

Supplement



Digital Standard IEEE 802.11n WLAN-N

R&S[®] AMU-K54
1402.9705.02

R&S[®] SMATE-K54
1404.7951.02

R&S[®] SMJ-K54
1409.2458.02

R&S[®] SMU-K54
1408.7562.02

R&S[®] AFQ-K254
1401.5806.02

R&S[®] AMU-K254
1402.9757.02

R&S[®] SMJ-K254
1409.2506.02

R&S[®] SMU-K254
1408.7610.02



Dear Customer,

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

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Trade names are trademarks of the owners.

Grouped Safety Messages









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







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

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

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

Symbols and safety labels

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

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

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

Tags and their meaning

| | |
|---------|---|
| DANGER | DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury. |
| WARNING | WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. |
| CAUTION | CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. |
| NOTICE | NOTICE indicates a property damage message. In the product documentation, the word ATTENTION is used synonymously. |

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

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 2000 m above sea level, max. transport altitude 4500 m above sea level.
A tolerance of $\pm 10\%$ shall apply to the nominal voltage and of $\pm 5\%$ to the nominal frequency.
2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.
4. If products/components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.
6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.
7. Operating the products requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to handle operating the products; otherwise injuries or material damage may occur. It is the responsibility of the employer to select suitable personnel for operating the products.
8. Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.
10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.
12. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.
13. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.
15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
16. For measurements in circuits with voltages $V_{\text{rms}} > 30 \text{ V}$, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.
18. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a license electrician.

Grouped Safety Messages

20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.
21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.
22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.
23. Rohde & Schwarz products are not protected against penetration of liquids, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.
24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.
25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.
26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.
27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.
28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.
29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.
30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).
31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.
32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.
33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.
34. Prior to cleaning, disconnect the product from the AC supply. Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluent for cellulose lacquers.

Informaciones elementales de seguridad

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







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

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

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

Símbolos y definiciones de seguridad

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

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

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

Palabras de señal y su significado

| | |
|-------------|--|
| PELIGRO | Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas. |
| ADVERTENCIA | Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas. |
| ATENCIÓN | Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas. |
| AVISO | Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo. |

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

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

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S válido lo que sigue:
como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4.500 m sobre el nivel del mar.
Se aplicará una tolerancia de $\pm 10\%$ sobre el voltaje nominal y de $\pm 5\%$ sobre la frecuencia nominal.
2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal especializado autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de la corriente conductora, control de funcionamiento).

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se produjeran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.
 4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.
 5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberán ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.
 6. Ciertos productos, como por ejemplo las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética.
- El empresario/usuario está comprometido a valorar y señalar áreas de trabajo en las que se corra un riesgo aumentado de exposición a radiaciones para evitar riesgos.
7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.
 8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del producto.
 9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.
 10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto. Puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro que es controlado su estado técnico de seguridad.
 11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (según la medida del cable de distribución, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

12. No utilice nunca el producto si está dañado el cable eléctrico. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.
13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A (utilización de fusibles de mayor amperaje sólo previa consulta con el grupo de empresas Rohde & Schwarz).
14. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.
15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.
16. En las mediciones en circuitos de corriente con una tensión de entrada de $U_{eff} > 30$ V se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos del estándar IEC950/EN60950.
18. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar heridas, fuego o daños en el producto.
19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, el circuito de suministro de corriente deberá estar protegido de manera que usuarios y productos estén suficientemente protegidos.
21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir cortocircuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.
22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.
23. Los productos R&S no están protegidos contra líquidos si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente para el usuario o de daños en el producto lo cual también puede llevar al peligro de personas.
24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.
25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.
26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. No cortocircuitar baterías ni acumuladores. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención células de litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Las baterías y acumuladores deben reutilizarse y no deben acceder a los vertederos. Las baterías y acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de evacuación y reciclaje.
28. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.
29. El producto puede poseer un peso elevado. Muévelo con cuidado para evitar lesiones en la espalda u otras partes corporales.
30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).
31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetados de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean observadas. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.
32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo. El fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.
33. Dado el caso de que esté integrado un producto de láser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación de producto. De otra manera pondrá en peligro su salud, ya que el rayo láser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo láser.
34. Antes de proceder a la limpieza, desconecte el producto de la red. Realice la limpieza con un paño suave, que no se deshilache. No utilice de ninguna manera agentes limpiadores químicos como, por ejemplo, alcohol, acetona o nitrodiluyente.

Digital Standard IEEE 802.11n WLAN-N

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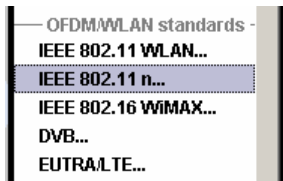
Digital Standard IEEE 802.11n WLAN-N

Introduction - Digital Standard WLAN-N

The R&S Signal Generator provides you with the ability to generate signals in accordance with the Wireless LAN standards IEEE 802.11n in its current D5.00 draft version.

WLAN-N Menu

The menu for setting the IEEE 802.11n WLAN-N 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 IEEE 802.11n WLAN-N digital standard is enabled and the transmission bandwidth is selected.

A button leads to the submenu for loading and saving the IEEE 802.11n WLAN-N configuration.

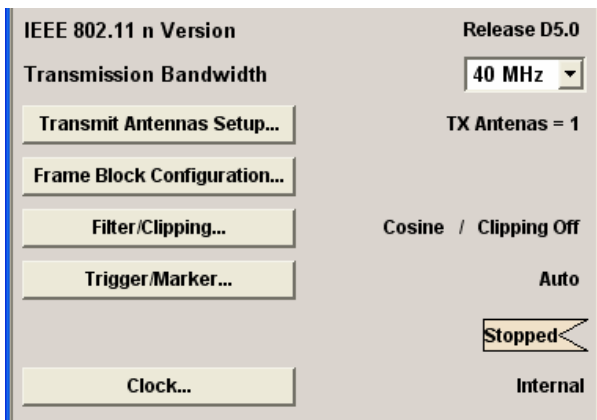
The buttons of the lower menu section lead to submenus for setting the transmission antennas and configuring the frame blocks.



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

The upper section of the menu is where the IEEE 802.11n WLAN-N digital standard is enabled and the transmission bandwidth is selected.

A button leads to the submenu for loading and saving the IEEE 802.11n WLAN-N configuration.



The buttons of the lower menu section lead to submenus for setting the transmission antennas and configuring the frame blocks.

General Settings for WLAN-N Signals

The upper menu section is where the IEEE 802.11n WLAN-N digital standard is enabled and the basic signal structure is configured.

State - WLAN-N

Enables/disables the IEEE 802.11n WLAN-N 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).

Remote-control command:
SOUR:BB:WLNN:STAT ON

Set to default - WLAN-N

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

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

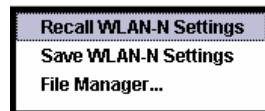
| Parameter | Value |
|---|--|
| General Parameters | |
| State | Does not change |
| Transmission Bandwidth | 40 MHz |
| TX Antennas | 1 |
| Filter | Cosine |
| Clipping | Off |
| Frame Blocks Configuration | |
| Frame Blocks | 1 |
| Frame Block Type | DATA |
| Frame Blocks State | On |
| Physical Mode | MIXED MODE |
| Tx Mode | HT-20 MHz |
| Frames | 1 |
| Idle Time | 0 ms |
| Data Source | PN9 |
| TX Antenna Setup | |
| Antennas | 1 |
| Mapping Coordinates | Cartesian |
| Output Destination | First set Baseband, rest is set to Off |
| Matrix Elements (Real, Imaginary, Magnitude, Phase) | All zero but diagonal = 1 |
| PPDU Configuration | |
| Spatial Streams | 1 |
| Space Time Streams | 1 |
| Extended Spatial Streams | 0 |
| Stream | QPSK |
| Data Length | 1024 bytes |
| Preamble/Header | ON |

| Parameter | Value |
|---------------------------|-------------------|
| General Parameters | |
| Guard | Long |
| Scrambler | On |
| Scrambler Init | 01 |
| Channel Coding | BCC |
| Rate | 1/2 |
| Interleaver | On |
| Service Field | 0000 |
| Time Domain Windowing | On |
| Transition Time | 100 ns |
| Spatial Mapping | |
| Mode | Spatial Expansion |
| Index k | 20 |

Save/Recall - WLAN-N

Calls the **Save/Recall** menu.

From the **Save/Recall** menu, the **File Select** windows for saving and recalling IEEE 802.11n WLAN-N configurations and the **File Manager** can be called.



IEEE 802.11n WLAN-N configurations are stored as files with the predefined file extension ***.wlann**. The file name and the directory they are stored in are user-definable.

The complete settings in the **IEEE 802.11n WLAN-N** menu are saved and recalled.

Recall IEEE 802.11n WLAN-N setting

Opens the **File Select** window for loading a saved IEEE 802.11n WLAN-N configuration.

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

Remote-control command:

```
MMEM:CDIR 'F:\gen_lists\wlann'
```

```
SOUR:BB:WLNN:SETT:CAT?
```

```
Response: 'wlann_1',wlann_2'
```

```
SOUR:BB:WLNN:SETT:LOAD 'wlann_1'
```

Save IEEE 802.11n WLAN-N setting

Opens the **File Select** window for saving the current IEEE 802.11n WLAN-N 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.

Remote-control command:

```
MMEM:CDIR 'F:\gen_lists\wlann'
```

```
SOUR:BB:WLNN:SETT:STOR 'wlann_3'
```

File Manager

Calls the **File Manager**.

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

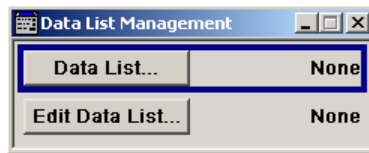
Remote-control commands:

```
MMEM:CDIR 'F:\gen_lists\wlann'
```

```
SOUR:BB:WLNN:SETT:DEL 'wlann_1'
```

Data List Management... - WLAN-N

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.

Remote-control commands:

Note:

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

Creating and editing the data list:

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

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

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

Selecting the data list:

```
SOUR:BB:WLNN:FBL1:DATA:DLIS
```

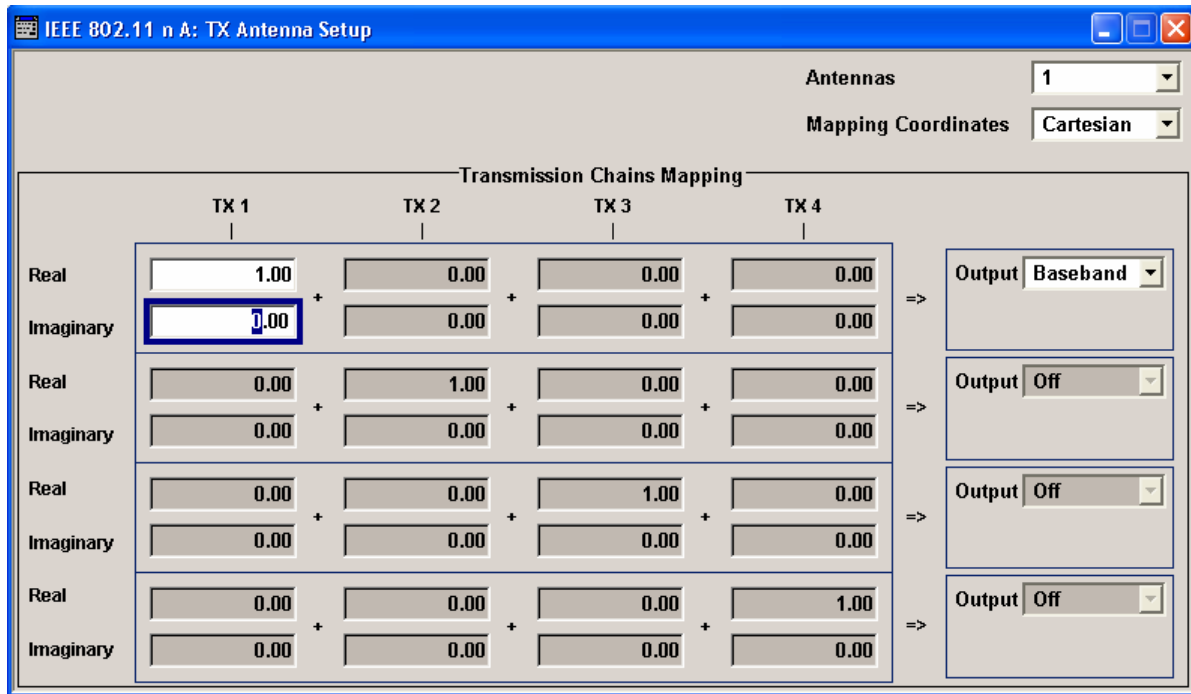
```
SOUR:BB:WLNN:FBL1:DATA:DSEL 'dlist1'
```

- Generate Waveform File... - WLAN-N** - Calls the **Generate Waveform** menu. This menu is used to store the WLAN-N output stream with "Baseband" destination as ARB signal in a waveform file.
- This file can be loaded in the **ARB** menu and processed as multi carrier or multi segment 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.
- Remote-control commands:
SOUR:BB:WLNN:WAV:CRE 'd:\temp\wlann.wv'
- Version - WLAN-N** - Displays the current version of the IEEE 802.11n WLAN-N standard (currently the D4.00 release).
- Remote-control command:
SOUR:BB:WLNN:VER?
Response: D4.0
- Transmission Bandwidth - WLAN-N** - Selects the transmission bandwidth. If the system bandwidth is set to 20 MHz, all invalid configurations in the frame blocks table are set to the default values.
- Remote-control command:
SOUR:BB:WLNN:BW BW40
- Transmit Antennas Setup - WLAN-N** - Calls the menu for configuring the TX antennas.
- The menu is described in section "[TX Antenna Setup - WLAN-N](#)", page 7.
- Remote-control command: n.a.
- Frame Block Configuration - WLAN-N** - Calls the menu for configuring the frame blocks.
- The menu is described in section "[Frame Block Configuration WLAN-N](#)", page 9.
- Remote-control command: n.a.
- Filter, Clipping - WLAN-N** - Calls the menu for setting the filter parameters and the clipping. The current setting is displayed next to the button.
- The menu is described in section "[Filter, Clipping - WLAN-N](#)", page 31.
- Remote-control command: n.a.

- Trigger - Marker - WLAN-N** Calls the menu for selecting the trigger source, for configuring the marker signals, and for setting the time delay of an external trigger signal (see section "[Trigger/Marker/Clock - WLAN-N](#)", page 28).
The currently selected trigger source is displayed to the right of the button.
Remote-control command: n.a.
- Execute Trigger - WLAN-N (R&S SMx and R&S AMU instruments only)**
Executes trigger manually.
A manual trigger can be executed only when an internal trigger source and a trigger mode other than **Auto** have been selected.
Remote-control commands:
SOUR:BB:WLNN:TRIG:SOUR INT
SOUR:BB:WLNN:SEQ RETR
SOUR:BB:WLNN:TRIG:EXEC
- Clock - WLAN-N (R&S SMx and R&S AMU instruments only)**
Calls the menu for selecting the clock source (see section "[Trigger/Marker/Clock - WLAN-N](#)", page 28).
Remote-control command: n.a.

TX Antenna Setup - WLAN-N

The Tx Antenna Setup is used to map the generated TX chains to different destinations (Baseband, File or OFF) and makes it possible to combine different TX antenna signals.



Antennas - WLAN-N

Selects the number of transmit antennas to be used.

Remote-control command:

SOUR : BB : WLNN : ANT : MODE A1

Mapping Coordinates - WLAN-N

Selects the coordinate system of the transmission chain matrix.

Remote-control command:

SOUR : BB : WLNN : ANT : SYST CART

Cartesian

Sets the cartesian coordinates system (Real, Imaginary).

Cylindrical

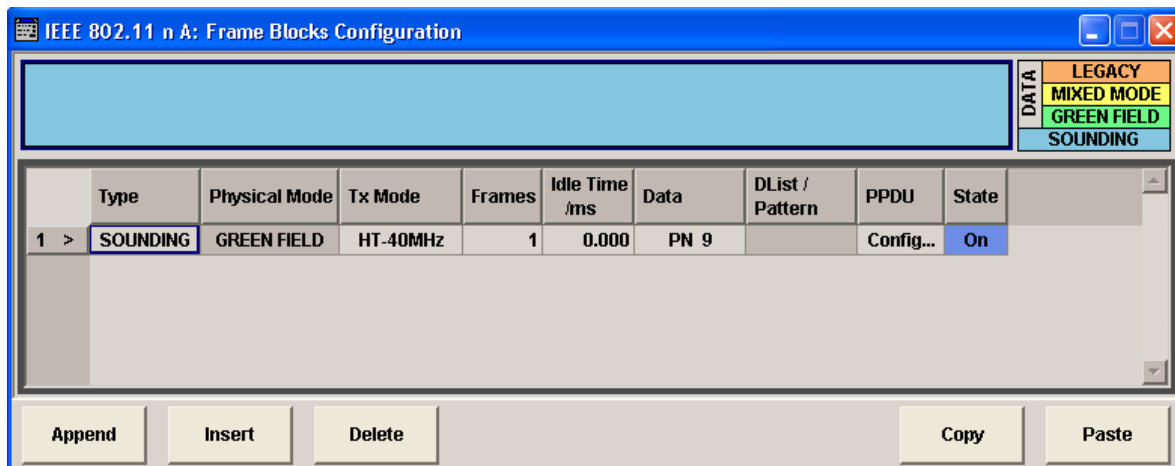
Sets the cylindrical coordinates system (Magnitude, Phase).

The values of the mapping matrix can be entered in the Transmission Chains Mapping table.

| | |
|---------------------------------|--|
| Real/Magnitude - WLAN-N | <p>Enters the value for the Real or Magnitude coordinates.</p> <p>For Cartesian mapping coordinates:</p> <p>Remote-control command: <code>SOUR:BB:WLNN:ANT:TCH1:TX1:REAL 200</code></p> <p>For Cylindrical mapping coordinates:</p> <p>Remote-control command: <code>SOUR:BB:WLNN:ANT:TCH1:TX1:MAGN 200</code></p> |
| Imaginary/Phase - WLAN-N | <p>Enters the value for the Imaginary or Phase coordinates.</p> <p>For Cartesian mapping coordinates:</p> <p>Remote-control command: <code>SOUR:BB:WLNN:ANT:TCH1:TX1:IMAG 200</code></p> <p>For Cylindrical mapping coordinates:</p> <p>Remote-control command: <code>SOUR:BB:WLNN:ANT:TCH1:TX1:PHAS 200</code></p> |
| Output - WLAN-N | <p>Selects the destination of the calculated IQ chains.</p> <p>OFF No mapping takes place.</p> <p>Remote-control command: <code>SOUR:BB:WLNN:ANT:TCH1:OUTP:DEST OFF</code></p> <p>Baseband The IQ chain is output to the baseband. Exactly one output stream can be mapped as "Baseband".</p> <p>Remote-control command: <code>SOUR:BB:WLNN:ANT:TCH1:OUTP:DEST BB</code></p> <p>File The IQ chain is saved in a file.</p> <p>Remote-control command: <code>SOUR:BB:WLNN:ANT:TCH1:OUTP:DEST FILE</code> <code>SOUR:BB:WLNN:ANT:TCH1:OUTP:FSEL</code> <code>'d:\files\wlnn_1.wv'</code></p> |

Frame Block Configuration WLAN-N

In the **Frame Blocks Configuration** menu, the configuration of the selected frame block is done.



Type - WLAN-N

Selects the PPDU type.

DATA

Only Data Long Training Fields are used to probe the channel.

Remote-control command:

SOUR:BB:WLNN:FBL1:TYPE DATA

SOUNDING

Staggered preambles are used to probe additional dimension of the MIMO channel. Only physical layer mode GREEN FIELD is available.

Remote-control command:

SOUR:BB:WLNN:FBL1:TYPE SOUN

Physical Mode - WLAN-N

Selects the preamble design. For physical type SOUNDING, only GREEN FIELD is available.

LEGACY

Compatible with 802.11 a/g OFDM devices.

Remote-control command:

SOUR:BB:WLNN:FBL1:PMOD LEG

MIXED MODE For High Throughput (HT) and 802.11a/g OFDM devices.

Note:

MIXED MODE transmissions can be detected by a physical layer transceiver of 802.11a/g OFDM, MAC FSC would however fail.

Remote-control command:

SOUR:BB:WLNN:FBL1:PMOD MIX

GREEN FIELD For HT only networks.

Remote-control command:

SOUR:BB:WLNN:FBL1:PMOD GFI

Tx Mode - WLAN-N

Sets the Tx mode. The available Tx modes are dependent on the physical mode.

Remote-control command:

SOUR:BB:WLNN:FBL1:TMOD L20

Frames - WLAN-N

Sets the number of frames to be transmitted in the current frame block.

Remote-control command:

SOUR:BB:WLNN:FBL1:FCO 50

Idle Time / ms - WLAN-N

Sets the time interval separating two frames in this frame block.

Remote-control command:

SOUR:BB:WLNN:FBL1:ITIM 0.5

Data - WLAN-N

Selects the data source.

Remote-control command:

SOUR:BB:WLNN:FBL1:DATA PN9

DList/Pattern - WLAN-N

Depending on the selected data source, selects a data list or allows to enter a user defined bit pattern.

Remote-control command:

SOUR:BB:WLNN:FBL1:DATA:PATT #H3F,8

SOUR:BB:WLNN:FBL1:DATA:DSEL 'dlist1'

| | |
|------------------------|---|
| PPDU - WLAN-N | <p>Calls the menu for PPDU configuration of the frame blocks.</p> <p>The menu is described in section "PPDU Configuration - WLAN-N", page 12.</p> <p>Remote-control command: n.a.</p> |
| State - WLAN-N | <p>Enables the corresponding frame block for transmission.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:STAT ON</p> |
| Append - WLAN-N | <p>Adds a default frame block behind the selected frame block.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL:APP or SOUR:BB:WLNN:AFBL</p> |
| Insert - WLAN-N | <p>Adds a default frame block before the selected frame block.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:INS 50</p> |
| Delete - WLAN-N | <p>Deletes the selected frame block.</p> <p>Remote-control command: SOUR:BB:WLNN:DFBL 10 or SOUR:BB:WLNN:FBL10:DL</p> |
| Copy - WLAN-N | <p>Copies the selected frame block.</p> <p>Remote-control command: SOUR:BB:WLNN:CFBL 10 or SOUR:BB:WLNN:FBL10:COPY</p> |
| Paste - WLAN-N | <p>Pastes the copied frame block behind the selected frame block.</p> <p>Remote-control command: SOUR:BB:WLNN:PFBL 10 or SOUR:BB:WLNN:FBL10:PAST</p> |

PPDU Configuration - WLAN-N

In the **PPDU Configuration** window, the PPDU configuration for all frames in the selected frame block is done.

The screenshot shows the 'IEEE 802.11 n A: PPDU Configuration for Frame Block 1' window. At the top, there are three vertical tabs: L-STF (blue), L-LTF (light blue), and L-SIG (purple). To the right of these tabs is a large orange area labeled 'Data Symbols = 115'. Below this is the 'Stream Settings' section with fields for 'Spatial Streams' (value 1), 'Extended Spatial Streams' (value 0), 'Space Time Streams' (value 1), and 'Space Time Block Coding' (value inactive). The 'Spatial Stream Modulation' section has four dropdown menus for 'Stream 1', 'Stream 2', 'Stream 3', and 'Stream 4', all set to 'QPSK'. The 'Data Settings' section includes: 'Data Bits Per Symbol' (72), 'Data Rate (Mbps)' (18), 'Data Length' (1 024 bytes), 'Number Of Data Symbols' (115), 'Preamble/Header Active' (checked), 'Guard' (Long), 'Scrambler' (On (User Init)), 'Scrambler Init (hex)' (01), 'Channel Coding' (BCC), 'Encoders' (1), 'Rate' (3/4), 'Interleaver Active' (checked), 'Service Field (hex)' (0000), and 'Time Domain Windowing Active' (checked), 'Transition Time' (100 ns). At the bottom, there are two buttons: 'Configure MAC Header and FCS...' and 'Spatial Mapping...', followed by the text 'Off'.

Spatial Streams - WLAN-N Enters the number of the spatial streams. For physical mode LEGACY, only value 1 is valid. For Tx Mode "HT-Duplicate", only value 1 is valid. In all other cases, the number of spatial streams depends on the number of antennas configured in the **TX Antenna Setup** window.

Remote-control command:
 SOUR:BB:WLNN:FBL1:SSTR 2

Space Time Streams - WLAN-N Enters the number of the space time streams. This value depends on the setting in the **Spatial Streams** field. Changing the number of the Spatial Streams immediately changes the value of the Space Time Streams to the same value.

Remote-control command:
 SOUR:BB:WLNN:FBL1:STST 2

| | |
|--|---|
| Extended Spatial Streams - WLAN-N | <p>Enters the value of the extended spatial streams. This field is active for frame block type SOUNDING only to probe additional dimensions to the channel.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : ESST 2</p> |
| Space Time Block Coding - WLAN-N | <p>Displays the status of the space time block coding.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : STBC : STAT?</p> |
| Stream n - WLAN-N | <p>Selects the modulation used for the spatial stream.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MOD1 QPSK</p> |
| Data Bits Per Symbol - WLAN-N | <p>Displays the number of data bits sent by an OFDM symbol on all spatial streams.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : DATA : BPS?</p> |
| Data Length - WLAN-N | <p>The command enters the size of the data field in bytes.</p> <p>For Data Length = 0, no data field will be generated for the case of a sounding frame.</p> <p>The maximum data length depends on the physical mode: In LEGACY mode, the maximum value is 4061 Bytes. In MIXED MODE and GREEN FIELD, the maximum value is 65495 Bytes.</p> <p>The data length is related to the number of data symbols. Whenever the data length changes, the number of data symbols is updated and vice versa.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : DATA : LEN 1000</p> |
| Preamble/Header Active - WLAN-N | <p>Activates/deactivates the preamble and signal fields of the frames in the current frame block. For data type = SOUNDING, the preamble and signal field are always activated and cannot be deactivated.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : PRE : STAT ON</p> |

| | |
|--|--|
| Scrambler - WLAN-N | <p>Selects the different options for the scrambler.</p> <p>OFF The scrambler is deactivated.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:SCR:MODE OFF</p> <p>On (Random Init) The scrambler is activated.</p> <p>The initialization value of the scrambler is selected at random. Each frame has a different random initialization value. This value is also different in case of successive recalculations with the same setting parameters so that different signals are generated for each calculation.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:SCR:MODE RAND</p> <p>On (User Init) The scrambler is activated.</p> <p>The initialization value of the scrambler is set to a fixed value that is entered at Scrambler Init (hex). This value is then identical in each generated frame.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:SCR:MODE USER</p> |
| Channel Coding - WLAN-N | <p>Selects whether channel coding (BCC) is used or not.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:COD:TYPE OFF</p> |
| Interleaver Active - WLAN-N | <p>Activates/deactivates the interleaver of the data field.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:ILE:STAT ON</p> |
| Time Domain Windowing Active - WLAN-N | <p>Activates/deactivates the time domain windowing. Time domain windowing is a method to influence the spectral characteristics of the signal, which is not stipulated by the standard. However, it does not replace oversampling and subsequent signal filtering.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:TDW:STAT ON</p> |

| | |
|--|--|
| Data Rate - WLAN-N | <p>Displays the PPDU data rate. This field is read-only.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:DATA:RATE?</p> |
| Number Of Data Symbols - WLAN-N | <p>Sets the number of data symbols per frame block.</p> <p>If the number of OFDM data symbols is changed, the generator calculates the data field length as a function of the set PPDU bit rate and displays it at Data Length.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:DATA:SYMB 1</p> |
| Guard - WLAN-N | <p>Selects whether a long or short guard interval is used for the OFDM guard. In physical mode GREEN FIELD or LEGACY, only long guard intervals are possible. In this case, the field is read-only.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:GUAR LONG</p> |
| Scrambler Init (hex) - WLAN-N | <p>Enters the initialization value for scrambling mode User. This value is then identical in each generated frame.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:SCR:PATT #H3F,8</p> |
| Encoders - WLAN-N | <p>Displays the number of encoders to be used. This value depends on the data rate. For data rate ≤ 300 Mps, this value is 1. Otherwise the number of encoders is 2.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:COD:ENC?</p> |
| Rate - WLAN-N | <p>Selects the coding rate.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:COD:RATE CR1D2</p> |
| Service Field (hex) - WLAN-N | <p>Enters the value of the service field. The standard specifies a default value of 0. Other values can be entered in hexadecimal form for test purposes or future extensions.</p> <p>Remote-control command: SOUR:BB:WLNN:FBL1:SERV:PATT #H3F,8</p> |

- Transition Time - WLAN-N** Sets the transition time when time domain windowing is active.
The transition time defines the overlap range of two OFDM symbols.
At a setting of 100 ns and if BW = 20 MHz, one sample overlaps.
Remote-control command:
SOUR:BB:WLNN:FBL1:TTIM 200
- Configure MAC Header and FCS - WLAN-N** Calls the menu of the MAC Header and FCS Configuration to configure the MAC of each frame in this frame block.
The menu is described in section "[MAC Header and FCS Configuration for Frame Block](#)", page 17.
Remote-control command: n.a.
- Spatial Mapping - WLAN-N** Calls the dialog for spatial mapping to configure the spatial mapping to be used for the selected frame block. The menu is described in section "[Spatial Mapping - WLAN-N](#)", page 25.
Remote-control command: n.a.

Frame Control - WLAN-N

Enters the value of the frame control field.

The MAC frame control field has a length of 2 bytes (16 bits) and is used to define the protocol version, the frame type, sub type, and its function, etc.. As an alternative, the individual bits can be set in the lower part of the graph.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:MAC:FCON #H100A,16
SOUR:BB:WLNN:FBL1:MAC:FCON:PVER #HC,2
SOUR:BB:WLNN:FBL1:MAC:FCON:TYPE #H8,2
SOUR:BB:WLNN:FBL1:MAC:FCON:SUBT #H5,4
SOUR:BB:WLNN:FBL1:MAC:FCON:TDS #H8,1
SOUR:BB:WLNN:FBL1:MAC:FCON:FDS #H0,1
SOUR:BB:WLNN:FBL1:MAC:FCON:MFR #H8,1
SOUR:BB:WLNN:FBL1:MAC:FCON:RETR #H0,1
SOUR:BB:WLNN:FBL1:MAC:FCON:PMAN #H0,1
SOUR:BB:WLNN:FBL1:MAC:FCON:MDAT #H8,1
SOUR:BB:WLNN:FBL1:MAC:FCON:WEP #H0,1
SOUR:BB:WLNN:FBL1:MAC:FCON:ORD #H8,1
```

| 802.11 MAC Frame Control Field | | | | | | | | | | |
|--------------------------------|-------|---------|-------|---------|-----------|-------|---------|-----------|-------|---------------|
| Protocol Version | Type | Subtype | To DS | From DS | More Frag | Retry | Pwr Mgt | More Data | WEP | Order |
| 00 | 00 | 0000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 bit (LSBits) | 2 bit | 4 bit | 1 bit | 1 bit | 1 bit | 1 bit | 1 bit | 1 bit | 1 bit | 1 bit (MSBit) |

Duration Id - WLAN-N

Enters the value of the duration ID field.

Depending on the frame type, the 2-byte field Duration/ID is used to transmit the association identity of the station transmitting the frame or it indicates the duration assigned to the frame type.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:MAC:DID #HA5A5,16
```

MAC Address - WLAN-N

Enters the value of the address fields 1 ... 4.

The MAC header may contain up to four address fields, but not all of them must be available. Each of the 4 address fields can be activated or deactivated. The fields are used for transmitting the basic service set identifier, the destination address, the source address, the receiver address and the transmitter address. Each address is 6 bytes (48 bit) long. The addresses can be entered in hexadecimal form in the entry field of each address field. The least significant byte (LSB) is in left notation.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:MAC:ADDR1:STAT ON
SOUR:BB:WLNN:FBL1:MAC:ADDR1 #H124836C7EA54,48
```


Sequence Control - WLAN-N

Activates/deactivates the sequence control field.

The sequence control field has a length of 2 bytes and is divided in two parts, the fragment number (4 bits) and the sequence number (12 bits) field. A long user data stream to be transmitted is first split up into MSDUs (MAC service data units) which can either be transmitted as PSDU frames or further divided into fragments. The sequence number and the fragment number are then used to number the individual subpackets of the user data stream to be transmitted. Thus, all PSDUs are assigned a consecutive number. This allows the receiver to arrange the data packets in the correct order, to determine whether an incorrectly transmitted packet was retransmitted and to find out whether packets are missing.

If the receiver can detect a packet without an error and does not request a retransmission, the sequence number is incremented by 1 for each packet (the field is reset to 0 at the latest after a count of 4095). The fragment number field is incremented by 1 when another fragment of the current MPDU is transmitted. The start count for the transmission (normally 0) and the number of packets required to increment the corresponding counter can be defined for both numbers. This is done with the parameters **Start Number** and **Incremented every ... packet(s)** (see below).

Example:

An error-free transmission of 50 packets (no packet retransmission) is to be simulated. The sequence number should be incremented by 1 for each packet. Since no packet is fragmented, the fragment counter can always remain at 0. In this case the following values have to be set:

| | | | | | | |
|----------------------------------|--|--|--|--|------------|--------|
| Address 2 (hex) | Address 3 (hex) | Sequence Control | | Address 4 (hex) | Frame Body | FCS |
| Enable <input type="checkbox"/> | Enable <input checked="" type="checkbox"/> | Enable <input checked="" type="checkbox"/> | Enable <input checked="" type="checkbox"/> | Enable <input checked="" type="checkbox"/> | | |
| 000 0000 0000 | 000 AC77 6ED2 | Frag | Sequ | 0002 3ED3 4290 | 0 - 4095 | |
| 6 bytes | 6 bytes | 4 bit | 12 bit | 6 bytes | bytes | 4 byte |
| Start Number (hex) 0 | | Start Number (hex) 000 | | Incremented Every 1 packet(s) | | |
| Incremented Every 4096 packet(s) | | | | | | |

If it is to be simulated that some packets are received incorrectly or if the response of the receiver should be tested when the same packet arrives several times, the number of packets required to increment the sequence number can be set to 2, for example. Each packet will then automatically be sent twice (with identical data).

Remote-control command:

```
SOUR : BB : WLNN : FBL1 : MAC : SCON : STAT ON
SOUR : BB : WLNN : FBL1 : MAC : SCON : FRAG : STAR #H0 , 4
SOUR : BB : WLNN : FBL1 : MAC : SCON : SEQ : STAR #H0 , 4
SOUR : BB : WLNN : FBL1 : MAC : SCON : FRAG : INCR 2
SOUR : BB : WLNN : FBL1 : MAC : SCON : SEQ : INCR 4
```

Start Number - WLAN-N Sets the start number of the fragment bits or the sequence bits of the sequence control.

Remote-control command:

```
SOUR : BB : WLNN : FBL1 : MAC : SCON : FRAG : STAR #H0 , 4
SOUR : BB : WLNN : FBL1 : MAC : SCON : SEQ : STAR #H0 , 4
```

Increment Every - WLAN-N Defines the number of packets required to increment the counter of the fragment bits or the sequence bits of the sequence control.

Remote-control command:

```
SOUR : BB : WLNN : FBL1 : MAC : SCON : FRAG : INCR 2
SOUR : BB : WLNN : FBL1 : MAC : SCON : SEQ : INCR 4
```

HT Config - WLAN-N Calls the menu for configuring the MAC HT (High Throughput).

Note:

Only the physical modes MIXED MODE or GREEN FIELD (QoS Data frames) provide the HT transmission technology. For physical mode LEGACY this configuration field is not indicated.

The menu is described in section "[MAC Header HT Configuration - WLAN-N](#)", page 21. Remote-control command: n.a.

Frame Body - WLAN-N Indicates the length of the user data (frame body).

Remote-control command: n.a.

FCS - WLAN-N Indicates the length of the check sum.

Remote-control command: n.a.

MAC Header HT Configuration - WLAN-N

The HT Control Field may be included in any frame except a non-QoS Data frame. The presence of the HT control field in frames carried in a HT PPDU is indicated by setting the order bit in the MAC header. The HT Control Field appears last in the MAC Header, excluding any security fields.

IEEE 802.11 n A: MAC Header HT Configuration for Frame Block 1

| QoS Control (hex) | | HT Control (hex) | |
|---------------------------------|-----------|------------------|--|
| Enable <input type="checkbox"/> | 0000 | 2 bytes | |
| Enable <input type="checkbox"/> | 0000 0000 | 4 bytes | |

| MAC HT Control Field | | | | | | | | |
|----------------------|---------------|----------|------------------|----------------|------------------|----------------------|----------------------|-----------------------|
| RDG / More PPDU | AC Constraint | Reserved | ZLF Announcement | CSI / Steering | Feedback Request | Calibration Sequence | Calibration Position | Link Adaption Control |
| 0 | 0 | 0000 0 | 0 | 00 | 00 | 00 | 00 | 0000 0000 0000 0000 |
| 1 bit (LSBit) | 1 bit | 5 bit | 1 bit | 2 bit | 2 bit | 2 bit | 2 bit | 16 bit (MSBit) |

QoS Control- WLAN-N

Control field (2 Bytes) with an embedded checkbox for activating the control mechanism of QoS Data Frames (Quality of Service).

The QoS solicits an acknowledgement policy from the receiver, according to specific feedback rules. QoS control ensures a high level of transmission performance like high bit rate, low latency or low bit error probability.

Information on contents of the QoS Control Data frame are for example duration request field, TXOP limit, AP Buffer State or queue size.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:MAC:QSC:STAT ON
SOUR:BB:WLNN:FBL1:MAC:QSC #H5A5A,16
```

HT Control - WLAN-N

Control field (2 Bytes) with an embedded checkbox for activating the control mechanism of HT Control (High Throughput). A hexadecimal response signal is displayed.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:MAC:HTC:STAT ON
SOUR:BB:WLNN:FBL1:MAC:HTC #H5a5a5a5a,32
```

| | |
|----------------------------------|--|
| RDG/More PDU - WLAN-N | <p>The RDG/More signal field (LSB, 1 bit) issues the reverse direction grant. When transmitted by an initiator or a responder, this field is interpreted differently.</p> <p>Transmitted by Initiator</p> <p>0 = No reverse grant.</p> <p>1 = A reverse grant is present, as defined by the Duration/ID field.</p> <p>Transmitted by Responder</p> <p>0 = The PDU carrying the MPDU is the last transmission by the responder.</p> <p>1 = The PDU carrying the MPDU is the last transmission by the responder.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MAC : HTC : RDGM #H8 , 1</p> |
| AC Constraint - WLAN-N | <p>Indicates the access point of the responder (1 bit).</p> <p>0 = The response may contain data from any TID (Traffic Identifier)</p> <p>1 = The response may contain data only from the same AC as the last data received from the initiator.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MAC : HTC : ACC #H8 , 1</p> |
| Reserved - WLAN-N | <p>This signal field (5 bit) is currently defined, but not used. It is set to zero by the transmitter and ignored by the receiver.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MAC : HTC : RES #HF8 , 5</p> |
| ZLF Announcement - WLAN-N | <p>The ZLF Announcement (1 bit) indicates that a ZLF (Zero Length Frame) will be transmitted after the frame.</p> <p>0 = no ZLF will follow</p> <p>1 = ZLF will follow</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MAC : HTC : ZLF #H8 , 1</p> |

| | |
|--------------------------------------|--|
| CSI Steering - WLAN-N | <p>Sets the position of the CSI feedback (2 bit)</p> <p>00 = CSI</p> <p>01 = uncompressed Steering Matrix</p> <p>10 = compressed Steering Matrix</p> <p>11 = Reserved</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MAC : HTC : CSI #HC , 2</p> |
| Feedback Request - WLAN-N | <p>Sets the type of feedback (2 bit):</p> <p>00 = no request</p> <p>01 = unsolicited feedback only</p> <p>10 = immediate feedback</p> <p>11 = aggregated feedback</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MAC : HTC : FREQ #HC , 2</p> |
| Calibration Sequence - WLAN-N | <p>Identifies the calibration sequence (2 bit). The field is included in each frame within the calibration procedure. Its value remains unchanged during one calibration procedure and is incremented each time a new calibration procedure starts.</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MAC : HTC : CAL : SEQ #H2 , 2</p> |
| Calibration Position - WLAN-N | <p>Sets the position in the Calibration Sounding Exchange sequence (2 bit):</p> <p>00 = Not a calibration frame (Default setting)</p> <p>01 = Calibration Start</p> <p>10 = Sounding Response</p> <p>11 = Sounding Complete</p> <p>Remote-control command: SOUR : BB : WLNN : FBL1 : MAC : HTC : CAL : POS #HC , 2</p> |

Link Adaption Control - WLAN-N

Sets the parameters of the link adaption control field. The following subfields enable configuring the response signal of the link adaption.

B0 (1bit) MA - MA payload

When the MA (Management Action) field is set to 1, the payload of the QoS Null Data MPDU (Medium Access Controller Protocol Data Unit) is interpreted as a payload of the management action frame.

B1 (1bit) TRQ - Sounding Request

1 = Request to the responder to transmit a sounding PPDU (Physical layer Protocol Data Unit).

B2 (1bit) MRQ - MCS Request

1 = Request for feedback of MCS (Modulation Coding Scheme).

B3-B5 (3bit) MRS - MRQ Sequence Identifier

Set by sender to any value in the range '000'-'110' to identify MRQ. = Invalid if MRQ = 0

B6-B8 (3bit) MFS - MFB Sequence Identifier

Set to the received value of MRS. Set to '111' for unsolicited MFB.

B9-B15 (7bit) MFB - MCS Feedback

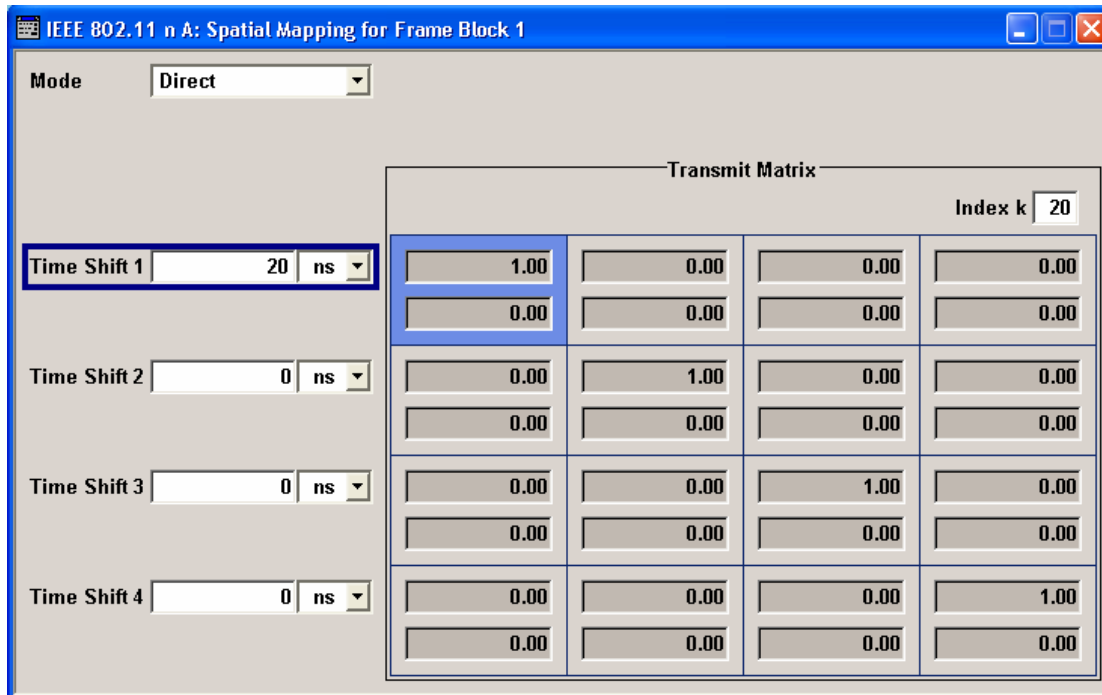
Link adaptation feedback containing the recommended MCS. When a responder is unable to provide MCS feedback or the feedback is not available, the MFB is set to 'all-ones' (default value) and also MFS is set to '1'.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:MAC:HT:LAC #H5A5A,16
```

Spatial Mapping - WLAN-N

The Wireless LAN standard IEEE 802.11n builds upon previous 802.11 standards by adding MIMO (Multiple-input, multiple-output). MIMO uses multiple transmitter and receiver antennas for increased data throughput via spatial multiplexing and increased range by exploiting the spatial diversity. Mode, time shifts and transmit parameters are defined in the menu **Spatial Mapping for Frame Block...**



When loaded, the spatial mapping dialog shows the frame block number for which this spatial mapping dialog is loaded. The transmit matrix corresponding to index k will have N_{TX} rows (representing the number of transmit antennas) and N_{STS} columns (representing the space time streams). The text label shows the spatial mapping mode selected in the dialog which is updated whenever the mode changes. In case of physical layer mode SOUNDING, a second sub-matrix horizontally sided to the transmit matrix with N_{TX} rows and N_{ESS} columns (representing the number of extended spatial streams) will be used as a transmit matrix for the Extended Long Training Fields (ELTF). The values displayed for the transmit matrices are additionally normalized (internally) so that the expectation of IQ sum-power of all antennas is 0 dB. Additionally for OFF, Direct, and Spatial Expansion, the expected IQ power is the same for all antennas and hence these modes can be intermixed (frame blocks for each) without caring about any power regulation issue. Relative RMS levels are displayed in the dialog for each antenna.

Mode- WLAN-N

Selects the spatial mapping mode for the selected frame block. Except of the beamforming mode, the matrix element values are loaded through the use of Info Class Methods.

Off

(only **LEGACY** frame)

The spatial mapping mode is switched off automatically.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:SMAP:MODE OFF
```

Direct

(only for physical modes **MIXED MODE** or **GREEN FIELD** and for $N_{TX} = N_{STS}$)

Sets the spatial mapping to **Direct** mode.

The transmit matrix is a CSD matrix, that is, a diagonal matrix of unit magnitude and complex values that represent cyclic shifts in the time domain.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:SMAP:MODE DIR
```

Spatial Expansion

(only for physical modes **MIXED MODE** or **GREEN FIELD**)

Sets the spatial mapping to **Expansion** mode.

The transmit matrix is the product of a CSD matrix and the Hadamard unitary matrix.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:SMAP:MODE EXP
```

Beamforming

Sets the spatial mapping to **Beamforming** mode.

The transmit matrix is the product of a CSD matrix and the Hadamard unitary matrix.

The **File** button is displayed to open a Browse popup. A file with source format *.bmf can be selected for the beamforming. The file must include 128 4*4 IQ elements (corresponding to the sub-carriers).

Note:

This feature is not available in this release.

Remote-control command:

```
SOUR:BB:WLNN:FBL1:SMAP:MODE BEAM
```

```
SOUR:BB:WLNN:FBL1:SMAP:BSEL
```

```
"d:\temp\test_sspi.bmf"
```


Index k - WLAN-N

Sets the index of the sub-carrier. A matrix is mapped to each sub-carrier. With the exception of k=0, the index can be set in the value range of -64 to 63.

Remote-control command:

SOUR : BB : WLNN : FBL1 : SMAP : IND 30

Time Shift - WLAN-N

Sets the spatial mapping time shift. This value is relevant for spatial mapping mode Direct and Spatial Expansion only.

Remote-control command:

SOUR : BB : WLNN : FBL1 : SMAP : TSH 1000

Transmit Matrix

| | | | |
|-------|------|------|------|
| -0.71 | 0.00 | 0.00 | 0.00 |
| 0.71 | 0.00 | 0.00 | 0.00 |
| 0.00 | 1.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 1.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | 0.00 | 0.00 | 1.00 |
| 0.00 | 0.00 | 0.00 | 0.00 |

I - WLAN-N

Displays the time shift value of element I of the selected row and column of the spatial transmit matrix.

Remote-control command:

SOUR : BB : WLNN : FBL1 : SMAP : ROW2 : COL2 : I ?

Q - WLAN-N

Displays the time shift value of element Q of the selected row and column of the spatial transmit matrix.

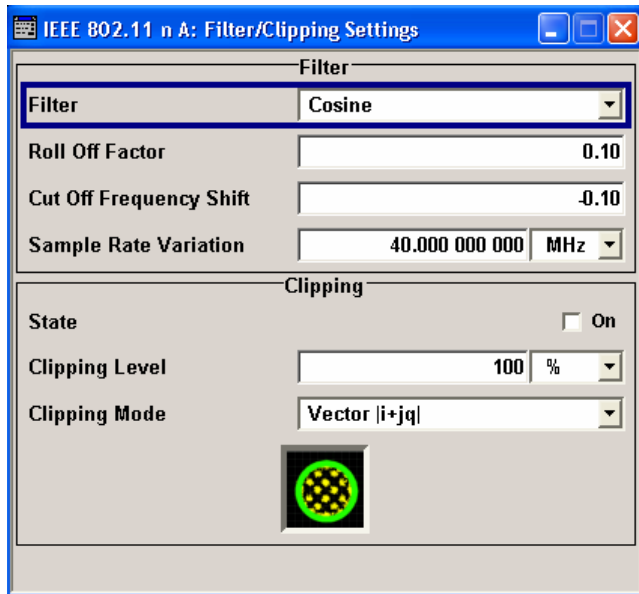
Remote-control command:

SOUR : BB : WLNN : FBL1 : SMAP : ROW2 : COL2 : Q ?

Filter, Clipping - WLAN-N

The **Filter, Clipping...** menu is reached via the WLAN-N main menu.

The filter type and parameters, the sample rate variation (**Filter** section) and clipping (**Clipping** section) are defined in this menu.



In the **Filter** section, the settings are made for the baseband filter.

Filter - WLAN-N

Selects baseband filter.

This opens a selection window containing all the filters available to the instrument.

The filter types are described in Section "*Baseband Filter - Custom Digital Mod*".

Remote-control command:

```
SOUR:BB:WLNN:FILT:TYPE RCOS
```

Roll Off Factor or BxT - WLAN-N

Enters the filter parameters.

The filter parameter offered (Roll Off factor or B*T) depends on the currently selected filter type. This parameter is always set to the default for each of the predefined filters.

Remote-control commands:

```
SOUR:BB:WLNN:FILT:PAR:APCO25 0.2
SOUR:BB:WLNN:FILT:PAR:COS 0.35
SOUR:BB:WLNN:FILT:PAR:GAUS 0.5
SOUR:BB:WLNN:FILT:PAR:PGA 0.5
SOUR:BB:WLNN:FILT:PAR:LPAS 0.5
SOUR:BB:WLNN:FILT:PAR:RCOS 0.35
SOUR:BB:WLNN:FILT:PAR:SPH 2
```

- Cut Off Frequency Factor - WLAN-N** (This feature is available for filter parameter Lowpass only.)
Sets the value for the cut off frequency factor. The cut off frequency of the lowpass filter can be adjusted to reach spectrum mask requirements.
Remote-control command:
SOUR:BB:WLNN:FILT:PAR:LPAS 0.5
- Cut Off Frequency Shift - WLAN-N** (This feature is available for filter parameter Cosine only.)
Sets the value for the cut off frequency shift. The cut off frequency of the cosine filter can be adjusted to reach spectrum mask requirements.
The value range is -1.0 to 1.0.
Remote-control command:
SOUR:BB:WLNN:FILT:PAR:COS:COFS 1.0
- Sample Rate Variation - WLAN-N**
Sets the sample rate of the signal.
A variation of this parameter only affects the ARB clock rate, all other signal parameters remain unchanged. If the sampling rate in the frame configuration menu is changed, this parameter is reset to the chosen sampling rate.
Remote-control command:
SOUR:BB:WLNN:SRAT:VAR 40000000
- Impulse Length - WLAN-N** (For R&S WinIQSIM2 only)
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.
Remote-control command:
SOUR:BB:WLNN:FILT:ILEN:AUTO ON
SOUR:BB:WLNN:FILT:ILEN 120
- Oversampling - WLAN-N** (For R&S WinIQSIM2 only)
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.
Remote-control command:
SOUR:BB:WLNN:FILT:OSAM:AUTO ON
SOUR:BB:WLNN:FILT:OSAM 20

The settings for clipping are collected in the Clipping section.

Clipping State - WLAN-N

Switches baseband clipping on and off.

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

WLAN-N signals may have high crest factors. High crest factors entail two basic problems:

- The nonlinearity of the power amplifier (compression) causes intermodulation which expands the spectrum (spectral regrowth).
- Since the level in the D/A converter is relative to the maximum value, the average value is converted with a relatively low resolution. This results in a high quantization noise.

Both effects increase the adjacent-channel power.

With baseband clipping, all the levels are 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. Since clipping the signal not only changes the peak value but also the average value, the effect on the crest factor is unpredictable.

Remote-control command:

```
SOUR:BB:WLNN:CLIP:STAT ON
```

Clipping Level - WLAN-N

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.

Remote-control command:

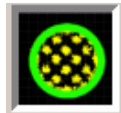
```
SOUR:BB:WLNN:CLIP:LEV 50
```

Clipping Mode - WLAN-N

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

Vector $|i + jq|$

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

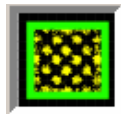


Remote-control command:

```
SOUR:BB:WLNN:CLIP:MODE VECT
```

Scalar $|i| + |q|$

The limit is related to the absolute maximum of all the $|i|$ and $|q|$ values. The I and Q components are mapped separately, the angle changes.



Remote-control command:

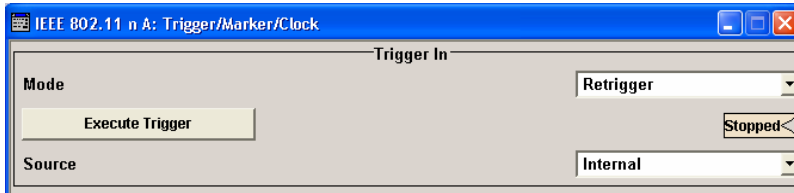
```
SOUR:BB:WLNN:CLIP:MODE SCAL
```

Trigger/Marker/Clock - WLAN-N

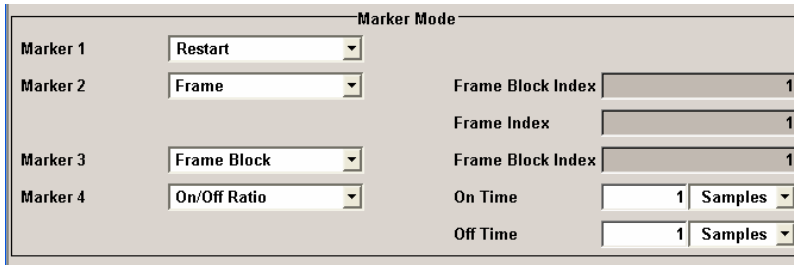
Note:

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

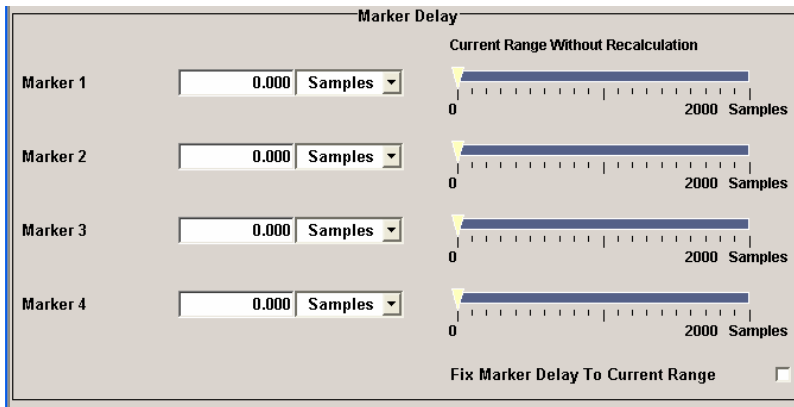
The **Trigger/Marker/Clock** menu can be reached via the IEEE 802.11n WLAN-N main menu.



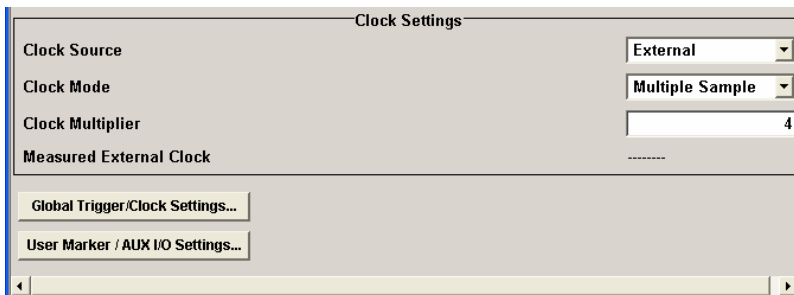
The **Trigger In** section is where the trigger for the IEEE 802.11n WLAN-N signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation (**Running** or **Stopped**) is indicated for all trigger modes.



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



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



The **Clock Settings** section is where the clock source is selected and - in the case of an external source - the clock type. The **Global Trigger/Clock Settings** button leads to a submenu for general trigger and clock settings. The **User marker / AUX I/O Settings** button leads to a submenu for mapping the AUX I/O connector on the rear of the instrument.

The **Trigger In** section is where the trigger for the IEEE 802.11n WLAN-N signal is set. The current status of the signal generation is displayed for all trigger modes.

Trigger Mode - WLAN-N

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

Selects trigger mode.

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

| | |
|------------------------|--|
| Auto | <p>The IEEE 802.11n WLAN-N signal is generated continuously.</p> <p>Remote-control command: SOUR:BB:WLNN:SEQ AUTO</p> |
| Retrigger | <p>The IEEE 802.11n WLAN-N signal is generated continuously. A trigger event (internal or external) causes a restart.</p> <p>Remote-control command: SOUR:BB:WLNN:SEQ RETR</p> |
| Armed_Auto | <p>The IEEE 802.11n WLAN-N-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously.</p> <p>Button Arm stops signal generation. A subsequent trigger event (internal with Execute Trigger or external) causes a restart.</p> <p>Remote-control command: SOUR:BB:WLNN:SEQ AAUT</p> |
| Armed_Retrigger | <p>The IEEE 802.11n WLAN-N-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.</p> <p>Button Arm stops signal generation. A subsequent trigger event (internal with Execute Trigger or external) causes a restart.</p> <p>Remote-control command: SOUR:BB:WLNN:SEQ ARET</p> |
| Single | <p>The IEEE 802.11n WLAN-N signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at Sequence Length. Every subsequent trigger event (internal with Execute Trigger or external) causes a restart.</p> <p>Remote-control command: SOUR:BB:WLNN:SEQ SING</p> |

Signal Duration Unit - WLAN-N (R&S SMx and R&S AMU instruments only)

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

Remote-control commands:
 SOUR:BB:WLNN:TRIG:SLUN SEQ

Signal Duration - WLAN-N (R&S SMx and R&S AMU instruments only)

Defines the length of the signal sequence to be output in the **Single** trigger mode. The input is to be expressed in samples. It is then possible to output deliberately just part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote-control commands:
 SOUR:BB:WLNN:TRIG:SLEN 2000

Running - Stopped - WLAN-N (R&S SMx and R&S AMU instruments only)

Displays the status of signal generation for all trigger modes. This display appears only when IEEE 802.11n WLAN-N is enabled (**State On**).

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

Running The IEEE 802.11n WLAN-N modulation signal is generated; a trigger was (internally or externally) initiated in triggered mode.

If Armed_Auto and Armed_Retrigger have been selected, generation of signals can be stopped with the Arm button. A new trigger (internally with Execute Trigger or externally) causes a restart.

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

Arm - WLAN-N (R&S SMx and R&S AMU instruments only)

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

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

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

Execute Trigger - WLAN-N (R&S SMx and R&S AMU instruments only)**(Trigger Source Internal only)**

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

Remote-control commands:

SOUR:BB:WLNN:TRIG:SOUR INT

SOUR:BB:WLNN:SEQ RETR

SOUR:BB:WLNN:TRIG:EXEC

Trigger Source - WLAN-N (R&S SMx and R&S AMU instruments only)

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

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

Remote-control command:

SOUR:BB:WLNN:TRIG:SOUR INT

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

Remote-control command:

SOUR:BB:WLNN:TRIG:SOUR OBAS

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

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

Remote-control command:

SOUR:BB:WLNN:TRIG:SOUR EXT | BEXT

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

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

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

Note

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

Remote-control command:

```
SOUR:BB:WLNN:TRIG:EXT:DEL 3
SOUR:BB:WLNN:TRIG:OBAS:DEL 3
```

Trigger Inhibit - WLAN-N**(only trigger source External or, in case of two-path instruments, trigger source Internal Other baseband)**

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.

Note:

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

Remote-control command:

```
SOUR:BB:WLNN:TRIG:EXT:INH 1000
SOUR:BB:WLNN:TRIG:OBAS:INH 1000
```

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

Marker x Mode - WLAN-N

Selects a marker signal for the associated MARKER output.

Restart

A marker signal is generated at the start of each signal sequence (period = all frame blocks).

Remote-control command:

```
SOUR:BB:WLNN:TRIG:OUTP1:MODE REST
```

Frame Block

Number of Frame Blocks = 1, that is, a marker signal is generated at the start of each frame block. Otherwise a specific frame block index is given and the whole frame block is marked.

Frame Block Index

Remote-control command:

```
SOUR:BB:WLNN:TRIG:OUTP1:MODE FBL
SOUR:BB:WLNN:TRIG:OUTP1:FBIN 1
```

Frame

Number of Frame Blocks = 1, that is, a marker signal is generated at the start of each frame in the single frame block. Otherwise, the frame block and frame index are entered and the specific frame is masked.

Frame Index

Remote-control command:

```
SOUR:BB:WLNN:TRIG:OUTP1:MODE FRAM
SOUR:BB:WLNN:TRIG:OUTP1:FBIN 1
SOUR:BB:WLNN:TRIG:OUTP1:FIND 50
```

Frame Active Part

Number of Frame Blocks = 1, that is, a marker signal is generated to mark every active part of each frame.

The active data transfer part (PPDU) of a frame period is marked with high, the inactive part (idle time) with low. This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

Otherwise, the frame block and frame index are entered and the active part of the specific frame is masked.

Remote-control command:

```
SOUR:BB:WLNN:TRIG:OUTP1:MODE FAP
SOUR:BB:WLNN:TRIG:OUTP1:FBIN 1
SOUR:BB:WLNN:TRIG:OUTP1:FIND 50
```

Pulse

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

Divider
Frequency MHz

Remote-control commands:

```
SOUR:BB:WLNN:TRIG:OUTP1:MODE PULS
SOUR:BB:WLNN:TRIG:OUTP1:PULS:DIV 4
SOUR:BB:WLNN:TRIG:OUTP1:PULS:FREQ?
```

Pattern

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

| |
|-----------|
| 0000 0000 |
|-----------|

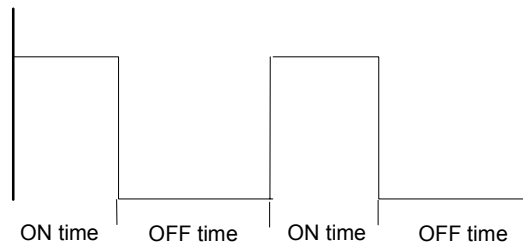
Remote-control commands:

```
SOUR:BB:WLNN:TRIG:OUTP1:MODE PATT
SOUR:BB:WLNN:TRIG:OUTP1:PATT #B1111,4
```

ON/OFF ratio

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

Start of signal



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

| | | |
|----------|---|-----|
| On Time | 2 | Sym |
| Off Time | 3 | Sym |

Remote-control commands:

```
SOUR:BB:WLNN:TRIG:OUTP1:MODE RAT
SOUR:BB:WLNN:TRIG:OUTP1:OFFT 20
SOUR:BB:WLNN:TRIG:OUTP1:ONT 20
```

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

Note:

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

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

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

The input is expressed as a number of samples.

If the setting "**Fix marker delay to 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.

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

Remote-control command:

```
SOUR:BB:WLNN:TRIG:OUTP2:DEL 20
```

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

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

The delay can be defined by moving the setting mark.

Remote-control command:

```
SOUR:BB:WLNN:TRIG:OUTP2:DEL:MAX?
```

```
SOUR:BB:WLNN:TRIG:OUTP2:DEL:MIN?
```

Fix marker delay to current range - WLAN-N**(R&S SMx and R&S AMU instruments only)**

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

Remote-control command:

```
SOUR:BB:WLNN:TRIG:OUTP:DEL:FIX ON
```

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

Note:

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

Clock Source - WLAN-N**(R&S SMx and R&S AMU instruments only)**

Selects the clock source (also see section "*Clock Signals*").

Internal

The internal clock reference is used to generate the sample clock.

Remote-control command:

SOUR:BB:WLNN:CLOC:SOUR INT

External

The external clock reference is fed in as the sample clock or multiple thereof via the CLOCK connector.

The sample rate must be correctly set to an accuracy of $\pm 2\%$ (see data sheet).

The polarity of the clock input can be changed with the aid of **Global Trigger/Clock Settings**.

In the case of two-path instruments, this selection applies to path A.

Remote-control command:

SOUR:BB:WLNN:CLOC:SOUR EXT

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

(Clock source **External** only)

Enters the type of externally supplied clock.

Sample

A sample clock is supplied via the CLOCK connector.

Remote-control command:

SOUR:BB:WLNN:CLOC:MODE SAMP

Multiple Sample

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

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

Remote-control command:

SOUR:WLNN:CLOC:MODE MSAM

- Clock Multiplier - WLAN-N (R&S SMx and R&S AMU instruments only)**
Enters the multiplication factor for clock type **Multiple**.
Remote-control command:
SOUR:BB:WLNN:CLOC:MULT 4
- Measured External Clock - WLAN-N (R&S SMx and R&S AMU instruments only)**
(Clock source **External** only)
Displays the measured frequency of the external clock signal. This enables the user to permanently monitor the frequency of the externally introduced clock.
This information is displayed only if the external clock source has been selected.
Remote-control command:
:CLOC:INP:FREQ?
- Global Trigger/Clock Settings - WLAN-N (R&S SMx and R&S AMU instruments only)**
Calls the **Global Trigger/Clock/Input Settings** menu. This menu is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.
In the case of two-path instruments, these settings are valid for both paths.
The parameters in this menu affect all digital modulations and standards, and are described in the section "[Global Trigger/Clock/Input Settings – Setup -Environment](#)".
- User Marker / AUX I/O Settings - WLAN-N (R&S SMx and R&S AMU instruments only)**
Calls the **User Marker AUX I/O Settings** menu. This menu is used to map the connector on the rear of the instruments, see section "[User Marker - AUX IO - Setup-Environment-Global...Settings](#)".

SOURce:BB:WLAN-N Subsystem

Remote-control Commands

Introduction - WLAN-N - Remote-control Commands

This subsystem contains commands for the primary and general settings of the IEEE 802.11n WLAN standard. These settings concern activation and deactivation of the standard, setting the transmission direction, filter, clock, trigger and clipping settings, defining the frame duration and the sequence length, as well as the preset setting.

The commands for defining the frame configuration for physical layer modes OFDM and CCK/PBCC are described in the next section. The commands are divided up in this way to make the comprehensive SOURce:BB:WLNN subsystem clearer.

The numerical suffix at SOURce distinguishes between path A and path B for two-path instruments:
 SOURce<1> = path A
 SOURce2 = path B

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

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

Command Table - WLAN-N

| Command | Parameters | Default unit | Comments |
|--|-------------------------|--------------|----------|
| [SOURce<[1]2>:]BB:WLNN:ANTenna:MODE | A1 A2 A3 A4 | | |
| [SOURce<[1]2>:]BB:WLNN:ANTenna:SYSTem | CARTesian CYLindrical | | |
| [SOURce<[1]2>:]BB:WLNN:ANTenna:TCHain<[1]...4>;OUTPut:DESTination | OFF BB FILE | | |
| [SOURce<[1]2>:]BB:WLNN:ANTenna:TCHain<[1]...4>;OUTPut:FSElect | <file name> | | |
| [SOURce<[1]2>:]BB:WLNN:ANTenna:TCHain<[1]...4>;TX<[1]...4>;IMAGinary | -1000...1000 | | |
| [SOURce<[1]2>:]BB:WLNN:ANTenna:TCHain<[1]...4>;TX<[1]...4>;MAGNitude | 0...1000 | | |
| [SOURce<[1]2>:]BB:WLNN:ANTenna:TCHain<[1]...4>;TX<[1]...4>;PHASe | 0...35999 | | |
| [SOURce<[1]2>:]BB:WLNN:ANTenna:TCHain<[1]...4>;TX<[1]...4>;REAL | -1000...1000 | | |
| [SOURce<[1]2>:]BB:WLNN:BWidth | BW20 BW40 | MHz | |
| [SOURce<[1]2>:]BB:WLNN:CFBLock | | | No query |
| [SOURce<[1]2>:]BB:WLNN:CLIPping:LEVel | 1...100 | PCT | |
| [SOURce<[1]2>:]BB:WLNN:CLIPping:MODE | VECTor SCALar | | |
| [SOURce<[1]2>:]BB:WLNN:CLIPping:STATe | ON OFF | | |
| [SOURce<[1]2>:]BB:WLNN:CLOCK:MODE | CHIP MCHip | | |
| [SOURce<[1]2>:]BB:WLNN:CLOCK:MULTIplier | 1... 64 | | |
| [SOURce<[1]2>:]BB:WLNN:CLOCK:SOURce | EXTernal INTernal | | |
| [SOURce<[1]2>:]BB:WLNN:DFBLock | | | No query |
| [SOURce<[1]2>:]BB:WLNN:FBLock:APPend | | | No query |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>;CODing:ENCoder | E1 E2 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>;CODing:RATE | CR2D3 CR3D4 CR5D6 | | NEU!!! |

| Command | Parameters | Default unit | Comments |
|---|---|--------------|------------|
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:CODing:TYPE | OFF BCC | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:DATA | PN9 PN11 PN15 PN16 PN20 PN21 PN23 ZERO ONE PATTErn DLISt | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:DATA:BPSymbol | | | Query only |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:DATA:DSElection | <data list> | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:DATA:LENGth | 0...4095 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:DATA:PATT | <bit pattern> | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:DATA:RATE | | | Query only |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:DATA:SYMBols | 1...Max | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:ESSTream | 1...4 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:FCOunt | 1...1024 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:GUARd | SHORT LONG | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:ILEaver:STATe | ON OFF | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:INSert | | | No query |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:ITIME | 0.0...1.0 | sec | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:ADDRess<1 2 3 4> | #H0000 0000 0000,48 ... #FFFFFFFF FF,48 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:ADDRess<1 2 3 4>:STA Te | ON OFF | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:DID | #H0000,16 ... #HFFFF,16 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol | #H0000,16 ... #HFFFF,16 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:FDS | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:MDATa | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:MFRagments | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:ORDer | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:PMANageme nt | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:PVERsion | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:RETRY | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:SUBType | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:TDS | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:TYPE | #H0,2 ... #H3,2 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtrol:WEP | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCSequence:STATe | ON OFF | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl | #H0,1 ... #HF,4 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:ACConstraint | #H0,1 ... #H1,1 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:CALibration: POSition | #H0,2 ... #H3,2 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:CALibration: SEQuence | #H0,2 ... #H3,2 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:CSISteering | #H0,2... ... #H3,2 | | |
| [SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:FREQuest | #H0,2... ... #H3,2 | | |

| Command | Parameters | Default unit | Comments |
|---|---|--------------|----------|
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:LAControl | #H0000,16 ... #HFFFF,16 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:RDGMore | #H0,1 ... #H1,1 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:REServed | #H0,5...H5,2 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:STATe | ON OFF | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:ZLF | #H0,1 ... #H1,1 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:QSControl | #H0000,16 ... #HFFFF,16 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:QSControl:STATe | ON OFF | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:FRAGment:INCRement | 0 ... 1024 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:FRAGment:START | #H0,1 ... #HF,4 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:SEQuence:INCRement | 0 ... 1024 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:SEQuence:START | #H0,1 ... #HFFF,12 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:STATe | ON OFF | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:STATe | ON OFF | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MODulation<1...4> | BPSK QPSK QAM16 QAM64 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:PMODE | LEGacy MIXed GFieId | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:PREamble:STATe | ON OFF | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:SCRambler:MODE | OFF USER RANDom | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:SCRambler:PATtern | <bit pattern> | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:SERVice:PATtern | <bit pattern> | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:SSTream | 1...4 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:STATe | ON OFF | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:STBC:STATe | INACTive ACTive | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:STSTream | 1...4 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:TDWindowing:STATe | ON OFF | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:TMODE | L20 LDUP LUP LLOW HT20 HT40 HTDup HTUP HTLow | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:TTIME | 0...1000 | ns | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:TYPE | DATA SOUNDing | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...1000>:SMAPping:BSElection | <file name> | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...1000>:SMAPping:INDEX | -64...63 | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...1000>:SMAPping:MODE | OFF DIRect EXPAansion BEAMforming | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...1000>:SMAPping:ROW<[1]...4>:COL<[1]...4>:I | | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...1000>:SMAPping:ROW<[1]...4>:COL<[1]...4>:Q | | | |
| [SOURce<[1]>:]BB:WLNN:FBLock<[1]...1000>:SMAPping:TSHift | -32000...32000 | | |
| [SOURce<[1]>:]BB:WLNN:FILTer:ILENgtH | 1...128 | | |

| Command | Parameters | Default unit | Comments |
|---|--|--------------|------------|
| [SOURCE<[1]>:]BB:WLNN:FILTER:ILENGTH:AUTO | ON OFF | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:OSAMPLING | 1...32 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:OSAMPLING:AUTO | ON OFF | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:PARAMETER:APCO25 | 0.15 ... 2.5 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:PARAMETER:COSINE | 0.00 ... 0.99 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:PARAMETER:COSINE:COFS | 0.05 ... 2.0 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:PARAMETER:GAUSS | 0.15 ... 2.5 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:PARAMETER:LPASS | 0.05...2.0 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:PARAMETER:PGAUSS | 0.15 ... 2.5 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:PARAMETER:RCOSINE | 0.00 ... 0.99 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:PARAMETER:SPHASE | 0.15 ... 2.5 | | |
| [SOURCE<[1]>:]BB:WLNN:FILTER:TYPE | RCOSINE LPASS COSINE GAUSS LGAUSS CONE COF705 PGAUSS COEQUALIZER COFEQUALIZER C2K3x APCO25 SPHASE EWPSHAPE RECTANGLE ENPSHAPE DIRAC | | |
| [SOURCE<[1]>:]BB:WLNN:PFBLock | | | No query |
| [SOURCE<[1]>:]BB:WLNN:PRESet | | | No query |
| [SOURCE<[1]>:]BB:WLNN:SEQUence | AUTO RETRIGGER AAUTO ARETRIGGER SINGLE | | |
| [SOURCE<[1]>:]BB:WLNN:SETTING:CATalog | | | Query only |
| [SOURCE<[1]>:]BB:WLNN:SETTING:DELEte | <file_name> | | |
| [SOURCE<[1]>:]BB:WLNN:SETTING:LOAD | <file_name> | | |
| [SOURCE<[1]>:]BB:WLNN:SETTING:STORe | <file_name> | | |
| [SOURCE<[1]>:]BB:WLNN:SRATE:VARiation | 400 Hz ... 40 MHz | Hz (c/s) | |
| [SOURCE<[1]>:]BB:WLNN:STATE | ON OFF | | |
| [SOURCE<[1]>:]BB:WLNN::TDWindowing:STATE | ON OFF | | |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:ARM:EXECute | | | No query |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:EXECute | | | No query |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:OBASeband:DELAy | 0 ... (2 ³² - 1) samples | | |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:OBASeband:INHibit | 0 ... (2 ³² - 1) samples | | |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:OUTPut:DELAy:FIXed | ON OFF | Hz | |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:OUTPut<[1]...4>:DELAy | 0 ... (2 ³² - 1) samples | | |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:OUTPut<[1]...4>:DELAy:FBINdex | 0...100 | | |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:OUTPut<[1]...4>:DELAy:FINDex | 0...1024 | | |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:OUTPut<[1]...4>:DELAy:MAXimum | | | Query only |
| [SOURCE<[1]>:]BB:WLNN:TRIGGER:OUTPut<[1]...4>:DELAy:MINimum | | | Query only |

| Command | Parameters | Default unit | Comments |
|--|---|--------------|------------|
| [SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:MODE | REStart FRAMe PULSe PATTeRn RATio FBLOck FAPart | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:OFFTime | 2 ... (2 ²⁴ - 1) samples | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:ONTime | 2 ... (2 ²⁴ - 1) samples | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:PATTeRn | #B0,1...#B111..1, 32 | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:PULSe:DIVider | 2 ... 1024 | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:PULSe:FREQUency | | | Query only |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:RMODe | | | Query only |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:SENGth | 0 ... (2 ³² - 1) samples | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:SLUNit | SAMPlE SEQUence | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger:SOURce | EXTeRnal INTeRnal BEXTeRnal OBASeband | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger[EXTeRnal<[1]2>]:DELay | 0 ... (2 ³² - 1) samples | | |
| [SOURce<[1]2>:]BB:WLNN:TRIGger[EXTeRnal<[1]2>]:INHibit | 0 ... (2 ³² - 1) samples | | |
| [SOURce<[1]2>:]BB:WLNN:VERSion | | | Query only |
| [SOURce<[1]2>:]BB:WLNN:WAVEform:CREate | | | No query |

SOURce-WLAN-N - Antenna

[SOURce<[1]2>:]BB:WLNN:ANTenna:MODE A1 | A2 | A3 | A4

The command selects the number of transmit antennas to be used.

Example: "BB:WLNN:ANT:MODE A1"
'one antenna is used for transmission.'

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| A1 | 1 | Device-specific |

SOURce-WLAN-N - Mapping Coordinates

[SOURce<[1]2>:]BB:WLNN:ANTenna:SYSTem CARTesian | CYLindrical

The command selects the coordinate system of the transmission chain matrix.

Example: "BB:WLNN:ANT:SYST CART"
'sets the coordinate system of the transmission chain matrix to Cartesian.'

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| CARTesian | - | Device-specific |

SOURce-WLAN-N - Transmission Chain Mapping - Output

[SOURce<[1]|2>:]BB:WLNN:ANTenna:TCHain<[1]...4>:OUTPut:DESTination OFF | BB | FILE

The command selects the destination of the calculated IQ chains.

Parameters: **OFF**

No mapping takes place.

BB

The IQ chain is output to the baseband. Exactly one output stream can be mapped as "Baseband".

FILE

The IQ chain is saved in a file.

Example: "BB:WLNN:ANT:TCH1:OUTP:DEST BB"
 'the IQ chain is saved in a file.

| *RST value | Resolution | SCPI |
|---|------------|-----------------|
| OFF (for antenna 2, 3, 4) Baseband (for antenna 1) | - | Device-specific |

SOURce-WLAN-N - Transmission Chain Mapping - Output File Select

[SOURce<[1]|2>:]BB:WLNN:ANTenna:TCHain<[1]...4>:OUTPut:FSElect <file name>

The command saves the IQ chain in a file.

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

Example: "BB:WLNN:ANT:TCH1:OUTP:FSEL 'd:\files\wlnn_1.wv'"
 'saves the IQ chain in the selected file.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Transmission Chain Mapping - Imaginary

[SOURce<[1]|2>:]BB:WLNN:ANTenna:TCHain<[1]...4>:TX<[1]...4>:IMAGinary -1000...1000

The command enters the value for the Imaginary coordinate.

Example: "BB:WLNN:ANT:TCH1:TX2:IMAG 500"
 'sets the imaginary coordinate for the selected transmission chain to 500.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 | 0.01 | Device-specific |

SOURce-WLAN-N - Transmission Chain Mapping - Magnitude

[SOURce<[1]>:]BB:WLNN:ANTenna:TCHain<[1]...4>:TX<[1]...4>:MAGNitude 0...1000

The command enters the value for the Magnitude coordinate.

Example: "BB:WLNN:ANT:TCH1:TX2:MAG 500"
'sets the magnitude coordinate for the selected transmission chain to 500.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 | 0.01 | Device-specific |

SOURce-WLAN-N - Transmission Chain Mapping - Phase

[SOURce<[1]>:]BB:WLNN:ANTenna:TCHain<[1]...4>:TX<[1]...4>:PHASe 0...35999

The command enters the value for the Phase coordinate.

Example: "BB:WLNN:ANT:TCH1:TX2:PHAS 500"
'sets the phase coordinate for the selected transmission chain to 500.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 | 0.01 | Device-specific |

SOURce-WLAN-N - Transmission Chain Mapping - Real

[SOURce<[1]>:]BB:WLNN:ANTenna:TCHain<[1]...4>:TX<[1]...4>:REAL -1000...1000

The command enters the value for the Real coordinate.

Example: "BB:WLNN:ANT:TCH1:TX2:REAL 500"
'sets the real coordinate for the selected transmission chain to 500.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 | 0.01 | Device-specific |

SOURce-WLAN-N - Transmission Bandwidth

[SOURce<[1]]2>:]BB:WLNN:BWidth BW20 | BW40

The command selects the transmission bandwidth. Whenever the bandwidth changes from 40 MHz to 20 MHz, the frame blocks are validated because some of them could be invalid in 20 MHz (invalid TX Mode).

Example: "BB:WLNN:BW BW40"
'sets the transmission bandwidth to 40 MHz.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| BW40 | | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Copy

[SOURce<[1]]2>:]BB:WLNN:CFBLock 1...100

The command copies the selected frame block.

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

Example: "BB:WLNN:CFBL5"
'copies frame block 5 for later insertion.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Clipping Level

[SOURce<[1]]2>:]BB:WLNN:CLIPping:LEVel 0...100 PCT

The command sets the limit for level 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.

Level clipping is activated with the command SOUR:BB:WLNN:CLIP:STAT ON

Example: "BB:WLNN:CLIP:LEV 80PCT"
'sets the limit for level clipping to 80% of the maximum level.

"BB:WLNN:CLIP:STAT ON"
'activates level clipping.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 100 PCT | 1 | Device-specific |

SOURce-WLAN-N - Clipping Mode**[SOURce<[1]|2>:]BB:WLNN:CLIPping:MODE** VECTor | SCALar

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

Parameters: **VECTor**

The reference level is the amplitude $|i+jq|$.

SCALar

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

Example:

"BB:WLNN:CLIP:MODE SCAL"

'selects the absolute maximum of all the I and Q values as the reference level.

"BB:WLNN:CLIP:LEV 80PCT"

'sets the limit for level clipping to 80% of this maximum level.

"BB:WLNN:CLIP:STAT ON"

'activates level clipping.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| VECTor | - | Device-specific |

SOURce-WLAN-N - Clipping State**[SOURce<[1]|2>:]BB:WLNN:CLIPping:STATe** ON | OFF

The command activates level clipping (Clipping). The value is defined with the command [SOURce:]BB:WLNN:CLIPping:LEVel, the mode of calculation with the command [SOURce:]BB:WLNN:CLIPping:MODE.

Example:

"BB:WLNN:CLIP:STAT ON"

'activates level clipping.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| OFF | | Device-specific |

SOURce-WLAN-N - Clock Mode

[SOURce<[1]|2>:]BB:WLNN:CLOCK:MODE SAMPlE | MSAMPlE

Note:

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

The command enters the type of externally supplied clock (:BB:WLNN:CLOCK:SOURCE EXTERNAL).

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

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

Example: "BB:WLNN:CLOCK:MODE SAMP"
'selects clock type **Sample**, i.e. the supplied clock is a sample clock.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| SAMPlE | - | Device-specific |

SOURce-WLAN-N - Clock Multiplier

[SOURce<[1]|2>:]BB:WLNN:CLOCK:MULTIPLIER 1...64

Note:

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

*This command is available for clock source **External** and in clock mode **Multiple Sample** only.*

For two path instruments the Multiple Sample mode is currently available for path A only.

The command specifies the multiplier for clock type **Multiplied** (:BB:WLNN: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.

Example: "BB:WLNN:CLOCK:SOURCE EXT"
'selects the external clock source. The clock is supplied via the CLOCK connector.

"BB:WLNN:CLOCK:MODE MSAM"
'selects clock type **Multiplied**, i.e. the supplied clock has a rate which is a multiple of the sample rate.

"BB:WLNN:CLOCK:MULT 12"
'the multiplier for the external clock rate is 12.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 4 | 1 | Device-specific |

SOURce-WLAN-N - Clock Source

[SOURce<[1]|2>:]BB:WLNN:CLOCK:SOURce INTernal | EXTernal | AINTernal

Note:

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

The command selects the clock source.

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

Parameter: **INTernal**

 The internal clock reference is used.

EXTernal

 The external clock reference is supplied to the CLOCK connector.

Example:

"BB:WLNN:CLOC:SOUR EXT"

'selects an external clock reference. The clock is supplied via the CLOCK connector.

"BB:WLNN:CLOC:MODE SAMP"

'specifies that a sample clock is supplied via the CLOCK connector.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| INTernal | - | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Delete

[SOURce<[1]|2>:]BB:WLNN:DFBLock 1...100

The command deletes the selected frame block.

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

Example:

"BB:WLNN:DFBL 10"

'deletes the selected frame block.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Append

[SOURce<[1]|2>:]BB:WLNN:FBLock:APPend

The command appends a frame block to the end of the frame blocks list.

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

Example: "BB:WLNN:FBL:APP"
'appends a frame block to the end of the frame blocks list.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Encoders

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:CODing:ENCoder?

The command queries the number of encoders to be used. This value depends on the data rate. For data rate ≤ 300 Mps, this value is 1. Otherwise the number of encoders is 2.

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

Example: "BB:WLNN:FBL5:COD:ENC?"
'queries the number of encoders to be used.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Coding Rate

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:CODing:RATE CR1D2 | CR2D3 | CR3D4 | CR5D6

This command selects the coding rate.

Example: "BB:WLNN:FBL5:COD:RATE CR1D2"
'sets the selected coding rate.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| CR1D2 | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Channel Coding

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:CODing:TYPE OFF | BCC

The command selects whether channel coding (BCC) is used or not.

Example: "BB:WLNN:FBL5:COD:TYPE OFF"
'no channel coding is used.'

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| BCC | | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Data

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:DATA ZERO | ONE | PATTErn | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt

This command selects the data source.

Parameters: PNxx

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

DLISt

A data list is used. The data list is selected with the command
BB:WLNN:FBLocks:DATA:DSEL

ZERO | ONE

Internal 0 and 1 data is used.

PATTErn

Internal data is used The bit pattern for the data is defined by the command
BB:WLNN:FBLocks:DATA:PATTErn.

Example: "BB:WLNN:FBL5:DATA PN9"
'sets PN9 as the data source.'

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| PN9 | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Data Bits Per Symbol

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:DATA:BPSymbol?

The command queries the number of data bits sent by an OFDM symbol on all spatial streams. This command is a query command and therefore has no *RST value.

Example: "BB:WLNN:FBL5:DATA:BPS?"
 'queries the number of data bits sent by an OFDM symbol on all spatial streams.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Data List

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:DATA:DSEL <data list>

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

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

Example: BB:WLNN:FBL5:DATA DLIS
 'selects the Data Lists data source.
 "MMEM:CDIR 'D:\Lists\DM\IqData'"
 'selects the directory for the data lists.
 "BB:WLNN:FBL5:DATA:DSEL 'dlist1'"
 'selects file 'dlist1' as the data source. This file must be in the directory D:\Lists\DM\IqData and have the file extension *.dm_iqd.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Data Length

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:DATA:LENGh 0...4095

The command enters the size of the data field in bytes.

For Data Length = 0, no data field will be generated for the case of a sounding frame.

The maximum data length depends on the physical mode: In LEGACY mode, the maximum value is 4061 Bytes. In MIXED MODE and GREEN FIELD, the maximum value is 65495 Bytes.

The data length is related to the number of data symbols. Whenever the data length changes, the number of data symbols is updated and vice versa.

Example: "BB:WLNN:FBL5:DATA:LENG 500
'sets the data length to 500 Bytes.

| *RST value | Resolution | SCPI |
|--|------------|-----------------|
| 1024 (for LEGACY) 65495 (for GREEN FIELD or MIXED MODE) | - | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Pattern

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:DATA:PATTern <bit pattern>

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

Example: "BB:WLNN:FBL5:DATA:PATT #H3F,8"
'sets the bit pattern.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Data Rate

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:DATA:RATE?

The command queries the PPDU data rate.

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

Example: "BB:WLNN:FBL5:DATA:RATE?"
'queries the data rate.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Number of Data Symbols**[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:DATA:SYMBOLs 1...Max**

The command sets the number of data symbols per frame block.

If the number of OFDM data symbols is changed, the generator calculates the data field length as a function of the set PPDU bit rate and displays it at Data Length.

Example: "BB:WLNN:FBL5:DATA:SYMB 1"
'sets the number of data symbols per frame block to 1.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Extended Spatial Streams**[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:ESSTream 1...4**

The command enters the value of the extended spatial streams. This field is active for frame block type SOUNDING only to probe additional dimensions to the channel.

Example: "BB:WLNN:FBL5:ESSTR 4"
'sets the number of the extended spatial streams to 4.

| *RST value | Resolution | SCPI |
|------------|------------|------|
| 1 | 1 | |

SOURce-WLAN-N - Frame Block Configuration - Frames**[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:FCOut 1...1024**

The command sets the number of frames to be transmitted in the current frame block.

Example: "BB:WLNN:FBL5:FCO 1"
'sets the number of transmitted frames in the current frame block to 1.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 1 | 1 | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Guard

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:GUARd SHORT | LONG

The command selects whether a long or short guard interval is used for the OFDM guard. In physical mode GREEN FIELD or LEGACY, only long guard intervals are possible. In this case, the field is read-only.

Example: "BB:WLNN:FBL5:GUAR LONG"
'sets a long guard interval.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| LONG | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Interleaver Active

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:ILEaver ON | OFF

The command activates/deactivates the interleaver of the data field.

Example: "BB:WLNN:FBL5:ILE:STAT ON"
'activates the interleaver.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| ON | - | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Insert

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:INSert

The command adds a default frame block before the selected frame block.

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

Example: "BB:WLNN:FB20:INS"
'inserts a default frame block before the selected frame block.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Idle Time

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:ITIME 0.0 ...1.0 sec

The command sets the time interval separating two frames in this frame block. The default unit for the time interval are seconds. However, the time interval can be set in milliseconds. In this case the unit has to be set.

Example: "BB:WLNN:FBL5:ITIME 2.5ms"
'sets the idle time to 2.5 msec.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 | 0.001 | Device-specific |

SOURce-WLAN-N - MAC Address

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:ADDRess<1|2|3|4> #H000000000000,48 #HFFFFFFFFFFFF,48

The command enters the value of the address fields 1 ... 4. Exactly 48 bits must be entered. Each address is 6 bytes (48 bit) long. The addresses can be entered in hexadecimal form in the entry field of each address field. The least significant byte (LSB) is in left notation.

Example: "BB:WLNN:FBL1:MAC:ADDR2 #H124836C7EA54,48"
'set the value for address field 2.

| *RST value | Resolution | SCPI |
|-------------------|------------|-----------------|
| #H000000000000,48 | | Device-specific |

SOURce-WLAN-N - MAC Address State

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:ADDRess<1|2|3|4>:STATe ON | OFF

The command activates/deactivates the selected address field.

Example: "BB:WLNN:FBL1:MAC:ADDR2:STAT ON"
'activates generation of address field 2.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| OFF | | Device-specific |

SOURce-WLAN-N - Duration Id

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:DID #H0000,16 ... #HFFFF,16

The command enters the value of the duration ID field. Depending on the frame type, the 2-byte field Duration/ID is used to transmit the association identity of the station transmitting the frame or it indicates the duration assigned to the frame type. Exactly 16 bit must be entered.

Example: "BB:WLNN:FBL1:MAC:DID #HA5A5,16"
'sets the value of the duration ID field.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| #H0000,16 | - | Device-specific |

SOURce-WLAN-N - Frame Control

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll #H0000,16 ... #HFFFF,16

The command enters the value of the frame control field. The frame control field has a length of 2 bytes (16 bits) and is used to define the protocol version, the frame type, and its function, etc.. As an alternative, the individual bits can be set with the following commands.

Example: "BB:WLNN:FBL1:MAC:FCON #H100A,16"
'sets the value of the frame control field.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| #H0000,16 | | Device-specific |

SOURce-WLAN-N - Frame Control Individual Bits

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:FDS #H0,1 ... #H1,1
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:MDATa #H0,1 ... #H1,1
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:MFRagments #H0,1 ... #H1,1
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:ORDer #H0,1 ... #H1,1
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:PMANagement #H0,1 ... #H1,1
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:PVERsion #H0,1 ... #H1,1
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:RETRY #H0,1 ... #H1,1
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:SUBType #H0,4 ... #HF,4
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:TDS #H0,1 ... #H1,1
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:TYPE #H0,2 ... #H3,2
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCONtroll:WEP #H0,1 ... #H1,1

The command enters the value of the individual bits of the frame control field.

Example: "BB:WLNN:FBL1:MAC:FCON:MDAT #H1,1"
'sets the value of the More Data bit.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| #H0,1 | | Device-specific |

SOURce-WLAN-N - FCS (checksum)

[SOURce<[1]]2>:]BB:WLNN:FBLock<[1]...100>:MAC:FCS:STATe ON | OFF

Activates/deactivates the calculation of the FCS (frame check sequence). The standard defines a 32-bit (4-byte) checksum to protect the MAC header and the user data (frame body).

Example: "BB:WLNN:FBL1:MAC:FCS:STAT ON"
'activates the calculation of the FCS.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| OFF | | Device-specific |

SOURce-WLAN-N - HT Control

[SOURce<[1]]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl #H0000,4 ... #HFFFF,4

The command sets the value for the HT control field.

Example: "BB:WLNN:FBL1:MAC:HTC #H5a5a5a5a,4"
'sets the value for the HT control field.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0000 0000 | - | Device-specific |

SOURce-WLAN-N - AC Constraint

[SOURce<[1]]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:ACConstraint #H0,1 ... #H1,1

The command sets the value for the AC signal field.

0 = The response may contain data from any TID (Traffic Identifier).

1 = The response may contain data only from the same AC as the last Data received from the initiator.

Example: "BB:WLNN:FBL1:MAC:HTC:ACC #H0,1"
'sets the AC signal field to 0 (The response may contain data from any TID)

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

SOURce-WLAN-N - Calibration Position

[SOURce<[1]]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:CALibration:POSition #H0,2... ... #H3,2

The command sets the value for the calibration position.

00 = Not a calibration frame (Default setting)

01 = Calibration Start

10 = Sounding Response

11 = Sounding Complete

Example: "BB:WLNN:FBL1:MAC:HTC:CAL:POS #H0,2"
'sets the Calibration Position signal field to 00 (Not a calibration frame).

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Calibration Sequence

[SOURce<[1]]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:CALibration:SEQuence #H0,2... ... #H3,2

The command sets the value for the calibration sequence.

Example: "BB:WLNN:FBL1:MAC:HTC:CAL:SEQ #H3,2"
'sets the value for the calibration sequence.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - CSI Steering

[SOURce<[1]]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:CSISteering #H0,2... ... #H3,2

The command sets the value for the CSI steering.

00 = CSI

01 = uncompressed Steering Matrix

10 = compressed Steering Matrix

11 = Reserved

Example: "BB:WLNN:FBL1:MAC:HTC:CSIS #H1,2"
'sets the value for the CSI steering to 01 (uncompressed Steering Matrix).

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Feedback Request

[SOURce<[1]]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:FREQest #H0,2... .. #H3,2

The command sets the value for the feedback request.

00 = no request

01 = unsolicited feedback only

10 = immediate feedback

11 = aggregated feedback

Example: "BB:WLNN:FBL1:MAC:HTC:FREQ #H2,2"
'sets the value for the feedback request to 10 (immediate feedback).

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Link Adaption Control

[SOURce<[1]]2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:LAControl #H0000,16 ... #HFFFF,16

The command sets the value for the Link Adaption Control.

B0 (1bit) MA - MA payload

When the MA (Management Action) field is set to 1, the payload of the QoS Null Data MPDU (Medium Access Controller Protocol Data Unit) is interpreted as a payload of the management action frame.

B1 (1bit) TRQ - Sounding Request

1 = Request to the responder to transmit a sounding PPDU (Physical layer Protocol Data Unit).

B2 (1bit) MRQ - MCS Request

1 = Request for feedback of MCS (Modulation Coding Scheme).

B3-B5 (3bit) MRS - MRQ Sequence Identifier

Set by sender to any value in the range '000'-'110' to identify MRQ. = Invalid if MRQ = 0

B6-B8 (3bit) MFS - MFB Sequence Identifier

Set to the received value of MRS. Set to '111' for unsolicited MFB.

B9-B15 (7bit) MFB - MCS Feedback

Link adaptation feedback containing the recommended MCS. When a responder is unable to provide MCS feedback or the feedback is not available, the MFB is set to 'all-ones' (default value) and also MFS is set to '1'.

Example: "BB:WLNN:FBL1:MAC:HTC:LAC #H5A5A,16"
'sets the value for the Link AdaptionControl.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - RDG/More PPDU

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:RDGMore #H0,1 ... #H1,1

The command sets the value for the RDG/More PPDU.

Transmitted by Initiator

0 = No reverse grant.

1 = A reverse grant is present, as defined by the Duration/ID field.

Transmitted by Responder

0 = The PPDU carrying the MPDU is the last transmission by the responder.

1 = The PPDU carrying the MPDU is the last transmission by the responder.

Example: "BB:WLNN:FBL1:MAC:HTC:RDGM #H0,1"
'sets the value for the RDG/More PPDU.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Reserved

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:REServed #H0,5...H5,2

This signal field is currently defined, but not used. It is set to zero by the transmitter and ignored by the receiver.

SOURce-WLAN-N - HT Control State

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:STATe ON | OFF

The command enables/disables HT Control.

Example: "BB:WLNN:FBL1:MAC:HTC:STAT ON"
'enables HT Control.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| OFF | | Device-specific |

SOURce-WLAN-N - ZLF Announcement

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:HTControl:ZLF #H0,1 ... #H1,1

The command sets the value for the ZLF announcement.

0 = no ZLF will follow

1 = ZLF will follow

Example: "BB:WLNN:FBL1:MAC:HTC:ZLF #H1,1"
'sets the value for the ZLF announcement to 1 (ZLF will follow).

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | | Device-specific |

SOURce-WLAN-N - QoS Control

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:QSControl #H0000,16 ... #HFFFF,16

The command sets the value for the QoS control field.

Example: "BB:WLNN:FBL1:MAC:QSC #H5A5A,16"
'sets the value for the QoS field.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - QoS Control State

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:QSControl:STATe ON | OFF

The command enables/disables the QoS control.

Example: "BB:WLNN:FBL1:MAC:QSC:STAT ON"
'enables the QoS control.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| OFF | - | Device-specific |

SOURce-WLAN-N - Fragment Increment

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:FRAGment:INCRement 0 ... 1024

Defines the number of packets required to increment the counter of the fragment bits of the sequence control.

Example: "BB:WLNN:FBL1:MAC:SCON:FRAG:INCR 2"
'two packets are required to increment the counter of the fragment bits.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 1 | | Device-specific |

SOURce-WLAN-N - Fragment Start

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:FRAGment:STARt #H0,4 ... #HF,4

The command enters the start number of the fragment bits of the sequence control.

Example: "BB:WLNN:FBL1:MAC:SCON:FRAG:STAR #H4,4"
'sets the start value of the fragment bits of the sequence control.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| #H0,04 | | Device-specific |

SOURce-WLAN-N - Sequence Increment

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:SEQuence:INCRement 0 ... 1024

Defines the number of packets required to increment the counter of the sequence bits of the sequence control.

Example: "BB:WLNN:FBL1:MAC:SCON:FRAG:INCR 2"
'two packets are required to increment the counter of the sequence bits.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 1 | | Device-specific |

SOURce-WLAN-N - Sequence Start

```
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:SEQuence:STARt #H0,4 ...
#HFFF,4
```

The command enters the start number of the fragment bits of the sequence control.

Example: "BB:WLNN:FBL1:MAC:SCON:SEQ:STAR #H4,4"
'sets the start value of the sequence bits of the sequence control.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| #H0,4 | | Device-specific |

SOURce-WLAN-N - Sequence Control State

```
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:SCONtrol:STATe ON | OFF
```

The command activates/deactivates the sequence control.

Example: "BB:WLNN:FBL1:MAC:SCON:STAT ON"
'activates the sequence control field.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| OFF | | Device-specific |

SOURce-WLAN-N - MAC Header State

```
[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MAC:STATe ON | OFF
```

The command activates/deactivates the generation of the MAC Header.

Example: "BB:WLNN:FBL1:MAC:STAT ON"
'activates the generation of the MAC Header.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| OFF | | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Stream

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:MODulation<1...4> BPSK | QPSK | QAM16 | QAM64

The command selects the modulation used for the spatial stream.

Example: "BB:WLNN:FBL5:MOD1 BPSK"
'sets BPSK as the modulation mode used for the spatial stream.'

| *RST value | Resolution | SCPI |
|--|------------|-----------------|
| QPSK BPSK for Tx Mode HT-Duplicate | - | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Physical Mode

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:PMODE LEGacy | MIXed | GFieLd

Selects the preamble design.

For physical type SOUNDING, only GREEN FIELD is available.

Parameters: **LEGACY**

Compatible with 802.11 a/g OFDM devices.

MIXED MODE

For High Throughput (HT) and 802.11a/g OFDM devices.

GREEN FIELD

For HT only networks.

Example: "BB:WLNN:FBL5:PMOD LEG"
'sets the physical mode to LEGACY.'

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| MIXED MODE | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Preamble/Header Active

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:PREamble:STATe ON | OFF

The command activates/deactivates the preamble and signal fields of the frames in the current frame block. For data type = SOUNDING, the preamble and signal field are always activated and cannot be deactivated.

Example: "BB:WLNN:FBL5:PRE:STAT ON"
'activates the preamble and signal fields of the frames in the current frame block.'

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| ON | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Scrambler

[SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:SCRambler:MODE OFF | RANDom | USER

The command selects the different options for the scrambler.

Parameters: **OFF**

The scrambler is deactivated.

RANDom

The scrambler is activated.

The initialization value of the scrambler is selected at random. Each frame has a different random initialization value. This value is also different in case of successive recalculations with the same setting parameters so that different signals are generated for each calculation.

USER

The scrambler is activated.

The initialization value of the scrambler is set to a fixed value that is set using the command `BB:WLNN:FBL5:SCR:PATT`. This value is then identical in each generated frame.

Example: "BB:WLNN:FBL5:SCR:MODE RAND"
'activates the scrambler with an random initialization value.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| RAND | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Scrambler Init

[SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:SCRambler:PATTern <bit pattern>

The command sets the initialization value for scrambling mode User. This value is then identical in each generated frame.

Example: "BB:WLNN:FBL5:SCR:PATT #H3F,8"
'sets the user defined initialization value for the scrambler.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Service Field

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:SERVice:PATTern <bit pattern>

The command sets the value of the service field. The standard specifies a default value of 0. Other values can be entered in hexadecimal form for test purposes or future extensions.

Example: "BB:WLNN:FBL5:SERV:PATT #H3F,8"
'sets the value for the service field.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Spatial Streams

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:SSTReam 1...4

The command sets the number of the spatial streams. For physical mode LEGACY, only value 1 is valid. For Tx Mode "HT-Duplicate", only value 1 is valid. In all other cases, the number of spatial streams depends on the number of antennas configured with command

SOURce:BB:WLNN:ANTenna:MODE.

Example: "BB:WLNN:FBL5:SSTR 4"
'sets the number of spatial streams to 4.

| *RST value | Resolution | SCPI |
|------------|------------|------|
| 1 | - | |

SOURce-WLAN-N - Frame Block Configuration - State

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:STATe ON | OFF

The command enables the corresponding frame block for transmission.

Example: "BB:WLNN:FBL5:STAT ON"
'enables frame block 5 for transmission.

| *RST value | Resolution | SCPI |
|------------|------------|------|
| OFF | - | |

SOURce-WLAN-N - PPDU Configuration - Space Time Block Coding

[SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:STBC:STATe ?

The command queries the status of the space time block coding.

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

Example: "BB:WLNN:FBL5:STBC:STAT?"
'queries the status of the space time block coding.

| *RST value | Resolution | SCPI |
|------------|------------|------|
| - | - | |

SOURce-WLAN-N - PPDU Configuration - Space Time Streams

[SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:STSTream 1...4

The command sets the number of the space time streams. This value depends on the number of spatial streams defined with command `SOURce:BB:WLNN:FBLock:SSTream`. Changing the number of the Spatial Streams immediately changes the value of the Space Time Streams to the same value.

Example: "BB:WLNN:FBL5:STST 4"
'sets the number of space time streams to 4.

| *RST value | Resolution | SCPI |
|------------|------------|------|
| 1 | - | |

SOURce-WLAN-N - Frame Block Configuration - Tx Mode

[SOURce<[1]2>:]BB:WLNN:FBLock<[1]...100>:TMODe L20 | LDUP | LUP | LLOW | HT20 | HT40 | HTDup | HTUP | HTLow

The command sets the Tx mode. The available Tx modes are dependent on the physical mode.

Example: "BB:WLNN:FBL5:TMOD HT40"
'sets the Tx mode to HT 40 MHz.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| HT20 | - | Device-specific |

SOURce-WLAN-N - PPDU Configuration - Transition Time

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:TTIME 0...1000 ns

The command sets the transition time when time domain windowing is active.

The transition time defines the overlap range of two OFDM symbols. At a setting of 100 ns and if BW = 20 MHz, one sample overlaps.

Example: "BB:WLNN:FBL5:TTIM 100"
'sets the transition time to 100 ns.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 100 | 1 | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Type

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:TYPE DATA | SOUNding

The command selects the PPDU type.

Parameters: DATA

Only Data Long Training Fields are used to probe the channel.

SOUNding

Staggered preambles are used to probe additional dimension of the MIMO channel. Only Physical Layer Mode GREEN FIELD is available.

Example: "BB:WLNN:FBL5:TYPE DATA"
'sets the PPDU type data.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| DATA | - | Device-specific |

SOURce-WLAN-N - Spatial Mapping Beamforming File Selection

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:SMAPping:BSElection <file name>

The command loads the selected file for beamforming.

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

Example: "BB:WLNN:FBL1:PMOD MIX"
"BB:WLNN:FBL1:SMAP:MODE BEAM"
"BB:WLNN:FBL1:SMAP:BSEL "d:\temp\test_scpi.bmf"
'loads the selected file for beamforming.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Spatial Mapping Index k

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:SMAPping:INDex -64...63

The command sets the index of the sub-carrier. A matrix is mapped to each sub-carrier. With the exception of $k=0$, the index can be set in the value range of -64 to 63

Example: "BB:WLNN:FBL1:SMAP:IND 30"
'sets the index of the sub-carrier to $k = 30$.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 20 | - | Device-specific |

SOURce-WLAN-N - Spatial Mapping Mode

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:SMAPping:MODE OFF | DIRect | EXPansion | BEAMforming

The command selects the spatial mapping mode for the selected frame block. Except of the Beamforming mode, the matrix element values are loaded through the use of Info Class Methods.

Parameters: OFF

(only **LEGACY** mode)

The spatial mapping mode is switched off automatically.

DIRect

(only for physical modes MIXED MODE or GREEN FIELD and for $N_{TX} = N_{STS}$)

Sets the spatial mapping to **Direct** mode.

The transmit matrix is a CSD matrix, that is, diagonal matrix of unit magnitude and complex values that represent cyclic shifts in the time domain.

EXPansion

(only for physical modes MIXED MODE or GREEN FIELD)

Sets the spatial mapping to **Expansion** mode.

The transmit matrix is the product of a CSD matrix and the Hadamard unitary matrix.

BEAMforming

Sets the spatial mapping to Beamforming mode.

The transmit matrix is the product of a CSD matrix and the Hadamard unitary matrix.

The File button is displayed to open a Browse popup. A file with source format *.bmf can be selected for the beamforming. The file must include 128 4×4 IQ elements (corresponding to the sub-carriers).

Note:

This feature is not available in this release.

Example: "BB:WLNN:FBL1:SMAP:MODE OFF"
'sets the spatial mapping mode to OFF, that is, the spatial mapping mode is switched off automatically.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| EXPansion | - | Device-specific |

SOURce-WLAN-N - Spatial Mapping I-Value

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:SMAPping:ROW<[1]...4>:COL<[1]...4>:I ?

The command queries the time shift value of element I of the selected row and column of the spatial transmit matrix.

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

Example: "BB:WLNN:FBL1:SMAP:ROW2:COL2:I?"
'queries the time shift value of element I for row 2, column 2.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Spatial Mapping Q-Value

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:SMAPping:ROW<[1]...4>:COL<[1]...4>:Q ?

The command queries the time shift value of element Q of the selected row and column of the spatial transmit matrix.

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

Example: "BB:WLNN:FBL1:SMAP:ROW2:COL2:Q?"
'queries the time shift value of element Q for row 2, column 2.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Spatial Mapping Time Shift

[SOURce<[1]>:]BB:WLNN:FBLock<[1]...100>:SMAPping:TSHift<[1]...4>: -32000 ns...32000 ns

The command sets the spatial mapping time shift. This value is relevant for spatial mapping mode Direct and Spatial Expansion only.

Example: "BB:WLNN:FBL1:SMAP:MODE TSH 1000"
'sets the spatial mapping time shift to 1000 ns.

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

SOURce-WLAN-N - Impulse Length

[SOURce<[1]]2>:]BB:WLNN:FILTer:ILENgtH 1...128

Note:

This command is available for R&S WinIQSIM2 only.

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

Example: "BB:WLNN:FILT:ILEN 10"
'sets the number of filter tabs to 10.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 10 | 1 | Device-specific |

SOURce-WLAN-N - Impulse Length Auto State

[SOURce<[1]]2>:]BB:WLNN:FILTer:ILENgtH:AUTO ON | OFF

Note:

This command is available for R&S WinIQSIM2 only.

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

Example: "BB:WLNN:FILT:ILEN:AUTO ON"
'the most sensible parameters are selected automatically.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| ON | - | Device-specific |

SOURce-WLAN-N - Oversampling

[SOURce<[1]]2>:]BB:WLNN:FILTer:OSAMpling 1...32

Note:

This command is available for R&S WinIQSIM2 only.

The command sets the upsampling factor.

Example: "BB:WLNN:FILT:OSAM 32"
'sets the upsampling factor to 32.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 32 | - | Device-specific |

SOURce-WLAN-N - Oversampling Auto State

[SOURce<[1]|2>:]BB:WLNN:FILTer:OSAMpling:AUTO ON | OFF

Note:

This command is available for R&S WinIQSIM2 only.

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.

Example: "BB:WLNN:FILT:OSAM:AUTO ON"
'the most sensible parameters are selected automatically.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| ON | - | Device-specific |

SOURce-WLAN-N - Filter Parameter APCO25

[SOURce<[1]|2>:]BB:WLNN:FILTer:PARAmeter:APCO25 0.05 ... 0.99

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

Example: "BB:WLNN:PAR:APCO25 0.2"
'sets the roll-off factor to 0.2 for filter type APCO25.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0.20 | 0.01 | Device-specific |

SOURce-WLAN-N - Filter Parameter Cosine

[SOURce<[1]|2>:]BB:WLNN:FILTer:PARAmeter:COSSine 0.00 ... 0.99

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

Example: "BB:WLNN:PAR:COSS 0.35"
'sets the roll-off factor to 0.35 for filter type Cosine.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0.35 | 0.01 | Device-specific |

SOURce-WLAN-N - Cut off Frequency Shift

[SOURce<[1]]2>:]BB:WLNN:FILTer:PARAmeter:COsine:COFS -0.1 ... 1.0

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

Example: "BB:WLNN:FILT:PAR:COs:COFS 0.04"
'the "cut of frequency shift" value is set to 0.04.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0.5 | | Device-specific |

SOURce-WLAN-N - Filter Parameter Pure Gauss

[SOURce<[1]]2>:]BB:WLNN:FILTer:PARAmeter:PGAuss 0.15 ... 2.5

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

Example: "BB:WLLN:FILT:PAR:GAUS 0.5"
'sets B x T to 0.5 for the Pure Gauss filter type.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0.5 | 0.01 | Device-specific |

SOURce-WLAN-N - Filter Parameter Gauss

[SOURce<[1]]2>:]BB:WLNN:FILTer:PARAmeter:GAUSSs 0.15 ... 2.5

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

Example: "BB:WLNN:PAR:COs 0.5"
'sets B x T to 0.5 for the Gauss filter type.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0.5 | 0.01 | Device-specific |

SOURce-WLAN-N - Cut Off Frequency Factor

[SOURce<[1]]2>:]BB:WLNN:FILTer:PARAmeter:LPASs 0.05...2.0

The command sets the cut off frequency factor for the Lowpass filter type.

Example: "BB:WLNN:FILT:PAR:LPAS 0.5"
'the cut of frequency factor is set to 0.5.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0.50 | 0.01 | Device-specific |

SOURce-WLAN-N - Filter Parameter Root Cosine

[SOURce<[1]|2>:]BB:WLNN:FILTer:PARAmeter:RCOSine 0.00 ... 0.99

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

Example: "BB:WLNN:PAR:RCOS 0.22"
'sets the roll-off factor to 0.22 for filter type Root Cosine.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0.22 | 0.01 | Device-specific |

SOURce-WLAN-N - Filter Parameter Split Phase

[SOURce<[1]|2>:]BB:WLNN:FILTer:PARAmeter:SPHase 0.15 ... 2.5

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

Example: "BB:WLNN:PAR:SPH 0.5"
'sets B x T to 0.5 for the Split Phase filter type.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 2.00 | 0.01 | Device-specific |

SOURce-WLAN-N - Filter Type

**[SOURce<[1]|2>:]BB:WLNN:FILTer:TYPE RCOSine|COSine|GAUSSs|LGAuss|CONE|EWPSHape|DIRac
COF705|COEQualizer|COFequalizer|C2K3x|APCO25|SPHase|RECTangle|PGAuss|ENPSHape|LPASs**

The command selects the filter type. The filter types are described in Chapter 4, Section "*Custom Dig Mod*".

Example: "BB:WLNN:FILT:TYPE COS"
'sets the filter type COSine.

| *RST value | Resolution | SCPI |
|-----------------------|------------|-----------------|
| Depends on layer mode | - | Device-specific |

SOURce-WLAN-N - Frame Block Configuration - Paste

[SOURce<[1]|2>:]BB:WLNN:PFBLock 1...99

The command pastes the selected frame block.

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

Example: "BB:WLNN:PFBL 20"
'pastes the frame block to row 20.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Set to Default

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

The command produces a standardized default for the IEEE 802.11n standard. The settings correspond to the *RST values specified for the commands.

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

Example: "BB:WLNN:PRES"
'resets all the IEEE 802.11n settings to default values.

| *RST value | Resolution | Dependencies | SCPI |
|------------|------------|--|-----------------|
| - | - | All IEEE 802.11n settings are preset. An overview is provided by Table in Chapter 4. | Device-specific |

SOURce-WLAN-N - Trigger Mode

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

Note:

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

The command selects the trigger mode.

Parameter: **AUTO**

The modulation signal is generated continuously.

RETRigger

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

AAUTo

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

SINGle

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

Example:

`"BB:WLNN:SEQ AAUT"`

'sets the **Armed_auto** trigger mode; the device waits for the first trigger (e.g. with *TRG) and then generates the signal continuously.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| AUTO | - | Device-specific |

SOURce-WLAN-N - User Settings Catalog**[SOURce<[1]|2>:]BB:WLNN:SETTING:CATalog?**

The command reads out the files with IEEE 802.11n settings in the default directory. The default directory is set using command `MMEM:CDIRECTory`. A path can also be specified, in which case the files in the specified directory are read. Only files with the file extension ***.wlann** will be listed.

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

Example:

`"MMEM:CDIR 'D:\user\wlann'"`

'sets the default directory to D:\user\wlann.

`"BB:WLNN:SETT:CAT?"`

'reads out all the files with IEEE 802.11n settings in the default directory.

Response: `"'wlann_1','wlann_2'"`

'the files `'wlann1'` and `'wlann2'` are available.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Delete User Settings

[SOURce<[1]]2>:]BB:WLNN:SETTING:DELEte <file_name>

The command deletes the selected file with IEEE 802.11n WLAN-N settings. The directory is set using command `MMEM:CDIRECTory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension `*.wlann` are listed and can be deleted.

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

Example: `"BB:WLNN:SETT:DEL 'wlann_1' "`
 `'deletes file 'wlann_1'.`

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Load User Settings

[SOURce<[1]]2>:]BB:WLNN:SETTING:LOAD <file_name>

The command loads the selected file with IEEE 802.11n WLAN-N settings. The directory is set using command `MMEM:CDIRECTory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension `*.wlann` will be loaded.

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

Example: `"BB:WLNN:SETT:LOAD 'wlann_1' "`
 `'loads file 'wlann_1'.`

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Store User Settings

[SOURce<[1]]2>:]BB:WLNN:SETTING:STORe <file_name>

The command stores the current IEEE 802.11n WLAN-N 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. IEEE 802.11n WLAN-N settings are stored as files with the specific file extensions `*.wlann`.

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

Example: `"BB:WLNN:SETT:STOR 'wlann_1' "`
 `'stores the current settings into file 'wlann_1'.`

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Sample Rate Variation

[SOURce<[1]|2>:]BB:WLNN:SRATe:VARiation 400 Hz ... 40 MHz

The command enters the output sample rate.

A variation of this parameter only affects the ARB clock rate, all other signal parameters remain unchanged. If the sampling rate in the frame configuration menu is changed, this parameter is reset to the chosen sampling rate.

Example: "BB:WLNN:SRAT:VAR 4000000"
"sets the output sample rate to 4 MHz.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 2 MHz | 0.001 Hz | Device-specific |

SOURce-WLAN-N - State

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

The command activates modulation in accordance with the IEE 802.11n WLAN-N standard. Activating this standard disables all the other digital standards and digital modulation modes (in case of two-path instruments, this affects the same path). .

Example: "BB:WLNN:STAT ON"
'activates modulation in accordance with the IEE 802.11n WLAN standard

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

SOURce-WLAN-N - PPDU Configuration - Time Domain Windowing Active

[SOURce<[1]|2>:]BB:WLNN:FBLock<[1]...100>:TDWindowing:STATe ON | OFF

The command activates/deactivates the time domain windowing. Time domain windowing is a method to influence the spectral characteristics of the signal, which is not stipulated by the standard. However, it does not replace oversampling and subsequent signal filtering.

Example: "BB:WLNN:FBL5:TDW:STAT ON"
'activates the time domain windowing.

| *RST value | Resolution | SCPI |
|------------|------------|------|
| ON | - | |

SOURce-WLAN-N - Trigger Arm**[SOURce<[1]]2>:]BB:WLNN:TRIGger:ARM:EXECute****Note:**

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

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

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

Example:

"BB:WLNN:TRIG:SOUR INT"
'sets internal triggering.

"BB:WLNN:TRIG:SEQ ARET"
'sets Armed_Retrigger mode, i.e. every trigger event causes signal generation to restart.

"BB:WLNN:TRIG:EXEC"
'executes a trigger, signal generation is started.

"BB:WLNN:TRIG:ARM:EXEC"
'signal generation is stopped.

"BB:WLNN:TRIG:EXEC"
'executes a trigger, signal generation is started again.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Trigger Execute**[SOURce<[1]]2>:]BB:WLNN:TRIGger:EXECute****Note:**

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

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

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

Example:

"BB:WLNN:TRIG:SOUR INT"
'sets internal triggering.

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

"BB:WLNN:TRIG:EXEC"
'executes a trigger.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Other Baseband Trigger Delay

[SOURce<[1]|2>:]BB:WLNN:TRIGger:OBASband:DELay 0 ... 2³²-1

Note:

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

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

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

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 samples | 1 sample | Device-specific |

SOURce-WLAN-N - Other Baseband Trigger Inhibit

[SOURce<[1]|2>:]BB:WLNN:TRIGger:OBASband:INHibit 0 ... 2³²-1

Note:

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

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.

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

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 samples | 1 sample | Device-specific |

SOURce-WLAN-N - Fixed Marker Delay

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

Note:

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

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

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| OFF | - | Device-specific |

SOURce-WLAN-N - Marker Delay

[SOURce<[1]>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:DELay 0 ... 2³² - 1 Samples

Note:

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

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

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 samples | 1 sample | Device-specific |

SOURce-WLAN-N - Frame Block Index

[SOURce<[1]>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:FBINdex 0...Max

The command sets the frame block index. For this/these frame block(s), a marker signal is generated. The maximum value depends on the number of the currently active frame blocks (max = 100).

Example: "BB:WLNN:TRIG:OUTP1:FBIN 5"
'sets the frame block index to 5.'

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | 1 | Device-specific |

SOURce-WLAN-N - Frame Index

[SOURce<[1]|2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:FINdex 1...Max

The command sets the frame index, that is, the frame to be marked in the frame block marked with command BB:WLNN:TRIGger:OUTPut:FBIndex. The maximum value depends on the number of frames set with command BB:WLNN:FBlock:FCOunt. The maximum value is 1024.

Example: "BB:WLNN:TRIG:OUTP1:FIND 100"
'sets the frame index to 100.'

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | 1 | Device-specific |

SOURce-WLAN-N - Fixed Marker Delay Maximum

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

Note:

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

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

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

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

"BB:WLNN:TRIG:OUTP:DEL:MAX "
'queries the maximum of the dynamic range.'

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Fixed Marker Delay Minimum

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

Note:

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

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

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

Example:

"BB:WLNN:TRIG:OUTP:DEL:FIX ON"

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

"BB:WLNN:TRIG:OUTP:DEL:MIN"

'queries the minimum of the dynamic range.

Response: "0"

'the minimum for the marker delay setting is 0 samples.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Marker Mode

[SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:MODE

REStart | FRAMe | FAPart | PULSe | PATTeRn | RATio | FBLoCk

The command defines the signal for the selected marker output.

Parameter:

REStart

A marker signal is generated at the start of each signal sequence (period = all frame blocks).

FRAMe

Number of Frame Blocks = 1, that is, a marker signal is generated at the start of each frame in the single frame block. Otherwise, the frame block and frame index are entered and the specific frame is masked.

FBLoCk

Number of Frame Blocks = 1, that is, a marker signal is generated at the start of each frame block. Otherwise, a specific frame block index is given and the whole frame block is marked.

FAPart

Number of Frame Blocks = 1, that is, a marker signal is generated to mark every active part of each frame.

The active data transfer part (PPDU) of a frame period is marked with high, the inactive part (idle time) with low. This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

Otherwise, the frame block and frame index are entered and the active part of the specific frame is masked.

PATtern

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

PULSe

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

RATio

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

Example: `"BB:WLNN:TRIG:OUTP2:MODE FRAM"`
'selects the frame marker signal on output MARKER 2.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| REStart | - | Device-specific |

SOURce-WLAN-N - Marker OFF-Period

`[SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:OFFTime 1.. 224 - 1 (1..16 777 215)`
samples

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

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 1 | 1 | Device-specific |

SOURce-WLAN-N - Marker ON-Period

`[SOURce<[1]2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:ONTTime 1.. 224 - 1 (1..16 777 215)`
samples

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

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 1 | 1 | Device-specific |

SOURce-WLAN-N - Marker Pattern

[SOURce<[1]|2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:PATTern #B0,1 ... #B111...1, 32

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

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

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

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

SOURce-WLAN-N - Marker Pulse Divider

[SOURce<[1]|2>:]BB:WLNN:TRIGger:OUTPut<[1]...4>:PULSe:DIVider 2 ... 2¹⁰

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

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

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

Response: `"66 000"`
'the resulting pulse frequency is 66 kHz.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 2 | 1 | Device-specific |

SOURce-WLAN-N - Marker Pulse Frequency

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

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

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

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

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

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

Response: `"33 000"`
'the resulting pulse frequency is 33 kHz.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N – Trigger Status

[SOURce<[1]]2>:]BB:WLNN:TRIGger:RMODe?

Note:

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

The command queries the current status of signal generation for all trigger modes with IEEE 802.11n WLAN modulation on.

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

Parameter:

RUN

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

STOP

the signal is not generated. A trigger event did not occur in the triggered modes, or signal generation was stopped by the command

:BB:WLNN:TRIG:ARM:EXECute (armed trigger modes only).

Example:

"BB:WLNN:TRIG:SOUR EXT"

'sets external triggering via the TRIGGER 1 connector.

"BB:WLNN:TRIG:MODE ARET"

'selects the Armed_Retrigger mode.

"BB:WLNN:TRIG:RMOD?"

'queries the current status of signal generation.

Response: "RUN"

'the signal is generated, an external trigger was executed.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N – Signal Duration

[SOURce<[1]|2>:]BB:WLNN:TRIGger:SLENgth 1 ... (2³²-1) samples

Note:

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

The command defines the length of the signal sequence to be output in the **Single** trigger mode (SOUR:BB:WLNN:SEQ SING). The input is made in terms of samples.

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

Example:

"BB:WLNN:SEQ SING"

'sets trigger mode Single.

" :BB:WLNN:TRIG:SLEN 200 "

'sets a sequence length of 200 samples. The first 200 samples of the current frame will be output after the next trigger event.

| *RST value | Resolution | SCPI |
|---------------|------------|-----------------|
| 26720 samples | 1 sample | Device-specific |

SOURce-WLAN-N - Signal Duration Unit

[SOURce<[1]|2>:]BB:WLNN:TRIGger:SLUNit SAMPlE | SEQuence

Note:

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

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

Parameter:

SAMPlE

Unit Sample. A single sample is generated after a trigger event.

SEQuence

Unit Sequence Length. A single sequence is generated after a trigger event.

Example:

"SOUR:BB:WLNN:SEQ SING"

'sets trigger mode Single.

"SOUR:BB:WLNN:TRIG:SLUN SEQ"

'sets unit Sequence for the entry of sequence length.

"SOUR:BB:WLNN:TRIG:SLEN 2"

'sets a sequence length of 2 sequences. Two sequences will be output after the next trigger event.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| SEQuence | - | Device-specific |

SOURce-WLAN-N - Trigger Source

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

The command selects the trigger source.

Parameter: **INTernal**

Triggering is executed by means of the Trigger command
SOURce<[1]|2>:BB:WLNN:TRIGger:EXECute or *TRG in the case of
remote control and by means of **Execute Trigger** in the case of manual
operation.

EXTernal

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

BEXTernal

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

OBASeband

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

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| INTernal | - | Device-specific |

SOURce-WLAN-N - External Trigger Delay

[SOURce<[1]|2>:]BB:WLNN:TRIGger[:EXTernal<[1]|2>]:DElay 0 ... 2³²-1

Note:

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

The command specifies the trigger delay (expressed as a number of 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.

Example: "BB:WLNN:TRIG:SOUR EXT"
 'sets an external trigger via the TRIGGER 1 connector.
 "BB:WLNN:TRIG:DEL 50"
 'sets a delay of 50 samples for the trigger.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 samples | 1 sample | Device-specific |

SOURce-WLAN-N - External Trigger Inhibit

[SOURce<[1]|2>:]BB:WLNN:TRIGger[:EXTeRnal<[1]|2>]:INHibit 0 ... 2³²-1

Note:

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

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.

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

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

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| 0 samples | 1 sample | Device-specific |

SOURce-WLAN-N - Version

[SOURce<[1]|2>:]BB:WLNN:VERSion?

The command queries the version of the IEEE 802.11n WLAN-N standard underlying the definitions. The command is a query command and therefore does not have an *RST value.

Example: "BB:WLNN:VERS?"
'queries the IEEE 802.11n WLAN-N version.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | Device-specific |

SOURce-WLAN-N - Create Waveform

[SOURce<[1]|2>:]BB:WLNN:WAVeform:CREate <file_name>

This command creates a waveform using the current settings of the **WLAN-N** 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.

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

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

"BB:WLNN:WAV:CRE 'wlann_1'"
'creates the waveform file wlann_1.wv in the default directory.

| *RST value | Resolution | SCPI |
|------------|------------|-----------------|
| - | - | device-specific |

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