R&S®SMBV100B
Vector Signal Generator
Service Manual

1178448202

Service Manual

Version 02

ROHDE&SCHWARZ

This manual describes the following signal generator:

- R&S®SMBV100B, order no. 1423.1003.02

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The following abbreviation is used throughout this guide: R&S®SMBV100B is abbreviated as R&S SMBV100B.

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

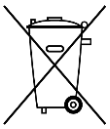
The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English.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

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

Safety labels on products

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

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

Symbol	Meaning	Symbol	Meaning
	Caution ! Hot surface		Alternating current (AC)
	Protective conductor terminal To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth		Direct/alternating current (DC/AC)
	Earth (Ground)		Class II Equipment to identify equipment meeting the safety requirements specified for Class II equipment (device protected by double or reinforced insulation)
	Frame or chassis Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

Signal words and their meaning

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

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

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

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

NOTICE Indicates information considered important, but not hazard-related, e.g. messages relating to property damage.
In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

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

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

Electrical safety

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

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the mains-supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with a protective conductor contact and protective conductor.
3. Intentionally breaking the protective conductor either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If there is no power switch for disconnecting the product from the mains, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the mains. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 m. Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, the disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cables on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

6. The product may be operated only from TN/TT supply networks fuse-protected with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fuse protection, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC 60950-1 / EN 60950-1 or IEC 61010-1 / EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

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

2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal/Environmental protection", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).
8. EMC classes (in line with EN 55011/CISPR 11, and analogously with EN 55022/CISPR 22, EN 55032/CISPR 32)
   - Class A equipment:
     Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings
     Note: Class A equipment is intended for use in an industrial environment. This equipment may cause radio disturbances in residential environments, due to possible conducted as well as radiated disturbances. In this case, the operator may be required to take appropriate measures to eliminate these disturbances.
   - Class B equipment:
     Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.

2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

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

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

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.
2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.

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

Waste disposal/Environmental protection

1. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.
2. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately.
   Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
3. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
4. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

For additional information about environmental protection, visit the Rohde & Schwarz website.

Instrucciones de seguridad elementales

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

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

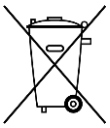
Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa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

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

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

Señalización de seguridad de los productos

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

Símbolo	Significado	Símbolo	Significado
	Aviso: punto de peligro general Observar la documentación del producto		Tensión de alimentación de PUESTA EN MARCHA / PARADA
	Atención en el manejo de dispositivos de peso elevado		Indicación de estado de espera (standby)
	Peligro de choque eléctrico		Corriente continua (DC)
	Advertencia: superficie caliente		Corriente alterna (AC)
	Conexión a conductor de protección		Corriente continua / Corriente alterna (DC/AC)
	Conexión a tierra		El aparato está protegido en su totalidad por un aislamiento doble (reforzado)
	Conexión a masa		Distintivo de la UE para baterías y acumuladores Más información en la sección "Eliminación/protección del medio ambiente", punto 1.
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)		Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser Más información en la sección "Funcionamiento", punto 7.		

Palabras de señal y su significado

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

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

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

Estados operativos y posiciones de funcionamiento

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

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

Seguridad eléctrica

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

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

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

Funcionamiento

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

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
   - Aparato de clase A:
     Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
     Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.
   - Aparato de clase B:
     Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
5. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
6. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
7. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.
8. En caso de devolver baterías de litio a las filiales de Rohde & Schwarz, debe cumplirse las normativas sobre los modos de transporte (IATA-DGR, código IMDG, ADR, RID).

Transporte

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

Eliminación/protección del medio ambiente

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.
2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado.
   Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, diríjase a su servicio de atención al cliente de Rohde & Schwarz.
3. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
4. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

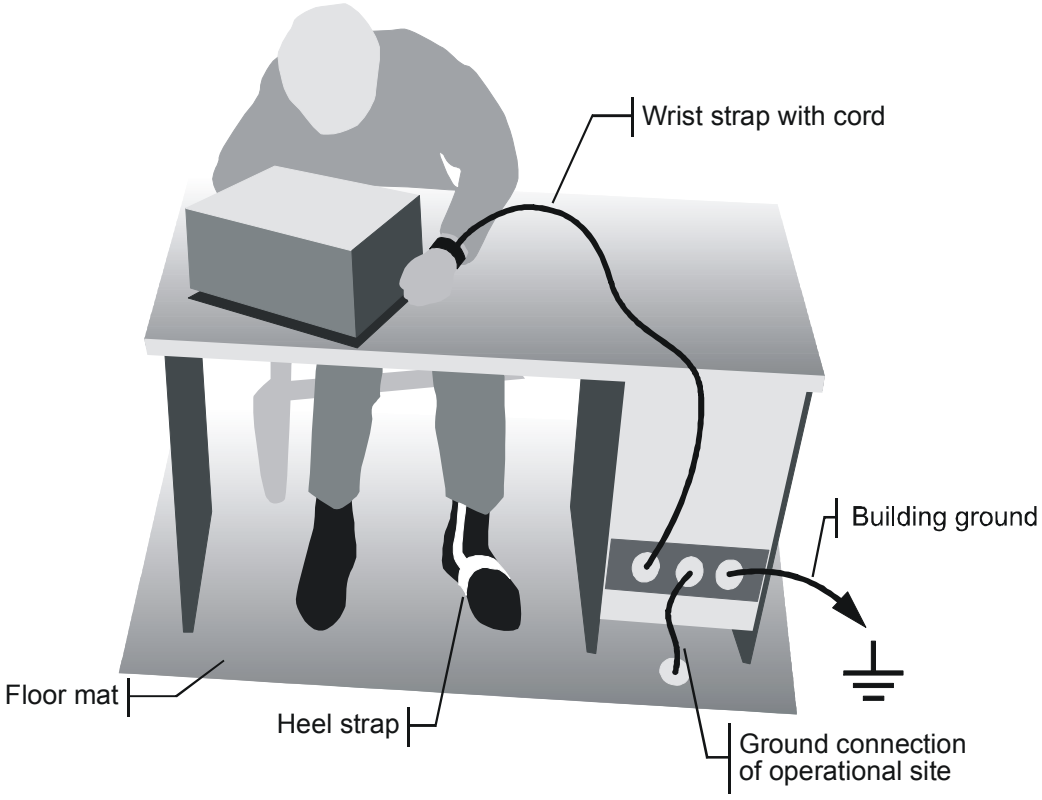
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).



The following two methods of ESD protection may be used together or separately:

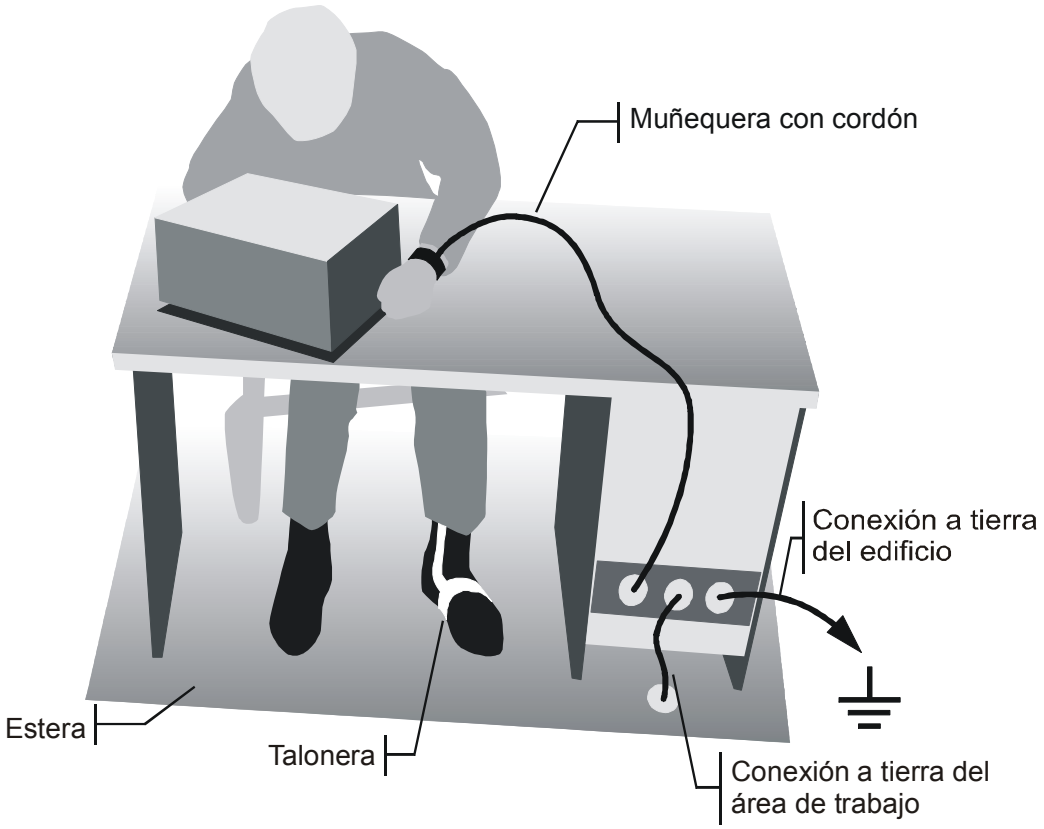
- Wrist strap with cord to ground connection
- Conductive floor mat and heel strap combination

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

Para evitar averías en los componentes electrónicos, el área de trabajo tiene que estar protegido contra descargas electroestáticas ESD (electrostatic discharge).



Los siguientes dos métodos de protección ESD pueden ser usados juntos o separados:

- Muñequera con cordón para conexión a tierra
- Combinación de estera antiestática y talonera

Procedure for servicing and repairs

This section contains information on shipping an instrument or module to your service center.

Please contact your local Rohde & Schwarz service center if your equipment needs to be serviced or repaired. You can find the current address of your representative at www.rohde-schwarz.com.

Shipping the instrument or module

We require the following information in order to answer your inquiry quickly and correctly and to determine whether the warranty is still valid for your product:

- Instrument model
- Serial number
- Firmware version
- Does the instrument have to be returned with this firmware?
- Detailed error description in case of repair
- Indication of desired calibration
- Contact person for questions

In many countries, an RMA process is available (pickup and delivery of your product). For details, contact your local representative.

When shipping the product, ensure that there is sufficient mechanical and antistatic protection.

- Where possible, use the original packaging to transport or ship the product. The front and rear protective covers prevent damage to the operating elements and the connectors.
- If you do not use the original packaging, ensure sufficient padding to prevent the product from moving around inside the box. Wrap antistatic film around the product to protect it from electrostatic charging.
- Comply with the relevant safety and security measures for products with batteries.

As the manufacturer, Rohde & Schwarz can ensure that your instruments perform optimally throughout their service life by regularly calibrating them on its own measurement systems. Rohde & Schwarz calibration includes preventative measures such as adjustments. The calibration documentation fulfills ISO 17025 requirements.

Contents

1 Performance Test

Test Instructions

To ensure that rated specifications are maintained, the following preparations must be made before checking the rated characteristics:

- Allow for a minimum warm-up time of 30 minutes at ambient temperature.
- Carry out all internal adjustments.
- The values are specified in the data sheet. Additional uncertainties introduced by the measurement equipment must be taken into account when checking the rated values.
  This performance test describes the steps for testing the R&S SMBV100B Signal Generator family and the installed options with respect to function and compliance with specifications.
  In the following, the term DUT (Device Under Test) is used for any signal generator of this family. The tests to be performed depend on the installed options. The values are given in the data sheet of the respective instrument.

1.1 Measuring Equipment and Accessories

The following instruments and accessories are used for the performance test.

Table 1-1: Recommended equipment

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S Order No.
1	Frequency counter	1 Hz to RFmax, resolution 0.1 Hz (included in RF analyzer item 19)		
2	Reference source for SSB noise measurements	Identical generator as DUT or generator with at least 10 dB lower SSB noise as DUT Frequency range up to RFmax	R&S SMA100A with R&S SMA-B106 and R&S SMA-B22	1400.0000K02 1405.0809.02 1405.1805.02
4	Controller	Industry standard PC/XT/AT with IEC 60625 interface, USB interface and LAN interface		
5	Signal generator	1 MHz to RFmax	R&S SMW200A R&S SMA100A R&S SMU200A R&S SMBV100A	

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S Order No.
6	Phase noise test assembly	Phase Noise Test Set or Mixer: 10 MHz to RFmax, branching filter 20 MHz, DC decoupling after the mixer Phase Noise Test Set with FSWPxx	R&S FSUP 26 or Mixer: f < 1 GHz: Minicircuits ZFM2H 1 GHz: < f < 13 GHz: Miteq DB0118LA2 R&S FSWP8 R&S FSWP26 with B1, B4, B61, B80, K7	1166.3505.27 1166.3505.51 FSWPxx: 1322.8003.08
7	Oscilloscope	Bandwidth ≥ 500 MHz, two channels with DC coupling	R&S RTM or similar	
8	RF power meter	1 MHz to RFmax	R&S NRP with R&S NRP Z55 or R&S NRP Z51 or R&S NRP Z91 or R&S NRP Z92	1143.8500.02 1138.2008.02 1138.0005.0x
9	Low-noise preamplifier	10 Hz to 10 MHz, gain > 20 dB, input noise < 4 nV (1 Hz)		
10	Low-noise preamplifier	100 kHz to RFmax, gain > 20 dB, noise figure < 10 dB		
11	VSWR bridge	1 MHz to RFmax, directivity > 30 dB	f < 4 GHz: R&S ZRC 3 GHz < f < 6 GHz: Agilent 773D	1039.9492.55
12	DC voltage source	Setting range 0 to 10 V		
13	RF power amplifier	10 MHz to RFmax, power > 33 dBm		
14	Arbitrary waveform generator	Differential Baseband Output	R&S SMBV100A with Option B10, B10F or B51 R&S SMU200A R&S AFQ100A R&S SMW200A With 2.5 MHz base-band filters	1407.6004K02 1141.2005.02 1410.9000.02
15	AC/DC voltmeter	10 Hz to 10 MHz	R&S URE3	0350.5315.03
16	Broadband FM demodulator	Included in RF analyzer item 19		
17	Pulse generator	Pulse repetition frequency up to 100 kHz Included in signal generator item 5		

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S Order No.
19	RF analyzer & Demodulator for analog modulations & FM-demodulator	1 MHz to RFmax * 2	R&S FSW8/13/26/40 with R&S FSW-B24 R&S FSW-K7 R&S FSQ26 with R&S FSU-B25 R&S FSQ K7	 1155.5001.26 1044.9298.02 1141.1796.02
20	Software for simulation of digital modulations	Generation of data for ARB generator	R&S WinIQSIM	

1.2 Test Assemblies

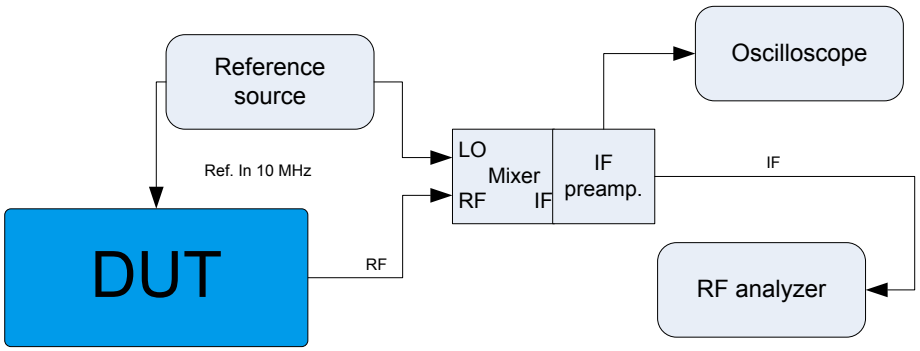
The device under test R&S SMBV100B is abbreviated as DUT hereinafter.

1.2.1 Test Assembly for SSB Phase Noise and Jitter

Test equipment:

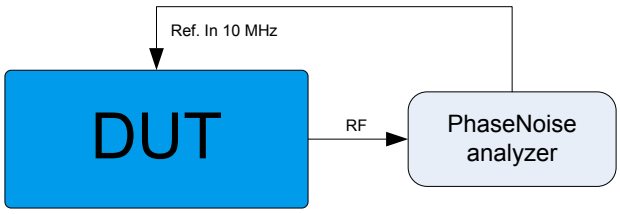
- Reference Source, (see Table 1-1, item 2)
- Phase noise test assembly consisting of mixer with low pass filter and preamplifier, (see Table 1-1, item 6)
- Oscilloscope, (see Table 1-1, item 7)
- RF analyzer, (see Table 1-1, item 19)

Test setup:



Test equipment:

- Phase noise test assembly with phase noise analyzer, (see Table 1-1, item 6)

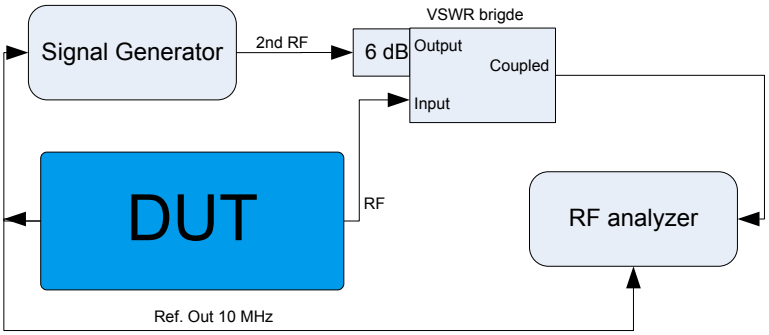


1.2.2 Test Assembly for Output Impedance (VSWR)

Test equipment:

- VSWR bridge, (see Table 1-1, item 11)
- Signal generator, (see Table 1-1, item 5)
- RF analyzer, (see Table 1-1, item 19)

Test setup:



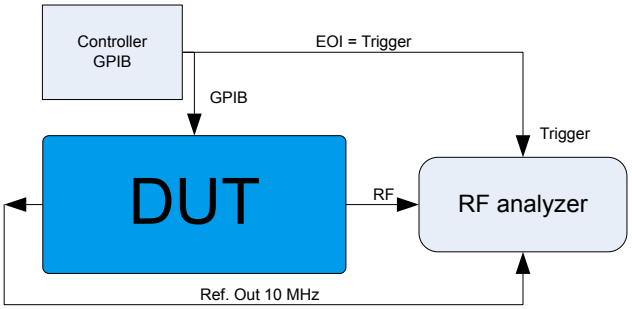
The INPUT of the directional coupler is directly screwed to the DUT. The second signal generator is connected to the line connector (OUTPUT), the analyzer to the coupling output (COUPLED) of the directional coupler.

1.2.3 Test Assembly for Setting Time

Test equipment:

- GPIB controller, (see Table 1-1, item 4)
- RF analyzer, (see Table 1-1, item 19)

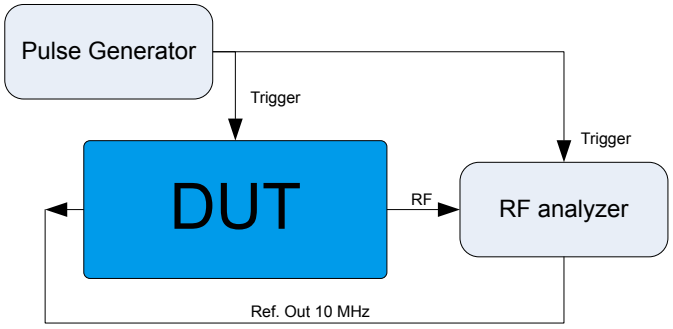
Test setup GPIB:



Test equipment:

- Pulse generator, (see Table 1-1, item 17)
- RF analyzer, (see Table 1-1, item 19)

Test setup list mode:

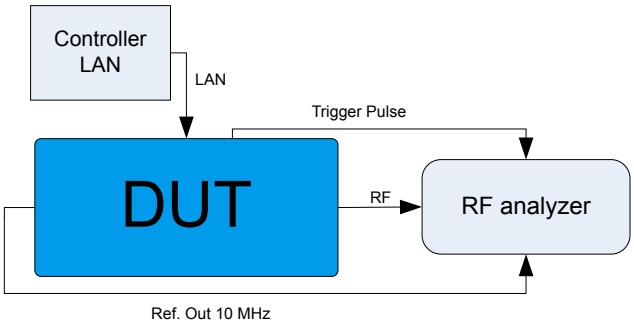


For instruments not equipped with R&S SMBVB-B86 (without GPIB interface):

Test equipment:

- LAN controller, (see Table 1-1, item 4)
- RF analyzer, (see Table 1-1, item 19)

Test setup:

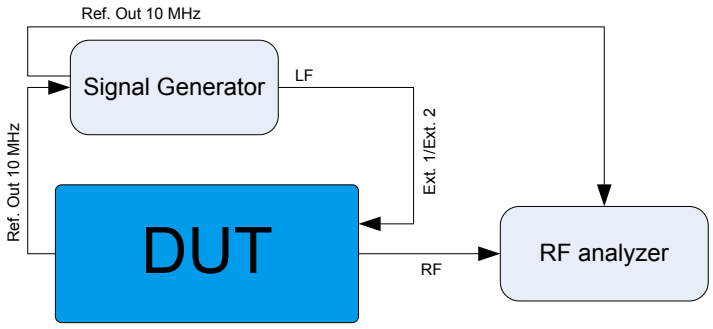


1.2.4 Standard Test Assembly for Analog Modulation

Test equipment:

- RF analyzer, (see Table 1-1 , item 19)
- Signal generator, (see Table 1-1, item 5)

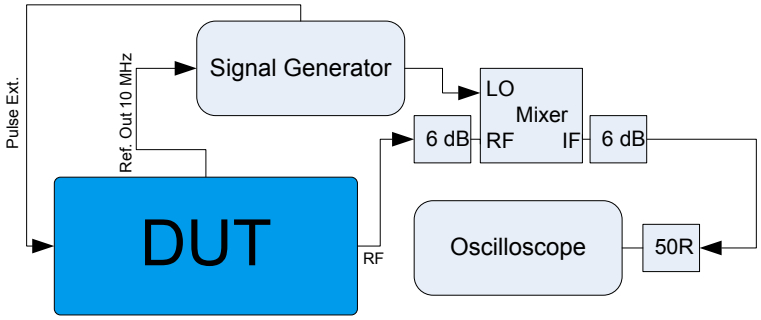
Test setup: The RF analyzer is used as a modulation analyzer. The signal generator is used as modulation source in case of external modulation.



1.2.5 Test Assembly for Pulse Modulation

Test equipment:
- Oscilloscope, (see Table 1-1, item 7)
- Signal generator, (see Table 1-1, item 5)
- Mixer

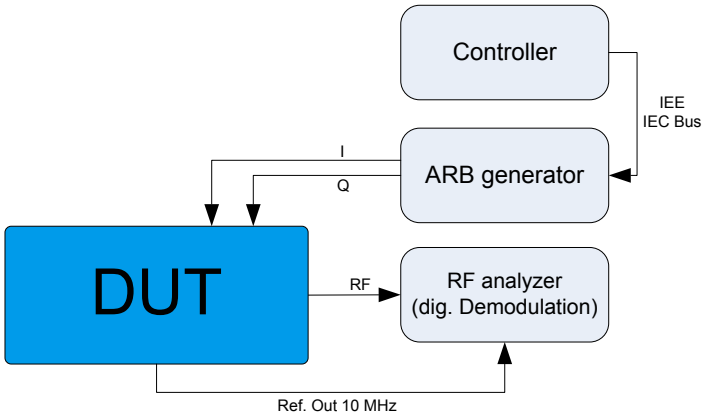
Test setup: The pulsed RF is mixed down to DC in phase and analyzed with an oscilloscope.



1.2.6 Test Assembly for I/Q Modulation

Test equipment:
- RF analyzer, (see Table 1-1 , item 19)
- Arbitrary waveform generator, (see Table 1-1, item 14)
- Software for simulation of digital modulations, (see Table 1-1, item 20)
- Controller, (see Table 1-1, item 4)

Test setup: The I/Q modulated RF is demodulated and analyzed by RF analyzer.



1.3 Preparation, Recommended Test Frequencies/Levels

To ensure proper conditions for the performance test and prevent setting errors, the instrument must be prepared as follows:

- Allow for a minimum warm-up time of 30 minutes at ambient temperature.
- Carry out all internal adjustments.
- Perform Preset to establish a defined initial state before configuring a new measurement.
  The following sections describe the procedures for checking the rated values. The values are specified in the data sheet. Additional uncertainties introduced by the measurement equipment must be taken into account when checking the rated values.
  The following table lists the important internal switch point frequencies and the recommended measurement frequencies derived from these frequencies. We recommend measurements at these frequencies unless particular test frequencies are specified.
  Read VCO switching frequencies (VCO12, VCO23 and VCO34) from device.

Table 1-2: Range limits, main test frequencies for CW Mode

Range	Frequency in MHz	Hardware switching points in MHz	Recommended test frequencies in MHz
R&S SMBVB-B103 or R&S SMBVB-KB106	0.008 to 6000	0.008, 0.2, 5, 10, 41, 52, 53, 70, 80, 85, 93.75, 100, 115, 155, 187.5, 194, 225, 226, 250, 267, 289, 290, 350, 351, 357, 375, 390, 470, 474, 512, 530, 641, 660, 750, 900, 930, 988, 1200, 1378, 1400, 1500, 1990, 2100, 2702, 3000, 3100, 3780, 3876, 4100, 4760, 6000	0.008, 0.2 0.21, 5 5.01, 10 10.01, 41 41.01, 52 52.01, 53 53.01, 70 70.01, 80 80.01, 85 85.01, 93.75 93.76, 100 100.1, 115 115.1, 155 155.1, 187.5 187.6, 194 194.1, 225 225.1, 226 226.1, 250 250.1, 267 267.1, 289 289.1, 290 290.1, 350 350.1, 351 351.1, 357 357.1, 375 375.1, 390 390.1, 470 470.1, 474 474.1, 512 512.1, 530 530.1, 641 641.1, 660 660.1, 750 750.1, 900 900.1, 930 930.1, 988 988.1, 1200 1201, 1378 1379, 1400 1401, 1500 1501, 1990 1991, 2100

Range	Frequency in MHz	Hardware switching points in MHz	Recommended test frequencies in MHz
			2101, 2702 2703, 3000 3001, 3100 3101, 3780 3781, 3876 3877, 4100 4101, 4760 4761, 6000

In the following, RF_{max} is the maximum output frequency of the instrument according to its frequency option.

For **high-resolution measurements** in the entire frequency range, a logarithmic frequency grid in 1-2-5 sequence is recommended up to 50 MHz; above this value, linear 50 MHz steps should be used up to the upper limit frequency.

The recommended test levels are at the upper and lower switching threshold of the attenuator. The electronic step attenuator of the DUT is switched depending on frequency, modulation parameters and level according to an internal stored table in approximately 5 dB steps for frequency options R&S SMBVB-B103, R&S SMBVB-KB106.

The switching thresholds can be detected under **Attenuator fixed range** in the **Level** menu. After setting all other parameters, the threshold level can be detected by level variation.

The level at which the attenuator fixed range changes is the threshold. By measuring at the last level setting of one range and the first level setting of the next range, the internal setting range borders are used. In the following, P_{max} is the highest level before switching the attenuator, and P_{min} is defined as P_{max} – 5 dB with same attenuator setting.

1.4 Test Procedures

1.4.1 Checking the Reference Frequency Accuracy

1.4.1.1 Checking the internal reference

Allow the DUT to warm up for at least 2 hours before starting the measurement.

Accredited calibration: Same coverage as performance test.

Test equipment:
- Frequency counter (see Table 1-1, item 1)

Test setup:
► Connect a calibrated frequency counter (see Table 1-1, item 1) to the REF OUT output (on rear panel).

Measurement 1: Measure the frequency.

► Settings on DUT:
- **Source mode** Internal Reference

The frequency deviation must not exceed the sum of deviations resulting from the frequency error in the rated temperature range and from aging.

Service limits: 0.80 * "Error at time of calibration in production".

If the specified accuracy is not met, the internal reference oscillator must be adjusted.

1.4.1.2 Checking the external reference

Test equipment:
- RF power meter (see Table 1-1, item 8)
- Signal generator (see Table 1-1, item 5)
- Frequency counter (see Table 1-1, item 1)

Test setup:
► Connect a RF power meter to the REF OUT output (on rear panel). Connect the signal generator to the REF IN (on rear panel).

Measurement 1: Measure the output level. It should be within the data sheet specifications.

1. Settings on DUT:
   - **Output mode** Input signal (loop through)
2. Settings on Reference Signal Generator:
   - **Frequency** recommended test frequencies
   - **Level** min. and max. specified input level from data sheet.

Recommended test frequencies: 5 MHz, 12.288 MHz, 13 MHz, 95 MHz and 100 MHz.

For instruments with option R&S SMBVB-K704 only:

Test setup:
1. Connect the Reference Signal generator to REF IN connector.
2. Connect the calibrated frequency counter to the REF OUT output (on rear panel).

Measurement 2: Check synchronisation of the DUT for the lower and upper bound of the specified input level range.

1. Settings on DUT:
   - **Source mode** External Reference
   - **Input mode** Variable
   - **Output mode** 10 MHz

2. Settings on Reference Signal Generator:
   - **Frequency** 5 MHz, 12.288 MHz, 13 MHz, 95 MHz, 100 MHz.
   - **Level** min. and max. specified input level from data sheet.
3. Check, if the DUT locks on the reference signal for both input levels. Check the locking range according to the datasheet.
4. Measure the output level. It should be within the data sheet specifications.

1.4.1.3 Checking the 1 GHz reference (only with R&S SMBVB-B3 option)

Accredited calibration: No minimum requirement.

Test equipment:
- Signal generator (see Table 1-1, item 5)
- Frequency counter (see Table 1-1, item 1)
- RF power meter (see Table 1-1, item 8)

Test setup:
► Connect an RF power meter to the REF 1G OUT output (on rear panel). Connect the signal generator to the REF 1G IN input (on rear panel).

Measurement 1: Supply an external reference signal via the signal generator and measure the output level at the output. It should be within the data sheet specifications.

1. Settings on DUT:
   - **Source mode** External
   - **Output mode** 1 GHz
2. Settings on Reference Signal Generator:
   - **Frequency** 1 GHz
   - **Level** min. and max. specified input level from data sheet.
3. Measure the output level at the REF 1G OUT.
4. Repeat the measurement with DUT setting **Output mode** 'Input Signal Loop Through'.
5. Repeat the measurement with DUT setting **Output mode** '10 MHz' at the REF OUT connector.

Test setup:
1. Connect the Reference Signal generator to REF 1G IN connector.
2. Connect the calibrated frequency counter to the REF 1G OUT output (on rear panel).

Measurement 2: Check synchronisation of the DUT for the lower and upper bound of the specified input level range.

1. Settings on DUT:
   - **Source mode** External
   - **Output mode** 1 GHz

2. Settings on Reference Signal Generator:
   - **Frequency** 1 GHz
   - **Level** min. and max. specified input level from data sheet.
3. Check, if the DUT locks on the reference signal for both input levels. Check the locking range according to the datasheet.

1.4.2 Checking the Frequency Accuracy

1.4.2.1 Frequency Setting

Accredited calibration: No minimum requirement.

Test method: The frequency setting is tested by running the internal synthesizer adjustments to check the frequency overlap of the VCOs.

Measurement 1: ► Run: Setup ⇨ Internal Adjustments ⇨ "MPLL"
There must be no error message.

1.4.2.2 Setting Time

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.3, "Test Assembly for Setting Time", on page 8.

Test method: The spectrum analyzer is operated as an FM demodulator. A controller transmits the start and the stop frequency via the IEC/IEEE bus. The analyzer is triggered by the positive edge on the EOI line of the IEC/IEEE bus or the trigger pulse in list mode. At switch over from start to stop frequency, the settling procedure is displayed on the screen of the analyzer.

Preparation of measurement:

1. Synchronize the reference frequencies of the DUT and the analyzer.
2. Make GPIB and RF connections.
3. Connect spectrum analyzers trigger connector to EOI line (pin 5) of IEC/IEEE bus.
4. Settings on DUT:
   - **Frequency** start frequency unmodulated
   - **Level Settings/Setting Characteristic** Auto
   - **Level** 0 dBm
5. Settings on spectrum analyzer:
   - **AMPT/REF LEVEL** 0 dBm
   - **FREQ** Stop frequency
   - **FM DEMOD** ON
   - **DEMOD BW** 100 kHz
   - **RANGE /DEVIATION PER DIV** 200 Hz
   - **MEAS TIME** 5 ms

- **TRIGGER** EXTERN
- **External triggering by positive edge at 1.4 V**

Measurement 1:

1. Set the analyzer to the stop frequency.
2. Set the DUT to the start frequency f_{start}
3. Send the stop frequency f_{stop} from the controller to the DUT.
   ⇨ The externally triggered analyzer displays the settling curve. The setting time is defined as the time required to make the frequency deviation from the stop frequency less than the specified deviation in the data sheet.
4. Switch on I/Q-Modulation:
   I/Q Settings Menu:
   - **Source** Analog Wideband I/Q Input
   - **State** On

   Supply 0.5 V DC to the I_{ext} Input and repeat the measurement.
5. Repeat Measurement in List Mode with CW
   Connect a Trigger source to External Trigger input of the spectrum analyzer and the Trigger input **User** of the DUT.
   Setting on DUT:
   List Mode Menu:
   - Generate List with recommended Frequencies and Levels.
   - **Run Mode** Learned (Frozen RF Settings)
   - Learn List Mode Data
   - **Mode** Extern Step
   - **State** on
   - Generate Trigger Pulses and measure the Setting Time.
6. Repeat List Mode Measurement with I/Q-Modulation switched on.

Measurements in list mode:

Only when List Mode is specified in the data sheet:

1. Connect pulse generator as trigger source to the **User** connector of DUT, analyzer and oscilloscope. External triggering at 1.4 V, positive edge.
2. Settings on DUT:
   - In List mode menu, generate a list containing all test frequencies with a level of 0 dBm each.
   - Set operating mode to **External Step**.
3. Settings on spectrum analyzer:
   - **DEMOD BW** 200 kHz
   - **MEAS TIME** 1 ms
4. Settings on pulse generator:
   - Single shot

5. With each pulse from the pulse generator, frequency jumps from F_n to F_{n+1}.
   ⇨ The settling curve is displayed on the screen of the externally triggered analyzer. Using the cursor, the time for reaching the specified deviation can be determined.

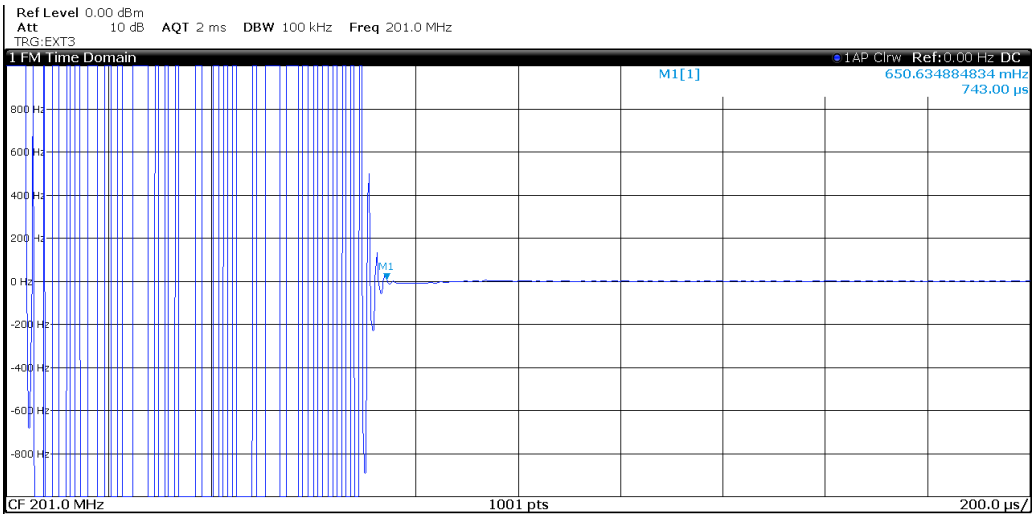
Recommended test frequencies and modes:

f_{start} in MHz	f_{stop} in MHz	Mode
0.2	0.201	CW, List
0.201	0.2	CW, List
5	5001	CW, IQ, List
5001	5	CW, IQ, List
10	10.001	CW, IQ, List
10.001	10	CW, IQ, List
80	80.001	CW, IQ, List
80.001	80	CW, IQ, List
100	100.001	CW, IQ, List
100.001	100	CW, IQ, List
250	250.001	CW, IQ, List
250.001	250	CW, IQ, List
267	267.001	CW, IQ, List
267.001	267	CW, IQ, List
1400	1400.001	CW, IQ, List
1400.001	1400	CW, IQ, List
1500	1500.001	CW, IQ, List
1500.001	1500	CW, IQ, List
3000	3000.001	CW, IQ, List
3000.001	3000	CW, IQ, List
3780	3780.001	CW, IQ, List
3780.001	3780	CW, IQ, List
3876	3876.001	CW, IQ, List
3876.001	3876	CW, IQ, List
4100	4100.001	CW, IQ, List
4100.001	4100	CW, IQ, List
4760	4760.001	CW, IQ, List
1500.001	VCO12	CW, IQ, List
VCO12	1500.001	CW, IQ, List
VCO12+0.001	VCO23	CW, IQ, List

f_{start} in MHz	f_{stop} in MHz	Mode
VCO23	VCO12+0.001	CW, IQ, List
VCO23+0.001	VCO34	CW, IQ, List
VCO34	VCO23+0.001	CW, IQ, List
VCO34+0.001	3000	CW, IQ, List
3000	VCO34+0.001	CW, IQ, List
3000.001	2*VCO12	CW, IQ, List
2*VCO12	3000.001	CW, IQ, List
2*VCO12+0.001	2*VCO23	CW, IQ, List
2*VCO23	2*VCO12+0.001	CW, IQ, List
2*VCO23+0.001	2*VCO34	CW, IQ, List
2*VCO34	2*VCO23+0.001	CW, IQ, List
2*VCO34+0.001	6000	CW, IQ, List
6000	2*VCO34+0.001	CW, IQ, List

Example:

Measurement



The marker is set to the time when the trace enters the specified interval of 201 MHz ± 20.1 Hz. The setting time is 743 µs.

1.4.3 Checking the Spectral Purity

1.4.3.1 Harmonics

Accredited calibration: No minimum requirement.

Test equipment:
- RF analyzer (see Table 1-1, item 19)

Test setup:
1. Connect the RF analyzer to the RF output of the DUT.
2. Synchronize the reference frequencies of analyzer and DUT.

Measurement 1:
1. Settings on analyzer:
   - **Reference level** test level + 3 dB, 10 dB/div.
   - **Span** 0 Hz
   - **Resolution bandwidth** 1 kHz
2. Settings on DUT:
   - **Frequency** test frequencies
   - **Level** test levels
3. First measure the level of the fundamental P_f at the test frequency f as a reference. Then measure the signal levels P_{2*f} and P_{3*f} at twice and three times the carrier frequency f.
   ⇨ The harmonic spacing is the measured harmonic level referred to the fundamental:
   - HD2 = P_f - P_{2*f}
   - HD3 = P_f – P_{3*f}

   (in dBc = referred to the carrier)
4. Repeat the measurement with I/Q-Modulation switched on.
5. **I/Q Settings** Menu:
   - **Source** Analog Wideband I/Q Input
   - **State** On
6. Supply 0.5 V DC to the I_{ext} Input.

Recommended test frequencies and levels:
► Test frequencies:
Recommended test frequencies according to Table 1-2 and from RF_{min} to RF_{max} in steps of 100 MHz.
Test levels: Maximum specified level for harmonics.

1.4.3.2 Subharmonics

Accredited calibration: No minimum requirement.

Test equipment:
- RF analyzer (see Table 1-1, item 19)

Test setup:
1. Connect the spectrum analyzer to the RF output of the DUT.
2. Synchronize the reference frequencies of analyzer and DUT.

Measurement 1:

► First the level of the fundamental is measured as reference, then a signal is searched for

- 0.5* and 1.5*test frequency for instruments equipped with R&S SMBVB-B103/ KB106 option.

⇨ The subharmonic spacing is the measured level referred to the reference level (dBc = referred to the carrier).

Recommended test frequencies and levels:

1. Test frequencies:
   Recommended test frequencies according to Table 1-2 and from RF_{min} to RF_{max} in steps of 100 MHz.
   Level: 10 dBm
2. Repeat Mesurement with I/Q-Modulation switched on.
   I/Q Settings Menu:
   - **Source** Analog Wideband I/Q Input
   - **State** On

   Supply 0.5 V DC to the I_{ext} Input.

1.4.3.3 Nonharmonics

Accredited calibration:

No minimum requirement.

Test equipment:

- RF analyzer (see Table 1-1, item 19)

Test setup:

1. Connect the RF analyzer to the RF output of the DUT.
2. Synchronize the reference frequencies of analyzer and DUT.

Measurement 1:

► First the carrier level P_f is measured at the test frequency f as reference and then the signal level P_{search} is measured at the analyzer search frequency.
⇨ The nonharmonic spacing D is the measured level referred to the reference level: $D = P_f - P_{search}$ (in dBc = referred to the carrier)

Some of the nonharmonics suppression values to be measured might be outside analyzer specifications. In case of doubt, repeat the measurement with a 3 dB attenuator pad at the analyzer input. If the nonharmonics suppression changes the nonharmonics are due to the analyzer. Because of the bell-shaped noise of the analyzer near the carrier, smaller resolution bandwidths may have to be used. To exclude amplitude independent nonharmonics of the analyzer, use a second generator with different synthesis architecture.

The measurement has to be performed with an analyzer span of 1 kHz at least.

Service limits:

reduce datasheet limits by 3 dB.

Recommended settings and sampling frequencies:

Table 1-3: Nonharmonics of the synthesis at test level 10.0 dBm, unmod.

Setting on DUT (Frequency in MHz)	Analyzer search frequency (in MHz)
66.930000	70.88000
77.590000	86.259800
455.203520	455.232140
881.777000	882.052500
999.900000	1000.000000
999.900000	1000.100000
1076.561000	1076.579200
1137.503000	1137.537300
1157.803000	1157.829700
1264.292000	1264.352500
1291.929000	1292.080000
1302.607000	1302.630200
1343.016000	1343.091700
1414.262000	1414.438600
1424.408000	1424.512200
1434.603000	1434.700900
1499.900000	1500.300000
1500.100000	1500.300000
1500.100000	1500.500000
1571.500000	1571.590900
1675.765000	1675.792200
1828.140000	1828.167200
1999.900000	2000.000000
1999.900000	2000.100000
2000.100000	2000.200000
2000.100000	2000.300000
2153.144000	2153.173300
2168.957000	2169.167900
2274.980000	2275.008570
2405.150000	2405.522300
2574.265000	2574.541500
2660.913000	2660.942970
2828.451000	2828.636700

Setting on DUT (Frequency in MHz)	Analyzer search frequency (in MHz)
3486.464000	3486.541700
3527.057000	3527.158900
3999.900000	3999.950000
3999.900000	4000.000000
3999.900000	4000.300000
4000.100000	4000.150000
4000.100000	4000.200000
4000.100000	4000.500000
4120.921000	4121.292300
4297.343000	4297.471100
4337.933000	4338.196300
4378.336000	4378.453000
4418.937000	4418.986400
4631.205000	4631.237300
4999.900000	5000.000000
5000.100000	5000.200000
5376.196000	5376.216200
5524.955000	5524.982200
5710.228000	5710.738500
5999.900000	6000.000000
5999.900000	6000.100000

1.4.3.4 Non-systematic nonharmonics

Accredited calibration: No minimum requirement.

Test equipment:
- RF analyzer (see Table 1-1, item 19)

Test setup:
1. Connect the RF analyzer to the RF output of the DUT.
2. Synchronize the reference frequencies of analyzer and DUT.

Measurement 1:
1. Settings on DUT:
   - **Level** 10 dBm
   - **Frequency** recommended test frequencies
2. Recommended settings on analyzer:
   - **Detector** Sample
   - Frequency far from the carrier:

- **AMPT/MIXER/MIXER LVL MANUAL** -5 dBm
- **Resolution bandwidth** 30 kHz
- **Video bandwidth** 1 kHz
- **Span** 10 MHz

- Frequency at 50 kHz to 1 MHz from the carrier:
  - **Resolution bandwidth** 1 kHz
  - **Video bandwidth** 1 kHz

  Average over at least 3 sweeps.

3. Search for nonharmonics from 10 kHz to 10 MHz offset from carrier.
4. Start searching at the positive frequency deviation.

Recommended test frequencies and levels:

1. Test frequencies:

Table 1-4: Non-systematic Nonharmonics of the synthesis at test level 10.0 dBm, unmod.

Setting on DUT (Frequency in MHz)	Analyzer search frequency (in MHz)
77.591000	68.908000
700.787000	700.813667
1571.500000	1571.590910
2579.693000	2579.665283
2762.520000	2762.543529
2803.138000	2803.153071
2935.758000	2935.579310
3437.509000	3437.480198
4509.337000	4509.254839
4712.546000	4712.641171
4753.130000	4753.140257
5240.570000	5240.467680
5443.746000	5443.976567
5524.955000	5524.981469
5606.287000	5606.308450
5871.400000	5871.341605

2. Repeat the measurement with external I/Q-Modulation switched on:
   - **I/Q Settings** Menu:
   - **Source** Analog Wideband I/Q Input
   - **State** On
   - Supply 0.5 V DC to the I_{ext} Input
3. Repeat the measurement with internal I/Q-Modulation switched on:
   - **I/Q Settings** Menu:

- **Source** Internal Baseband
- **State** On

ARB Menu:

- **Create Test Signal** Const I/Q
- **I Value** 0.5 FS
- **Q Value** 0.5 FS
- **Generate Signal RAM**

4. Repeat the measurement at 1 GHz with I/Q-modulation switched on. Check for nonharmonics from 10 kHz to 20 MHz from carrier at P_{min} with a reduced analyzer Resolution bandwidth of 5 Hz. Nonharmonics from 40 Hz to 10 kHz from carrier should be below data sheet value at 10 kHz
   Factory Limit: ??? dBc

Some of the nonharmonics suppression values to be measured might be outside analyzer specifications. In case of doubt, repeat the measurement with a 3 dB attenuator pad at the analyzer input. If the nonharmonics suppression changes the nonharmonics are due to the analyzer. Because of the bell-shaped noise of the analyzer near the carrier, smaller resolution bandwidths may have to be used. To exclude amplitude independent nonharmonics of the analyzer, use a second generator with different synthesis architecture.

1.4.3.5 Wideband Noise

Test equipment:
- RF analyzer (see Table 1-1, item 19)

Test setup:
1. Connect the RF analyzer to the RF output of the DUT.
2. Synchronize the reference frequencies of analyzer and DUT.

Test method:
The carrier power is measured first. Then the center frequency of the analyzer is increased by 30 MHz and the noise power in a small bandwidth is measured. The difference of the carrier power and the noise power in 1 Hz bandwidth, which is calculated from the measurement, is defined as wideband noise. Because wideband noise degrades with lower electronic levels at the output step attenuator input, the output level of the generator has to be set to the lowest level before switching the step attenuator.

Measurement 1:
1. Settings on DUT:
   - **Frequency** test frequency
   - Set **Level** to +10 dBm
   - **Level Settings Characteristic** auto
2. Settings on analyzer:
   - **Center** test frequency
   - **Reference level** Level of DUT + 1 dB

- **Attenuator** D_{min} = Reference Level - P_{1dB} ⇨ round to next larger available Attenuation of the analyzer (P_{1dB} = analyzer P1dB level at test frequency)
- **Span** 110 kHz
- **Detector** RMS
- **Sweep Time Manual** 1 s
- Switch on channel power measurement with 100 kHz bandwidth

3. Measure the channel power P_{ref} with the center frequency of the analyzer set to the test frequency.
4. Increase the analyzer center frequency by 10 MHz.
5. Inhibit the switching of the attenuator with AMPT RF ATTEN MANUAL without entering a value so that the input mixer is not overdriven.
6. Lower the reference level of the analyzer by 20 dB, measure the new channel power P_{noise}
7. Minimize the output level on the DUT by means of RF OFF, measure the channel power P_{res}

Evaluation:

1. If the power P_{res} < P_{noise} - 0.41 dB the inherent noise power of the analyzer can be subtracted:

$$W\_Noise = -P_{ref} + 10 * \log 10(10^{Pnoise/10} - 10^{\mathrm{Pres}/10}) - 50dB$$

2. If the power P_{res} > P_{noise} - 0.41 dB the analyzer resolution is not sufficient for a precise measurement. The true result is in such case certainly more than 10 dB below the measured value. The result then is at least:

$$W\_Noise = -P_{ref} + P_{noise} - 50dB - 10dB$$

⇨ The difference between the power W_{noise} in dBm and the power P_{ref} in dBm is the broadband noise floor in dBc.

Recommended test frequencies and levels:

1. Recommended test frequencies:
16 MHz, 28 MHz, 41.1 MHz, 52.1 MHz, 53 MHz, 53.001 MHz, 69 MHz, 69.001 MHz, 79.1 MHz, 80.001 MHz, 85 MHz, 85.001 MHz, 100 MHz, 100.001 MHz, 115 MHz, 115.001 MHz, 155 MHz, 155.001 MHz, 194 MHz, 194.001 MHz, 225 MHz, 225.001 MHz, 226 MHz, 226.001 MHz, 250 MHz, 250.001 MHz, 289 MHz, 289.001 MHz, 290 MHz, 290.001 MHz, 350 MHz, 350.001 MHz, 351 MHz, 351.001 MHz, 470 MHz, 470.001 MHz, 474 MHz, 474.001 MHz, 510 MHz, 510.001 MHz, 530 MHz, 530.001 MHz, 660 MHz, 660.001 MHz, 875 MHz, 875.001 MHz, 900 MHz, 900.001 MHz, 988 MHz, 988.001 MHz, 1200 MHz, 1200.001 MHz, 1400 MHz, 1400.001 MHz, 1900 MHz, 1900.001 MHz, 2100 MHz, 2100.001 MHz, 3000 MHz, 3000.001 MHz, 3100 MHz, 3100.001 MHz, 4100 MHz, 4100.001 MHz, 6000 MHz.
Recommended test level:

+10 dBm

2. Repeat the measurement with I/Q-Modulation switched on:
3. **I/Q Settings** Menu:
   - **Source** Internal baseband, generate full scale DC signal in baseband (i. e. MCCW-signal with 1 carrier)
   - **Mode** IQ wideband on
   - **State** On
4. Supply 0.5 V DC to the I_{ext} Input
5. For Each test frequency:
   Set **Level Settings Characteristic** auto
   Determine P_{min} as described above
   Set **Level Settings Characteristic** Strictly Monotone
   Set **Level** 10 dBm
   Measure the Wideband Noise

1.4.3.6 SSB Phase Noise

Accredited calibration:

No minimum requirement.

The SSB phase noise of the DUT can be measured directly if a Phase Noise Test Set is available. A R&S®FSWP or any other analyzer with phase noise option is suitable if its own phase noise is at least 6 dB less than the guaranteed DUT Phase noise in the data sheet.

Measurement: Set the Level of the DUT to 10 dBm. For the measurment at 67 GHz set the Level of the DUT to 13 dBm. Measure the phase noise at recommended offset with the analyzer in phase noise mode.

If no suited analyzer is available, the Phase noise can be measured with the aid of a second generator and a mixer.

Test equipment:

- RF analyzer (see Table 1-1, item 19)
- Reference source for SSB noise measurements (see Table 1-1, item 2)
- Phase noise test assembly (see Table 1-1, item 6)

Test assembly:

See Chapter 1.2, "Test Assemblies", on page 7.

Test method:

The two generators are set to the test frequency and synchronized with a phase offset of 90 ° (phase quadrature). Mixing to 0 Hz suppresses the RF carrier. Due to the phase quadrature, the mixer supplies a voltage representing the phase difference between the input signals. This voltage is measured with the spectrum analyzer and can be converted into SSB phase noise.

Measurement 1:

1. Set the levels of the two generators in accordance with the specifications of the mixer used (unmodulated or I/Q modulation with max. level).
2. For calibration, reduce the level of the DUT by 40 dB and detune one signal generator by 20 kHz. Check the signal for harmonics; the 2nd and 3rd harmonic should

be more than 30 dB below the fundamental. Measure the reference value at 20 kHz at the analyzer and note it down.

3. Set the detuned signal generator to the previous frequency and set the signal generators for phase quadrature. To this end, raise the level of the DUT to the previous level and call Delta Phase in the Frequency/Phase menu. Observe the output voltage of the mixer on the oscilloscope and vary the phase until the voltage becomes zero.
4. Read the noise voltage, normalized to a bandwidth of 1 Hz (noise level) from the analyzer

Evaluation:

► Determine the difference relative to the reference level and add to the value found 6 dB for the second (correlated) sideband and 40 dB for level switchover. If the S/N ratio of the reference source is not at least 10 dB better than that of the DUT, the noise component of the reference signal generator must be determined and subtracted as well.
⇨ The corrected S/N ratio is the wanted measured value.

Example:

The measured reference level is assumed to be 12 dBm. A noise level of -78 dBm (1 Hz) is determined at 20 kHz. The difference is 90 dB, plus the correction for the second sideband (6 dB) and level switchover (40 dB), yielding an S/N ratio of -136 dB or a noise level of -136 dBc (dB referred to the carrier power). If two identical signal generators have been used, the result must be reduced by 3 dB for the (uncorrelated) noise power of the reference signal generator.

⇨ The final result is then -139 dBc.

Recommended test frequencies:

► Measurement at 10 MHz, 100 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz and 6 GHz with 20 kHz Offset in Mode CW and Mode I/Q-extern with 0.5 V DC supplied to the I_{ext} Input.

1.4.3.7 Residual FM

Accredited calibration:

No minimum requirement.

Test equipment:

- RF analyzer (see Table 1-1, item 19)
- Reference source for SSB noise measurements (see Table 1-1, item 2)
- Phase noise test assembly (see Table 1-1, item 6)

Test assembly:

See Chapter 1.2.1, "Test Assembly for SSB Phase Noise and Jitter", on page 7.

Test method:

The Residual FM is calculated from the phase noise measurement data. The measurement setup and procedure is identical to the phase noise measurement. The Residual FM of the DUT can be measured directly if a Phase Noise Test Set is available. An R&S®FSWP or any other analyzer with phase noise option can be used to determine the Residual FM value. If not available, perform the following procedure.

Measurement 1:

1. Settings on DUT:

- **Frequency** 1 GHz
- **Level** Level P_{max}, unmodulated

2. Settings on RF analyzer:
   - **Coupling** DC
   - **FILTER-TYPE** FFT
   - **RBW** 10 Hz
   - **DETECTOR** SAMPLE
   - Set up measurement and calibrate as described under SSB Phase Noise Measurement.

The Residual FM is defined as

$$\sigma = \sqrt{2 \cdot \int_{f\,\min}^{f\,\max} L_{\Phi}(f) \cdot f^2 df}$$

with $L_{\Phi}(f)$ being the single side band phase noise.

1. Set Analyzer Start and Stop Frequency to
   F_{start} = *300 Hz* and F_{stop} = *3 kHz*
2. Read Trace Data $T(\mu)$ with $\mu\varepsilon$ *[1, N]* and N = *625* from spectrum analyzer and calculate the summed residual FM of the DUT and the Reference Signal Generator

$$\sigma = \sqrt{2\sum_{\mu=1}^{N} \frac{10^{(T(\mu)-P_{ref}-46dB)/10}}{RBW} \cdot \frac{F_{stop}-F_{start}}{N} \left(F_{start} + (\mu-1) \cdot \frac{F_{stop}-F_{start}}{N-1} \right)^2}$$

   with P_{ref} being the reference level from the SSB Phase Noise Measurement with 40 dB reduced level with 20 kHz detuned frequency.
   The sum of the residual FM of the DUT and the Reference Signal Generator should be well below the guaranteed value of the DUT, so no correction of the measurement result is necessary.
3. Repeat measurement with a test bandwidth of 20 Hz to 23 kHz in two steps: First sweep from 20 Hz to 1 kHz with a RBW of 3 Hz and then sweep from 1 kHz to 23 kHz with a RBW of 100 Hz. Calculate the Residual FM for both measurements with the formula given above. The Residual FM from 20 Hz - 23 kHz is:

$$\sigma_{20\,Hz-23\,kHz} = \sqrt{\sigma^2_{20\,Hz-1\,kHz} + \sigma^2_{1\,kHz-23\,kHz}}$$

1.4.3.8 Residual AM

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

The RF-Signal is demodulated by an AM demodulator integrated in the spectrum analyzer. Alternatively, the RF-signal of the DUT can be demodulated with a zero Bias Schottky Detector. The demodulated signal from the detector is fed to the Spectrum analyzer RF input.

Test method: The described method is valid for demodulation with a zero Bias Schottky Detector.

Measurement 1:

1. Settings on DUT:
   - **Frequency** 1 GHz
   - Level according to the mixer specification in linear range
   - **AM-Source** internal
   - **AM Depth** 1 %
   - **LF-Gen-Frequency** 10 kHz
   - **Level** 12 dBm
2. Settings on sprectrum analyzer:
   - **Coupling** DC
     (an external Preamplifier with > 30 dB Gain and a DC-blocking Capacitor is necessary (f-3 dB < 10 Hz)).
   - **FILTER TYPE** FFT
   - **RBW** 100 Hz
   - ***F_{start} 9900 Hz***
   - ***F_{stop} 10100 Hz***
   - **DETECTOR** MAX PEAK

► Calibrate the setup:

- Measure power level P_{ref} [dBm] at f = 10 kHz.

1. Switch off AM
2. Settings on spectrum analyzer:
   - **RBW** 3 Hz
   - ***F_{start} 20 Hz***
   - ***F_{stop} 1 kHz***
   - **DETECTOR** SAMPLE

► Read Trace T(µ) with $\mu \in [1, N]$ and $N = 625$ from spectrum analyzer and calculate the summed power.

$$P = \sum_{\mu=1}^{N} \frac{10^{T(\mu)/10}}{RBW} \cdot \frac{F_{stop} - F_{start}}{N}$$

► Repeat Measurement with:

- **RBW** 100 Hz
- ***Fstart** 1 kHz*
- ***Fstop** 23 kHz*

- Calculate Power as above

► Calculate the residual AM:

$$AM_{residual} = \frac{1}{\sqrt{2}} \cdot \sqrt{\frac{P_{20Hz-1kHz} + P_{1kHz-23kHz}}{10^{P_{ref}/10}}}[\%]$$

Test frequencies: 1 MHz, 5.001 MHz, 10 MHz, 50 MHz, 80 MHz, 80.001 MHz, 100 MHz, 1 GHz, 1.9 GHz, 1.901 GHz, 2.7 GHz, 3 GHz, 3.001 GHz, 3.6 GHz, 3.601 GHz, 4.1 GHz, 4.101 GHz, 5.4 GHz and 6 GHz

1.4.4 Checking the Level Data

1.4.4.1 Level Accuracy

Accredited calibration: Same coverage as performance test for levels ≥ -40 dBm.

Test method: The level uncertainty is measured in two steps. First, the frequency response is measured at a fixed level with high frequency resolution. Then the level dependant uncertainty is measured at fixed frequencies over the specified range.

Test equipment:
- RF power meter (see Table 1-1, item 8)
- RF analyzer (see Table 1-1, item 19)
- Low noise preamplifier (see Table 1-1, item 9/10)

Test method for levels in measurement range of power meter

Test equipment:
- RF power meter (see Table 1-1, item 8)

Test setup: ► Connect power meter to RF output socket.

Measurement 1:

1. Settings on DUT:
   - **Level** test levels
   - **ALC mode** Auto
2. Measure the level $P_{absolute}$ at the recommended test frequencies up to RF_{max}
   ⇨The level error is the deviation of the measured level from the set value.
3. Repeat the measurement with IQ-Modulation switched on, starting at 100 kHz RF frequency.
4. I/Q Settings menu:
   - **Source** Analog Wideband I/Q Input
   - **State** On
5. Supply 0.5 V DC to the I_{ext} Input.

Recommended test levels for frequency response measurement:

1. **Level** -20 dBm, +18 dBm or maximum specified level (for accredited measurement), whichever is lower (+5 dBm ≤ 0.2 MHz) and +20 dBm or maximum specified level, whichever is lower (+5 dBm ≤ 0.2 MHz).
2. **I/Q mode with ALC mode:** Sample & Hold
   +7 dBm (+5 dBm ≤ 0.2 MHz)
   0 dBm and +20 dBm or maximum specified level, whichever is lower (+5 dBm ≤ 0.2 MHz).

Recommended test frequ. for level frequency response measurement:

► 8 kHz, 10 kHz, 15 kHz, 20 kHz, 30 kHz, 50 kHz, 70 kHz, 100 kHz, 150 kHz, 200 kHz, 201 kHz, 1 MHz, 3 MHz, 5 MHz, 5.001 MHz, 5 MHz, 8 MHz, 9.9 MHz, 10 MHz, 20 MHz, 41 MHz, 52 MHz, 53 MHz, 70 MHz, 80 MHz, 85 MHz, 100 MHz, 115 MHz, 155 MHz, 194 MHz, 200 MHz, 225 MHz, 226 MHz, 250 MHz, 289 MHz, 290 MHz, 350 MHz, 351 MHz, 470 MHz, 474 MHz, 530 MHz, 660 MHz, 900 MHz, 988 MHz, 1200 MHz, 1400 MHz, 2100 MHz, 3000 MHz, 3100 MHz, 4100 MHz, 6000 MHz, and from 12.5 MHz to 6000 MHz in steps of 25 MHz.
I/Q mode: starting from 100 kHz.

Service limits:

- Data sheet version < 05.00:
  Reduce limits by 0.15 dB (f ≥ 200 kHz)
- Data sheet version ≥ 05.00:
  Reduce limits by 0.25 dB (f < 200 kHz)
  Reduce limits by 0.15 dB (f ≥ 200 kHz)

Test method for low levels

Test principle:

Low levels can only be measured using a frequency selective measurement instrument. Spectrum analyzers with digital IF are best suited for this measurement due to their low linearity error. The absolute accuracy of these analyzers is not sufficient for this measurement. So a relative measurement referred to the measurements performed with the power meter is used to increase the accuracy of the measurement.

Only by switching the input attenuator and preamplifier (when available) of the analyzer the needed dynamic range of more than 120 dB can be reached. After switching the analyzer attenuator or preamplifier, a continuity calibration is to be carried out. It is therefore recommended to switch the attenuator not until reaching 50 dB under full scale, since the linearity errors are very small in this range.

Test equipment:

- RF analyzer (see Table 1-1, item 19)

Test setup:

► Connect the spectrum analyzer to the RF output of the DUT with precision RF measurement cables.

Measurement 1:

1. Settings on DUT:
   - **Frequency** recommended test frequencies
   - **Level** 20 dBm or maximum specified level, whichever is lower, unmodulated
2. Settings on analyzer:
   - **Test frequency**
   - **SPAN** 10 Hz

- **FILTER TYPE** FFT
- **RES BW** 5 Hz
- Set Marker to test frequency
- **Reference level Pref** +21 dBm

3. Read the marker level P_{Marker} and calculate the correction factor
   $C = P_{absolute} - P_{Marker}$
   with $P_{absolute}$ from the measurements performed with the power meter.
4. Now decrease the DUT level in 5 dB steps and calculate the output power P by adding the Correction factor C to the marker readout.
5. As soon as the marker level P_{Att1} is lower than P_{ref} -45 dB increase the sensitivity of the analyzer by reducing the input attenuation, switching on the internal preamplifier if available and reducing the resolution bandwidth to 1 Hz for levels below -90 dBm. Set the analyzer reference level to P_{Att1} + 1 dB. After switching the analyzer sensitivity read out the marker level P_{Att2} and recalculate the Correction factor:
   $C_{new} = C_{old} + P_{Att1} - P_{Att2}$
6. Continue the measurement down to -120 dBm in 5 dB steps.
7. Repeat measurement with **ALC state Off (Table)** for the frequencies 201 kHz, 51 MHz, 487.5 MHz, 1987.5 MHz and 5987.5 MHz.

Recommended test frequencies:

►
- Data sheet version < 05.00:
  0.1 MHz (factory test only), 0.201 MHz, 9 MHz, 51 MHz, 99 MHz, 487.5 MHz and from 987.5 MHz to 5987.5 MHz in steps of 1 GHz.
- Data sheet version ≥ 05.00:
  8.35 kHz, 15.35 kHz, 20.35 kHz, 70.35 kHz, 100.35 kHz, 200 kHz, 201 kHz, 9 MHz, 51 MHz, 99 MHz, 487.5 MHz and from 987.5 MHz to 5987.5 MHz in steps of 1 GHz.

Service limits: Reduce Limits by 0.1 dB

1.4.4.2 Maximum Level

Test equipment: For instruments equipped with R&S SMBVB-B103, R&S SMBVB-KB106:

- RF analyzer (see Table 1-1, item 19)
- Coaxial attenuator (see Table 1-1, item 21)

Test setup:

► Connect the spectrum analyzer with Coaxial attenuator to the RF output of the DUT with precision RF measurement cables.

Measurement 1:

1. Settings on DUT:
   - **Frequency** recommended test frequencies
   - **Level** 20 dBm or maximum specified level, whichever is lower, unmodulated

- **Level Limit** Set the internal level limit of the R&S SMBV100B to its maximum value.

2. Settings on analyzer:
   - **Test frequency**
   - **SPAN** 10 Hz
   - **FILTER TYPE** FFT
   - **RES BW** 5 Hz
   - Set Marker to test frequency
   - **Reference level Pref** +21 dBm
3. Read the marker level P_{Marker} and calculate the correction factor
   $C = P_{absolute} - P_{Marker}$
   with $P_{absolute}$ from the measurements performed with the power meter.
4. Now increase the DUT level to 36 dBm and calculate the output power P by adding the Correction factor C to the marker readout.
5. Repeat the measurement with IQ-Modulation switched on.
   I/Q Settings menu:
   - **Source** Analog Wideband I/Q Input
   - **State** On
   - **Baseband Gain** +8 dB

   Supply 0.5 V DC to the I_{ext} Input.
6. Apply the following maximum levels.

Table 1-5: For instruments equipped with options R&S SMBVB-B103 or R&S SMBVB-KB106

Frequency in MHz	P_{max} in dBm without options R&S SMBVB-K31/B32	P_{max} in dBm with option R&S SMBVB-K31	P_{max} in dBm with option R&S SMBVB-B32
0.008...0.200	Data sheet version: • < 05.00: - • ≥ 05.00: +5	Data sheet version: • < 05.00: - • ≥ 05.00: +5	Data sheet version: • < 05.00: - • ≥ 05.00: +17
0.200...1	+13	+13	+21
1...10	+18	+21	+21
10...4000	+18	+21	+25
4000...6000	+18	+20	+25

IQ-Mode:

Table 1-6: For Instruments equipped with options R&S SMBVB-B103 or R&S SMBVB-KB106

Frequency in MHz	P_{max} in dBm without options R&S SMBVB-K31/B32	P_{max} in dBm with option R&S SMBVB-K31	P_{max} in dBm with option R&S SMBVB-B32
0.100...1	not specified, but measured	not specified, but measured	not specified, but measured
1...10	+18	+21	+21

Frequency in MHz	P_{max} in dBm without options R&S SMBVB-K31/B32	P_{max} in dBm with option R&S SMBVB-K31	P_{max} in dBm with option R&S SMBVB-B32
10...4000	+18	+21	+25
4000...6000	+18	+20	+25

Interpolate linearly between the applied limits.

7. Reset the **Level Limit** to its default value or perform a factory preset.

Recommended test frequencies:

► Recommended test frequencies according to Table 1-2, 1.001 MHz, 2 MHz, 3 MHz, 4 MHz and from RF_{min} to RF_{max} in steps of 100 MHz.
IQ-Mode: Starting from 100 kHz.

1.4.4.3 Interruption-free level setting range

Test equipment:

- RF analyzer (see Table 1-1, item 19)
- Coaxial attenuator (see Table 1-1, item 21)

Test setup:

► Connect the analyzer with Coaxial attenuator to the RF output of the DUT.

Measurement 1:

1. Settings on DUT:
   - **Frequencies** 5 MHz, 51 MHz, 400 MHz, 1.1 GHz, 2.2 GHz, From 3 GHz to 6 GHz in steps of 1 GHz, unmodulated.
   - **Level** 5.1 dBm (= Reference)
   - **Level/EMF** menu
     – **Level Settings characteristic** Uninterrupted Level Settings
2. Settings on analyzer:
   - Same as for the measurement of level frequency response and linearity. Measure the signal level P_{ref} as reference value.
3. Now reduce the level at the DUT in steps of 5 dB and measure the deviations from the nominal level difference.
   ⇨ The following deviations should not be exceeded:

Level Difference to P_{ref}	Tolerance in dB
0 dB	Reference
-5 dB	For Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106: 0.10 dB for f < 51 MHz. 0.05 dB for 51 MHz ≤ f ≤ 6 GHz
-10 dB	For Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106: 0.15 dB for f < 51 MHz. 0.10 dB for 51 MHz ≤ f ≤ 6 GHz

Level Difference to P_{ref}	Tolerance in dB
-15 dB	0.25 dB for f < 51 MHz. 0.20 dB for f ≥ 51 MHz. 0.25 dB for f > 40 GHz.
-20 dB	0.30 dB for f < 51 MHz. 0.25 dB for f ≥ 51 MHz. 0.40 dB for f > 40 MHz.

1. Repeat the measurement with the **high dynamic uniterrupted Mode** R&S SMBVB-K724.
   - **Settings on DUT:**
   - **Frequencies** 52.001 MHz, 3 GHz, 6 GHz, 10 , 20 GHz, 30 GHz, 40 GHz, 41 GHz and 50 GHz.
   - **Level/EMF** menu
     – **Level Settings characteristic** High Dyn. Uninterrupted
     – **ALC-mode** Table &On
2. Settings on analyzer:
   - Same as for the measurement of level frequency response and linearity. Measure the signal level P_{ref} as reference value.
3. Now reduce the level as described in the following table and measure the deviations from the nominal level difference.

Level Difference to P_{ref}	Tolerance in dB
0	Reference
-10	<0.25 dB
-10.1	<1 dB
-20	<1 dB
-20.1	<2 dB (typ.)
-30	<2 dB (typ.)
-40	<2 dB (typ.)
-40.1	<3 dB (typ.)
-50	<3 dB (typ.)
-50.1	<4 dB (typ.)
-60	<4 dB (typ.)

1.4.4.4 Output Impedance

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.2, "Test Assembly for Output Impedance (VSWR)", on page 8.

Test method: For the VSWR measurement of a source the effect of the level control must be taken into account. For this purpose, an auxiliary generator is used which transmits a wave with a slightly offset carrier frequency into the DUT. The difference frequency has to be within the control bandwidth of the level control. In the case of ideal source impedance, the wave from the auxiliary generator is not reflected by the DUT. In the case of not ideal DUT source impedance, the output wave of the DUT and the reflected wave of the auxiliary generator are superimposed on one another. A directional coupler couples a part of these outgoing superimposed waves to an analyzer. The frequency offset, results in a beat of the superimposed outgoing waves. The VSWR is the ratio between the maximum and minimum amplitude of the beat.

Measurement 1: For frequencies ≤ 6GHz

Test assembly with second signal generator and VSWR bridge.

1. Settings on DUT:

		without option R&S SMBVB-B32		**with option R&S SMBVB-B32**		
		Path settings `[f].[m].[n]`				
Attenuator	**Detector** `cal:lev:det:mode []`	**f <= 80 MHz**	**f > 80 MHz**	**f <= 10 MHz**	**10 MHz < f <= 80 MHz**	**f > 80 MHz**
	ATT	A.1.5	B.2.2	-	-	-
	HP	-	-	C.2.2	D.3.2	E.3.2
Att0	HP	-	-	C.3.1	D.4.1	E.6.1
Att0	ATT	A.2.1	B.4.1	C.3.1	D.4.1	E.6.1
Att0	OPU	A.2.1	B.4.1	C.3.1	D.4.1	E.6.1
Att5	OPU	A.2.2	B.4.2	C.3.2	D.4.2	E.6.2
Att10	OPU	A.2.3	B.4.3	C.3.3	D.4.3	E.6.3
Att30	OPU	A.2.7	B.4.7	C.3.7	D.4.7	E.6.7

- **Remote commands:**
  - `cal:lev:ampl:stag:freq [f]`
  - `cal:lev:ampl:stag [m]`
  - `cal:lev:ampl:stag:sub [n]`
- **Level Detector** Force level detector with remote command `cal:lev:det:mode [AUTO, OPU, OPUx, ATT, ATTx, HP, HPx]` as stated above.
- **Frequency** Test frequencies

2. Settings on spectrum analyzer:
   - **Test frequency**, **Span** 0 Hz, measured test level + 6 dB
   - **Resolution and video bandwidth** 10 kHz
   - **Linear level** scale

- **Sweep time** 20 ms

3. Settings on second signal generator:
   - Set the frequency to the test frequency -100 Hz
   - Set minimum level, unmodulated
4. Vary the reference level to bring the line displayed on the screen of the spectrum analyzer approximately into the middle of the screen. Measure the voltage of the signal $V_{ref.}$
5. Unscrew the VSWR bridge from the DUT and let the test port open. Increase the level of the second signal generator until the voltage on the analyzer is V_{ref} ± 0.5 %.
6. Screw the VSWR bridge onto the DUT again.
7. Measure the maximum voltage V_{max} and minimum voltage V_{min} of the sinusoidal trace for each configuration in the above table. Calculate the VSWR VSWR = V_{max} / V_{min}.

Recommended test frequencies and levels:

► For Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106:
Test frequencies: 200.001 kHz, 1.01 MHz, 7.9 MHz, from 10 MHz every 5 MHz up to 100 MHz from 100 MHz every 50 MHz up to RF_{max}

Service limits: 1.75

1.4.4.5 Level Setting Time

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.3, "Test Assembly for Setting Time", on page 8.

Test method: The RF analyzer is operated as a fast level meter in zero span. A controller transfers the start and the stop level via the IEC bus. The analyzer is triggered by the positive edge on the EOI line of the IEC bus. At switch over from start to stop level, the setting procedure is displayed on the screen of the analyzer.

Preparation of measurement:

1. Synchronize the reference frequencies of the DUT and the analyzer.
2. Make IEC/IEEE bus and RF connections.
3. Connect the spectrum analyzer trigger input to the EOI line (pin 5) of the IEC/IEEE bus.
4. Setting on DUT:
   - **Frequency** test frequency
   - **Level** start level
5. Settings on spectrum analyzer:
   - **REFERENCE LEVEL** target level + 3 dB
   - **AMPLITUDE LOG RANGE** 10 dB

- **RESOLUTION BANDWIDTH** 200 kHz
- **VIDEO BANDWIDTH** 2 MHz
- **SPAN** 0 Hz
- **SWEEP TIME** 1 s / 2 ms
- **TRIGGER** EXTERN
- **External triggering** by positive edge at 1.4 V

Measurement 1:

1. First send the start and then the stop level from controller.
   ⇨ The externally triggered analyzer displays the settling curve. The setting time is defined as the time from which on the level deviation from the final level (= level 1 second after switch over) is less than the specified deviation in the data sheet.
2. Measure the recommended steps in mode **ALC ON** and **ALC OFF Table**.
3. Measure the recommended steps with IQ-Modulation switched on:
   - **I/Q Settings** Menu:
     – **State** On
     – **Source** Analog Wideband I/Q Input
     – Supply 0.5 V DC to the I_{ext} Input.
     – in mode **ALC ON**, **ALC OFF Table** and **ALC OFF Sample&Hold**
4. Measure the recommended steps in List Mode.
   Connect a Trigger source to External Trigger input of the spectrum analyzer and the trigger input **Inst. Trig.** of the DUT.
   Setting on DUT:
   - **ALC** Auto

   List Mode Menu:
   - Generate List with recommended frequencies and levels.
   - **Run Mode** Learned (frozen RF settings)
   - Learn list mode data
   - **Mode** Extern step
   - **State** on
   - **Attenuator** Auto
   - Generate trigger pulses and measure the setting time.
5. Repeat List Mode Measurement with I/Q-Modulation switched on.

Recommended test frequencies and levels:

► Frequencies: 1 MHz, 10 MHz, 30 MHz, 375 MHz, 1 GHz, 2 GHz, 3 GHz, 4.5 GHz and 6 GHz.

Start level	Stop level
-120 dBm	13 dBm
-27.3 dBm	2.7 dBm
2.7 dBm	-27.3 dBm

*For appropriate specified setting times see datasheet.

1.4.5 Checking the Internal Modulation Generator

1.4.5.1 Frequency Accuracy

Accredited calibration:

No minimum requirement.

The LF-Generator is integrated into a FPGA clocked with the same reference frequency as the synthesizer. Therefore, the LF frequency has the same accuracy as the RF and has not to be measured.

1.4.5.2 Output Voltage Accuracy and Frequency Response

Output Voltage Accuracy

Accredited calibration:

No minimum requirement.

Test equipment:

- AC voltmeter (see Table 1-1, item 15).

Test method:

The output level of the LF Generator is measured direct with an AC voltmeter.

Test setup:

► Connect the AC voltmeter to the LF socket of the DUT.

Measurement of level accuracy:

► Settings on DUT:

- **LF Output** Menu:
  - **LF Gen Frequency** 1 kHz
  - Set **LF Output Voltage** to recommended levels and measure the output level.

Recommended test levels for level accuracy:

3 mV, 10 mV, 30 mV, 100 mV, 300 mV, 1 V , 2 V, 3 V and 4 V.

Frequency Response

Accredited calibration:

No minimum requirement.

Test equipment:

- Power sensor for lower frequencies (see Table 1-1, item 8)

.

Test method:

The output level of the LF Generator is measured directly with the power sensor.

Test setup:

► Connect the power sensor to the LF socket of the DUT.

Measurement of frequency response:

1. Settings on DUT:
   - **LF Output** Menu:
     - **LF Output Voltage** 1 V
     - Set **LF Gen Frequency** to recommended test frequencies and measure the output level.
2. Determine the highest and the lowest level V_{max} and V_{min}
   The frequency response in dB is defined as:
   $D = 20*\log_{10}(V_{max}) - 20*\log_{10}(V_{min})$

Recommended test frequencies:
10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz

For instruments with R&S SMBVB-K24 option additionally check

2 MHz, 3 MHz, 4 MHz, 5 MHz, 6 MHz, 7 MHz, 8 MHz, 9 MHz, 10 MHz.

1.4.5.3 Distortions

Accredited calibration:
No minimum requirement.

Test equipment:
- Spectrum analyzer (see Table 1-1, item 19)

Test method:
The fundamental and harmonics of the LF-generator are measured with the analyzer. The analyzer calculates the Total Harmonic Distortion (THD) with the 'Harmonic Distortion' function.

Test setup:
► Connect the spectrum analyzer to the LF socket of the DUT.

Measurement of frequency settings and distortion:

1. Settings on DUT:
   - **LF Output** Menu:
     – **LF Gen Voltage** 1 V
     – Set **LF Gen Frequency** 1 kHz
2. Settings on spectrum analyzer:
   - **RF INPUT** DC
   - **AMPT REF LEVEL** 10 dBm
   - **FREQ CENTER** LF Gen Frequency
   - **MEAS ⇨ HARMONIC DISTOR**
   - **RF ATTEN MANUAL** increase automatically set attenuator by 10 dB
3. Read the THD.
4. Repeat the measurement at the recommended test frequencies by changing the DUT LF Gen Frequency and the analyzer center frequency.

Recommended test frequencies:
100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz.

Service limits:
f < 100 kHz: 0.09 %

1.4.6 Checking the Amplitude Modulation

Apply limits only for frequencies greater than 200 kHz according to specification in datasheet.

1.4.6.1 AM depth error

Accredited calibration:
No minimum requirement.

Test assembly:
See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Measurement of accuracy versus modulation depth:

1. Settings on DUT:
   - **RF** On
   - **Frequency** recommended test frequencies
   - **Level** 0 dBm
   - **Amplitude Modulation** Menu:
     - **AM Path 1 State** On
     - **AM Path 1 Source** LF Generator 1
   - **Modulation Sources** Menu:
     - **LF Generator 1 Frequency** 1 kHz
2. Settings on analyzer:
   - **AMPTD** ⇨ **REF LEVEL** test level + 6 dB
   - **FREQ** ⇨ **CENTER** 150 MHz
   - **FM DEMOD**
     - **FMDEMOD ON**
     - **RESULT DISPLAY** ⇨ **AM**
     - **DEMOD BW** 50 kHz
     - **RANGE** ⇨ **DEVIATION PER DIV** 20 %
     - **MEAS TIME** 100 ms
3. Set the **AM Path 1 Depth** to the recommended modulation depths and read the modulation depth **±peak/2** from the analyzer.

Recommended test frequencies:

201 kHz, 10 MHz, 150 MHz, 1 GHz, 6 GHz

Recommended modulation depths:

m = 5 %, 10 % to 90 % in steps of 10 % and 96 %.

Repeat measurement at 150 MHz with AM Depth 30% and Modulation Source **Ext.**.

Measurement of accuracy versus RF:

1. Settings on DUT:
   - **RF** On
   - **Frequency** recommended test frequencies
   - **Level** 0 dBm
   - **Amplitude Modulation** Menu:
     - **AM Path 1 State** On
     - **AM Path 1 Source** LF Generator 1
     - **AM Path 1 Depth** 80 %
   - **Modulation Sources** Menu:
     - **LF Generator 1 Frequency** 1 kHz
2. Settings on analyzer:
   - **AMPTD** ⇨ **REF LEVEL** 6 dBm
   - **FREQ** ⇨ **CENTER** same as DUT
   - **FM DEMOD**
     - **FMDEMOD ON**
     - **RESULT DISPLAY** ⇨ **AM**
     - **DEMOD BW** 50 kHz
     - **RANGE** ⇨ **DEVIATION PER DIV** 20 %

– **MEAS TIME** 100 ms

3. Measure the modulation depth for all recommended test frequencies.

Recommended test frequencies: 100 kHz, 200 kHz, 1 MHz, 8 MHz, 20 MHz, 51 MHz, 100 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz up to RF_{max} in steps of 2 GHz.

1.4.6.2 AM Distortion

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Amplitude Modulation** Menu:
     – **AM Path 1 depth** 30 %
     – **AM Path 1 Source** LF Generator 1
   - **Modulation Sources** Menu:
     – **LF Generator 1 Frequency** 1 kHz
2. Settings on spectrum analyzer:
   - **AMPTD** ⇨ **REF LEVEL** 6 dBm
   - **FREQ** ⇨ **CENTER** test frequency
   - **FM DEMOD**
     – **FMDEMOD** On
     – **RESULT DISPLAY** ⇨ **AM**
     – **RESULT DISPLAY** ⇨ **AF SPECTRUM**
     – **DEMOD BW** > 7* f_{mod}
     – **RANGE** ⇨ **DEVIATION PER DIV** 20 %
     – **MEAS TIME** 0.16 s
3. Measure the THD for all recommended test frequencies.
   To convert the displayed THD value in dB to percent calculate:
   THD_{pct} = 100 * 10 ^ (THD_{dB}/20).
4. Repeat the measurement with AM depth set to 80 %.

Recommended test frequencies: 100 kHz; 200 kHz; 8 MHz; 20 MHz; 51 MHz; 80 MHz; 80.1 MHz; 100 MHz; 1 GHz; 2 GHz; 3 GHz, 4 GHz up to RF_{max} in steps of 2 GHz.

1.4.6.3 AM Frequency Response

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Measurement 1:

1. Settings on DUT:

- **RF** On
- **Frequency** 201 kHz, 50 MHz, 1 GHz, 6 GHz
- **Level** 0 dBm
- **Amplitude Modulation** Menu:
  - **AM Path Source** Internal
  - **AM Path 1 depth** 60 %

2. Settings on spectrum analyzer:

- **AMPTD** ⇨ **REF LEVEL** 6 dBm
- **FREQ** ⇨ **CENTER** 1 GHz
- **FM DEMOD**
  - **FMDEMOD** On
  - **RESULT DISPLAY** ⇨ **AM**
  - **RESULT DISPLAY** ⇨ **AF SPECTRUM**
  - **DEMOD BW** 200 kHz
  - **RANGE** ⇨ **DEVIATION PER DIV** 20 %
  - **MEAS TIME** ≥ $16/f_{mod}$ s

3. Settings on the signal generator:

- Set the internal modulation generator frequency to the frequencies given below and measure the modulation depth in RMS.

Gen. frequency	10 Hz	100 Hz	1 kHz	5 kHz	10 kHz	30 kHz	50 kHz	100 kHz
MEAS TIME	0.8 s	0.2 s	0.2 s	0.2 s	0.2 s	0.2 s	0.2 s	0.2 s

⇨ The modulation frequency response in dB is the difference between the greatest and the smallest modulation depth m_{max} and m_{min}:
$m_{max-min} = 20 * \log_{10} (m_{max}) - 20 * \log_{10} (m_{min})$

Measurement 2: Measure the Modulation Frequency Response (AM depth error in dB) vs the recommended test frequencies for a modulation frequency of 50 kHz and an AM depth set to 60 %.

Recommended test frequencies: 100 kHz, 200 kHz, 8 MHz, 20 MHz, 51 MHz, 79 MHz, 80.1 MHz, 90 MHz and from 100 MHz to RF_{max} in steps of 100 MHz.

1.4.6.4 Synchronous PhiM with AM

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Measurement 1:

1. Settings on DUT:

- **RF** On
- **Level** PEP = P_{max}, 0 dBm
- **Amplitude Modulation** Menu:

  - **AM Path 1 Source** LF Generator 1
  - **AM Path 1 depth** 30 %
- **Modulation Sources** Menu:
  - **LF Generator 1 Frequency** 1 kHz

2. Settings on spectrum analyzer:
   - **AMPTD** ⇨ **REF LEVEL** 3 dBm
   - **FM DEMOD**
     - **DEMOD BW** 12.5 kHz
     - **MEAS TIME** 100 ms
     - **RESULT DISPLAY** ⇨ **PM**

► Measure the resulting phase modulation with peak detection (±peak/2-value).

Recommended test frequencies: 100 kHz, 200 kHz, 8 MHz, from 10 MHz to 100 MHz in steps of 10 MHz, from 200 MHz to 900 MHz in steps of 100 MHz, from 1 GHz to 6 GHz in steps of 200 MHz,

Service limits: < 0.15 rad

1.4.7 Checking the Frequency Modulation (Option R&S SMBVB-K720)

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Test method FFT demodulation (option FS-K7):

1. The FM deviation and distortion are determined by digital signal processing in the spectrum analyzer.

2. Settings on spectrum analyzer:
   - **AMPTD** ⇨ **REF LEVEL** test level
   - **FREQ** ⇨ **CENTER** test frequency
   - **FM DEMOD**
     - **FMDEMOD** On
     - **RESULT DISPLAY** FM resp. PM
     - **DEMOD BW** > 2 * (deviation + f_{mod}) for FM
     - **DEMOD BW** > 2 * fmod * (1 + deviation) for PM
     - **RANGE** ⇨ **DEVIATION PER DIV** 0.5 * deviation
     - **MEAS TIME** 3/f_{mod} for distortion (up to 3rd harmonic)
     - **RESULT DISPLAY** FM resp. PM / AF SPECTRUM
     - **DEMOD BW** > 2 * (deviation + 3.5 * f_{mod}) for FM
     - **DEMOD BW** > 7 * f_{mod} * (1 + deviation) for PM
     - **MEAS TIME** 16/f_{mod}

1.4.7.1 FM Setting Uncertainty

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Test method: FFT Demodulation, see Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.

Measurement 1:

► Settings on DUT:

- **RF** On
- **Level** 0 dBm
- **Frequency Modulation** Menu:
  - **FM Path 1 State** On
  - **FM Path 1 Source** LF Generator 1

Recommended settings:

1. Measurement in **FM Mode** High Bandwidth

Center Frequency in MHz	LF Gen Frequency in kHz	FM Deviation in kHz
8	2	2500
250	2	2500
250.1	2	1250
750.1	2	5000
1000	2	5000
1500	2	5000

For higher frequencies perform the measurement according to the following table (RF_{max} depending on installed option R&S SMBVB-B103/-KB106)

Center Frequency in MHz	LF Gen Frequency in kHz	FM Deviation in kHz
3000	2	100
6000	2	100

2. Measurement in **FM Mode** Low Noise

Center Frequency in MHz	LF Gen Frequency in kHz	FM Deviation in kHz
8	2	50
750.1	2	50
1000	2	50
1500	2	50

For higher frequencies perform the measurement according to the following table (RF_{max} depending on installed option R&S SMBVB-B103/-KB106)

Center Frequency in MHz	LF Gen Frequency in kHz	FM Deviation in kHz
3000	2	100
6000	2	100

3. Repeat the measurement in **FM Mode** High Bandwidth with FM source **external** and the follwoing settings.

Center Frequency in MHz	LF Gen Frequency in kHz	FM Deviation in kHz
1000	2	5000

1.4.7.2 FM Distortion

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Test method: FFT Demodulation, see Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Frequency Modulation** Menu:
     - **FM Path 1 State** On
     - **FM Path 1 Source** LF Generator 1
   - **Modulation sources** Menu.
     - **LF Generator 1 Frequency** 2 kHz
2. Settings on spectrum analyzer:
   - **DEMOD BW** 5 * FM deviation
   - **RANGE ⇨ DEVIATION PER DIV** 250 kHz
   - **RESULT DISPLAY** FM / AF SPECTRUM
   - **SWEEP** MEAS TIME 2.5 ms
   - **FREQ** AF STOP 50 kHz
3. Read the THD from the display.
   To convert to percent calculate
   $THD_{pct} = 100 * 10 \wedge (THD_{dB}/20)$

Recommended settings:

1. Measurement in **FM Mode** High Bandwidth:

Center Frequency in MHz	FM Deviation in kHz
8	500
250	500
250.1	250
750.1	1000
1000	1000
1500	1000
3000	2000
6000	4000

2. Measurement in **FM Mode** Low Noise (RF_{max} depending on installed option R&S SMBVB-B103/-KB106):

Center Frequency in MHz	FM Deviation in kHz
8	500
750.1	100
1000	100
1500	100
3000	200
6000	400

1.4.7.3 FM Frequency Response

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Test method: FFT Demodulation, see Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Frequency Modulation** Menu:
     - **FM Path 1 Source** External 1
     - **FM Mode** Normal
     - **FM Path 1 Deviation** 1 MHz
   - **Modulation sources** Menu:
     - **External 1 Coupling** DC
     - **LF Generator 1 Shape** Sine
2. Setting on the signal generator:
   - For frequencies up to 300 kHz the internal LF generator of the signal generator is used, > 300 kHz the RF output.
   - It is recommended to use an AC voltmeter (see Table 1-1, item 15) to control the correct input voltage.
   - **LFGen Voltage** 0.707 V
   - **State** On
   - **RF Level** 10 dBm (equivalent to 1 V peak voltage).
3. Settings on spectrum analyzer:
   - FFT Demodulation
4. Vary the signal generator frequency and measure the modulation depth.
   ⇨ The modulation frequency response is the factor between the greatest and the smallest modulation depth.

5. Repeat the measurement with the internal modulation generator with the setting **FM Path 1 Source Internal**.

Recommended settings:

1. LF in logarithmic steps
   4 steps per decade (1, 1.8, 3.2, 5.6)
2. Measurement in **FM Mode** High Bandwidth (RF_{max} depending on installed option R&S SMBVB-B103/-KB106):

Center Frequency in MHz	Mod-Source	F mod	FM Deviation in kHz
8	Int., Ext. DC	10 Hz … 1 kHz	500
50	Ext. AC	10 Hz … 10 MHz	500
250	Ext. AC	1 kHz … 10 MHz	500
250.1	Ext. AC	1 kHz … 10 MHz	250
750.1	Ext. AC	1 kHz … 10 MHz	1000
1000	Int., Ext. AC, Ext. DC	1 kHz … 10 MHz	1000
1500	Ext. AC	1 kHz … 10 MHz	1000
3000	Ext. AC	1 kHz … 10 MHz	2000
6000	Ext. AC	1 kHz … 10 MHz	4000

3. Measurement in **FM Mode** Low Noise (RF_{max} depending on installed option R&S SMBVB-B103/-KB106):

Center Frequency in MHz	Mod-Source	F mod	FM Deviation in kHz
8	Int., Ext. DC	10 Hz … 1 kHz	500
750.1	Ext. AC	1 kHz … f_{stop}	100
1000	Ext. AC	1 kHz … f_{stop}	100
1500	Ext. AC	1 kHz … f_{stop}	100
3000	Ext. AC	1 kHz … f_{stop}	200
6000	Ext. AC	1 kHz … f_{stop}	400

f_{stop} = 100 kHz.

1.4.7.4 Synchronous AM with FM

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Measurement 1:

1. Settings on DUT:
   - **RF** On

- **Level** 0 dBm
- **Frequency Modulation** Menu:
  - **FM Path 1 State** On
  - **FM Path 1 Source** LF Generator 1
  - **FM Mode** High Bandwidth
  - **FM Path 1 Deviation** 40 kHz
- **Modulation Sources** Menu:
  - **LF Generator 1 Frequency** 1 kHz
  - **LF Generator 1 Shape** Sine

2. Settings on spectrum analyzer:
   - **AMPTD / REF** LEVEL 6 dBm
   - **FREQ / CENTER** test frequency
   - **FMDEMOD**
     - **FMDEMOD** On
     - **RESULT DISPLAY** AM / AF SPECTRUM
     - **AF Start** 0 Hz
     - **AF Stop** 5 kHz
     - **RES BW** 30 Hz
     - **DEMOD BW** 100 kHz
     - **IF BW MANUAL** 10 MHz
     - **RANGE** REFERENCE VALUE 0.2 %
     - **MEAS TIME** 3 ms
3. Read the AM depth at 1 kHz modulation frequency from the demodulated AF spectrum.

Test frequencies: 8.001 MHz, 350 MHz, 350.001 MHz, 750.1 MHz, 1000 MHz, 1500 MHz, 3 GHz, 6 GHz.

1.4.7.5 Carrier Frequency Offset with FM

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Frequency** 1 GHz
   - **Frequency Modulation** Menu:
     - **FM Path 1 State** On
     - **FM Path 1 Source** LF Generator 1
     - **FM Path 1 Deviation** 1 MHz
   - **Modulation Sources** Menu:
     - **LF Generator 1 Frequency** 1 MHz
     - **LF Generator 1 Shape** Sine

2. Settings on spectrum analyzer:
   - **AMPTD / REF** LEVEL 0 dBm
   - **FREQ / CENTER** 1 GHz
   - **SPAN** 10 kHz
   - **MKR / SIGNAL COUNT / NEXT / CNT RESOL** 10 Hz
3. Terminate the DUT External Modulation input with 50 Ω and execute the internal FM offset adjustment.
4. Execute a single sweep. Using **MKR / PEAK**, read counted marker frequency.
   ⇨ The offset is the difference between marker frequency and set carrier frequency.
5. Repeat measurement with FM source external, impedance 50 Ω and high Z, coupling AC and DC (4 measurements).

1.4.8 Checking the Phase Modulation

1.4.8.1 PhiM Setting Uncertainty

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Test method: FFT Demodulation, see Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Phase Modulation** Menu:
     - **PhiM Path 1 State** On
     - **PhiM Path 1 Source** LF Generator 1
     - **PhiM Path 1 Deviation** 1 rad
   - **Modulation Sources** Menu:
     - **LF Generator 1 Freq** 1 kHz
     - **LF Generator 1 Shape** Sine
2. Settings on spectrum analyzer:
   See Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.

Recommended settings:

1. Measurement in **PhiM** High Dev

Center Frequency in MHz	LF Gen Frequency in kHz	PhiM Deviation in rad
8	10	10
350	10	10

Center Frequency in MHz	LF Gen Frequency in kHz	PhiM Deviation in rad
350.1	10	10
750.0	10	10
1000	10	10
1500.1	10	10

For higher frequencies perform the measurement according to the following table (RF_{max} depending on installed option R&S SMBVB-B103/-KB106)

Center Frequency in MHz	LF Gen Frequency in kHz	PhiM Deviation in rad
3000.1	10	10
3500	10	10
4900	10	10
5400	10	10
6000	10	10

2. Measurement in **PhiM Mode** High BW

Center Frequency in MHz	LF Gen Frequency in kHz	PhiM Deviation in rad
500	10	0.001
500	10	0.01
500	10	0.1
500	10	0.5

3. Measurement in **PhiM Mode** Low Noise

Center Frequency in MHz	LF Gen Frequency in kHz	PhiM Deviation in rad
8	10	0.0625
1000	10	0.125
1500.1	10	0.25

For higher frequencies perform the measurement according to the following table (RF_{max} depending on installed option R&S SMBVB-B103/-KB106)

Center Frequency in MHz	LF Gen Frequency in kHz	PhiM Deviation in rad
3000.1	10	0.5
6000	10	0.5

4. Repeat the measurement with PhiM source **external** and the follwoing settings.

Center Frequency in MHz	LF Gen Frequency in kHz	PhiM Deviation in rad	PhiM Mode
70.687	10	0.5	High BW
1000	10	0.125	Low Noise
3000	10	40	High Dev

1.4.8.2 PhiM Distortion

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Test method: FFT Demodulation, see Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Phase Modulation** Menu:
     - **PhiM Path 1 State** On
     - **PhiM Path 1 Source** LF Generator 1
     - **PhiM Mode** High Bandwidth
   - **Modulation Sources** Menu.
     - **LF Generator 1 Freq** 10 kHz
     - **LF Generator 1 Shape** Sine
2. Settings on spectrum analyzer:
   - See Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.
   - **SWEEP** MEAS TIME 2.5 ms
   - **FREQ** AF STOP 50 kHz
   - **AMPTD** REF LEVEL 0 dBm
   - **FREQ / CENTER** test frequency
3. Read THD from the Display.
   To convert to percent calculate
   THD_{pct} = 100 * 10 ^ (THD_{dB}/20)

Recommended settings:

1. CF sweep:
   - Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106:
     8 MHz, 10 MHz, 250 MHz, 500 MHz, 812 MHz, 940 MHz, 1067 MHz, 1194 MHz, 1321 MHz, 1484 MHz, 2.2 GHz, 4 GHz, 6 GHz.
2. **PhiM Path 1 deviation** maximum deviation specified for PhiM distortion.

1.4.8.3 PhiM Frequency Response

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.4, "Standard Test Assembly for Analog Modulation ", on page 9.

Test method: FFT Demodulation, see Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Phase Modulation** Menu:
     - **PhiM Path 1 State** On
     - **PhiM Path 1 Source** External 1
     - **PhiM Path 1 Deviation** 1 rad
   - **Modulation Sources** Menu:
     - **External 1 Coupling** AC
2. Setting on the signal generator:
   - For frequencies up to 300 kHz the internal LF generator of the signal generator is used, > 300 kHz the RF output.
   - It is recommended to use an AC voltmeter (see Table 1-1, item 15) to control the correct input voltage.
   - **LFGen Voltage** 0.707 V
   - **State** On
   - **RF Level** 10 dBm (equivalent to 1 V peak voltage).
3. Settings on spectrum analyzer:
   - See Chapter 1.4.7, "Checking the Frequency Modulation (Option R&S SMBVB-K720)", on page 45.
4. Vary the signal generator frequency and measure the modulation depth.
   ⇨ The modulation frequency response is the factor between the greatest and the smallest modulation depth.

Recommended settings:

1. LF in logarithmic steps
   3 steps per decade (1, 2, 5) from 10 kHz to 500 kHz
2. CF sweep:
   - in Mode High Dev.:
     RF = 79.9 MHz, deviation = 0.3125 rad, f_{mod} = 10 kHz … 500 kHz
   - in Mode High Bw.:
     Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106:
     RF = 187.4 MHz, deviation = 0.125 rad, f_{mod} = 10 kHz … 5 MHz
     RF = 3001 MHz, 4 GHz and 5.4 GHz, deviation = 0.125 rad, f_{mod} = 10 kHz … 10 MHz
   - in Mode Low Noise

RF = 500 MHz, deviation = 0.125 rad, f_{mod} = 1 kHz … 100 kHz

1.4.9 Checking the Pulse Modulation

1.4.9.1 ON/OFF Ratio

Accredited calibration: No minimum requirement.

Test equipment:
- Spectrum analyzer (see Table 1-1, item 19)
- Pulse generator (see Table 1-1, item 17)

Test setup: ► To determine the ON/OFF ratio, connect the spectrum analyzer to the RF output socket of the DUT and let the PULSE EXT input open.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Frequency** recommended test frequencies
   - **Pulse Modulation** Menu:
     – **Source** External 1
     – **State** On
     – **Polarity** Inverse
2. Settings on analyzer:
   - **FREQ/CENTER** test frequency
   - **SPAN** 0 Hz
   - **AMPT/REF LEVEL** 0 dBm
   - **BW ⇨ RES BW MANUAL** 3 kHz
   - **SWEEP ⇨ SWEEP TIME MANUAL** 100 ms
   - **MEAS ⇨ TIME DOM POWER** On
3. Determine the output level of the DUT at the recommended test frequencies with **Pulse Modulation ⇨ Polarity Inverse** and **Pulse Modulation ⇨ Polarity Normal**.
   ⇨ The level difference between the output level with Polarity Inverse and Polarity Normal is the ON/OFF ratio.

Recommended test frequencies: 5 MHz, 50 MHz, 150 MHz, 400 MHz and from 1 GHz to RF_{max} in steps of 100 MHz.

Recommended test level: P_{min}

Factory limits: Increase datasheet limit by 2 dB.

1.4.9.2 Rise/ Fall Time and Pulse Overshoot

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.5, "Test Assembly for Pulse Modulation ", on page 10.

Test method: The RF signal is down converted to 0 Hz in phase. Thus, the IF output reproduces the RF amplitude vs. time.

Measurement 1:

1. Setting on pulse generator:
   - For adjustment statically high level
   - For measurement square wave pulse sequence with a frequency of 1 MHz, TTL level
2. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - **Frequency** recommended test frequencies
   - **Pulse Modulation** Menu:
     - **State** On
     - **Transition Type** Smoothed
3. Settings on signal generator:
   - **RF** On
   - **Level** Recommended Lo-Level of Mixer
   - **Frequency** same as DUT
4. Settings on oscilloscope:
   - Adjust V/div according to the mixer in use
   - Time base 20 ns/div
   - Trigger:
     - for adjustment free running
     - for measurement 50 % of signal amplitude, rising and falling edge
5. Adjustment:
   - At each test frequency adjust phase using menu RF Mod / Frequency / Phase settings. Vary the delta phase to obtain maximal signal output at the mixers IF port. The voltage at maximum corresponds to 100 % of RF amplitude.
6. Measurement:
   - Evaluate the down converted pulse-modulated signal on the oscilloscope:
     - Rise time = time between 10 % and 90 % of signal amplitude.
     - Fall time = time between 90 % and 10 % of signal amplitude.
     - Pulse Overshoot: Determine the peak value of demodulated signal V_{peak} and the signal level of settled pulse $V_{settled}$.
     - Pulse Overshoot [in %]

       $$= 100 * \frac{V_{Peak} - V_{settled}}{V_{settled}}$$
   - Repeat the measurement in Pulse Modulation mode **Transition Type** fast.

Recommended test frequencies:

Mode **Transistion Type** smoothed: 700 MHz and from 1 GHz to 6 GHz in steps of 1 GHz.

Mode **Transistion Type** fast: 700 MHz and from 1 GHz to 6 GHz in steps of 1 GHz

1.4.9.3 Video Feedthrough

Accredited calibration:

No minimum requirement.

Test equipment:

- Oscilloscope with 50 Ω Feed-through termination on input, (see Table 1-1, item 7).
- Pulse generator (see Table 1-1, item 17).

Test setup:

► To determine the Video crosstalk, connect the oscilloscope input to the RF output socket of the DUT and connect the Pulse generator output to the PULSE EXT input of the DUT and the Trigger Input of the Oscilloscope.

Measurement 1:

1. Settings on pulse generator:
   - Square wave pulse sequence with a frequency of 100 kHz
   - TTL level
2. Settings on DUT:
   - **RF** On
   - **Frequency** recommended test frequencies
   - **Level** +10 dBm and +15 dBm
   - **Pulse Modulation** Menu:
     - **State** On
     - **Source** External 1
3. Settings on the oscilloscope:
   - **Amplitude** 150 mV/Div
   - **Sweep Time** 10 ns/Div
   - **Bandwidth** 500 MHz
   - **Trigger Offset** -20 ns
   - **Trigger Source** Trigger Input
   - **Trigger Level** 1.4 V
   - **Trigger Slope** positive
4. Measure the Peak to Peak Signal Level of the rising edge of the pulse. Set Trigger Slope to negative and measure the Peak to Peak Signal Level of the falling edge of the pulse.
   ⇨ The Peak to Peak Value of the rising and the falling Edge of the Pulse have to be below the guaranteed Video Crosstalk.

Recommended test frequencies:

3.25, 4.25 and 6.0 GHz.

1.4.10 Checking the Pulse Generator

1.4.10.1 PULSE VIDEO Signal

Accredited calibration: No minimum requirement.

Test equipment:
- Oscilloscope with 50 Ω Feed-through termination on input, (see Table 1-1, item 7).

Test setup:
1. Connect the PULSE VIDEO socket on the rear of the DUT to the oscilloscope.
2. Connect the PULSE SYNC output socket of the DUT to the second channel of the oscilloscope.

Measurement 1:
1. Settings on DUT:
   - **Pulse Modulation menu**
     - **State** On
     - **Source** Pulse Generator
   - **Pulse Generator** Menu:
     - **State** On
     - **Pulse Period** 100 ns
     - **Pulse Width** 50 ns
2. Settings on oscilloscope:
   - **Amplitude** 1 V/Div
   - **Time base** 25 ns/Div
   - **Trigger Level** 2 V
   - **Trigger Slope** rising edge
   - **Trigger source** Channel with VIDEO signal
3. Check the signal for
   - 50 ns ± 3 ns pulse width
   - 100 ns ± 2 ns pulse period
   - 2 V to 3.5 V amplitude
   - Rise and fall time < 5 ns.
4. Check the PULSE SYNC output for synchronous timing with the start of the VIDEO signal.

1.4.11 Checking the I/Q Modulation

1.4.11.1 Input Impedance (VSWR)

Accredited calibration: No minimum requirement.

Test assembly: See Chapter 1.2.2, "Test Assembly for Output Impedance (VSWR)", on page 8

Test method: ► Same as for the output impedance of the DUT.

Test setup: ► Connect the test port of the VSWR bridge to the I- or Q-inputs.

Measurement 1:

1. Settings on DUT:
   - **Frequency** 900 MHz
   - **RF** On
   - **Level** 0 dBm (PEP)
   - **I/Q Settings** Menu:
     - **State** On
     - **Source** Analog Wideband I/Q Input
2. Settings on signal generator:
   - **Level** 10 dBm
   - **Frequency** test frequencies
3. Let the measuring port of the VSWR bridge unconnected and measure the level P_{ref} as reference level.
4. Connect the VSWR bridge to the I input and measure the level P_I.
5. Calculate the VSWR:

$$VSWR = \frac{1+\sqrt{P_I / P_{ref}}}{1-\sqrt{P_I / P_{ref}}}$$

6. Repeat the measurement for the Q input.

Recommended test frequencies: 1 MHz, 10 MHz, 20 MHz, 40 MHz, 60 MHz, 80 MHz and 100 MHz to 1.25 GHz or maximum specified I/Q-Modulation-Frequency in steps of 25 MHz.

1.4.11.2 RF Frequency Response due to Modulation

Accredited calibration: No minimum requirement.

Test equipment:
- Spectrum analyzer, (see Table 1-1, item 19).
- Signal generator, (see Table 1-1, item 5).

Test setup: ► Connect the RF output of the DUT to the spectrum analyzer, and connect the signal generator to the I input of the DUT.

Test method: By applying a sinewave AC voltage to I (or Q) input, an amplitude modulation with a suppressed carrier is generated. The modulation frequency response is determined by measuring the sideband power as a function of the frequency of the applied AC voltage. The difference between the highest and the lowest sideband level, found by varying the modulation frequency is the frequency response to be measured.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Frequency** Test frequency
   - **Level** 0 dBm
   - **ALC** Sample & Hold
   - **I/Q Settings** Menu:
     - **Source** Analog Wideband I/Q Input
     - **Crest Factor** 3 dB
     - **Gain** 4 dB
     - **State** On
2. Settings on signal generator:
   - **Level** 4 dBm corresponding to 0.5 V (V_{peak})
3. Settings on spectrum analyzer:
   - **AMPT/REF LEVEL** 5 dBm
   - **SPAN** 1 MHz
   - **Center** carrier frequency ± modulation frequency
4. Measure the sideband levels for these modulation frequencies or up to the specified max. modulation frequency:
   1 MHz, 5 MHz, from 10 MHz to 250 MHz in 10 MHz steps.
5. Set I/Q-Wideband on and measure the sideband levels for modulation frequencies:
   1 MHz, 5 MHz, from 10 MHz to 250 MHz in 10 MHz steps and from 200 MHz to 1 GHz or maximum specified I/Q-Modulation-Frequency in 100 MHz steps.
   ⇨ The modulation frequency response is the difference between the highest and the lowest measured sideband level.

Recommended test frequencies:

For instruments equipped with R&S SMBVB-B103 orR&S SMBVB-KB106:

For IQ wideband mode off: 70 MHz, 80 MHz, 80.1 MHz, 85 MHz, 100 MHz, 115 MHz, 155 MHz, 225 MHz, 290 MHz, 350 MHz, 470 MHz, 530 MHz, 660 MHz, 900 MHz, 1200 MHz, 1400 MHz, 2100 MHz, 3100 MHz, 4100 MHz, 5750 MHz, 6000 MHz with Modulation Frequencies up to maximum specified Modulation Frequencies. Apply no limits for f=6000 MHz.

For IQ wideband mode on: 53 MHz, 70 MHz, 80 MHz, 80.1 MHz, 85 MHz, 100 MHz, 155 MHz, 194 MHz, 226 MHz, 289 MHz, 351 MHz, 474 MHz, 660 MHz, 900 MHz, 988 MHz, 1400 MHz, 2100 MHz, 3100 MHz, 4100 MHz, 5000 MHz with Modulation Frequencies up to maximum specified Modulation Frequencies.

1.4.11.3 Static Error Vector

Accredited calibration:

No minimum requirement.

Test equipment:

- RF analyzer, (see Table 1-1, item 19).
- Arbitrary waveform generator, (see Table 1-1, item 14).

Test setup:

1. Connect the spectrum analyzer to the RF output of the DUT.
2. Set 10 MHz References of DUT and spectrum analyzer to **internal**!
3. Connect the Arbitrary waveform generator to the DUT baseband input.

Measurement 1: Instead of a static measurement, an equivalent dynamic measurement with a low symbol rate is carried out.

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm (PEP)
   - **I/Q Settings** Menu:
     - **State** On
     - **Source** Analog Wideband I/Q Input
     - **I/Q wideband mode** On
2. Generate a modulation signal on the ARB generator using the controller and the simulation program:
   - Modulation 16QAM
   - No coding
   - SQR COS filter with α = 0.5
   - PRBS-9 data sequence
   - Pulse width and over sampling 32
   - Length 1000 symbols
   - Symbol clock 100 kHz
3. Check if the amplitude imbalance of both channels on the ARB generator is < 0.05 dB and the DC-Offset is < 0.5 mV. Adjust if necessary.
4. Make the corresponding settings on the demodulator. Result length 800 symbols.
5. Measure the error vector magnitude (peak and rms) at the recommended test frequencies.

Recommended test frequencies: For Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106:

10 MHz, 80 MHz, 80.1 MHz, 100 MHz, 250 MHz to 6 GHz in steps of 250 MHz.

1.4.11.4 Residual Carrier and Leakage I/Q-Modulation

Accredited calibration: No minimum requirement.

Test equipment:
- RF analyzer, (see Table 1-1, item 19).

Test setup:
► Connect the spectrum analyzer to the RF output of the DUT.

Test method: The I/Q-inputs of the DUT are left open and no modulation-signal is fed into the instrument.

The Residual Carrier is the level difference between the output signal in CW Mode and with I/Q-modulation switched on at the test frequency.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Frequency** test frequency
   - **Level** +5 dBm
   - **I/Q State** off
   - **I/Q Source** Analog Wideband I/Q Input
2. Settings on analyzer:
   - **FREQ/CENTER** 1 MHz
   - **SPAN** 0 Hz
   - **AMPT/REF LEVEL** +10 dBm
   - **BM/RES BW/MANUAL** 30 KHz
3. Measure the carrier level P_{ref} at the test frequency in CW-mode (**I/Q State** off) as reference and then the carrier level with I/Q-modulation switched on (**I/Q State** on) at the test frequency.
   ⇨ The carrier suppression is:
   $D_{carrier} = P_{ref} - P_{carrier}$ in dBc referred to the carrier.

Recommended test frequencies:

For Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106:

12.5 MHz to 5.9875 GHz in 25 MHz steps

1.4.11.5 I/Q Imbalance

Accredited calibration:

No minimum requirement.

Test equipment:

- RF analyzer, (see Table 1-1, item 19).
- Arbitrary waveform generator, (see Table 1-1, item 14).

Test setup:

1. Connect the spectrum analyzer to the RF output of the DUT.
2. Connect the Arbitrary waveform generator to the DUT baseband input.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Frequency** 900 MHz
   - **Level** 0 dBm (PEP)
   - **Level** Menu:
     – **ALC State** Off (Table)
   - **I/Q Settings** Menu:
     – **State** On
     – **Source** Analog Wideband I/Q Input
   - **Impairments State** On
   - **Imbalance** 1.0 dB

2. Settings on analyzer:
   - **Center frequency** test frequency
   - **SPAN** 1 MHz
   - **Reference level** test level +3 dB
   - **Scale** 1 dB/div
3. Apply a DC voltage of 0.5 V to the I-input and 0 V to the Q-input. Measure the output level P_I. Then apply a DC voltage of 0.5 V to the Q-input and 0 V to the I-input. Measure the level P_Q.
   The Imbalance is: $P_I - P_Q$

1.4.11.6 Two Tone Intermodulation

Accredited calibration: No minimum requirement.

Test equipment:
- Spectrum analyzer, (see Table 1-1, item 19).
- Baseband Signal generator.

Test setup:
1. Connect I/Q-Signals from the Baseband Signal Generator to the I/Q Modulation Inputs of the DUT.
2. Connect the spectrum analyzer to the RF output of the DUT.
3. Synchronize the 10 MHz Reference of all instruments.

Test method: A two carrier signal in analog Baseband with symmetrical Carrier Spacing from the RF-carrier is generated by feeding a sinusoidal signal with f_{mod} to the I-Input. The carrier-spacing in the RF-frequency range is two times the frequency of the modulation signal ($2^* f_{mod}$). The Two Tone Intermodulation is the level difference between the two carriers and the unwanted Intermodulation products caused by nonlinearities in the signal chain.

Measurement 1:
1. Settings on Baseband Signal Generator:
   - **ARB**
     - **Create sinusoidal Waveform** with 0.5 V Peak
     - **State** On
   - **Carrier Spacing**
     - 10 MHz, 20 MHz, 40 MHz and 80 MHz
2. Settings on DUT:
   - **RF** On
   - **Frequency** recommended test frequencies
   - **Level** 0 dBm
   - **I/Q Settings** Menu:
     - **State** On
     - **Source** Analog Wideband I/Q Input
3. Settings on analyzer:
   - **FREQ CENTER** Measurement Frequency

- **SPAN** 0 Hz
- **BW** 1 kHz
- **Sweep Time** 10 ms
- **AMPT/REF LEVEL** 3 dBm

4. For every Test Frequency:
   Measure the carrier level at at RF- f_{mod} and RF+ $_{fmod}$.
   Measure the level of the Intermodulation products at RF-n* f_{mod}, with n = -3, -2, +2 and +3.
   The Two Tone Intermodulation Suppression is the difference between the carrier with the lower level and the highest Intermodulation Product.
5. Feed the modulation Signal to the Q-Input and repeat Measurement at 1 GHz.

Recommended test frequencies:

For Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106:

200 MHz, 500 MHz to 6 GHz in 500 MHz steps.

1.4.12 Checking the Phase Coherence Levels (Option R&S SMBVB-K90)

Accredited calibration:

No minimum requirement.

Test equipment:

- The second Signal generator (see Table 1-1, item 5) is connected to the LO IN-connector.
- The RF power meter (see Table 1-1, item 8) is connected to LO OUT-connector.

Test method:

A LO-Signal from the second signal generator is fed into the LO input. With LO-Coupling mode set to external and the LO Out State switched on the power at the LO-out SMA-connector is measured with the power meter.

Measurement 1:

1. Settings on DUT:
   - **RF** State ON
   - **Level** -30 dBm
   - **Frequency** recommended test frequencies or RF_{max}, whichever is lower
   - **Frequency/Phase** Menu:
     – **LO Coupling ⇒ Mode** External
     – **LO Coupling ⇒ Out State** On
   - **IQ-Modulation** On
2. Settings on second signal generator:
   - **Level** + 10 dBm
   - **Frequency** recommended test frequencies
   - **RF** State ON
3. Set the frequency of the DUT and the second generator to the recommended test frequencies.
   Measure the output level at the LO OUT connector to be within the guaranteed level limits.

4. Repeat Measurement with DUT setting:
   - **LO Coupling** ⇨ **Mode** Internal
   - **LO Coupling** ⇨ **Out State** On

Recommended test frequencies:

For Instruments equipped with R&S SMBVB-B103 or R&S SMBVB-KB106:

80.1 MHz and from 100 MHz to 6 GHz in steps of 100 MHz.

1.4.13 Checking the Differential I/Q Output

Before the measurement, Signal Analyzer R&S FSQ must be calibrated as follows by means of a reference measurement at the measurement frequency in question:

1. Connect the RF output of the DUT to the power meter and measure the output level.
2. Include the measured level as a reference value/calibration value in the R&S FSQ.

1.4.13.1 Differential Signal Balance

Accredited calibration:

No minimum requirement.

Test-generator functionality is available with protection level 1.

Test equipment:

- RF analyzer, (see Table 1-1, item 19).
- Arbitrary waveform generator, (see Table 1-1, item 14).

Test setup:

► Connect the signal analyzer to the I-, Q-, I Bar- and Q Bar-output of the DUT.

Test method:

A single sideband signal is generated using the test generator functionality within the DAC BOARD. Positive or negative frequency offsets are set by the **Frequency** parameter. The test frequencies are set one after the other.

Measurement 1:

1. Settings on DUT:
   - `:TEST:BB:GENerator:SOURce SINE`
   - `:TEST:BB:GENerator:FREQuency test frequency`
   - `:TEST:BB:GENerator:GAIN 0.9`
   - `:TEST:BB:GENerator:STATe ON`
   - **I/Q Out** Menu:
     - **Output Type** Differential
     - **Mode** Normal
2. Settings on analyzer:
   - **FREQ CENTER** 1 MHz
   - **SPAN** 0 Hz
   - **AMPT/REF LEVEL** + 10 dBm
   - **BW /RES BW MANUAL** 30 kHz

Recommended test frequencies: 1 MHz, 10 MHz

Exit test generator: :TEST:BB:GENerator:STATe OFF

1.4.13.2 Output Voltage

Accredited calibration: No minimum requirement.

Test-generator functionality is available with protection level 1.

Test equipment:
- AC/DC Voltmeter, (see Table 1-1, item 15).

Test setup:
► Connect the signal analyzer to the I-, Q-, I Bar- and Q Bar-output of the DUT.

Test method: A single sideband signal is generated using the test generator functionality within the DAC BOARD. Positive or negative frequency offsets are set by the **Frequency** parameter. The test levels are set one after the other.

Measurement 1:

1. Settings on DUT:
   - `:TEST:BB:GENerator:SOURce SINE`
   - `:TEST:BB:GENerator:FREQuency 100 kHz`
   - `:TEST:BB:GENerator:GAIN 0.9`
   - `:TEST:BB:GENerator:STATe ON`
   - **I/Q Out** Menu:
     - **Output Type** Single Ended
     - **Mode** Variable
     - **I/Q I Level EMF** 1 V
2. Settings on multimeter:
   - **COUPLING** AC
   - **DETECTOR** RMS

   Multiply measured voltage with √2.

Recommended test level: Measurement level: 2 V, 1.5 V, 1 V, 0.4 V and 0.2 V.

Exit test generator: `:TEST:BB:GENerator:STATe OFF`

1.4.13.3 Bias Voltage

Accredited calibration: No minimum requirement.

Test-generator functionality is available with protection level 1.

Test equipment:
- AC/DC Voltmeter, (see Table 1-1, item 15).

Test setup:
► Connect the signal analyzer to the I-, Q-, I Bar- and Q Bar-output of the DUT.

Test method: The bias voltage is measured for different values.

Measurement 1:

1. Settings on DUT:
   - `:TEST:BB:GENerator:SOURce CONStant`

- `:TEST:BB:GENerator:GAIN 0.0`
- `:TEST:BB:GENerator:STATe ON`
- **I/Q Out** Menu:
  - **Output Type** Single Ended
  - **Mode** Variable
  - **I/Q I Level EMF** 0.1 V
  - **Couple I/Q Bias** On
  - **I Bias EMF** measurement bias

2. Settings on multimeter:
   - **COUPLING** AC

Recommended test level: Check bias: -3.6 V, -1 V, -0.3 V, -0.1 V, -0.03 V, -0.01 V, 0 V, +0.002 V, 1 V and 3.6 V

Exit test generator: `:TEST:BB:GENerator:STATe OFF`

1.4.13.4 Offset Voltage

Accredited calibration: No minimum requirement.

Test-generator functionality is available with protection level 1.

Test equipment:
- AC/DC Voltmeter, (see Table 1-1, item 15).

Test setup:
► Connect the signal analyzer to the I-, Q-, I Bar- and Q Bar-output of the DUT.

Test method: The I and I Bar (or Q and Q Bar) voltage are measured for different offset values. The differential offset is obtained from the differences between I and I Bar (or Q and Q Bar) at a particular offset.

Measurement 1:

1. Settings on DUT:
   - `:TEST:BB:GENerator:SOURce CONStant`
   - `:TEST:BB:GENerator:GAIN 0.0`
   - `:TEST:BB:GENerator:STATe ON`
   - **I/Q Out** Menu:
     - **Output Type** Differential
     - **Mode** Variable
     - **I/Q I Level EMF** 1 V
     - **Couple I/Q Bias** On
     - **I Bias EMF** 0 V
     - **I (or Q) Offset EMF** measurement offset
2. Settings on multimeter:
   - **COUPLING** DC

Recommended test level: Check offset: -300 mV, -150 mV, -30 mV, -10 mV, -3 mV, -1 mV, 0 mV, +0.1 mV, 30 mV, 150 mV and 300 mV

Exit test generator: `:TEST:BB:GENerator:STATe OFF`

1.4.14 Checking the Internal Baseband Generator

1.4.14.1 Modulated RF Frequency Response over the Complete Unit

Accredited calibration: No minimum requirement.

Test equipment: RF power meter (see Table 1-1, item 8)

Test setup: ► Connect the RF output of the DUT to the RF power meter.

Test method: The internal Test-Generator is generating a sine single-side-band signal. The modulation frequency response is determined by measuring the sideband power as a function of the frequency of the applied single-sideband signal. The difference between the highest and lowest sideband level, found by varying the modulation frequency, is the frequency response to be measured.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Frequency** measurement frequencies
   - **Level** 0 dBm
   - **I/Q Mod** Wideband I/Q On
   - **ACL OFF (Sample & Hold)**
   - `:TEST:BB:GENerator:SOURce SINE`
   - `:TEST:BB:GENerator:FREQuency test frequency`
   - `:TEST:BB:GENerator:GAIN 1.0`
   - `:TEST:BB:GENerator:STATe ON`
2. Settings on the RF power meter:
   Set **frequency correction** to measurement frequency + test frequency.

   The modulation frequency response is the difference from the highest to the lowest sideband.

Recommended test frequencies:

Measurement frequencies / GHz f_{RF}	Frequency-Options:	Test frequencies ± / MHz
0.85, 1.75, 2.1, 3.5, 5.0	all	0 (reference), 1, 10, 20:10:90, 100:25:250

The maximum test frequency is limited by $f_{RF}/4$.

Exit test generator: `:TEST:BB:GENerator:STATe OFF`

1.4.14.2 Suppression of Image Sideband in Mode Internal Baseband I/Q

Accredited calibration: No minimum requirement.

Test equipment:
- RF analyzer (see Table 1-1, item 19).

Test setup: ► Connect the RF output of the DUT to the signal analyzer.

Test method: The internal Test-Generator is generating a single-side-band sine signal. The image rejection is the difference between the sine signal and its mirror on the opposite side of the center frequency.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Frequency** measurement frequency
   - **Level** 0 dBm
   - **I/Q Mod** Wideband I/Q On
   - `:TEST:BB:GENerator:SOURce SINE`
   - `:TEST:BB:GENerator:FREQuency test frequency`
   - `:TEST:BB:GENerator:GAIN 1.0`
   - `:TEST:BB:GENerator:STATe ON`
2. Settings on analyzer:
   - **FREQ CENTER** measurement frequency
   - **SPAN** 3 x test frequency
   - **BW COUPLING RATIO SPAN / RBW MANUAL** 300
   - **AMPT/REF LEVEL** 5 dBm
   - **MKR /MARKER 1** Set to peak

In the displayed spectrum, use MARKER DELTA to measure the image rejection.

Recommended test frequencies:

Test frequencies

Measurement frequencies / GHz	Frequency-Options:	Test frequencies ± / MHz
3.0, 5.0	all	0 (reference), 1, 10, 20:10:90, 100:25:250

Exit test generator: `:TEST:BB:GENerator:STATe OFF`

1.4.14.3 I/Q Output, Offset, Wideband Noise

Accredited calibration: No minimum requirement.

Test equipment:
- RF analyzer (see Table 1-1, item 19).
- Multimeter (see Table 1-1, item 15).

Test setup: ► Connect the signal analyzer to the I/(and Q)-output of the DUT.

Test method: The internal Test-Generator is generating a single-side-band sine signal at 10 MHz. Subsequently, the noise power (all carriers switched off) is measured at 11 MHz.

Measurement 1:

1. Settings on DUT:
   - `:TEST:BB:GENerator:SOURce SINE`
   - `:TEST:BB:GENerator:FREQuency 10 MHz`

- `:TEST:BB:GENerator:GAIN 0.9`
- `:TEST:BB:GENerator:STATe ON`

2. Settings on analyzer:
   - **FREQ CENTER** 10 MHz
   - **SPAN** 0 Hz
   - **AMPT/REF LEVEL** 5 dBm
   - **BW /RES BW MANUAL** 100 kHz
   - **MKR / MARKER** 1
3. Measure carrier level at 10 MHz in dBm (reference measurement).
4. Settings on DUT:
   - **Carrier 1 State** Off
5. Settings on analyzer:
   - **FREQ CENTER** 11 MHz
   - **AMPT/REF LEVEL** -40 dBm
   - **AMPT/RF ATTEN MANUAL** 0 dBm
   - **TRACE / DETECTOR** RMS
   - **BW /SWEEP TIME MANUAL** 50 ms
   - **MKR FCT / NOISE MEAS**
6. Measure the noise level at 11 MHz in dBm and calculate the wideband noise.
   Calculation:
   Wideband noise = noise level - (carrier level + 3 dB), (add +3 dB, as it is sine).

Test setup: ► Connect the multimeter to the I and Q output of the DUT.

Measurement 1: ► Check offset.

1.4.14.4 IQ Output, Spurious Free Dynamic Range (SFDR)

Accredited calibration: No minimum requirement.

Make sure that the measured spurious signal does not come from the analyzer. The following tests can be performed for this purpose:

- Switch off the signal from the DUT and repeat the measurement; if the signal remains, it may come from the analyzer.
- Output the signal from the DUT with a slight frequency offset; if the signal remains, it may come from the analyzer.

Test equipment:
- RF analyzer (see Table 1-1, item 19).

Test setup: ► Connect the signal analyzer to the I- and to the Q output of the DUT.

Test method: The internal test generator is generating a single-side-band sine signal for every test frequency. The next highest signal in the spectrum outside the carrier is measured.

Measurement 1:

1. Settings on DUT:
   - `:TEST:BB:GENerator:SOURce SINE`
   - `:TEST:BB:GENerator:FREQuency test frequencies`
   - `:TEST:BB:GENerator:GAIN 1.0`
   - `:TEST:BB:GENerator:STATe ON`
2. Test frequencies
   2 MHz, 5 MHz, 10 MHz, 20 MHz, 40 MHz, 80 MHz, 125 MHz
3. Settings on analyzer:
   - **FREQ CENTER** 126 MHz
   - **SPAN** 250 MHz
   - **AMPT/REF LEVEL** 5 dBm
   - **AMPT / RF ATTEN MANUAL** 25 dB
   - **BW /RES BW MANUAL** 300 kHz
   - **BW / SWEEP TIME MANUAL** 50 ms
   - **TRACE / DETECTOR** RMS
   - **MKR / MARKER** 1
   - **MKR → PEAK**
   - **MKR / MARKER** 2
   - **MKR → NEXT PEAK**
4. If a delta occurs, read off the spacing of the spurious signals on the RF signal analyzer.

Exit test generator: `:TEST:BB:GENerator:STATe OFF`

1.4.14.5 Aliasing Filter – D/A Converter, Interpolation Spectra

Accredited calibration: No minimum requirement.

Make sure that the measured spurious signal does not come from the analyzer. The following tests can be performed for this purpose:

- Switch off the signal from the DUT and repeat the measurement; if the signal remains, it may come from the analyzer.
- Output the signal from the DUT with a slight frequency offset; if the signal remains, it may come from the analyzer.

Test equipment:
- RF analyzer (see Table 1-1, item 19).

Test setup:
1. Connect the signal analyzer to the RF output of the DUT.
2. Synchronize the reference frequencies of the DUT and the analyzer.

Test method: The internal Test-Generator is generating a single-side-band sine signal for every test frequency. The level measured at the measurement frequency gives the value for the suppression of the interpolation.

Measurement 1:

1. Settings on DUT:
   - **RF** On
   - **Level** 0 dBm
   - `:TEST:BB:GENerator:SOURce SINE`
   - `:TEST:BB:GENerator:FREQuency test frequencies`
   - `:TEST:BB:GENerator:GAIN 1.0`
   - `:TEST:BB:GENerator:STATe ON`
2. Settings on analyzer:
   - **FREQ CENTER** measurement frequency
   - **SPAN** 0 Hz
   - **AMPT/REF LEVEL** -10 dBm
   - **BW /RES BW MANUAL** 30 kHz
   - **BW / SWEEP TIME MANUAL** 200 ms
   - **TRACE / DETECTOR** RMS
   - **MKR / MARKER** 1

Recommended test frequencies:

Frequency 4 GHz

Test frequencies (MHz)	Measurement frequencies (MHz)
39.9	3439.9
39.9	4560.1
239.9	3649.9
239.9	4350.1

1.4.14.6 GSM Edge and GSM Edge Burst

Accredited calibration:

No minimum requirement.

The equipment layout for generating GSM/EDGE signals includes the option R&S SMBVB-K40 (Digital Standard GSM/EDGE).

Test equipment:

- RF analyzer with options R&S FSQ-K70 or R&S FSW-K70 or (Vector Signal Analysis) and R&S FS-K5 or R&S FSW-K10 (GSM/EDGE Measurements), (see Table 1-1, item 19).

Test setup:

► Connect signal analyzer to RF output of DUT.

Measurement method:

1. Set Custom Digital Mod in the baseband; set standard GSM/EDGE here. Perform the measurements with the GSM/EDGE measurement setting of the R&S FSQ or R&S FSW.
2. Set standard GSM/EDGE in the baseband. Perform the measurements with the GSM/EDGE measurement setting of the R&S FSQ or R&S FSW.

Measurement 1

1. Settings on DUT:
   - **Level** max. level -3 dB, refer to data sheet (depending on options)

- **Frequencies** 910 MHz, 1850 MHz and 5 GHz
- **Custom Digital Mod**
  - **State** ON
  - **Set acc. To Standard** GSM/EDGE

2. Settings on analyzer:
   - **VSA**
   - **FREQ CENTER** 910 MHz, 1850 MHz and 5 GHz
   - **DIGITAL STANDARD GSM/EDGE** EDGE NB
   - **ADJUST REF** LVL
3.
4. Settings on analyzer:
   - **FREQ CENTER** 910 MHz, 1850 MHz and 5 GHz
   - **MEAS CHAN PWR** ACP
   - **CP /ACP** CONFIG
     - **NO. OF ADJ CHAN** 3
     - **CHANNEL BANDWIDTH** 30 kHz (all entries)
     - **CHANNEL SPACING** 200 kHz (all entries)
     - **ADJUST SETTINGS**
   - **MEAS CHAN PWR** ACP
   - **ADJUST REF** LVL
   - **NOISE CORR** ON
5. Check ACP (take the smaller of the two measurement values UPPER/LOWER in each case):
   Adjacent Channel, Alternate Channel, 2nd Alternate Channel.

Measurement 2:

1. Settings on DUT:
   - **Level** max. level, refer to data sheet (depending on options)
   - **Frequencies** 910 MHz and 1850 MHz and 5 GHz
   - **GSM/EDGE**
     - **State** ON
     - **Slot** 0
       Burst Type Edge
   - **GSM/EDGE**
     - **State** ON
     - **Slot** 0
       Burst Type Edge
2. Settings on analyzer:
   - **GSM/EDGE**
   - **FREQ CENTER** 910 MHz, 1850 MHz
     (and 5 GHz)
   - **GSM/EDGE**
     - **DEMOD SETTINGS**

MODULATION EDGE
AUTO LEVEL&TIME

- **GSM/EDGE**
  - **POWER VS TIME**
    START REF MEAS

LIMIT CHECK PASSED has to be indicated on the analyzer.

3. Settings on analyzer:
   - **GSM/EDGE**
     - **TRANSIENT SPECTRUM**
       START REF MEAS

   LIMIT CHECK PASSED has to be indicated on the analyzer.

4. Settings on analyzer:
   - **GSM/EDGE**
     - **MODULATION SPECTRUM**
       START REF MEAS

   LIMIT CHECK PASSED or MARG has to be indicated on the analyzer.

1.4.14.7 Modulation Error for WCDMA - 3GPP

Accredited calibration: No minimum requirement.

Test equipment:
- RF analyzer with option R&S FSQ-K70 or R&S FSW-K70 (Vector Signal Analysis), (see Table 1-1, item 19).

Test setup:
► Connect signal analyzer to RF output of DUT.

Test method:
► Set Custom Digital Mod to standard WCDMA-3GPP in the baseband. Perform the measurements with the 3GPP measurement setting of the R&S FSQ or R&S FSW.

Measurement 1:

1. Settings on DUT:
   - **Level** max. level, refer to data sheet (depending on options)
   - **Frequencies** 2160 MHz
   - **Custom Digital Mod**
     - **State** ON
     - **Set acc. To Standard** WCDMA-3GPP
2. Settings on analyzer:
   - **VSA**
   - **FREQ CENTER** 2160 MHz and 5 GHz
   - **DIGITAL STANDARD 3G-WCDMA** 3G WCDMA FWD
   - **ADJUST REF** LVL
3. Check EVM in Modulation Accuracy Table.

1.4.14.8 Adjacent Channel Power for 3GPP FDD

Accredited calibration: No minimum requirement.

The equipment layout for generating GSM/EDGE signals includes the option R&S SMBVB-K42 (Digital Standard 3GPP FDD).

Test equipment:
- Signal analyzer with option R&S FSQ-K70 or R&S FSW-K70 (Vector Signal Analysis), (see Table 1-1, item 19).

Test setup:
► Connect signal analyzer to RF output of DUT.

Test method:
► Set standard 3GPP FDD in the baseband. Perform the measurements with the 3GPP measurement setting of the R&S FSQ or R&S FSW.

Measurement 1:

1. Settings on DUT:
   - **Level** +2 dBm RMS
   - **Frequencies** 2160 MHz and 5 GHz
   - **3GPP FDD**
     – **Test Setups** Test_Model_1_64channels
     – **State** ON
   - **ARB**
     – **State** ON
     – **Load Waveform** 3GPP_TM1_64.wv
   - **I/Q Settings**
   - **Manual Gain Unicod** 3GPP ACP optimized 3 dB
2. Settings on analyzer:
   - **FREQ CENTER** 2160 MHz
   - **MEAS CHAN PWR** ACP
   - **CP /ACP STANDARD WCDMA** 3GPP FWD
   - **ADJUST REF** LVL
   - **NOISE CORR** ON
   - **SWEEP SWEEP TIME** MANUAL 1 s
3. Check ACLR:
   Alternate Channel (take the smaller of the two measurement values UPPER/ LOWER).

1.4.14.9 Additive White Gaussian Noise (R&S SMBVB-K62)

Accredited calibration: No minimum requirement.

Test equipment:
- Signal analyzer (see Table 1-1, item 19).

Test setup:
► Connect signal analyzer to RF output of DUT.

Test method:
A digital modulated signal is generated and noise is added. Using the channel power measurement facility of the spectrum analyzer, the carrier power and the power of a

section of the noise spectrum is determined. By expanding the result to the system bandwidth, the carrier to noise ratio can be reconstructed.

The noise generator is a firmware option, realized in an FPGA. The functionality of this FPGA is tested with one measurement, data are guaranteed by design.

Measurement 1:

1. Settings on DUT:
   - **Level** 0 dBm
   - **Frequency** 1 GHz
   - **RF** State On
2. Settings on DUT if Unicod is installed:
   - **Baseband Custom Digital Modulation**
     - **Set to default (GSM), Symbol Rate** 500 Hz
     - **State** On
   - **AWGN/IMP AWGN**
     - **Additive Noise, System Bandwidth** 1 MHz
     - **Carrier/Noise Ratio** 20.00 dB
     - **State** On
3. Settings on analyzer:
   - **FREQ CENTER** 1 GHz
   - **MEAS CHAN PWR** ACP
     - **CP /ACP CONFIG CHANNEL BANDWIDTH** 100 kHz
   - **AMPT REF LEVEL** 10 dBm
   - **BW RES BW MANUAL** 30 kHz
     - **VIDEO BW MANUAL** 300 kHz
   - **TRACE DETECTOR** RMS
   - **SWEEP SWEEP TIME MANUAL** 2 s
4. Measure carrier power and denote as a reference.
5. Settings on DUT if Unicod is not installed:
   - **AWGN/IMP AWGN**
     - **Noise only, System Bandwidth** 1 MHz
     - **Noise Level** -20.00 dB
     - **State** On
6. Now retune center frequency of the analyzer to 1.0003 GHz.
7. Measure the noise power.
   Since the measurement bandwidth is a tenth of the system bandwidth, the result is to be corrected by 10 dB.
   ⇨ The result is carrier power – noise power – 10 dB.

1.4.15 Checking the Baseband

Accredited calibration:

No minimum requirement.

Internal Test 1, Self Test of Base Band Board:

Test equipment: Not needed

Test setup: No connection required, internal test

Test method: All connections, data paths and memory inside the Baseband boards are tested with PRBS data; Voltage levels of internal digital power supplies are checked against valid limits.

Measurement 1: Run remote command `TEST:BAS?` Result: 0 → OK, 1 → FAIL

Internal Test 2, Connection test of Baseband:

Test equipment: Not needed

Test setup: No connection required, internal test

Test method: The digital data paths between the BBM module (DAC board) and all coder / fader are tested with internal PRBS signal. Each connection is tested for 3 seconds.

Measurement 1: Run remote command `TEST:BB:CONN?` Result: 0 → OK, 1 → FAIL. Depending on the number of coder / fader, the test takes up to 144 seconds (SCPI timeout needs to be set accordingly).

x denotes the appropriate Baseband Board, Range 1...6

External Test 1, BNC Connectors of Baseband:

Test equipment: -

Test setup:
1. Perform the following connections:
   - FRONT BNC USER 1 - FRONT BNC USER 2
   - REAR BNC USER 3 - REAR BNC USER 4
   - REAR BNC USER 3 - REAR BNC USER 5
2. The test has to be performed once for every connection described above.

Test method: The physical BNC connectors are tested to be used as input and output. Furthermore, threshold and impedance are verified.

Measurement 1: Set up connection, e.g. `TEST1:BB:BNC:SOUR USER1` and `TEST1:BB:BNC:DEST USER2`

Run remote command `TEST:BB:BNC:CONN?` Result: 0 → OK, 1 → FAIL

1.4.16 Checking the Front Unit

The R&S SMBV100B is equipped with a front unit, compromising a keyboard, leds, display and touch screen.

1.4.16.1 Keyboard

Accredited calibration: No minimum requirement.

Test setup: None.

Test method: An internal test program is used to check all keys and the knob.

Measurement 1:
- Settings on DUT:
  – **Setup → Maintenance → Check Front Panel ...**
  Follow the advices on the screen, every key must be pressed once.

1.4.16.2 Touchpanel

Accredited calibration: No minimum requirement.

Test setup: None.

Test method: An internal test program and visual inspection are used to check the touch panel.

Measurement 1:
- Settings on DUT:
  – **Setup → Maintenance→ Check Touch Panel...**
  Start the calibration, all points must be accepted.

Measurement 2: Check the touch screen for absence of streaks, using a platic rod. Apply usual pressing force.

1.4.16.3 Digital interfaces

Accredited calibration: No minimum requirement.

Connect a R&S®NRP power sensor to the sensor socket and check, if the sensor trigger works.

For optional Remote-Control via GPIB and USB-In: check connection.

1.4.16.4 Selftest

Accredited calibration: No minimum requirement.

Test setup: None.

Test method: Internal Selftest

Measurement 1: Execute the internal Selftest. Check the output result for "pass".

2 Adjustment

This chapter describes all necessary measures to restore the performance of the R&S SMBV100B after module replacement.

There are no manual adjustments to be performed. Internal and external adjustment routines are implemented for this purpose.

Spare part RF boards are tested at Rohde & Schwarz with calibrated working standards according to the performance test. All measurement values are within the specified values including the measurement uncertainty as a minimum guard band.

OCXOs (Option R&S SMBVB-B1 and R&S SMBVB-B1H) are tested at Rohde & Schwarz for the frequency adjustment range and the control voltage for an exact 10 MHz output frequency. This control voltage is coded in a digital value and stored on the modules.

If a calibration of the instrument is strictly necessary, the performance test should be performed completely.

After replacing assemblies always run the internal selftest which has to finish successfully, additionally check the following table to see which service procedure you perform.

The external adjustment data stored in the eeprom of the MB300 (A100, Motherboard). On firmware startup, the modules in use are checked to be the ones the external adjustment data is valid for. If modules do not match the adjustment data, the firmware rejects the stored adjustment data and asks for the needed external adjustment.

Changed module	Required adjustments	Internal Selftest	Recommended Test Procedure (refer to Chapter “Performance Test)
MB300 (Motherboard)	Internal Adjustments: Setup/Internal Adjustments/Adjust All External Adustments: All	Perform Selftest	Complete test procedure
RFBB (RF-Board)	Internal Adjustments: Setup/Internal Adjustments/Adjust All External Adustments: All	Perform Selftest	Complete test procedure
HP6 (Ultra High Power)	Internal Adjustments: Setup/Internal Adjustments/Adjust All External Adustments: All	Perform Selftest	Complete test procedure
IQB.BV (IQ-Board)	Internal Adjustments: Setup/Internal Adjustments/Adjust All External Adustments: All	Perform Selftest	Complete test procedure
OCX10M (OCXO-Board)	None	Not needed	Reference frequency accuracy
FRONT.BV (Front module)	None	Perform Selftest	None

Changed module	Required adjustments	Internal Selftest	Recommended Test Procedure (refer to Chapter “Performance Test)
PSU300 (power supply unit)	None	Perform Selftest	None
IFB.BV (Interface-Board, GPIB/USB connectivity)	None	Perform Selftest	None
MEM.BV (CFAST connectivity board)	None	Perform Selftest	None
CFAST memory card	None	Perform Selftest	None
mSATA memory card	None	Perform Selftest	None
IPM24 (processor unit board)	None	Not needed	None
BBW	Internal Adjustments: Setup/Internal Adjustments/Adjust All External Adustments: All	Perform Selftest	Complete test procedure
DACB.BV	Internal Adjustments: Setup/Internal Adjustments/Adjust All External Adustments: All	Perform Selftest	Complete test procedure

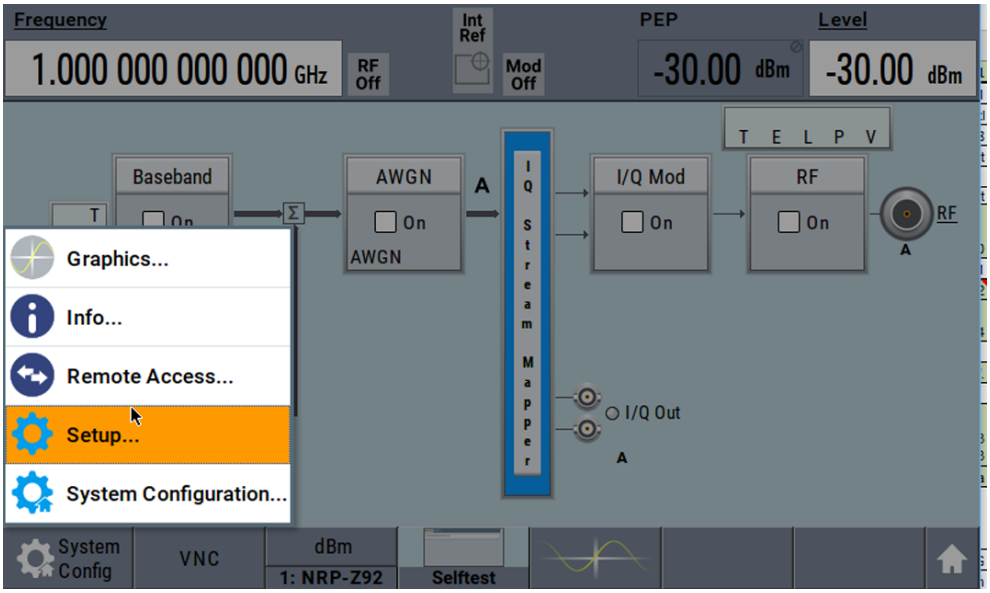
2.1 Selftest

The internal selftest of the R&S SMBV100B provides various tests of voltages, temperatures and other functional tests. It includes tests for all relevant modules within the device.

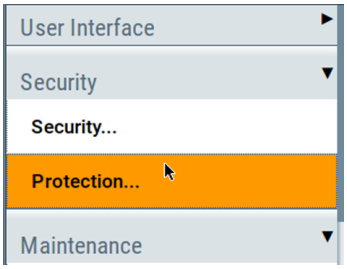
It is protected by protection level 3. So this protection has to be unlocked each time after the device is switched on.

Access:

1. Select "System Config > Setup".



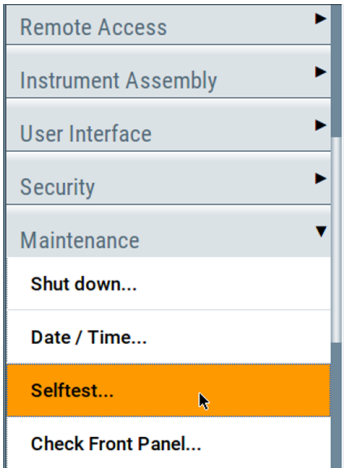
2. Select "Security > Protection".



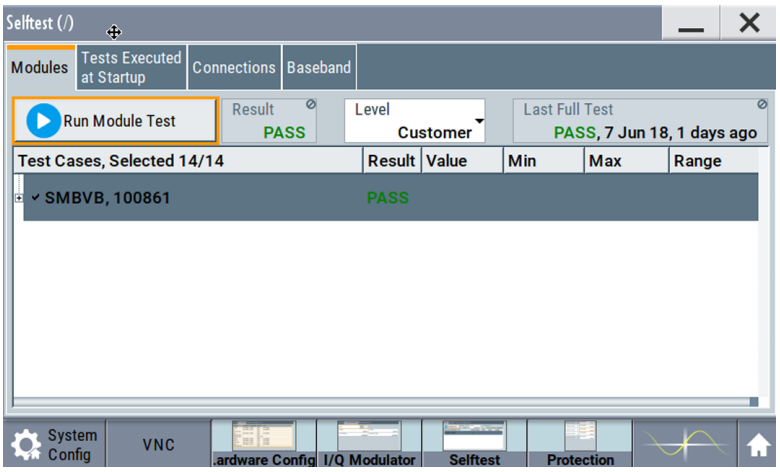
3. In the entry field of "Protection Level3", type in "490451 > Enter".

The unchecked checkbox indicates that the protection of level 3 is unlocked.

4. Close the dialog.
5. In the setup menu, select "Maintenance > Selftest".



6. Select "Run Module Test".



After a few seconds, the R&S SMBV100B displays the result. If the selftest is successful, all results are indicated by status "PASS".

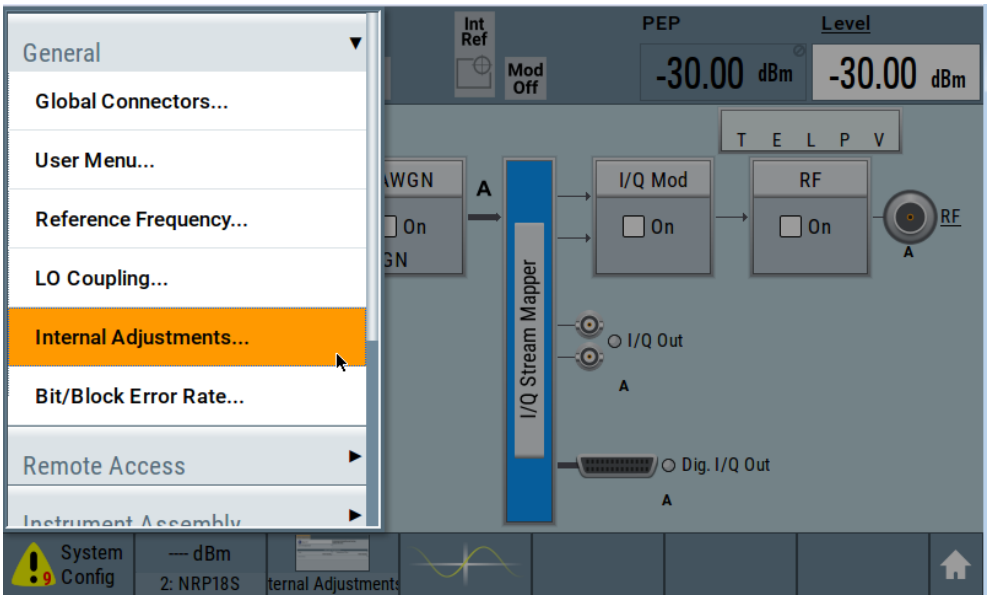
When one or more test routines failed, the instrument indicates "FAIL". In this case, contact your local Rohde & Schwarz service department.

2.2 Internal Adjustments

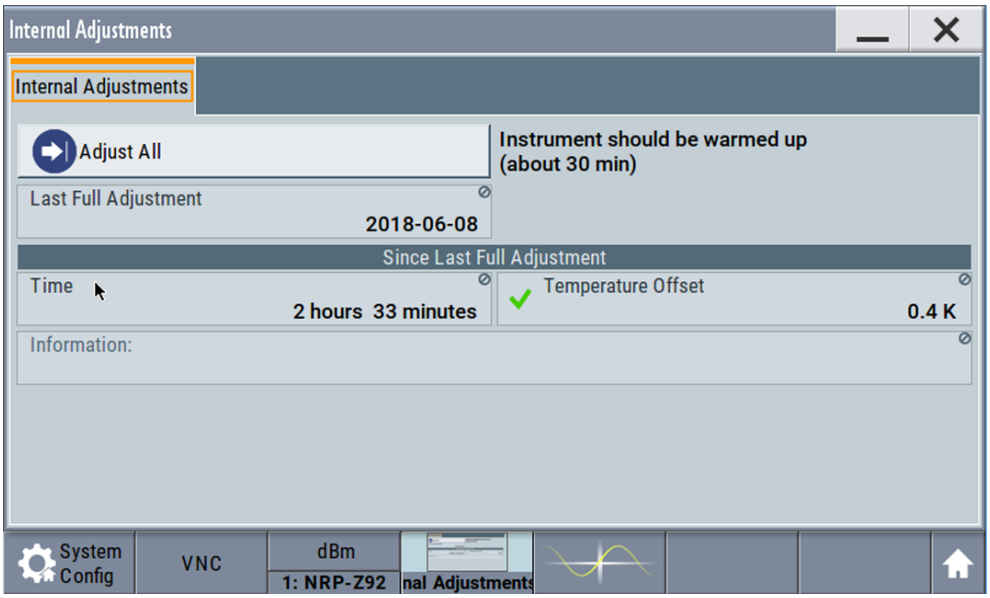
To perform the internal adjustments, make sure to keep the warm-up time of at least 30 minutes.

Access:

1. Select "System Config > Setup > Internal Adjustments".



2. Select "Adjust All".



The internal adjustments can take about 1 to 2 hours depending on the installed options.

2.3 External Adjustments

Four external adjustments have to be performed as listed in the table below.

Please notice the attenuator mentioned in the table to avoid damages to the spectrum analyzer because of the high output power of the R&S SMBV100B.

Adjustment	Test sequence	Equipment	Hints
Absolute Level Correction	SMBB_SMBVB_Absolut_Level_Cor	Power sensor8 kHz – 6 GHz, min. +20 dBm (e.g. NRP-Z51)	Switch-off RF before connecting the Power sensor. Be aware of the high output power of the R&S SMBV100B.
Relative SATT Correction	SMBB_SMBVB_Relative_SATT_Corr	Spectrum analyzer FSW	Switch-off RF before connecting the Spectrum analyzer. Be aware of the high output power of the R&S SMBV100B.
RFLEVEL_Max Correction	SMBB_RFLEVEL_Max_6GHz	Attenuator 10 dB, 10W (1137.7770.00) Spectrum analyzer FSW	During this adjustment, high output power is generated, so please use the 10 dB attenuator to avoid any damage.
IQ_RFLEVEL_Max Correction	SMBVB_IQ_RFLEVEL_Max_6GHz	Spectrum analyzer FSW	Switch-off RF before connecting the Spectrum analyzer. Be aware of the high output power of the R&S SMBV100B.

Use the G5 software to perform these external adjustments (Figure 1). There is no special sequence to perform these external adjustments, but it is recommended that you keep the order as described.

Perform the internal adjustments before starting the external adjustments and consider the warm-up time of at least 30 minutes.

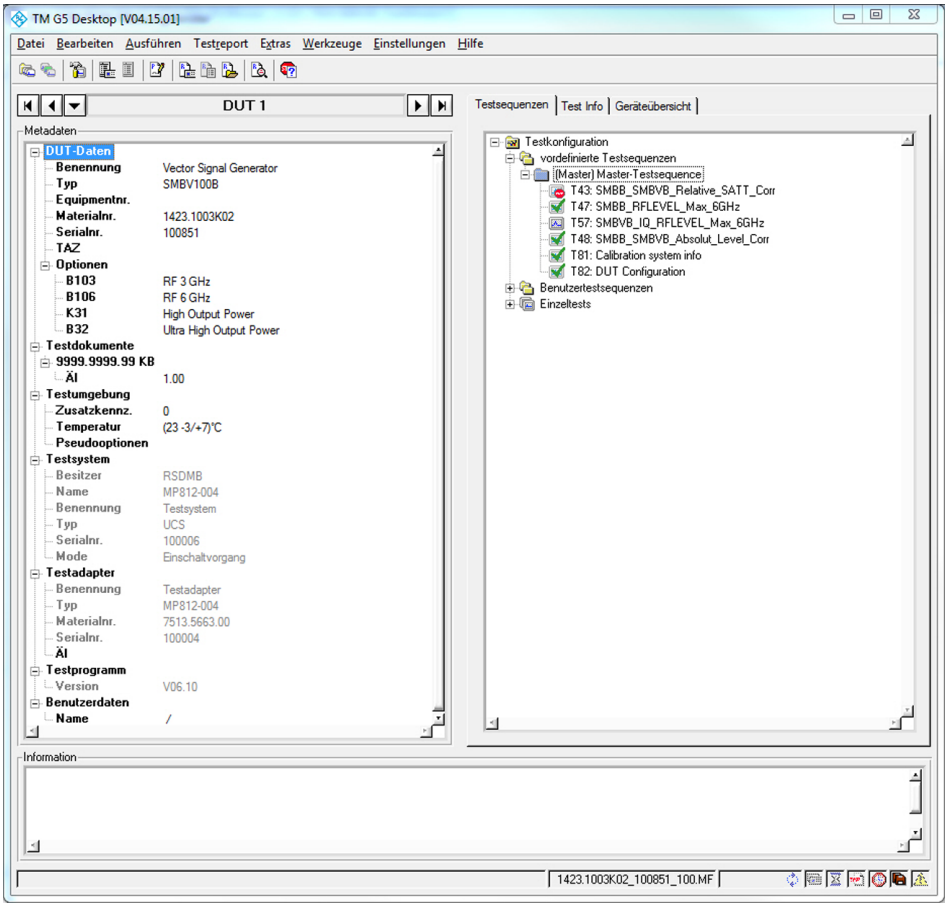


Figure 2-1: List of external adjustments for R&S SMBV100B with the R&S G5 environment.

3 Installing Options

3.1 Installing Hardware Options

Hardware options are identifiably by the B suffix, e.g. R&S SMBVB-B106.

Only the following hardware options are retrofitable in our service plants:

- R&S SMBVB-B1 (OCXO-Reference Oscillator)
- R&S SMBVB-B1H (High Performance OCXO Reference Oscillator)
- R&S SMBVB-B3 (1GHz Reference In/Out)

Note the mounting instructions enclosed with the options.

3.2 Installing Software Options

Software options are identifiably by the K or B suffix, e.g. R&S SMBVB-B106 or R&S SMBVB-K704.

All available software options are already included in the latest firmware. They are ready to operate after they are enabled by means of a key code supplied with the option.

Only if the R&S SMBV100B is equipped with an older firmware version, a firmware update before enabling the software option can be required. The information on the valid firmware versions for the purchased software option is provided together with the option.

3.3 Options Overview

A list of all available hardware and software options is provided in the data sheet, or on the Rohde & Schwarz Internet site of the product, see:

www.rohde-schwarz.com/product/smbv100b.

4 Installation of New R&S SMBV100B Firmware

For information on how to update the firmware refer to the release notes. The most recent version of the release notes, and the latest firmware version are provided on the Rohde & Schwarz website of the product, see:

https://www.rohde-schwarz.com/firmware/smbv100b

The release notes describe in detail the requirements and the various options for updating the firmware.

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