:DSFP PED
enables packet editor under data source for packet.
BB:BTO:PCON:SNSV ONE
sets the SEQN bit of the first CRC data packet at the start of a
connection.
```

[[:SOURce<hw>]:BB:BTOoth:PCONfiguration:SRMode <SrMode>

The command indicates the interval between two consecutive page scan windows, determines the behavior of the paging device.

Parameters:

<SrMode> R0|R1|R2
R0
 The scan interval is equal to the scan window T_w page scan (continuous nscan) and maximal 1.28s.
R1
 The scan interval is maximal 1.28s.
R2
 The scan interval is maximal 2.56s.
 *RST: R0

Example:

```
BB:BTO:PCON:PTYP FHS
sets the packet type.
BB:BTO:PCON:DSFP PED
enables packet editor under data source for packet.
BB:BTO:PCON:SRM R0
sets the scan repetition mode.
```

[[:SOURce<hw>]:BB:BTOoth:PCONfiguration:VDATa <VData>

The command selects the data source for the voice field.

Parameters:

<VData> ALL0|ALL1|PATTERN|PN09|PN11|PN15|PN16|PN20|PN21|
PN23|DLIST

*RST: PN09

Example:

BB:BTO:PCON:VDAT ALL1
sets the voice data type.

4.8 Dirty Transmitter Test

[:SOURce<hw>]:BB:BT0oth:DTTTest:DTTState.....	96
[:SOURce<hw>]:BB:BT0oth:DTTTest:FDDeviation.....	96
[:SOURce<hw>]:BB:BT0oth:DTTTest:FDRate.....	97
[:SOURce<hw>]:BB:BT0oth:DTTTest:SPHase.....	97
[:SOURce<hw>]:BB:BT0oth:DTTTest:STDefault.....	97
[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE.....	98
[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:LONG:SET<ch>:CFOffset.....	98
[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:LONG:SET<ch>:MINDex.....	98
[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:LONG:SET<ch>:STATE.....	99
[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:LONG:SET<ch>:STERror.....	99
[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:SHORT:SET<ch>:CFOffset.....	100
[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:SHORT:SET<ch>:STATE.....	100
[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:SHORT:SET<ch>:STERror.....	101

[:SOURce<hw>]:BB:BT0oth:DTTTest:DTTState <DttState>

The command activates/deactivates the Dirty Transmitter Test. For Basic Rate packets, each set of parameters in the Dirty Transmitter Setting table below is used for a duration of 20 ms. After 20 ms, the following set is used, continuing with the first set after the sequence is completed.

For EDR packets, the parameter sets apply for 20 packets each.

Parameters:

<DttState> 0|1|OFF|ON

*RST: OFF

Example:

BB:BTO:DTT:DTTS ON
activates the Dirty Transmitter Test.

[:SOURce<hw>]:BB:BT0oth:DTTTest:FDDeviation <FdDeviation>

The command enters a frequency drift rate.

A sine wave is used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset. The maximum deviation reached during the drift equals the set frequency drift deviation.

Parameters:

<FdDeviation> float

Range: -100 kHz to 100 kHz
 Increment: 1 KHz
 *RST: 25 kHz

Example:

BB:BTO:DTT:FDD 25
 enters frequency drift deviation.

[:SOURCE<hw>]:BB:BTOoth:DTTTest:FDRate <FdRate>

The command enters a frequency drift rate.

A sine wave is used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset with the set frequency drift rate.

Parameters:

<FdRate> 0.3 KHz|0.5 KHz|1.6 KHz|10 KHz

Range: 0.3 kHz to 10 kHz
 *RST: 1.6 kHz

Example:

BB:BTO:DTT:FDR 1.6
 enters frequency drift rate.

[:SOURCE<hw>]:BB:BTOoth:DTTTest:SPHase <SPHase>

The command enters a start phase.

The start phase of the sine wave used to drift the modulated Bluetooth signal around center frequency + carrier frequency offset is set here.

Parameters:

<SPHase> integer

Range: 0 to 359
 Increment: 1
 *RST: 0
 Default unit: degree

Example:

BB:BTO:DTT:SPH 0
 enters a start phase.

[:SOURCE<hw>]:BB:BTOoth:DTTTest:STDefault

The command calls the default settings for the Dirty Transmitter Test.

Example:

BB:BTO:DTT:STD
 calls the default settings.

Usage: Setting only

[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE <Table>

The command calls the table settings.

Parameters:

<Table> NOTable|SHORT|LONG

Example:

```
BB:BTO:PTYP DH1
calls the default settings.
BB:BTO:DTT:TABLE LONG
calls the default settings.
```

[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:LONG:SET<ch>:CFOffset <CfOffset>

The command enters a carrier frequency offset.

The carrier frequency offset shows the deviation of the transmitted initial center frequency from carrier frequency.

Parameters:

<CfOffset> float

Range: -150 kHz to 150 kHz

Increment: 1 kHz

Example:

```
BB:BTO:PTYP DH1
sets the packet type.
BB:BTO:DTT:TABLE LONG
enters the table type
BB:BTO:DTT:TABLE:LONG:SET2:CFOF 14
enters a carrier frequency offset.
```

[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:LONG:SET<ch>:MINDex <MIndex>

The command enters the modulation index.

The modulation index specifies the frequency deviation..

The modulation index h is defined as

$$h = \frac{2\Delta f}{f_{symbol}}$$

where

f_{symbol} = "symbol rate", set with the command `[:SOURce<hw>]:BB:BT0oth:SRATe:VARiAtion`

Δf = "frequency deviation", set with the command `[:SOURCE<hw>] :BB:BT0oth: MSETtings:FDEVIation`

According to the Bluetooth standard, the modulation index is allowed to vary between 0.28 and 0.35.

Parameters:

<MIndex> float
 Range: 0.28 to 0.35
 Increment: 0.01

Example:

```
BB:BTO:PTYP DH1
sets the packet type.
BB:BTO:DTT:TABL LONG
enters the table type
BB:BTO:DTT:TABL:LONG:SET2:MIND 0.3
enters a modulation index.
```

`[:SOURCE<hw>] :BB:BT0oth:DTTtest:TABLE:LONG:SET<ch>:STATE <State>`

The command activates or deactivates the corresponding parameter set for the long table. If a set deactivated, its parameters are skipped in the sequence. Instead, the next active set is used.

For Basic Rate packets, each set applies to 20ms of signal.

Parameters:

<State> 0|1|OFF|ON

Example:

```
BB:BTO:PTYP DH1
sets the packet type.
BB:BTO:DTT:TABL LONG
enters the table type
BB:BTO:DTT:TABL:LONG:SET2:STAT ON
activates the set 2 in the long table.
```

`[:SOURCE<hw>] :BB:BT0oth:DTTtest:TABLE:LONG:SET<ch>:STERror <StError>`

The command enters a symbol timing error in ppm.

The Symbol Timing Error modifies the symbol clock frequency by the set amount.

Parameters:

<StError> float
 Range: -150 ppm to 150 ppm
 Increment: 1 ppm

Example: BB:BTO:PTYP DH1
sets the packet type.
BB:BTO:DTT:TABL LONG
enters the table type
BB:BTO:DTT:TABL:LONG:SET2:STER -20
enters a symbol timing error.

**[[:SOURce<hw>]:BB:BTOoth:DTTTest:TABLE:SHORT:SET<ch>:CFOffset
<CfOffset>**

The command enters a carrier frequency offset.

The carrier frequency offset shows the deviation of the transmitted initial center frequency from carrier frequency.

Parameters:

<CfOffset> float
Range: -150 kHz to 150 kHz
Increment: 1 kHz

Example: BB:BTO:PTYP DH1
sets the packet type.
BB:BTO:DTT:TABL SHOR
enters the table type
BB:BTO:DTT:TABL:SHOR:SET2:CFOF 65
enters a carrier frequency offset.

[[:SOURce<hw>]:BB:BTOoth:DTTTest:TABLE:SHORT:SET<ch>:STATE <State>

The command activates or deactivates the corresponding parameter set in the short table. If a set deactivated, its parameters are skipped in the sequence. Instead, the next active set is used.

For EDR packets, each set applies to 20 packets.

Parameters:

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

Example: BB:BTO:PTYP DH1
sets the packet type.
BB:BTO:DTT:TABL SHOR
enters the table type
BB:BTO:DTT:TABL:SHOR:SET2:STAT ON
activates the set 2 in the short table.

[[:SOURce<hw>]:BB:BT0oth:DTTTest:TABLE:SHORT:SET<ch>:STERror <StError>

The command enters a symbol timing error in ppm.

The Symbol Timing Error modifies the symbol clock frequency by the set amount.

Parameters:

<StError> float
 Range: -150 ppm to 150 ppm
 Increment: 1 ppm

Example:

```
BB:BT0:PTYP DH1
sets the packet type.
BB:BT0:DTT:TABL SHOR
enters the table type
BB:BT0:DTT:TABL:SHOR:SET2:STER 20
enters a symbol timing error.
```

4.9 LE Commands

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[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SCACcuracy.....	117
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SLATency.....	117
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SSValue.....	117
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[:SOURce<hw>]:BB:BT0oth:BCRole <BcRole>

Determines the controller role. Depending on the selected channel type different roles are assigned to the controller. For channel type "Data", master or slave can be assigned. If channel type "Advertising" is selected, the parameter is read only and displayed directly above the graph.

Parameters:

<BcRole> MASTer|SLAVe

MASTER
Assigns master role to the controller.

SLAVE
Selects slave as controller role.

*RST: MASTer

Example:

SOUR:BB:BTO:BCR MAST
master as controller role.
SOUR:BB:BTO:BCR SLAV
slave as controller role.

[[:SOURce<hw>]:BB:BT0oth:BM0De <BMode>

Determines the digital Bluetooth standard. Basic Rate + EDR or Bluetooth Low Energy are available.

Parameters:

<BMode> BASic|BLENergy

BASic
Selects the Bluetooth mode Basic Rate + EDR.

BLENergy
Selects the Bluetooth mode Low Energy.

*RST: BASic

Example:

SOUR:BB:BTO:BM0D BLEN
Bluetooth mode Low Energy.

[[:SOURce<hw>]:BB:BT0oth:CTYPe <CType>

Determines the channel type. Advertising and data are available.

Parameters:

<CType> ADVertising|DATA

ADVertising
Selects channel type Advertising.

DATA
Selects channel type Data. Devices in a connected state transmit data channel packets in connection events with a start point and an interval.

*RST: ADVertising

Example: SOUR:BB:BTO:CTYP ADV
channel type Advertising.
SOUR:BB:BTO:CTYP DATA
channel type Data.

[:SOURce<hw>]:BB:BT0oth:DTTTest:TPConfiguration:TPInterval <TpInterval>

Sets the time interval between two consecutive test packets, with regard to the starting points.

Parameters:

<TpInterval> float
Range: 0.625 to 12.5
Increment: 0.001
*RST: 0.625

Example: SOUR:BB:BTO:DTT:TPC:TPIN 1.0
sets a time interval of 1.0.

[:SOURce<hw>]:BB:BT0oth:DTTTest:TPConfiguration:UPLength <UpLength>

Sets the payload length.

Parameters:

<UpLength> integer
Range: 1 to 37
*RST: 1

Example: SOUR:BB:BTO:DTT:TPC:UPL 37
sets a payload length of 37.

[:SOURce<hw>]:BB:BT0oth:DTTTest:TPConfiguration:UPSource <UpSource>

Selects the data source used for the payload test packets.

Parameters:

<UpSource> PN09|PAT1|PAT2|PN15|PAT3|PAT4|PAT5|PAT6
PN9 / PN15
Select a PRBS-modulated data sequence
(PRBS = pseudo random binary sequence) for testing.
PAT1 ... PAT6
Pattern is predefined.
*RST: PN09

Example: SOUR:BB:BTO:DTT:TPC:UPS PN09
PRBS-modulated data sequence for testing.

```
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:ACTable <AcTable>
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:DCTable <DcTable>
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:DCMTable
  <DcmTable>
```

The data channel map table indicates the entire data set of the channels in a table.

Every channel is represented with bit positioned as per the data channel index. LSB represents data channel index 0 and the bit in position 36 represents data channel index 36.

If the channel is used channel its bit is to be set to '1'. Bit value '0' indicates that the channel is unused.

The bits in positions 37, 38 and 39 shall be set to zero upon transmission and ignored upon receipt.

Note: This parameter is relevant for data event and advertising frame configuration with the packet types:

- CHANNEL_MAP_REQ
- CONNECT_REQ

Parameters:

<DcmTable> string

Example:

```
SOUR:BB:BT0:ECON:ACTable NOT
Entire data set for Advertising Channel Table
SOUR:BB:BT0:ECON:DCT NOT
Entire data set for Data Channel Table
SOUR:BB:BT0:ECON:PCON:DCMT NOT
Entire data set for Channel Map Table
```

```
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:ACTable:SET<ch>:STATE <State>
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:DCTable:SET<ch>:STATE <State>
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:DCMTable:
  SET<ch>:STATE <State>
```

Indicates used and unused data channels.

Note: This parameter is relevant for data event and advertising frame configuration with the packet types:

- CHANNEL_MAP_REQ
- CONNECT_REQ

Parameters:

<State> 0|1|OFF|ON

*RST: ON

Example: SOUR:BB:BTO:ECON:ACT:SET2:STAT ON
 State in Advertising Channel Table
 SOURCE:BB:BTO:ECON:DCT:SET1:STAT ON
 State in Data Channel Table
 SOUR:BB:BTO:ECON:PCON:DCMT:SET1:STAT ON
 State in Data Channel Map Table

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:AEDelay <AeDelay>

Sets a time delay between the start times of two consecutive advertising events. The value is added to the advertising event interval.

Parameters:

<AeDelay> float
 Range: 0.0 to 10.0
 *RST: 0.0

Example: SOUR:BB:BTO:ECON:AED 10.0
 sets a time delay of 10.0 s.

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:AEInterval <AeInterval>

Sets the time interval between two consecutive advertising events, with regard to the starting points.

Parameters:

<AeInterval> float
 Range: 20.0 to 10240.0
 *RST: 20.0

Example: SOUR:BB:BTO:ECON:AEIN 20.0
 sets a time interval of 20.0.

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:APInterval <ApInterval>

Sets the time interval between packets starting points of two consecutive packets in the advertising channel.

Parameters:

<ApInterval> float
 Range: 1.3 to 1.5
 *RST: 1.3

Example: SOUR:BB:BTO:ECON:APIN 1.3
 sets a time interval of 1.3.

[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:LCMode <LcMode>

Select the link layer connection mode. In order to provide safe transmission of payload data, the data in the packet can be encrypted. If activated, the payload data follows MIC (Message authentication Code).

Parameters:

<LcMode> UENC|ENC

UENC

Payload data is transmitted without encoding.

ENC

The link layer connection runs in encrypted mode.

*RST: UENC

Example:

SOUR:BB:BT0:ECON:LCM UENC

without encoding.

SOUR:BB:BT0:ECON:LCM ENC

in encrypted mode.

[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:LTKey <LtKey>

Indicates the time the controller needs to receive the long term key from the host. After this time, the controller is ready to enter into the last phase of encryption mode setup.

Parameters:

<LtKey> integer

Example:

SOUR:BB:BT0:ECON:LCM ENC

SOUR:BB:BT0:ECON:LTK

#H00000000000000000000000000000000,128

In encrypted mode, the code can be edited.

[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:AADDRESS <AAddress>

Sets the access address of the link layer connection (32-bit string).

Parameters:

<AAddress> integer

Example:

SOUR:BB:BT0:ECON:PCON:AADD #H00000000,32

sets an access address.

**[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:ACID <Acid>
[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:ACASsigned <AcAssigned>**

**[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SCASsigned
<ScAssigned>**

[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:SCID <Scid>

**[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:ICASsigned
<IcAssigned>**

[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:ICID <Icid>

Sets the advertiser's device address. In bluetooth low energy systems all the transmissions start with an 8 bit preamble followed by an access address. The access address is composed of a the parts "Company_Id" (LSB) and the "Company_assigned" (MSB). Beside the address fields the notation is given. For advertising channel packets the format of the device address differs, depending on the selected address type.

- "Public Address Types"
The public address is given from the registration authority IEEE and is composed of:
 - LSB: 24 bits = company_assigned
 - MSB: 24 bits = company_id
- "Private Address Type"
A private address is optional and composed of:
 - LSB: 24 bits = hash
 - MSB: 24 bits = random

Parameters:

<Icid> integer

Example:

```
SOUR:BB:BT0:ECON:PCON:ACID #H000000,24
SOUR:BB:BT0:ECON:PCON:ACAS #H000000,24
Company_Assigned and Company_Id in Advertiser's Device
Address)
SOUR:BB:BT0:ECON:PCON:SCAS #H000000,24
SOUR:BB:BT0:ECON:PCON:SCID #H000000,24
Company_Assigned and Company_Id in Scanners Device
Address)
SOUR:BB:BT0:ECON:PCON:ICAS #H000000,24
SOUR:BB:BT0:ECON:PCON:ICID #H000000,24
Company_Assigned and Company_Id in Initiators Device
Address)
```

[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:CID <Cid>

Sets the company identifier of the manufacturer of the Bluetooth Controller. A 16 bit value is set.

Note: This parameter is relevant for data frame configuration and for the packet type LL_VERSION_IND.

Parameters:

<Cid> integer

*RST: 0

Example: `SOUR:BB:BTO:ECON:PCON:CID #H0000,16`
 sets the company ID.

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:CINstant
 <CInstant>

Sets a connection instant for indicating the connection event at which the new connection parameters are taken in use.

Parameters:

<CInstant> float

 Range: 0 to 1000

 *RST: 0

Example: `SOUR:BB:BTO:ECON:PCON:CINS 2`
 sets a connection instant.

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:CINterval
 <CInterval>

(for data event and advertising frame configuration with the packet type CONNECT_REQ)

Set the time interval between the start points of two consecutive connection events.

Parameters:

<CInterval> float

 Range: 7.5 to 4000.0

 *RST: 7.5

Example: `SOUR:BB:BTO:UPTY CREQ`
 sets packet type CONNECT_REQ
 `SOUR:BB:BTO:ECON:PCON:CINT 7.5`
 sets a time interval.

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:CIValue <CiValue>

Sets the initialization value for the CRC (Cyclic Redundary Check, 24 bits) calculation. A packet has been received correctly, when it has passed the CRC check.

Parameters:

<CiValue> integer

Example: `SOUR:BB:BTO:ECON:PCON:CIV #H000000,24`
 sets the initialization value for the CRC.

[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:DATA <Data>

Selects the data source used for the payload.

Parameters:

<Data> ALL0|ALL1|PATTern|PN09|PN11|PN15|PN16|PN20|PN21|PN23|DLIS

All 0 / All 1

0 data and 1 data is generated internally.

Pattern

Pattern is user definable.

PN xx

Pseudo-random noise sequence. XX can be equal to 9, 11, 15, 16, 20, 21, 23.

Data List

Internal data from a programmable data list is used. The data list can be generated by the Data List Editor or generated externally.

*RST: PN09

Example:

```
SOUR:BB:BTO:ECON:PCON:DATA ALL0 | ALL1
SOUR:BB:BTO:ECON:PCON:DATA PATT
SOUR:BB:BTO:ECON:PCON:DATA:DPAT #H3F, 8
SOUR:BB:BTO:ECON:PCON:DATA PN09
SOUR:BB:BTO:ECON:PCON:DATA DLIS
SOUR:BB:BTO:ECON:PCON:DATA:DSEL 'bluetooth-le'
```

[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:DATA:DPATtern <DPattern>

The command selects the data for a pattern.

Parameters:

<DPattern> integer

*RST: 0

Example:

```
BB:BTO:ECON:PCON:DATA PATT
sets the data type.
BB:BTO:ECON:PCON:DATA:DPAT #B010101, 6
selects the data for a pattern
```

[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:DATA:DSELECTION <DSelection>

The command selects data list file.

Parameters:

<DSelection> string

Example: BB:BTO:ECON:PCON:DATA DLIS
selects the data type.
BB:BTO:ECON:PCON:DSEL Bluetooth-le
selects the file for the data.

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:DLEnGth
<DLength>

Enters the payload data length in bytes.

Parameters:

<DLength> float
Range: 0 to 31
*RST: 0

Example: SOUR:BB:BTO:ECON:PCON:DLEN 31
payload data length is 31 bytes.

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:DWHitening
<DWhitening>

Activates or deactivates the Data Whitening. Evenly distributed white noise is ideal for the transmission and real data can be forced to look similar to white noise with different methods called Data Whitening. Applied to the PDU and CRC fields of all packet types, whitening is used to avoid long equal sequences in the data bit stream.

Parameters:

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

Example: BB:BTO:ECON:PCON:DWH ON
activates data whitening.

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:ECODE <ECode>

Sets the error code value to inform the remote device why the connection is about to be terminated in case of LL_TERMINATE_IND packet. On the other hand, this parameter for LL_REJECT_IND packet is used for the reason a request was rejected. A 8 bit value is set.

Note: This parameter is relevant for data frame configuration and the packet type:

- LL_TERMINATE_IND
- LL_REJECT_IND

Parameters:

<ECode> integer
 *RST: 0

Example:

SOUR:BB:BTO:ECON:PCON:ECOD #H00,8
 sets the error code

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:EDIVersifier
 <EDiversifier>

Sets the encrypted diversifier of the master for device identification. The parameter is an initialization vector provided by the Host in the HCI_ULP_Start_Encryption command.

Parameters:

<EDiversifier> integer

Example:

SOUR:BB:BTO:ECON:PCON:EDIV #H0000, 16
 sets the encrypted diversifier of the master.

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:FSLength
 <FsLength>

Enables that the feature set length is indicated. FeatureSet indicates whether the Controller features are used or not. All the data in FeatureSet is RFU(zero).

Parameters:

<FsLength> float
 Range: 1 to 26
 *RST: 26

Example:

SOUR:BB:BTO:ECON:PCON:FSL 12
 feature set length is 12.

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:HLEnigth
 <HLength>

(for data event and advertising frame configuration with the packet type CONNECT_REQ)

Sets the difference from the current channel to the next channel. The master and slave devices determine the data channel in use for every connection event from the channel map. Hop_length is set for the LL connection and communicated in the CONNECT_REQ and CHANNEL_MAP_REQ packets.

Parameters:

<HLength> integer

Range: 5 to 16

*RST: 5

Example:

```
SOUR:BB:BTO:UPTY CREQ
sets packet type CONNECT_REQ
SOUR:BB:BTO:ECON:PCON:HLEN 10
hop length is 10.
```

**[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:LCTimeout
<LcTimeout>**

(for data event and advertising frame configuration with the packet type:

CONNECT_REQ

Defines the maximum time between two correctly received Bluetooth Low Energy packets in the LL connection before the connection is considered lost.

Parameters:

<LcTimeout> float

Range: 100.0 to 32000.0

*RST: 100.0

Example:

```
SOUR:BB:BTO:UPTY CREQ
sets packet type CONNECT_REQ
SOUR:BB:BTO:ECON:PCON:LCT 150
LL Connection Timeout is 150.
```

**[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:MIVector
<MiVector>**

[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:SIVector <SiVector>

Sets the master's or the slave's portion of the initialization vector (IVm/IVs).

Parameters:

<SiVector> integer

Example:

```
SOUR:BB:BTO:ECON:PCON:MIV #H0000000000000000, 32
(Master).
SOUR:BB:BTO:ECON:PCON:SIV #H0000000000000000, 32
(Slave).
```

[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:MSKD <Mskd>

[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:SSKD <Sskd>

Sets the master's or the slave's portion of the session key diversifier (SKDm/SKDs).

Parameters:**<Sskd>** integer**Example:**

```
SOUR:BB:BTO:ECON:PCON:MSKD
#H0000000000000000,64
(Master).
SOUR:BB:BTO:ECON:PCON:SSKD
#H0000000000000000,64
(Slave).
```

**[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:NCInterval
<NcInterval>**

(for data event and advertising frame configuration with the packet type CONNECTION_UPDATE_REQ)

Set the time interval between the start points of two consecutive connection events.

Parameters:**<NcInterval>** float

Range: 7.5 to 4000.0
*RST: 7.5

Example:

```
SOUR:BB:BTO:UPTY CUR
sets packet type CONNECTION_UPDATE_REQ
SOUR:BB:BTO:ECON:PCON:NCIN 7.5
sets a time interval.
```

**[[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:NLCTimeout
<NlcTimeout>**

(for data event and advertising frame configuration with the packet type CONNECTION_UPDATE_REQ)

Defines the maximum time between two correctly received Bluetooth Low Energy packets in the LL connection before the connection is considered lost.

Parameters:**<NlcTimeout>** float

Range: 100.0 to 32000.0
*RST: 100.0

Example:

```
SOUR:BB:BTO:UPTY CUR
sets packet type CONNECTION_UPDATE_REQ
SOUR:BB:BTO:ECON:PCON:NLCT 150
LL Connection Timeout is 150.
```

**[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:NSLatency
<NsLatency>**

(for data event and advertising frame configuration with the packet type CONNECTION_UPDATE_REQ)

Sets a number of consecutive connection events the slave can ignore for asymmetric link layer connections.

Parameters:

<NsLatency> integer

Range: 0 to 1000

*RST: 0

Example:

```
SOUR:BB:BT0:UPTY CUR
sets packet type CONNECTION_UPDATE_REQ
SOUR:BB:BT0:ECON:PCON:NSL 10
sets the number of consecutive connection events.
```

[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:NSValue <NsValue>

Sets the start value of the next expected packet from the same device in the LL connection ("N"ext"E"xpected "S"equence"N"umber). This parameter can be set in the first event. From the second event this field is not indicated.

Parameters:

<NsValue> integer

Range: 0 to 1

*RST: 1

Example:

```
SOUR:BB:BT0:ECON:PCON:NSV 1
Start Value is 1.
```

**[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:NWOffset
<NwOffset>**

(for data event and advertising frame configuration with the packet type CONNECTION_UPDATE_REQ)

Sets the start point of the transmit window.

Parameters:

<NwOffset> float

Range: 0.0 to 5000.0

*RST: 0.0

Example: `SOUR:BB:BTO:UPTY CUR`
 sets packet type CONNECTION_UPDATE_REQ
 `SOUR:BB:BTO:ECON:PCON:NWOF 800.0`
 sets the start point of the transmit window.

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:NWSize <NwSize>

(for data event and advertising frame configuration with the packet type CONNECTION_UPDATE_REQ)

Sets the size of the transmit window, regarding to the start point.

Parameters:

<NwSize> float
 Range: 1.25 to 10.0
 *RST: 1.25

Example: `SOUR:BB:BTO:UPTY CUR`
 sets packet type CONNECTION_UPDATE_REQ
 `SOUR:BB:BTO:ECON:PCON:NWS 8.0`
 sets the size of the transmit window.

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:TAType <TaType>
[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:RAType <RaType>

Selects the address type of the controller device. Depending on the Bluetooth controller role either Tx or Rx or both address types are assigned. Subdivided into private and random, a Bluetooth LE device address consists of 48 bits. The format of the device address differs depending on the selected address type.

Parameters:

<RaType> PUBLIC|RANDOM
 PUBLIC
 Allocates a unique 48 bit address to each bluetooth LE device.
 The public address is given from the registration authority IEEE.
 RANDOM
 Allocates a 48 bit address to each bluetooth LE device. A random
 address is optional.
 *RST: PUBLIC

Example: `SOUR:BB:BTO:ECON:PCON:TATY PUBL`
 `SOUR:BB:BTO:ECON:PCON:RATY RAND`

[:SOURCE<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:RVECTOR <RVector>

Sets the random vector of the master for device identification. The parameter is an initialization vector provided by the Host in the HCI_ULP_Start_Encryption command.

Parameters:

<RVector> integer

Example:

```
SOUR:BB:BTO:ECON:PCON:RVEC
#H0000000000000000,64
sets the random vector of the master.
```

[:SOURCE<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:SCACcuracy
 <ScAccuracy>

Defines the master's clock accuracy with specified encoding. This parameter is used by the slave to determine required listening windows in the LL connection. It is a controller design parameter known by the Controller.

Parameters:

<ScAccuracy> SCA0|SCA1|SCA2|SCA3|SCA4|SCA5|SCA6|SCA7
 *RST: SCA0

Example:

```
SOUR:BB:BTO:ECON:PCON:SCAC SCA1
sets the encoding value
```

[:SOURCE<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:SLATency
 <SLatency>

(for data event and advertising frame configuration with the packet type CONNECT_REQ)

Sets a number of consecutive connection events the slave can ignore for asymmetric link layer connections.

Parameters:

<SLatency> integer
 Range: 0 to 1000
 *RST: 0

Example:

```
SOUR:BB:BTO:UPTY CREQ
sets packet type CONNECT_REQ
SOUR:BB:BTO:ECON:PCON:SLAT 10
sets the number of consecutive connection events.
```

[:SOURCE<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:SSValue <SsValue>

Sets the sequence number of the packet. This parameter can be set in the first event. From the second event this field is not indicated.

Parameters:

<SsValue> integer
 Range: 0 to 1
 *RST: 0

Example:

SOUR:BB:BTO:ECON:PCON:SSV 1
 sets the sequence number of the packet.

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:SVNumber
 <SvNumber>

Sets a unique value for each implementation or revision of an implementation of the Bluetooth Controller. A 16 bit value is set.

Note: This parameter is relevant for data frame configuration and for the packet type: LL_VERSION_IND.

Parameters:

<SvNumber> integer
 *RST: 0

Example:

SOUR:BB:BTO:ECON:PCON:SVN #H0000,16
 sets the sub version number

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:UTYPE <UType>

Enables that an invalid control packet is indicated. The CtrType field indicates the value of the LL control packet that caused the transmission of this packet.

Parameters:

<UType> integer

Example:

SOUR:BB:BTO:ECON:PCON:UTYP #H8, 00
 enables that an invalid control packet is indicated.

[:SOURce<hw>]:BB:BTOoth:ECONfiguration:PCONfiguration:VNUMBER
 <VNumber>

Sets the company identifier of the manufacturer of the Bluetooth Controller. A 8 bit value is set.

Note: This parameter is relevant for data frame configuration and for the packet type LL_VERSION_IND.

Parameters:

<VNumber> integer
 *RST: 0

Example: `SOUR:BB:BTO:ECON:PCON:VNUM #H00,8`
sets the version number

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:W0FFset
<W0ffset>

(for data event and advertising frame configuration with the packet type CONNECT_REQ)

Sets the start point of the transmit window.

Parameters:

<W0ffset> float

Range: 0.0 to 5000.0
*RST: 0

Example: `SOUR:BB:BTO:UPTY CREQ`
sets packet type CONNECT_REQ
`SOUR:BB:BTO:ECON:PCON:W0FF 800.0`
sets the start point of the transmit window.

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PCONfiguration:W5IZe <W5Ize>

(for data event and advertising frame configuration with the packet type CONNECT_REQ)

Sets the size of the transmit window, regarding to the start point.

Parameters:

<W5Ize> float

Range: 1.25 to 10.0
*RST: 1.25

Example: `SOUR:BB:BTO:UPTY CREQ`
sets packet type CONNECT_REQ
`SOUR:BB:BTO:ECON:PCON:W5IZ 8.0`
sets the size of the transmit window.

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:PNUMber <PNUMber>

Sets the number of Tx packets per event. Each connection contains at least one data channel packet. The maximum number of packets per event is determined by the duration of the connection event interval.

Parameters:

<PNUMber> float

Range: 1 to 2580
*RST: 1

Example: `SOUR:BB:BTO:ECON:PNUM 2580`
 sets the number of Tx packets per event.

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:SINTerval <SInterval>

Sets the time interval between the starting points of two consecutive windows during which the scanner is operating in an advertising channel.

Parameters:

<SInterval> float
 Range: 2.5 to 10240.0
 *RST: 2.5

Example: `SOUR:BB:BTO:ECON:SINT 3.5`
 sets the time interval.

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:SWINdow <SWindow>

Sets the length of the window during which the scanner is operating in the advertising channel. Note that the scan window is less or equal to the value of the scan interval.

Parameters:

<SWindow> float
 Range: 2.5 to 10240.0
 *RST: 2.5

Example: `SOUR:BB:BTO:ECON:SWIN 2.5`
 sets the length of the window.

[:SOURce<hw>]:BB:BT0oth:ECONfiguration:WOINfo?

(for data event and advertising frame configuration with the packet type CONNECT_REQ)

Queries the start point of the transmit window.

Return values:

<WoInfo> string

Example: `SOUR:BB:BTO:UPTY CREQ`
 sets packet type CONNECT_REQ
 `SOUR:BB:BTO:ECON:PCON:WOIN?`
 queries the start point of the transmit window.

Usage: Query only

[[:SOURce<hw>]:BB:BT0oth:ECONfiguration:WSINfo?

(for data event and advertising frame configuration with the packet type CONNECT_REQ)

Queries the size of the transmit window, regarding to the start point.

Return values:

<WsInfo> string

Example:

```
SOUR:BB:BT0:UPTY CREQ
sets packet type CONNECT_REQ
SOUR:BB:BT0:ECON:PCON:WSIN?
queries the size of the transmit window.
```

Usage: Query only

[[:SOURce<hw>]:BB:BT0oth:UPTYpe <UpType>

Selects the packet type. The available packets depend on the selected channel type.

Parameters:

<UpType> AIND|ADIND|ANIND|SREQ|SRSP|CREQ|ADCind|DATA|CUREq|
CMReq|TIND|EREQ|ERSP|SEReq|SERSp|URSP|FREQ|FRSP|
TPACket|PEReq|PERSp|VIND|RIND

*RST: AIND

Example:

```

SOUR:BB:BTO:UPTY AIND
SOUR:BB:BTO:UPTY ADIN
SOUR:BB:BTO:UPTY ANIN
SOUR:BB:BTO:UPTY ADC
SOUR:BB:BTO:UPTY SREQ
SOUR:BB:BTO:UPTY SRSP
SOUR:BB:BTO:UPTY CREQ
SOUR:BB:BTO:UPTY TPAC
Channel type "Advertising"
SOUR:BB:BTO:UPTY DATA
SOUR:BB:BTO:UPTY CUR
SOUR:BB:BTO:UPTY CMR
SOUR:BB:BTO:UPTY TIND
SOUR:BB:BTO:UPTY LER
SOUR:BB:BTO:UPTY SERS
SOUR:BB:BTO:UPTY FREQ
SOUR:BB:BTO:UPTY TPAC
Channel type "Data" and Controller role "Master".
SOUR:BB:BTO:UPTY DATA
SOUR:BB:BTO:UPTY TIND
SOUR:BB:BTO:UPTY LERS
SOUR:BB:BTO:UPTY SER
SOUR:BB:BTO:UPTY SERS
SOUR:BB:BTO:UPTY URSP
SOUR:BB:BTO:UPTY FRSP
SOUR:BB:BTO:UPTY TPAC
Channel type "Data" and Controller role "Slave".

```

[:SOURce<hw>]:BB:BTOoth:USLength <UsLength>

Selects the number of frames or events depending on the packet type. The signal repeats after the specified number of frames/events.

For SCAN_REQ and CONNECT_REQ packet, the sequence length is expressed in "Frames".

For TERMINATE_IND packets, a default value according to the specification is given:

Master: 'SlaveLatency + 6'

Slave: '6'

For all other packet types the sequence length is expressed in "Events".

Parameters:

<UsLength>	float
Range:	1 to 1000
*RST:	1

Example: `SOUR:BB:BTO:USL 1000`
 selects the number of frames or events.

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