# R&S® FS-Z10
Coherence Unit
Manual

1173.0008.32 – 03

ROHDE&SCHWARZ
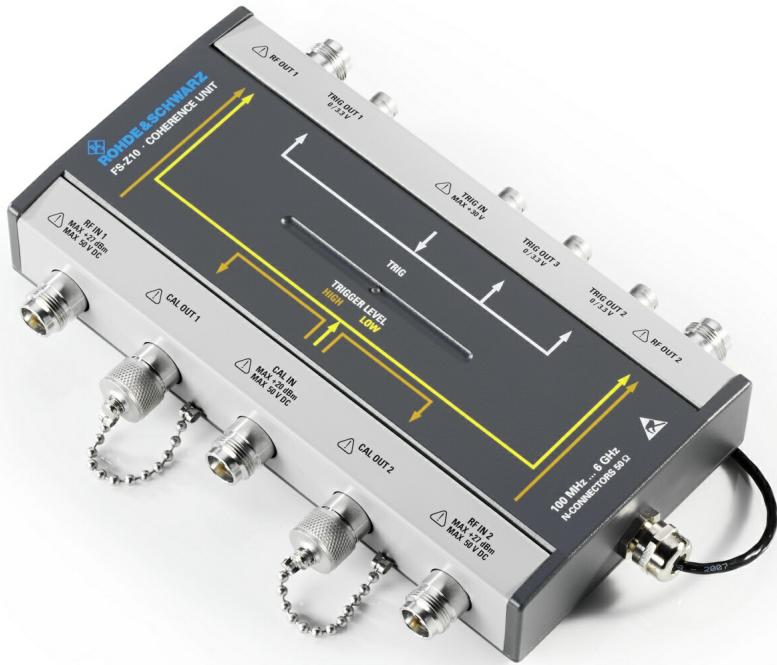
The Manual describes the following R&S®FS-Z10, Coherence Unit (1171.6509.02).

The firmware of the instrument makes use of several valuable open source software packages. the most important of them are listed below, together with their corresponding open source license. The verbatimlicense texts are provided on the user documentation CD-ROM (included in delivery).

Package	Link	License
Xitami	http://www.xitami.com	2.5b6

Rohde&Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

The following abbreviations are used throughout this manual:
R&S®FS-Z10 is abbreviated as R&S FS-Z10 .

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

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

Basic Safety Instructions

Symbols and safety labels

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

Be careful when handling electrostatic sensitive devices	ON/OFF supply voltage	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double (reinforced) insulation

Tags and their meaning

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

⚠ 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 the possibility of incorrect operation which can result in damage to the product.
In the product documentation, the word ATTENTION is used synonymously.

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

Basic Safety Instructions

Operating states and operating positions

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

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
   predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency.

2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or death.

3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

Electrical safety

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

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

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

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

4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.

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

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

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

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

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

10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.

11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.

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

13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

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".

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3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.

4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.

5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.

6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.

7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

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

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

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Batteries and rechargeable batteries/cells

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

1. Cells must not be taken apart or crushed.

2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.

3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.

4. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.

5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.

6. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.

7. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.

8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

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

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

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

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

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

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

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

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.

Informaciones elementales de seguridad

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

Símbolos y definiciones de seguridad

Aviso: punto de peligro general Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Adver-tencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa

Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)	Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Informaciones elementales de seguridad

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**	PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.
⚠ **ADVERTENCIA**	ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.
⚠ **ATENCIÓN**	ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.
AVISO	AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo. En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

Estados operativos y posiciones de funcionamiento

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

Informaciones elementales de seguridad

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue:
como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal.

2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, pueden causarse lesiones o incluso la muerte.

3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.

2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.

3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.

Informaciones elementales de seguridad

4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.

5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.

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

7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.

8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.

9. En las mediciones en circuitos de corriente con una tensión U_{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", 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. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.

2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista,

control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.

2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.

3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.

4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.

5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.

7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).

8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Informaciones elementales de seguridad

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.

3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (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.

2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Qualitätszertifikat
Certificate of quality
Certificat de qualité

Sehr geehrter Kunde,
Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde & Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

Der Umwelt verpflichtet
ı Energie-effiziente, RoHS-konforme Produkte
ı Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
ı ISO 14001-zertifiziertes Umweltmanagementsystem

Dear Customer,
You have decided to buy a Rohde & Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde & Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

Environmental commitment
ı Energy-efficient products
ı Continuous improvement in environmental sustainability
ı ISO 14001-certified environmental management system

Cher client,
Vous avez choisi d'acheter un produit Rohde & Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde & Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.

Engagement écologique
ı Produits à efficience énergétique
ı Amélioration continue de la durabilité environnementale
ı Système de gestion de l'environnement certifié selon ISO 14001

75 Years of Driving Innovation

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ROHDE & SCHWARZ

Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish.
We will take care that you will get the right information.

Europe, Africa, Middle East	Phone +49 89 4129 12345 customersupport@rohde-schwarz.com
North America	Phone 1-888-TEST-RSA (1-888-837-8772) customer.support@rsa.rohde-schwarz.com
Latin America	Phone +1-410-910-7988 customersupport.la@rohde-schwarz.com
Asia/Pacific	Phone +65 65 13 04 88 customersupport.asia@rohde-schwarz.com

ROHDE&SCHWARZ

1171.0500.22-05.00

ROHDE&SCHWARZ
EC Certificate of Conformity

$$C\,E$$

Certificate No.: 2007-77

This is to certify that:

Equipment type	Stock No.	Designation
FS-Z10	1171.6509.02	Coherence Unit

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electromagnetic compatibility
  (2004/108/EC)

Conformity is proven by compliance with the following standards:

EN 61326 : 1997 + A1 : 1998 + A2 : 2001 + A3 : 2003
EN 55011 : 1998 + A1 : 1999 + A2 : 2002, Klasse B

For the assessment of electromagnetic compatibility, the limits of radio interference for Class B equipment as well as the immunity to interference for operation in industry have been used as a basis.

Affixing the EC conformity mark as from 2007

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich, 2007-11-27   Central Quality Management MF-QZ / Radde

Table of Contents

1   Introduction

Many modern applications (e.g. multiple input multiple output, PA radar) require the synchronous transmission of two or more signals. The hardware properties of the transmitters result in timing shifts, gain differences and phase offsets between the RF signals. These parameters are difficult to estimate and might additionally also result from the cables used to connect the device under test (DUT) to the signal analyzers or from differences between the internal clocks of the analyzers used. Therefore, the task of the coherence unit remote software is to perform an accurate measurement of these differences by compensating effects that do not originate from the DUT itself. In addition the software enables the user to compensate these signal differences and save the compensated signals on a local drive.

The measurement requires a Rohde & Schwarz coherence unit, two Rohde & Schwarz spectrum analyzers (R&S FSQ, R&S FSV or R&S FSG), a signal generator (e.g. R&S SMU) to generate a reference signal and a desktop PC to run the software.

The coherence unit remote software includes the following features:

● Coherence measurement of two RF-signals regarding phase, timing and gain differences.
● Calibration mode to measure the properties of the cables used to connect the device under test to the Coherence Unit.
● Automatic compensation of signal-differences (phase, timing and/or gain) resulting from these cables.
● Save and recall calibration-data.
● Save and recall software settings.
● Optional compensation of differences (phase, timing and/or gain) between the two signals received from the device under test.
● Remote control support using SCPI-commands to perform automated tests.
● Measurement result list and capture buffer overview of both RF-signals
● Measurements in single- or continuous-mode.
● Display of phase, timing, and gain differences as graph vs. time.
● Automatic configuration of the analyzers using the settings specified in the graphical user interface.
● Save compensated or non-compensated IQ-signals in 32bit floating point or text format to your hard drive.

The Coherence Unit combined with the corresponding software provides an easy and cost-efficient way to measure differences in phase, timing and gain between two radio frequency signals. Unwanted distortions (e.g. temperature changes of the cables) which could decrease the accuracy of such a measurement will be compensated automatically using a reference signal created by a signal generator. This means that the measured signal differences will only result from the device under test itself. In addition to the actual measurement it is also possible to compensate the measured differences and store the corrected IQ-data in a file.

2   System Overview

2.1   Measurement Task

In order to measure the coherence between two RF signals, the problem is not only the signal analysis itself, but also the fact that additional disruptive factors caused by the test environment must be accounted for. Such factors include:

● Thermal fluctuations that affect the channel characteristics and therefore interfere with the results.
● Additional inaccuracies caused by cables with different properties.
● Trigger offsets between the connected analyzers.
● Local oscillator phase offsets between the connected analyzers.
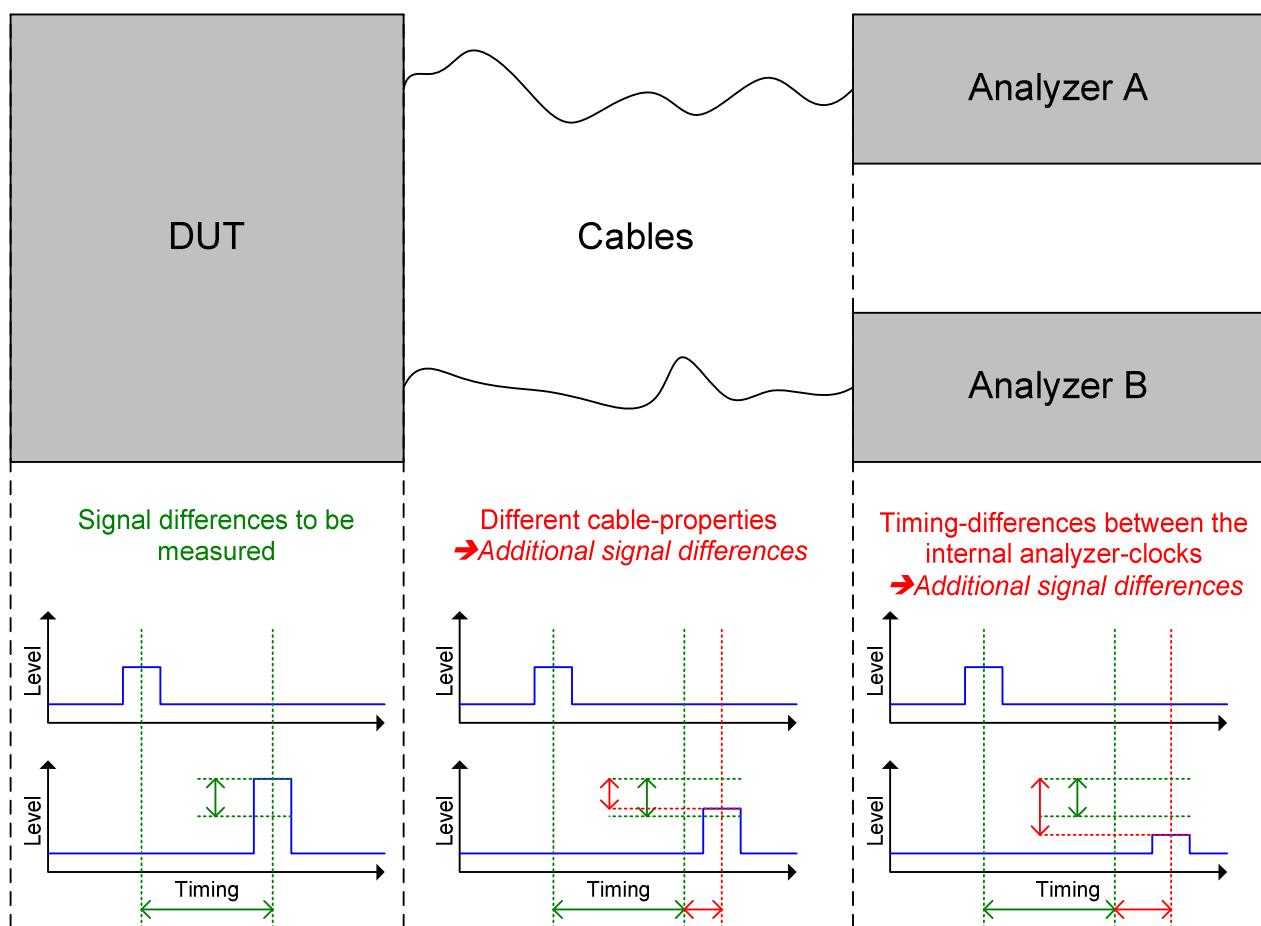

Figure 2-1: Problem description

2.2   General Solution

A general solution would be to avoid the disruptive factors as far as possible. In practice that would mean the following:

- Calibrate the cables used to connect the devices and compensate the cable parameters.
- All measurements have to be performed in an isolated environment with constant temperature.
- The two analyzers have to be synchronized exactly regarding frequency, phase and trigger time.

2.3   Rohde & Schwarz Solution

The solution proposed by Rohde & Schwarz is to use the coherence unit. To avoid the inaccuracies, the coherence unit remote software detects which of the differences between the two signals were caused by the DUT and which were caused by peripheral factors each time a measurement is performed. The signal differences due to peripheral factors have to be compensated by the software to allow an exact measurement of the current test signal. For this reason, a reference signal supplied by an extra signal generator must be measured before analyzing the current test data. The reference signal will be split and sent to both analyzers using the reference signal path shown in Figure 2-2.
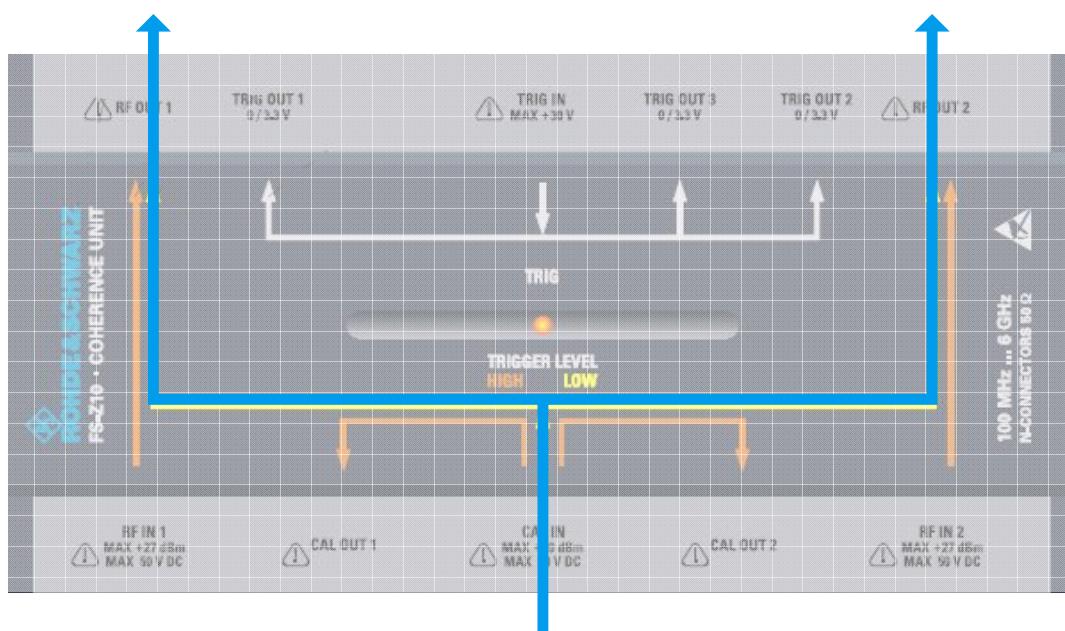

Figure 2-2: Coherence Reference Signal path

The differences measured in this approach result exclusively from the differences caused by the analyzers and the cables used to connect the coherence unit to the analyzers and will automatically be compensated for the following measurement.

After having detected the periphery properties the system will switch to the measurement signal paths shown in Figure 2-3 and the actual measurement will be performed on the measurement-part of the signal.
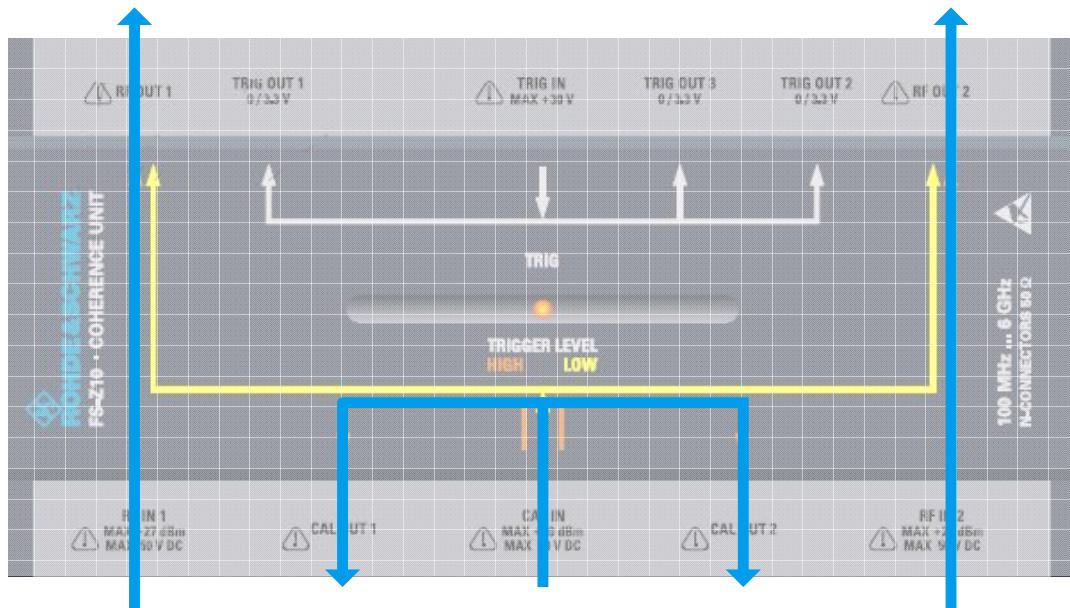
Figure 2-3: Coherence Measurement Signal path

The resulting signal structure is shown in the following figure:
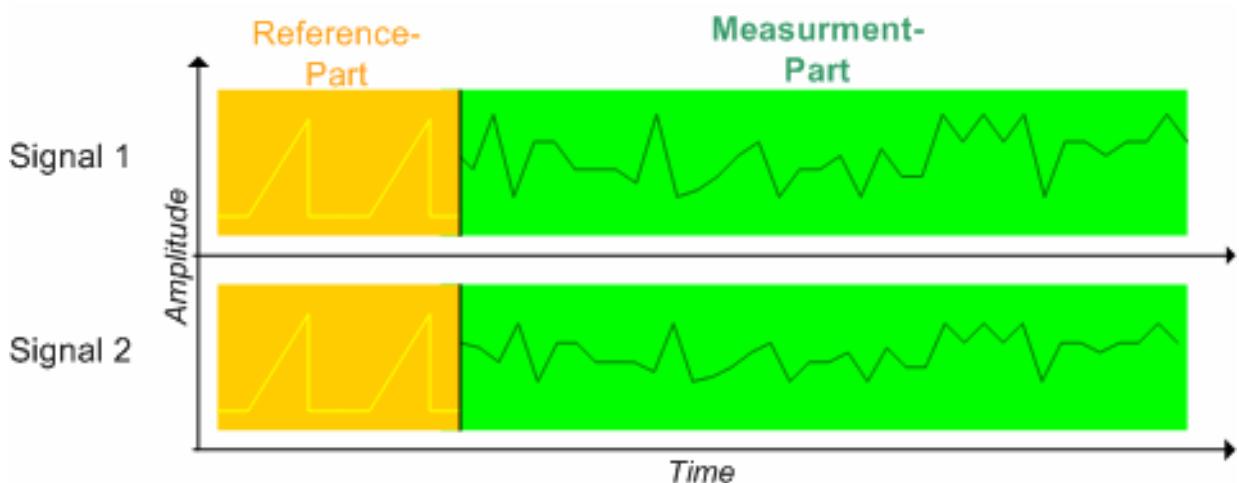
Figure 2-4: Data captured during a measurement

3   Putting into Operation

"Putting into Operation" explains the control elements and connectors of the R&S Coherence Unit with the aid of the front and rear views and describes how to put the device into operation.

Specifications of interfaces can be seen in the data sheet.

3.1   Legend for Front Panel View
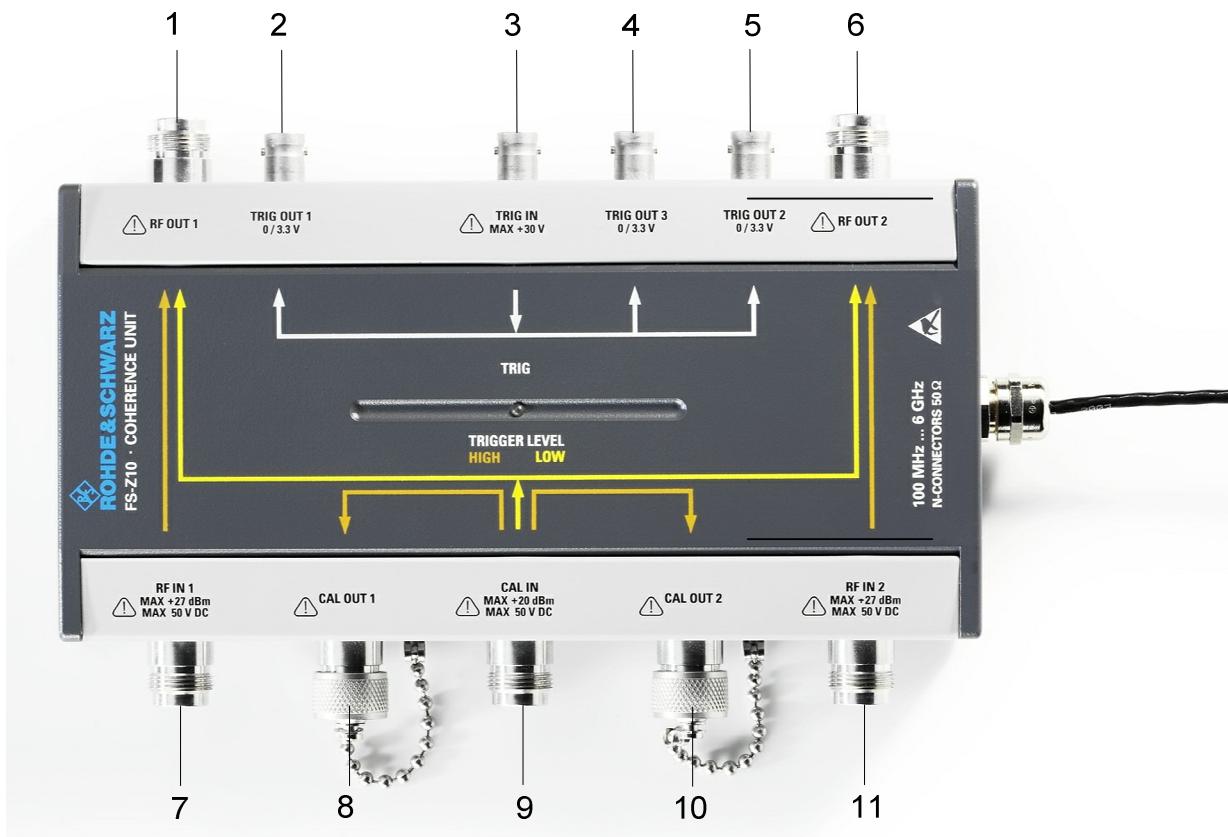
Number	Description
1	RF OUT 1; Connect to the RF input of analyzer A.
2	TRIG OUT 1; Connect to the trigger input of analyzer A
3	TRIG IN; Connect to the "NOISE SOURCE CONTROL" output of analyzer A.
4	TRIG OUT 3; Additional trigger output. This output might be used to trigger the reference signal generator if external attenuation is being used.
5	TRIG OUT 2; Connect to the trigger input of analyzer B.
6	RF OUT 2; Connect to the RF input of analyzer B.
7	RF IN 1; Used to connect one of the RF outputs of your device under test to the coherence unit.
8	CAL OUT 1; Only used during calibration. Connect to "RF IN 1" via one of the RF cables that will be used for later measurements.
9	CAL IN; Reference signal input. Connect the RF output of your reference signal generator here.
10	CAL OUT 2; Only used during calibration. Connect to "RF IN 2" via the other one of the RF cables that will be used for later measurements.
11	RF IN 2; Used to connect the other RF output of your device under test to the coherence unit.

3.2   Unpacking the R&S Coherence Box

1. Remove the instrument from its packaging (see separate unpacking instruction) and check the equipment for completeness using the delivery note and the accessory lists for the various items.

2. Check the instrument for any damage. If there is damage, immediately contact the carrier who delivered the instrument. In this case, make sure not to discard the box and packing material.

It is advisable to keep the original packing material in order to prevent control elements and connectors from being damaged in case the instrument is to be transported or shipped at a later date.

4 Installing the Software

4.1 Hardware and Software Requirements

PC Hardware Requirements

	Minimum	Recommended
RAM	1 GByte	2 GByte
Harddisc	15 MByte free space	50 MByte free hard disc space
Monitor	VGA monitor (640x480)	SVGA color monitor, resolution 800x600 or better
IEEE Bus	Optional	Optional

PC Software Requirements

	Minimum	Recommended
OS	Windows XP	Windows XP
VISA		---

4.2 Installation

Installing the Coherence Unit Remote Software requires two steps:

1. Preparing the PC (installing Microsoft .NET Framework 2.0, VISA and additional components).

2. Installing the Coherence Unit software itself.

4.2.1 Preparing the PC

The following steps show how to set up the PC for running the coherence unit remote software.

1. Make sure that the **Microsoft .NET Framework 2.0** is properly installed on your system.

2. Make sure that the **Intel IPP Library** is properly installed on your system.

3. Make sure that **VISA**. is properly installed on your system.

Details on each installation step can be found in the following sections.

4.2.1.1   Install Microsoft .NET Framework Version 2.0

To install the coherence unit remote software, Microsoft .NET Framework 2.0 or a later version must be installed. To check if .NET Framework is installed and to install .NET Framework, perform the following steps:

1. Navigate to the installation location (typically the CD ROM drive).

2. Start *\Install\Microsoft .NET Framework 2.0\Check for .NET Installed.exe*.

If a message box appears claiming that .NET Framework is not installed:

► Start *\Install\Microsoft .NET Framework 2.0\dotnetfx.exe* and follow the instructions on the screen.

4.2.1.2   Install Intel IPP

The coherence unit remote software makes use of the Intel IPP library. To install the library perform the following steps:

1. Navigate to the installation location (typically the CD ROM drive).

2. Start *\Install\IntelIPP\Intel IPP Library Version 4.1\setup.exe* and follow the instructions on the screen.

4.2.1.3   Install VISA

In order to make communication to the instruments possible, VISA (Virtual Instrument Software Architecture) must be installed. This driver allows you to access instruments connected via IEEE/IEC bus or LAN bus to the PC.

1. If a National Instruments IEEE/IEC bus card or any other National Instruments hardware or National Instruments software is used, please visit http://www.ni.com/visa to get the latest version for the installed operating system

2. If an Agilent IEEE/IEC card is used, please visit http://www.agilent.com and search for the latest VISA version for the installed operating system.

3. If neither a National Instruments nor Agilent hardware or software is available, please contact Rohde & Schwarz for information on how to get an up-to-date VISA version.

4.2.2   Installing the Coherence Unit Remote Software

After installing all required components, the Coherence Unit software can be installed. In order to start this installation process:

1. Navigate to the installation location (typically the CD ROM drive).
2. Start *Install.exe* and follow the instructions on the screen.

The software will install the following:

1. The **coherence unit remote software** itself including an uninstall tool.
2. A **start menu** entry in "Programs → R&S Coherence Control ".
3. A **desktop shortcut** "R&S Coherence Control".

After the installation is completed, the software can be started from the start menu entry or via the desktop shortcut.

4.2.3   Uninstalling the Coherence Unit Remote Software

Please ensure that no other software is using the software component before uninstalling it.

All installed components (coherence unit remote software and additional components) can be uninstalled using the "Add or Remove Software" function from the Windows Start menu in "Start -> Settings -> Control Panel -> Add or Remove Software".

The following components are removed by the uninstallation process of the coherence unit remote software:

► Rohde & Schwarz coherence unit remote software.

4.3   Starting the Software

To start the coherence unit remote software, select "Programs→R&S Coherence Control → Coherence Control" from the Windows start menu or execute the "CoherenceUnit.exe" file in the installation directory.

5   Setting up a Measurement

To achieve best accuracy, it is advisable to calibrate the cables used to connect the DUT to the coherence unit before starting the actual measurement. For this reason, the coherence unit remote software provides a calibration mode and a measurement mode. These two modes require different instrument connections.

Make sure that both analyzers use the external reference clock supplied by the signal generator.

5.1   Calibration Mode

The task of the calibration mode is to measure phase-, timing- and gain-differences caused by the cables used to connect the device under test to the Coherence Unit.

To perform a calibration connect the instruments as shown in the following figure:
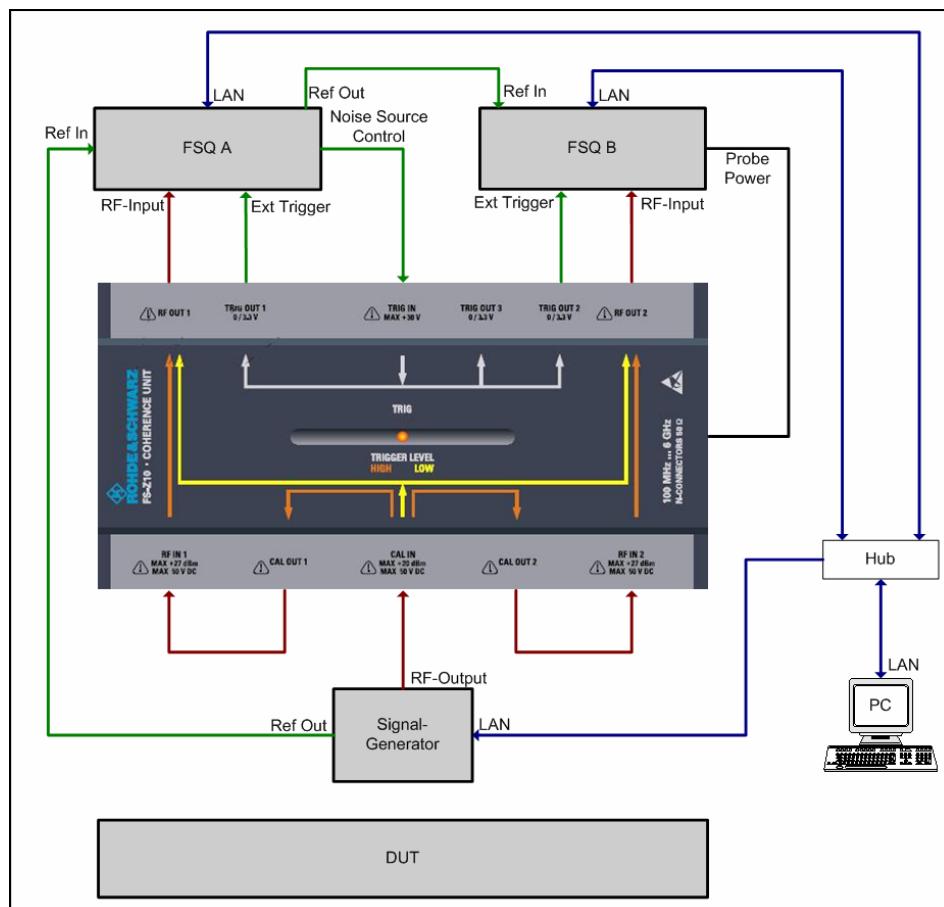
Figure 5-1: Cable Connections for Calibration Mode

5.2   Measurement Mode

The measurement mode denotes the actual test mode. The signal differences which were measured during calibration mode will be compensated automatically.

To perform a measurement connect the instruments as shown in the following figure:
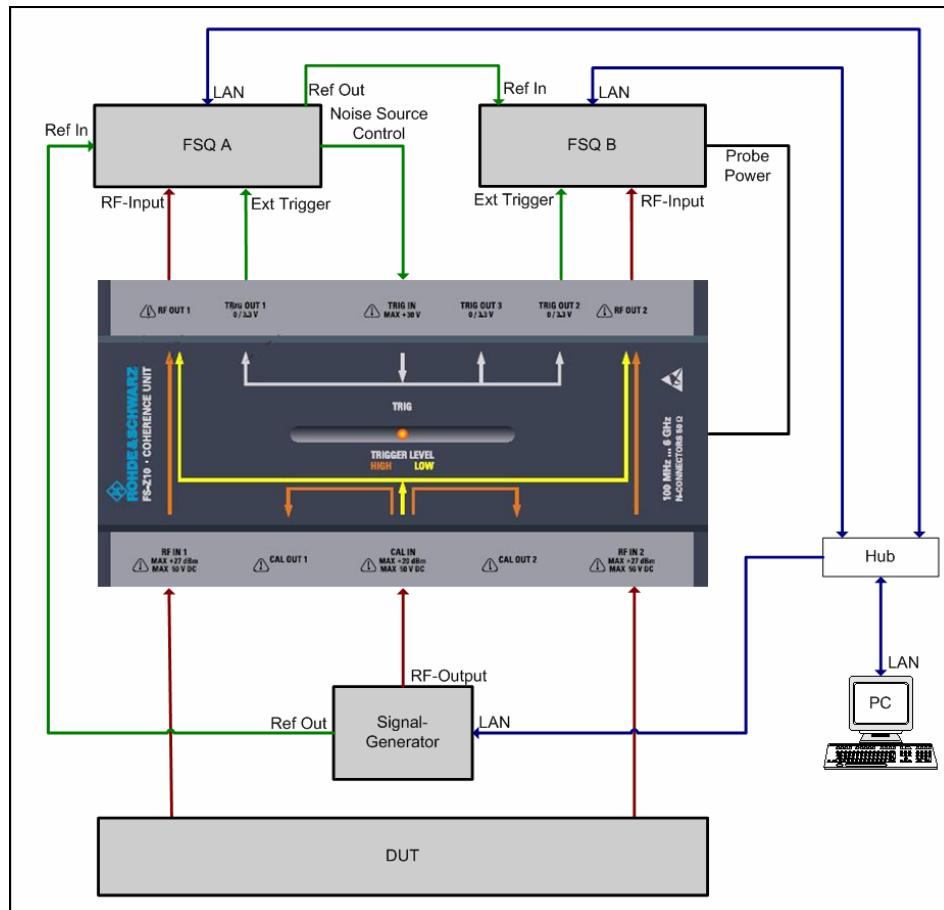
Figure 5-2: Cable Connections for measurement mode

6   Performing a Measurement

6.1   Perform Calibration

The first step is to calibrate your cables using the Calibration Mode. You may also perform a measurement without calibration, though the result accuracy will be lower.

Perform the following steps to do the calibration:

1. Connect your devices as described in chapter 5 (Calibration Mode).

2. Set the addresses of the connected analyzers (or make sure that the analyzer addresses were previously set correctly) in the "Hardware Setup" in the "Settings" menu.

3. It is advisable to configure a reference level in the "Settings" menu which will be similar to that used for measurement of the DUT. Note: If autoleveling is activated the reference level will be set to 0 dBm for the calibrations.

4. Configure the "Data Capture Settings" corresponding to the signals you are using in the "Settings" menu.

5. Press the "Calibrate" Key in the hotkey bar.

The software will perform several calibrations and average the results in order to improve the measurement accuracy. The number of averages to be performed can be defined in the general settings menu. If the calibration was successful, the calibration-display in the header-bar will switch to "CAL".

➡   Remote: `INIT:CABL`

6.2   Perform a Measurement

Perform the following steps to do the measurement:

1. Connect your devices as described in section 'Setting up a Measurement'

2. Press the "RUN SGL" button for a single measurement or the "RUN CONT" button for continuous measurements.

3. View the results of your measurement as graph or result list (switch views via "Display" softkey) or watch the results of the last measurements as results vs. time (press the "Meas Results" softkey).

➡ Remote: `INIT:IMM`

6.3   Use of External Attenuators

The RF inputs of the R&S FS-Z10 support a maximum power of 27 dBm. If signals with higher power are to be measured it is necessary to add external attenuators to the measurement setup (see Figure 6-1).
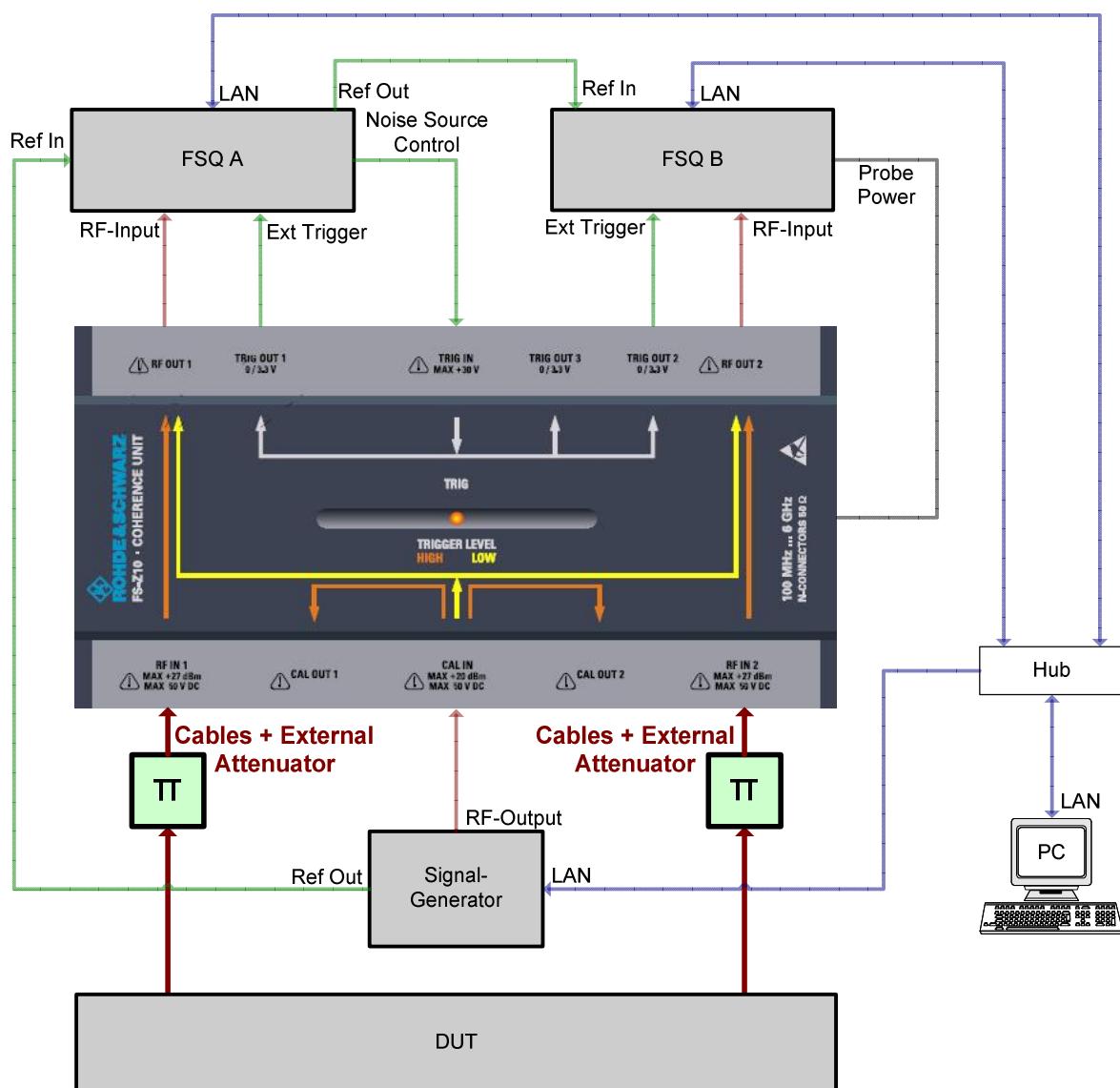
Figure 6-1: Measurement setup including external attenuation.

However, these attenuators cause additional unwanted phase-, timing- and gain differences which need to be taken into account during the calibration process (see Figure 6-2).
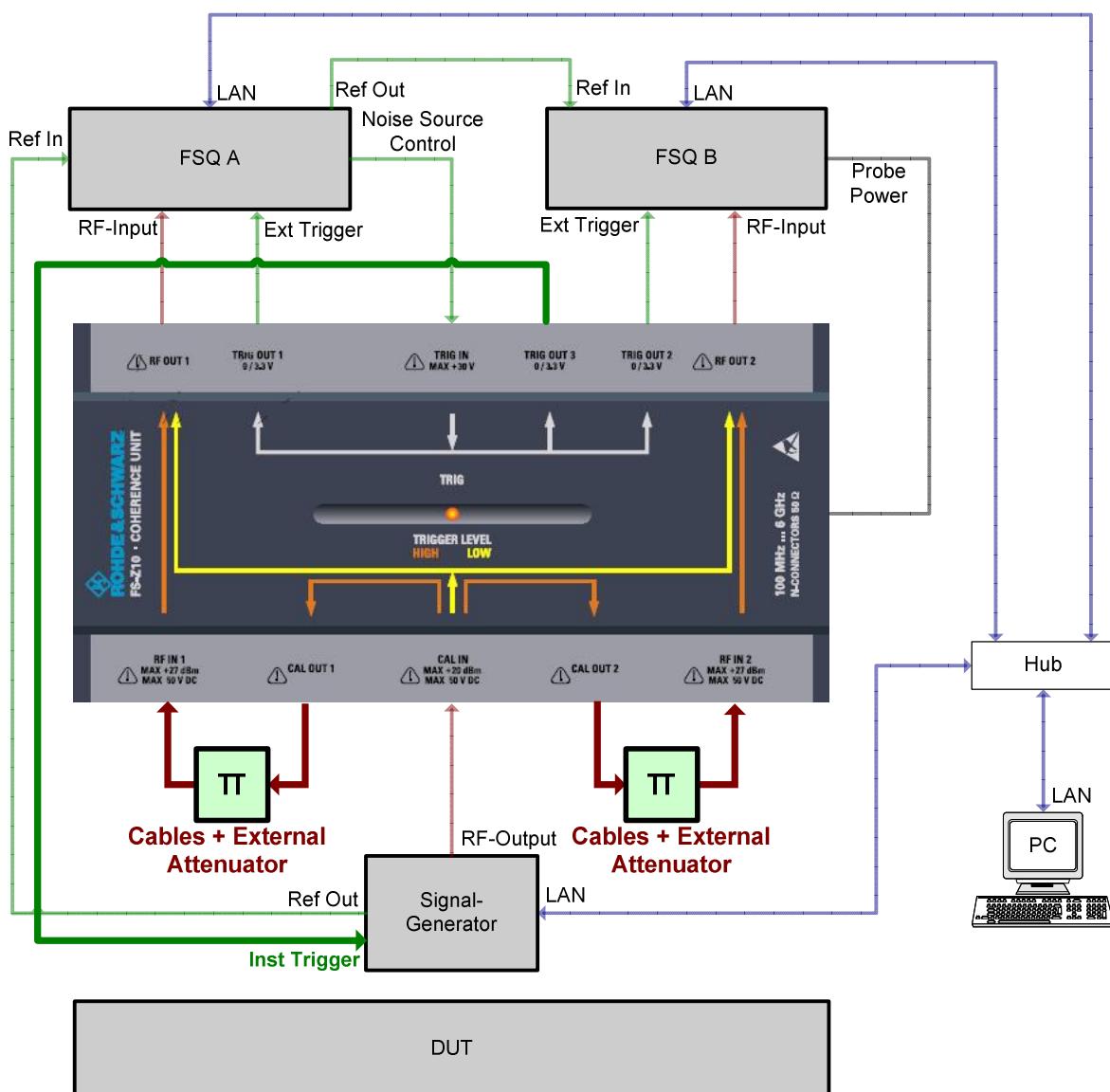
Figure 6-2: Calibration setup including external attenuation.

Some difficulties arise due to the fact that the external attenuation only attenuates the Measurement Part of the signal (see Figure 2-3: Coherence Measurement Signal path) but not the Reference Part (see Figure 2-2: Coherence Reference Signal path). As a result of this the reference part of the signal might have a significantly higher level than the measurement part.
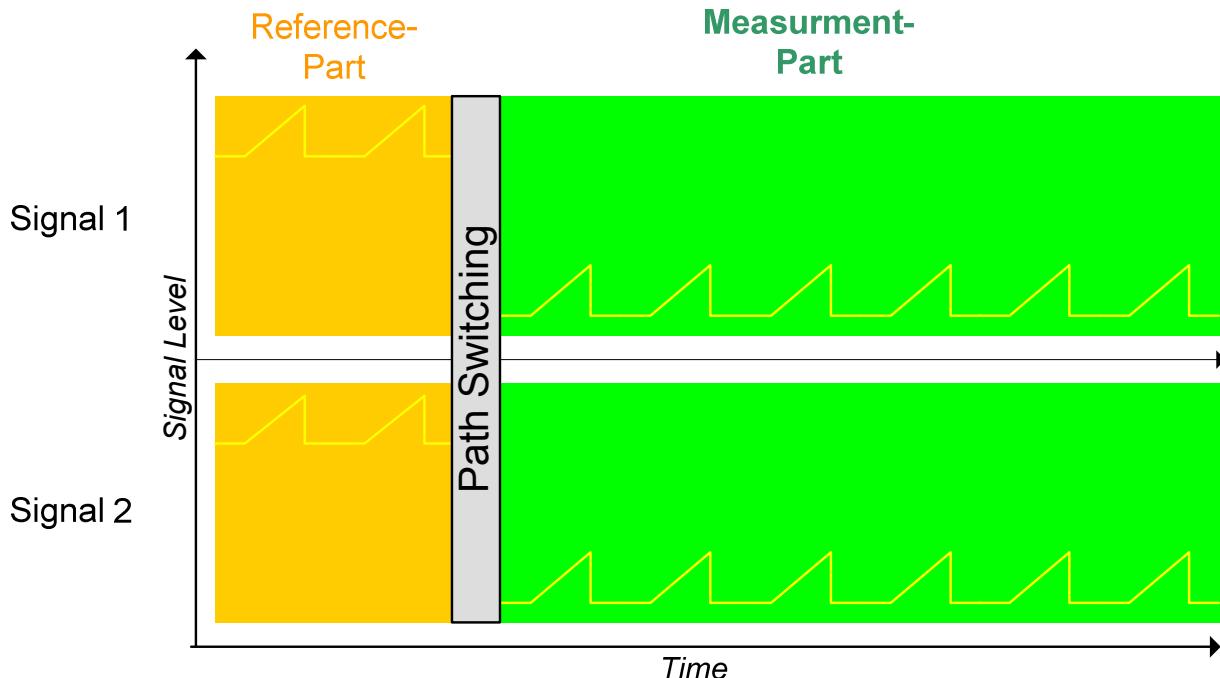

Figure 6-3: Signal structure of a calibration sweep with uncompensated external attenuation.

For optimal measurement accuracy, the analyzer should have a reference level setting closely matched to the input signal level for both signal parts. In order to achieve this the reference signal generator needs to adjust its signal output power at the same instant that the FS-Z10 switches from the reference path to the measurement path (see Figure 6-4). To meet this timing requirement an additional trigger cable needs to be connected from "TRIG OUT 3" to the instrument trigger input of the generator ("INSTR TRIG").
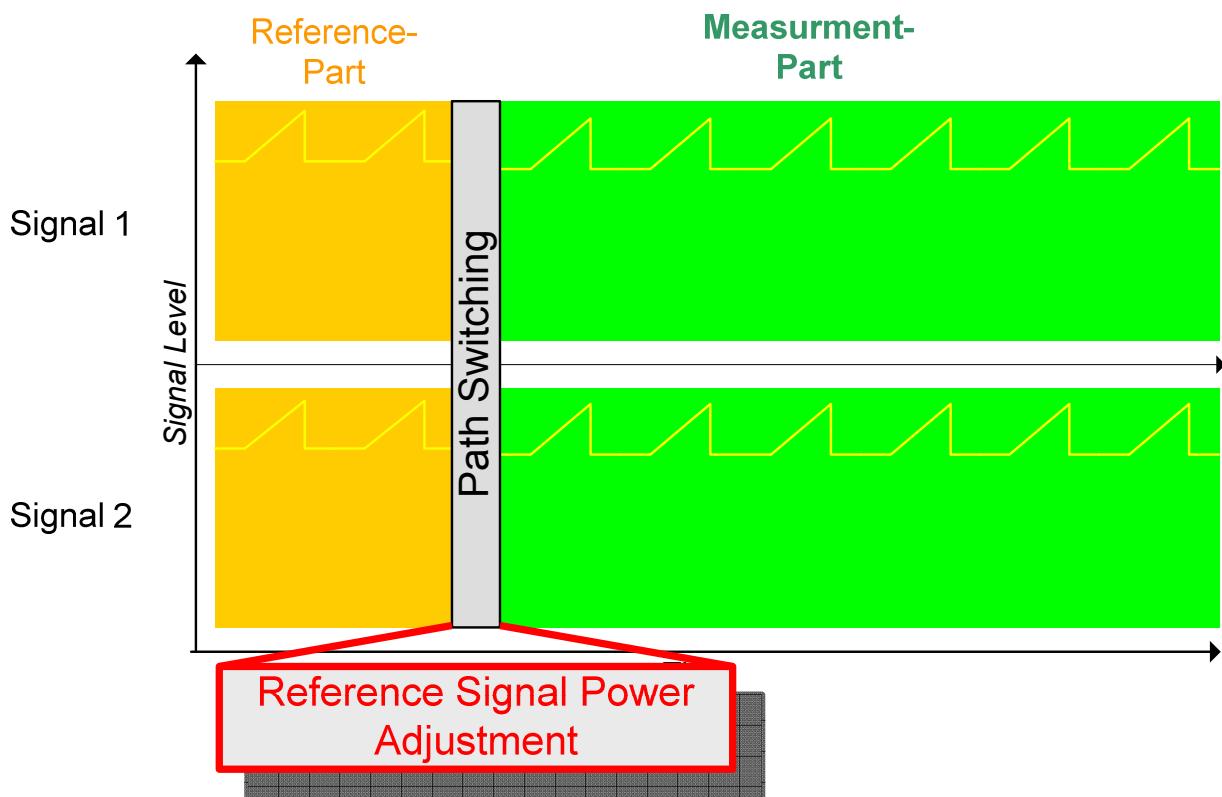
Figure 6-4: Signal structure of a calibration sweep with compensated external attenuation.

The FS-Z10 Remote Software provides the possibility of either configuring the external attenuation values manually, or of detecting them automatically (see chapter 8.1). However, the automatic detection is only possible during the calibration process and not during the measurement.

The external attenuation functionality is not supported if an R&S SMIQ signal generator is used as the reference signal generator because this generator type does not meet the timing requirements.

7   Explanation of the Results

7.1   Result Overview

Figure 7-1: Description of the Result Overview

The result overview provides a summary of the most relevant measurement settings and results. The following values are displayed:

Value	Description
1. Frequency	Displays the currently selected centre frequency for both analyzers.
2. Sample Rate	Displays the currently selected sample rate for both analyzers.
3. High Accuracy Mode	Indicates if the software is currently running in high accuracy mode (see chapter 9.3).
4. Ref Level(A|B)	Displays the current reference levels of both analyzers (analyzer A and analyzer B).
5. Capture Length	Displays the currently selected capture length in seconds and in samples.
6. High Accuracy Service No	Displays the high accuracy service number of the currently selected high accuracy file (see chapter 9.3.1).
7. Calibration Status	Displays the current calibration state (see chapter 6.1).
8. Measurement DVM	Displays the current Difference Vector Magnitude (see chapter 7.4).
9. Serial Number	Displays the serial number of the currently selected high accuracy file. If you are running the software in high accuracy mode this number must be identical to the serial number of your Coherence Unit. (see chapter 9.3.2)

7.2 Capture Buffers View

Capture Buffers	Switch to Capture Buffers view. ➡ Remote: `CALC:FEED 'PVT'`

The Capture Buffers View shows the power vs. time for both paths. Screen A directly plots the power values received from Analyzer A while Screen B performs some compensations before plotting the data. These compensations handle all unwanted differences caused by the periphery such as cabling or clock offsets between the analyzers.
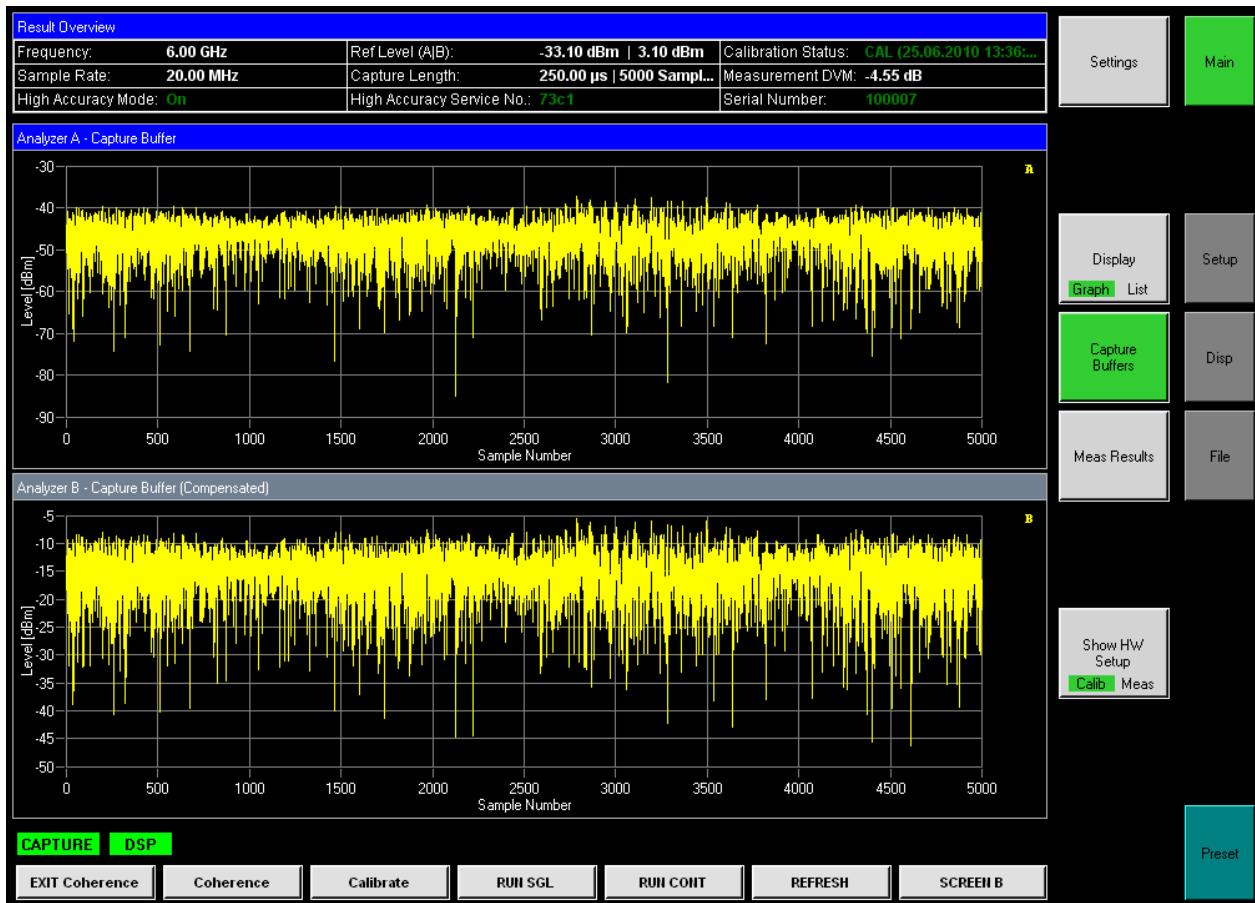
7.3   Meas Results View

Meas Results	Switch to Meas Results view. ➡ Remote: `CALC:FEED 'RVT'`

The Meas Results View contains a graphical display of all measurement results such as Phase Difference, Timing Difference, Gain Difference and DVM, plotted over time. The graphs are reset on each new continuous sweep start.
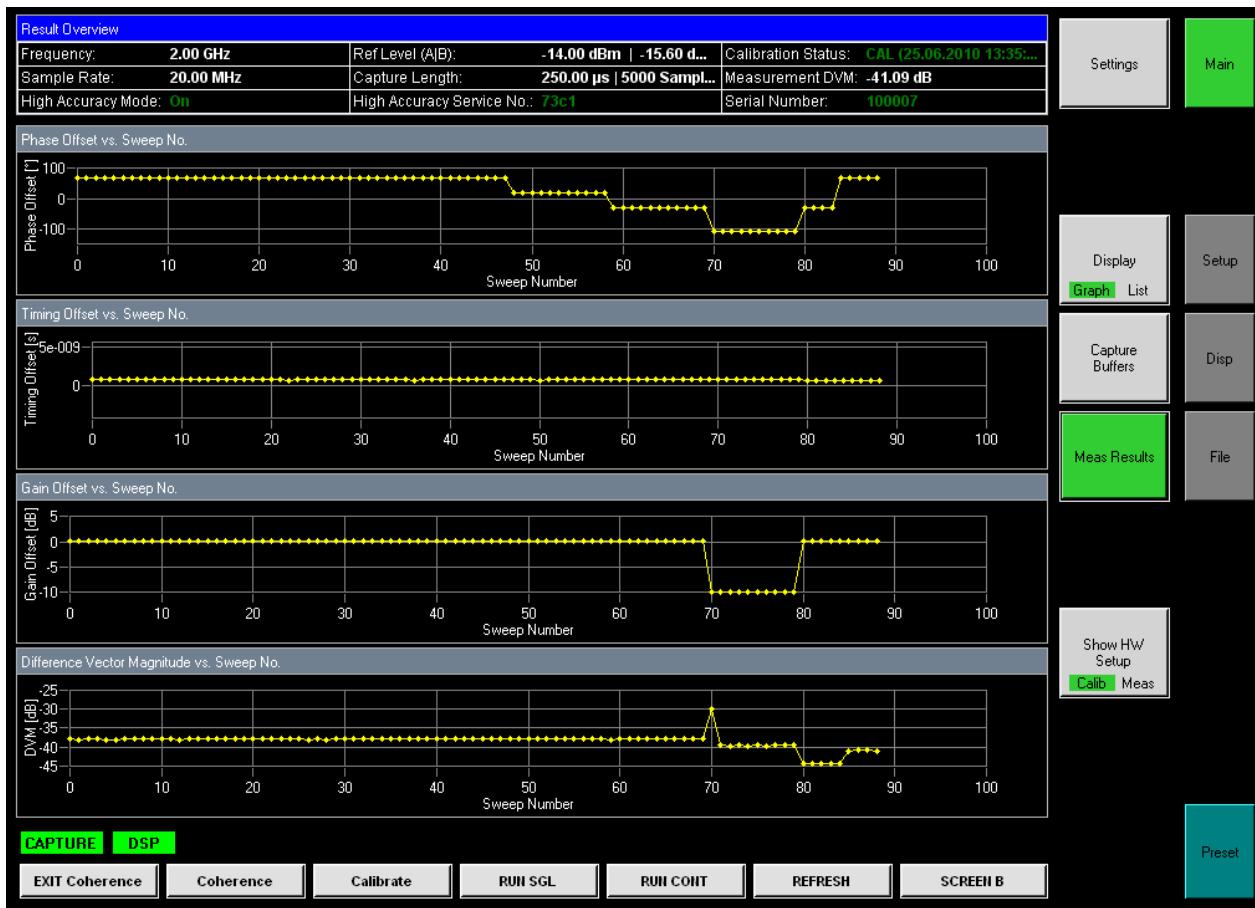
The accuracy of the result displayed in the Meas Results View can be improved by activating the High Accuracy Mode (for details see chapter 9.3).

7.4   Result List View

	Switch back and forth between Graph and List view.
Display Graph List	➡ Remote: `Not available.`

The screenshot shown in the following figure shows the result list after having performed a calibration and a measurement.

Result List		
	Measurement Result	**Calibration Result (Avg. 3 of 15)**
Phase Difference (φ) between A and B	-0.87 °	-68.10 °
Timing Difference (τ) between A and B	-10 ps	-460 ps
Gain Difference (g) between A and B	-0.27 dB	-0.72 dB
Underlying Formula: $Signal_B(t) = g \cdot Signal_A(t-\tau) \cdot e^{j \cdot \varphi}$		
Difference Vector Magnitude	-31.4440 dB	-36.1429 dB

Figure 7-2: Result list

The column to the right shows the results of the calibration and the column to the left shows the results of the current measurement. The three parameters φ (= phase difference), τ (= timing difference) and *g* (= gain difference) describe the coherence of signal A and signal B as shown in the following formula:

$$s_B(t) = g \cdot s_A(t-\tau) \cdot e^{j \cdot \varphi}$$

The difference vector magnitude (DVM) is used to check the accuracy of the results. The DVM is calculated by comparing signal A with the fully compensated signal B using the following formula:

$$DVM = 10 \cdot \log_{10} \left(\frac{\sum_t \left| s_B(t) - s_A(t) \right|^2}{\sum_t \left| s_A(t) \right|^2} \right)$$

The accuracy of the result displayed in the Result List View can be improved by activating the High Accuracy Mode (for details see chapter 9.3).

7.5 Logfile in Continuous Mode

If you are running the software in continuous mode, a logfile will be created. The file will be stored under "**<Program Folder>\Logfile.txt**" and contains information about every sweep since the last time "RUN CONT" was pressed.

```
     0         10        20        30        40        50        60     T   70        80        90       100
 1 #     Sweep started at 29.01.2009 14:20:22
 2 #     Format: Phase-offset[°]|Time-offset[s]|Gain-offset[dB]|Difference Vector Magnitude|Time of day|Date
 3
 4 +0.0967|-3.04721295833588E-11|+0.0008|-32.37|14:20:37|29.01.2009
 5 +0.0014|+1.46384816616774E-11|+0.0039|-32.44|14:20:40|29.01.2009
 6 +0.1190|-6.38663768768311E-12|+0.0011|-32.41|14:20:44|29.01.2009
 7 -0.0798|-3.91304492950439E-11|+0.0050|-32.44|14:20:47|29.01.2009
 8 -0.1628|+2.4472177028656E-11|+0.0007|-32.40|14:20:51|29.01.2009
 9 +0.1090|+2.91481614112854E-11|+0.0004|-32.37|14:20:55|29.01.2009
10 +0.0111|+1.39757990837097E-11|+0.0021|-32.43|14:20:58|29.01.2009
11 +0.1576|+2.96264886856079E-11|+0.0064|-32.33|14:21:02|29.01.2009
12 -0.0171|-8.24034214019775E-12|+0.0014|-32.41|14:21:05|29.01.2009
13 -0.0726|+3.81380319595337E-11|+0.0064|-32.40|14:21:09|29.01.2009
14 -0.0423|-1.935213804245E-11|+0.0008|-32.46|14:21:12|29.01.2009
15 -0.0439|-1.16020441055298E-11|+0.0012|-32.43|14:21:16|29.01.2009
16 +0.2550|+2.08377838134766E-11|+0.0021|-32.36|14:21:19|29.01.2009
17 +0.1130|-5.61624765396118E-11|-0.0057|-32.37|14:21:23|29.01.2009
18 +0.1856|+1.69237260706723E-11|+0.0040|-32.39|14:21:26|29.01.2009
```

Figure 7-3: Logfile for continuous mode

8   Settings

<table>
<tr>
<td>

Settings

</td>
<td>

The *SETTINGS* softkey opens the Settings dialog which contains two tabs: Primary and Advanced. To see the content of the tabs as shown below, click one of the tabs.

Settings
Primary | Advanced

The Settings dialog is only available if all connected instruments have been identified before. Otherwise the user will be prompted if the instruments shall be identified.

Read Hardware Properties

Connect to the following instruments?

AnalyzerA: GPIB::20
AnalyzerB: TCPIP::10.114.10.183
Signal Generator: TCPIP::10.114.11.26

OK   Abbrechen

</td>
</tr>
</table>
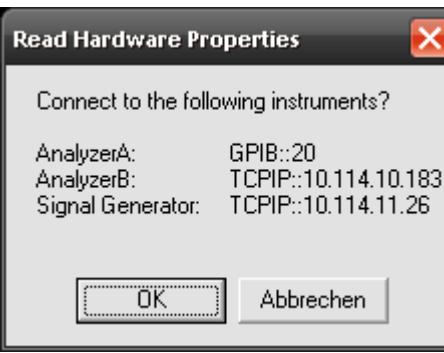
8.1   Primary Settings

Figure 8-1: Primary settings window (all fields are dimmed because no instruments are connected)

The hardware setup of the connected instruments determines which fields will be available and which will be unavailable.

Frequency

Specifies the *Center Frequency* of the signal to be measured.
The maximum frequency depends on the hardware configuration of your instruments.

➡   Remote: `FREQ:CENT 1GHz`

Sampling Rate

Sampling Rate	20 MHz

Specifies the *Sampling Rate* to be used for the measurement. This setting will automatically adjust the maximum signal bandwidth to be measured. Check the manuals of your spectrum analyzers for details about the available bandwidth as a function of the sampling rate used.

The maximum sampling rate depends on the hardware configuration of your instruments.

➡ Remote: `TRAC:IQ:SRAT 20MHz`

Available Bandwidth

Available Bandwidth	15,8 MHz

Displays the maximum bandwidth available for the currently selected sampling rate.

The maximum available bandwidth depends on the hardware configuration of your instruments.

➡ Remote: –

Capture Length

Capture Length	250 µs	5 kSamples

Specifies the length of the signal to be analyzed, measured in seconds or samples. Note that the total number of samples recorded will be greater because of the reference signal part and the signal overhead, which is necessary to align the data streams.

The maximum number of samples which can be recorded depends on the hardware configuration of your instruments.

➡ Remote: `SWEE:TIME 250us`
➡ Remote: `SWEE:SAMP 5000`

Auto level

Auto Level	☑

Determines whether the reference level for measurements is measured automatically (enabled) or entered manually by the user (disabled).

When the Auto Level check box is enabled, the coherence unit remote software will measure the reference level automatically at the start of each measurement sweep. This ensures that the reference level is always set at the ideal level for obtaining accurate results, but will slightly increase the required measurement time.

➡ Remote: `POW:AUTO`

Allow 0dB Atten.

Allow 0dB Atten.   ☐

Determines if the auto level routine is allowed to set the mechanical attenuation of the analyzers to 0dB.

In order to achieve optimum matching between the FS-Z10 RF outputs and the analyzers, the attenuation should never be 0dB. Therefore, by default, the auto-level routine will not be allowed to set 0 dB attenuation in the analyzers. If, however, external attenuators are used between the FS-Z10 and the analyzers, the software should be allowed to set the internal attenuators to 0dB to achieve the best possible dynamic for the measurement.

This setting is only available if autoleveling is activated.

➡ Remote: `POW:AUTO:ZATT OFF`

Reference Level

	Analyzer A	Analyzer B
Reference Level	-10 dBm	-10 dBm

Specifies the *RF Reference Levels* to use when performing measurements, or displays the detected reference levels when *Auto Level* is enabled.

➡ Remote: `CONF:POW:EXP:RF1 -10dBm`

RF Attenuation

RF Attenuation	Auto ▼	Manual ▼
	10 dB	10 dB

RF Attenuation specifies the mechanical attenuation to be applied to the input RF signal. If *Auto* has been selected, the *RF Attenuation* will be set automatically as a function of the current *reference level*.

➡ Remote: `INP:ATT1:AUTO ON`

➡ Remote: `INP:ATT1 10dB`

External Attenuation

Auto detect Ext. Att	☐	
Ext. Attenuation	0 dB	5 dB

The FS-Z10 Remote Software provides the possibility to compensate external attenuation used in your test setup, which should not be part of the measurement results.

An additional trigger cable from the "TRIG OUT 3"-output of the FS-Z10 to the "INST TRIG IN"-input of the generator needs to be connected if external attenuation is being used.

Refer to Chapter 6.3 Use of External Attenuators for a detailed description on this feature.

➡   Remote: `CONF:CUN:EXT:AUTO ON`

➡   Remote: `CONF:CUN:EXT1 0dB`

Compensation Settings

Compensate Phase	☐
Compensate Timing	☐
Compensate Gain	☐

The coherence unit software provides the possibility to compensate phase, timing or gain differences between the two received signals. The differences caused by peripheral factors such as the cables or the internal analyzer clock offsets will always be compensated. The actual signal differences caused by the device under test will only be compensated if the corresponding item is activated in the compensation settings. To perform the compensation, signal B will be modified by the software using a phase shift, a timing offset and a gain offset. The compensated signal will be displayed in capture buffer B and may optionally also be saved to the hard disc (see chapter 10.3)

Note: The results displayed in the result list will not be affected by the compensation settings.

➡   Remote: `CONF:CUN:CPH OFF`

➡   Remote: `CONF:CUN:CTIM OFF`

➡   Remote: `CONF:CUN:CGA OFF`

Hardware Settings

	Nr	State	VISA RSC	Device
▶ 🔴	1	Master		A: No Device
🔴	2			B: No Device
🔴	3			SigGen: No Device

The *Hardware Settings* configure the instrument connections. Clicking one of the buttons in the VISA RSC column opens the "Instrument Connection Configuration" dialog.

➡ Remote: `CONF:ADDR1` 'TCPIP::192.168.0.1'

➡ Remote: `CONF:ADDR2` 'GPIB::28'

➡ Remote: `CONF:ADDR3` 'GPIB::20'

8.2 Advanced Settings
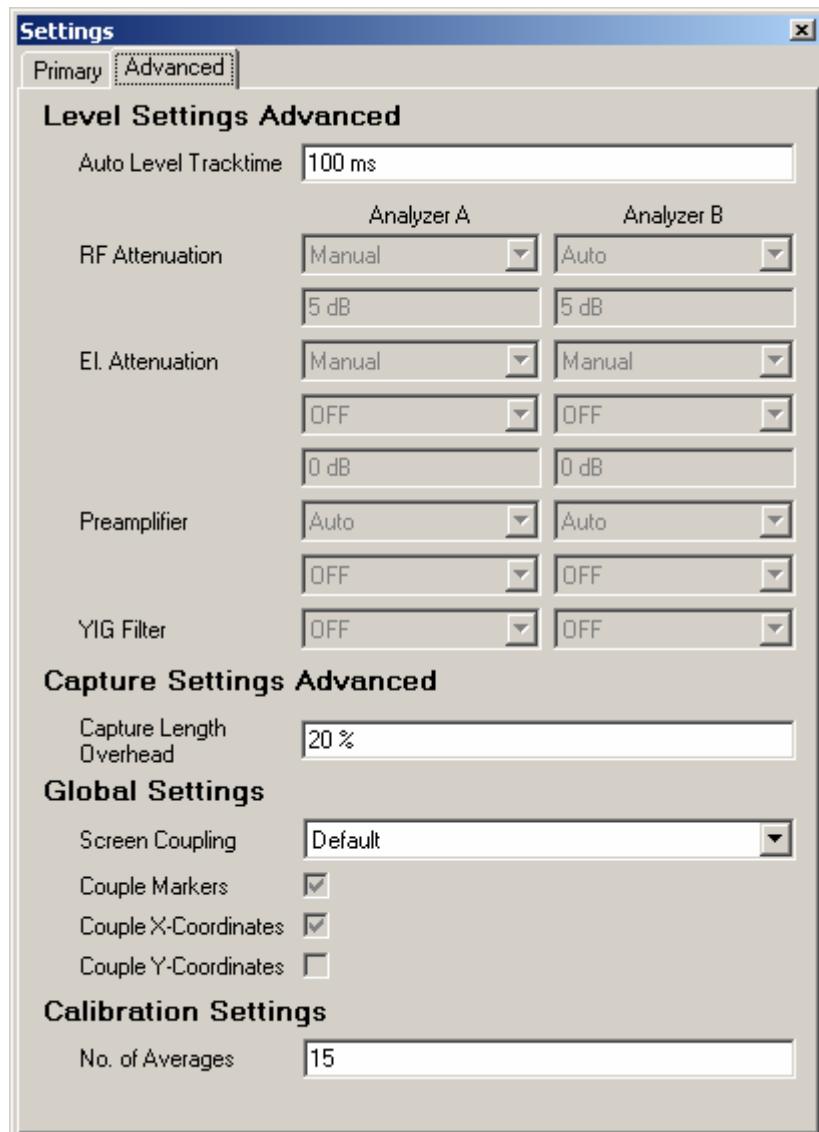
*Figure 8-2: Advanced settings window*

Auto Level Tracktime

Auto Level Tracktime specifies the sweep time used for the auto level measurements. This settings is important for signals with varying signal power (e.g. bursted signals). Make sure that this time is long enough to capture the signal level maximum.

➡ Remote: POW:AUTO:TIME 100ms

El. Attenuation

El. Attenuation	Manual	Manual
	ON	ON
	5 dB	5 dB

El. Attenuation specifies the electrical attenuation to be applied to the input RF signal. The hardware setup of your instruments determines whether electrical attenuation is available. The attenuation may be set manually or automatically.

➡ Remote: `INP:EATT2:AUTO OFF`

➡ Remote: `INP:EATT2:STAT ON`

➡ Remote: `INP:EATT2 5dB`

Preamplifier

Preamplifier	Auto	Manual
	OFF	OFF

The *Preamplifier* settings specify whether a preamplifier is applied to the RF signal or not. The hardware setup of your instruments determines whether a preamplifier is available.

➡ Remote: `INP:GAIN2:AUTO OFF`

➡ Remote: `INP:GAIN2:STAT OFF`

YIG Filter

YIG Filter	OFF	OFF

The *YIG Filter* settings specify whether a YIG filter is used. The hardware setup of your instruments determines whether a YIG filter is available.

➡ Remote: `INP:FILT:YIG2 OFF`

Capture Length Overhead

Capture Length Overhead	20 %

In order to get the correct number of valid signal samples specified in the *Capture Length* setting, a certain overhead of samples must be captured. The number of overhead samples necessary depends on the timing difference of the two test signals. The higher the expected timing difference is, the higher the *Capture Length Overhead* should be set.

The percent value refers to the capture length defined in the *Capture Length* setting. For example, a signal overhead of 20 % while using a capture length of 1000 samples would result in an effective capture length of 1200 samples.

➡ Remote: `CONF:CUN:CLOV 0.2`

Screen Coupling Settings

Screen Coupling	Default ▼
Couple Markers	☑
Couple X-Coordinates	☑
Couple Y-Coordinates	☐

The default configuration of the user interface includes Screen Coupling for markers and X-coordinates. This means that the X-axes for all visible graphs will always be identical and that all visible markers will move if the marker position for one of the graphs changes.

In some cases it might be appropriate to disable this coupling (Screen Coupling "Off") or to configure the coupling in a different way. (Screen Coupling "Custom").

These settings will only affect the graphical user interface and won't have any effect on the measurement results.

➡ Remote: `Not available.`

No. of Averages

No. of Averages	15

In order to get a more stable calibration result, multiple calibrations will be performed and the results will be averaged by the software. Averaging can be disabled by setting this parameter to 1.

➡ Remote: `CONFigure:CUNit:CCOunt 15`

9   Setup Submenu

Setup	Switches to the Setup submenu.

The setup menu contains hardware-dependant settings and the R&S Support Button. A detailed description of the Setup-Submenu-entries will be given in the following chapters.

9.1   Configure Instrument Connections
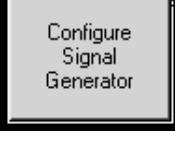
Configure Analyzer A Configure Analyzer B Configure Signal Generator	In order to communicate with the instruments, the Rohde & Schwarz analyzers and the signal generator must be connected with the PC using either an IEEE/IEC bus or LAN connection. The type of connection and the address can be selected by the *<CONFIGURE ANALYZER CONNECTION>* softkey:
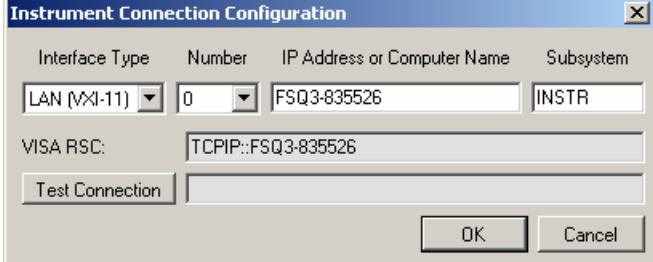
Figure 9-1: Instrument Connection Configuration window

If more than one interface is available on the PC (e.g. because two LAN cards are installed), please select the appropriate interface *Number*. The *Subsystem* does not need to be changed.

Depending on the *Interface Type*, different types of addresses must be entered:

Interface	Description	Address equivalent to …
GPIB Instrument	IEEE/IEC bus system using the IEEE 488 protocol	Instrument primary GPIB address (0 to 31). Default value is 20 for the R&S FSQ.
LAN *VXI-11 protocol*	LAN bus system using the VXI-11 protocol (supported with R&S FSQ firmware	Host address as TCP/IP address or computer name. Contact your local IT support if you are not sure what to enter here.

	version 3.65 or later)	
LAN *RSIB protocol*	LAN bus system using a Rohde & Schwarz-specific protocol (supported with all R&S FSQ firmware versions)	Host address as TCP/IP address or computer name. Contact your local IT support if you are not sure what to enter here.

→ Remote: CONF:ADDR1 'TCPIP::192.168.0.1'

→ Remote: CONF:ADDR2 'GPIB::28'

→ Remote: CONF:ADDR3 'GPIB::20'

9.2   Identify Instruments

	Queries the currently connected hardware in order to identify the instrument types of the two analyzers and of the reference signal generator.
Identify Connected Instruments	→ Remote: INST:IDEN

Some of the features of the FS-Z10 Remote Software depend on the hardware properties of the analyzers and the signal generator to be used (e.g. the settings dialog or the save-/recall-functionality). The "Identify Connected Instruments"-softkey provides the possibility to automatically query the hardware configuration of the currently connected instruments in order to unlock all available features.

9.3   High Accuracy Mode (Optional)

	Activates or deactivates the High Accuracy Mode.
High-Accuracy-Mode On Off	→ Remote: CONF:CUN:HAM ON

The Coherence Unit Software provides the opportunity to use an optional High Accuracy Mode. This mode takes hardware characteristics of a specific FS-Z10 into account and therefore leads to improved overall accuracy of the results. The properties of your specific device can be found in the form of a ".dat"-file which can be downloaded from the Rohde&Schwarz website (see chapter 9.3.2).

9.3.1   How to select a High Accuracy File

Select High-Accuracy -File	Opens a file dialog to select a high accuracy file. ➡ Remote: `CONF:CUN:HAF 'C:\MyZ10Data\1234_111111.dat'`

To select a High Accuracy File choose "Setup → Select High Accuracy File" in the Coherence Unit Control Software and select the file corresponding to the serial number of your Coherence Unit. On success the "High Accuracy Mode"-entry of the header will show the serial number and the service number of your coherence unit.

The "High Accuracy Service No." is only relevant if your FS-Z10 has been at the Rohde&Schwarz service. After each service the hardware characteristics of your unit might have changed. In this case a sticker holding the "High Accuracy Service No." will be placed onto the upper side of the FS-Z10 (see chapter 9.3.2 for details on how to obtain an up-to-date High Accuracy File).

The "Serial Number" can be found on the front side of the FS-Z10 (see chapter 9.3.2).

9.3.2   How to Obtain the High Accuracy Files

The high accuracy files are specific for each coherence unit. To obtain a high accuracy file for your specific device, perform the following steps (Internet access is necessary):

1. Open a browser and go to *www.rohde-schwarz.com*

2. Select "Service & Support"

3. Select "Download Search"

4. Select the R&S FS-Z10 in the product selection box and click OK

5. Select "Device Specific Data" and click OK

6. Click the high-accuracy data link

7. Enter the device-specific serial number of your coherence unit

> Make sure that your high accuracy file is always up-to-date. You need to download a new file if your coherence unit has been serviced by Rohde & Schwarz.

9.4   R&S Support

	This button automatically stores to file the current settings of the software as well as the currently available IQ-data.
RS Support	

The R&S Support button creates the three files "***FSZ10_SupportFile_Settings.XML***", "***FSZ10_SupportFile_IQData_A.txt***" and "***FSZ10_SupportFile_IQData_B.txt***" in the program installation folder. In case of a support request these files should be sent to Rohde&Schwarz to make processing of the request as fast as possible.

10 File Submenu
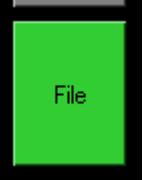
File	Opens the file menu.

10.1   Store or Restore General Settings

Save Settings	Store current general settings to file. ➥ Remote: `MMEM:CUN:STOR:SETT 'C:\Z10-Data\MySettings.XML'`
Recall Settings	Restore general settings from file. ➥ Remote: `MMEM:CUN:LOAD:SETT 'C:\Z10-Data\MySettings.XML'`

The FS-Z10 Remote Software offers the possibility of saving and recalling the configuration of the General Settings menu. All entries except the instrument addresses are included in the Save-/Recall-functionality.

The Save-/Recall-functionality is only available if the instruments currently connected to the software have already been identified ("FILE→IDENTIFY INSTRUMENTS"). This is to make sure that only settings which are compatible with the current instruments can be recalled.

10.2   Store or Restore Calibration Data

Save Calibration Data	Store current calibration information to a file. ➥ Remote: `MMEM:CUN:STOR:CAL 'C:\Z10-Data\MyCalData.CAL'`

Recall Calibration Data	Restore calibration information from a previously created file. ➡ Remote: `MMEM:CUN:LOAD:CAL 'C:\Z10-Data\ MyCalData.CAL'`

Another feature of the FS-Z10 Remote Software is the possibility to store and restore calibration data. This can, for example, be very useful when performing measurements on multiple center frequencies or multiple sample rates, since the calibration step requires different cable connections to the actual measurement.

Using the save-functionality, it is possible to record calibration data over a range of different frequencies and sample rates, without changing the cable connections. After calibration the cabling can then be changed to perform the actual measurements, whereby the appropriate calibration data for each measurement can be restored.

> Previously stored calibration files are only valid for the cables they were created for and under similar environmental conditions.

10.3   Export of IQ-data

Save IQ Data	Save the currently captured IQ-data to two files containing capture buffer A and compensated capture buffer B. ➡ Remote: `MMEM:CUN:STOR:IQ 'C:\Z10-Data\MyIQData.iqw'` ➡ Remote: `MMEM:CUN:STOR:IQ 'C:\Z10-Data\MyIQData.dat'`

Purpose

The coherence unit remote software is able to process I/Q data from Rohde & Schwarz analyzer hardware. Captured I/Q data can also be stored in various formats for e.g. processing with other external tools or for support purposes.

Format

I/Q data can be formatted either in binary form or as ASCII files. The data is linearly scaled using the unit Volt.

- For **binary format**, data is expected as 32-bit floating point data, Little Endian format (also known as LSB Order or Intel format).
(Example: 0x1D86E7BB in hexadecimal notation will be decoded to −7.0655481E-3.)
The data order can be either IQIQIQ or II..IQQ..Q.
- For **ASCII format**, data will be stored as one I/Q pair per line using "+" as separator.

```
    0          10          20        T
    |..........|..........|..........|....
 1 0.01349493 + 0.0036109077i
 2 0.0141201 + 0.002062474i
 3 0.01450802 + 0.0003087162i
 4 0.01434396 + −0.001497102i
 5 0.01355301 + −0.00326724i
 6 0.01250191 + −0.004937051i
 7 0.01087716 + −0.006425653i
 8 0.008839711 + −0.007682517i
 9 0.006391725 + −0.008507098i
10 0.003802441 + −0.008914463i
11 0.0007567597 + −0.008803447i
12 −0.002401507 + −0.008267699i
```

Fig. 10-1: Extract from I/Q data ASCII file

Usage – Export

To export captured I/Q data, select *<SAVE>* or *<SAVE AS>* .

The two I/Q data sets received from the two analyzers will be stored in the two files *<filename>_A* and *<filename>_B*. The current settings determine whether the I/Q data stored in file B will be compensated or not.

11   Remote Control

11.1   Description of commands

This section specifies all the remote control commands specific to the FS-Z10 Remote Control Software. Only those commands provided for this option are specified. For details of remote control commands provided by the instruments used please refer to the corresponding user manuals.

11.1.1   Notation

In the following sections, all commands implemented in the software are first listed in tables and then described in detail, arranged according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

11.1.1.1   Table of Commands

Command:

In the command column, the table provides an overview of the commands and their hierarchical arrangement (see indentations).

Parameter:

The parameter column indicates the requested parameters together with their specified range.

Unit:

The unit column indicates the basic unit of the physical parameters.

Comment:

In the comment column an indication is made on:

– whether the command does not have a query form,
– whether the command has only one query form
– whether the command is implemented only with a certain option of the instrument

Indentations:

The different levels of the SCPI command hierarchy are represented in the table by means of indentations to the right. The lower the level, the further the indentation to the right. Please note that the complete notation of the command always includes the higher levels as well.

Example:

SENSe:FREQuency:CENTer is represented in the table as follows:

```
SENSe                           first level

     :FREQuency                 second level

          :CENTer               third level
```

Individual description

The individual description contains the complete notation of the command. An example for each command, the *RST value and the SCPI information are included as well.

Upper/lower case notation

Upper/lower case letters are used to mark the long or short form of the key words of a command in the description. The instrument itself does not distinguish between upper and lower case letters.

Special characters

A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.

Example: `SENSe:FREQuency:CW|:FIXed`

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:

`SENSe:FREQuency:CW 1E3 = SENSe:FREQuency:FIXed 1E3`

A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command is different, depending on which parameter is used.

Example: Selection of the parameters for the command

`DISPlay:FORMat FULL | SPLit`

If parameter FULL is selected, full screen is displayed, in the case of SPLit, split screen is displayed.

[ ]   Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards. Parameters in square brackets can be incorporated optionally in the command or omitted as well.

{ }   Parameters in braces can be incorporated optionally in the command, either not at all, once or several times.

Description of parameters

Due to the standardisation, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<...>) and will be briefly explained in the following.

<Boolean>

This keyword refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword OFF or by the numeric value 0, the "on" state is indicated by ON or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

<numeric value>,<num>

These keywords mark parameters which may be entered as numeric values or are set using specific keywords (character data).The following keywords given below are permitted:

MINimum   This keyword sets the parameter to the smallest possible value.

MAXimum   This keyword sets the parameter to the largest possible value.

DEFault   This keyword is used to reset the parameter to its default value.

UP   This keyword increments the parameter value.

DOWN   This keyword decrements the parameter value.

The numeric values associated to MAXimum/ MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example: `SENSe:FREQuency:CENTer? MAXimum`

returns the maximum possible numeric value of the center frequency as result.

This keyword is provided for commands the parameters of which consist of a binary data block.

11.2   CALCulate Subsystem

List of commands

CALCulate<1..4>:FEED[?]

CALCulate<1..4>:FEED[?]

Change the displayed result type. Currently "Power vs. Time" and "Results vs. Time" are available. The suffix can be ignored.

Example

```
"CALC:FEED 'RVT'"
```

Select the "Results vs. Time" display.

Parameters

'PVT' | 'RVT'

Characteristics

*RST value: ON

SCPI: device-specific

11.3   CONFigure Subsystem

The CONFigure subsystem contains commands for configuring complex measurement tasks. The CONFigure subsystem is closely linked to the functions of the FETCH subsystem, where the measurement results of the measurements are queried.

List of commands

CONFigure:ADDRess<1|2|3>[?]
CONFigure:CUNit:CGAin[?]
CONFigure:CUNit:CLOVerhead[?]
CONFigure:CUNit:CPHase[?]
CONFigure:CUNit:CTIMing[?]
CONFigure:CUNit:EXTatten:AUTO[?]
CONFigure:CUNit:HAFilename[?]
CONFigure:CUNit:HAMode[:STATe][?]
CONFigure:CUNit:CCOunt [?]
CONFigure:POWer:EXPected:RF<1|2>[?]

CONFigure:ADDRess<1|2|3>[?]

Configures the VISA addresses of the analyzers and the signal generator to be used.

Example

```
"CONF:ADDR1 'TCPIP::192.168.0.1'"
"CONF:ADDR2 'TCPIP::192.168.0.2'"
"CONF:ADDR3 'GPIB::28'"
```

Configure the FS-Z10 software to connect to the two analyzers via LAN on the IP addresses "192.168.0.1" and "192.168.0.2". The signal generator will be addressed via IEC-bus using the address 28.

Parameters

Instrument addresses in form of a VISA-string.

Characteristics

*RST value: not available

SCPI: device-specific

CONFigure:CUNit:CGAin[?]

Activates or deactivates gain compensation of capture buffer B.

Example

"CONF:CUN:CGA ON"

Activates gain compensation.

Parameters

ON|OFF

Characteristics

*RST value: OFF

SCPI: device-specific

CONFigure:CUNit:CLOVerhead[?]

Configures the capture length overhead. The number of samples captured from the analyzers for each measurement depends on this setting. A higher capture length overhead will result in a shorter maximum capture length.

Example

"CONF:CUN:CLOV 0.3"

Set the capture length overhead to 30%.

Parameters

Numeric value

Characteristics

*RST value: 0.2

SCPI: device-specific

CONFigure:CUNit:CPHase[?]

Activates or deactivates phase compensation of capture buffer B.

Example

"CONF:CUN:CPH ON"

Activates phase compensation.

Parameters

ON|OFF

Characteristics

*RST value: OFF

SCPI: device-specific

CONFigure:CUNit:CTIMing[?]

Activates or deactivates timing compensation of capture buffer B.

Example

`"CONF:CUN:CTIM ON"`

Activates timing compensation.

Parameters

ON|OFF

Characteristics

*RST value: OFF

SCPI: device-specific

CONFigure:CUNit:EXTatten:AUTO[?]

Activates or deactivates the automatic detection of the external attenuation used during the calibration process. This option is not available if a SMIQ is used as reference generator.

Example

`"CONF:CUN:EXT:AUTO ON"`

Activates the automatic detection of external attenuation.

Parameters

ON|OFF

Characteristics

*RST value: OFF

SCPI: device-specific

CONFigure:CUNit:EXTatten<1|2>[?]

Configures the expected external attenuation for each of the two signal-paths. The suffix <1|2> is used to select analyzer A or B. This setting is only available if automatic detection of external attenuation is disabled. This option is not available if a SMIQ is used as reference generator.

Example

```
"CONF:CUN:EXT2 20dB "
```

Sets the external attenuation for path B to 20 dB.

Parameters

Numeric Value in dB

Characteristics

*RST value: 0dB

SCPI: device-specific

CONFigure:CUNit:HAFilename[?]

Loads a high accuracy file from disc or queries the path of the currently selected file.

Example

```
"CONF:CUN:HAF 'C:\MyHighAccFiles\26d7_100001.dat'"
```

Loads the high accuracy file 26d7_100001.dat.

Parameters

File path as string.

Characteristics

*RST value: not affected by *RST

SCPI: device-specific

CONFigure:CUNit:HAMode[:STATe][?]

Activates or deactivates the high accuracy mode. Changing the accuracy mode will directly affect all current results.

Example

```
"CONF:CUN:HAM ON"
```

Activates the high accuracy mode.

Parameters

ON|OFF

Characteristics

*RST value: not affected by *RST

SCPI: device-specific

CONFigure:CUNit:CCOunt [?]

Configures the number of averages used for the calibration.

Example

`"CONF:CUN:CCO 10"`

Set the number of calibration averages to 10.

Parameters

Numeric value

Characteristics

*RST value: 15

SCPI: device-specific

CONFigure:POWer:EXPected:RF<1|2>[?]

Configures the expected maximum input power (= reference level) for each of the two analyzers. The suffix <1|2> is used to select analyzer A or B.

Example

`"CONF:POW:EXP:RF2 0dBm"`

Configure analyzer B to use a reference level of 0dBm.

Parameters

Numeric value in dBm

Characteristics

*RST value: -10 dBm

SCPI: device-specific

11.4   FETCh Subsystem

List of commands

FETCh:CUNit:DVM?
FETCh:CUNit:GDIFf?
FETCh:CUNit:HACNo?
FETCh:CUNit:PDIFf?
FETCh:CUNit:SERNo?
FETCh:CUNit:TDIFf?

FETCh:CUNit:DVM?

Returns the difference vector magnitude for the last measurement or of the last calibration. The result unit is dB.

Example

`"FETC:CUN:DVM? MEAS"`

Returns the DVM calculated at the last measurement process.

Parameters

[MEAS]|CAL

Characteristics

*RST value: -

SCPI: device-specific

FETCh:CUNit:GDIFf?

Returns the measured gain difference of the last measurement or of the last calibration. The result unit is dB.

Example

`"FETC:CUN:GDIF? MEAS"`

Returns the gain difference received at the last measurement process.

Parameters

[MEAS]|CAL

Characteristics

*RST value: -

SCPI: device-specific

FETCh:CUNit:HACNo?

Returns the high accuracy service number corresponding to the currently selected high accuracy file as string.

Example

`"FETC:CUN:HACN?"`

Returns the current high accuracy service number.

Characteristics

*RST value: -

SCPI: device-specific

FETCh:CUNit:PDIFf?

Returns the measured phase difference of the last measurement or of the last calibration. The result unit is degrees.

Example

`"FETC:CUN:PDIF? CAL"`

Returns the phase difference received at the last calibration process.

Parameters

[MEAS]|CAL

Characteristics

*RST value: -

SCPI: device-specific

FETCh:CUNit:SERNo?

Returns the high accuracy serial number corresponding to the currently selected high accuracy file as string.

Example

`"FETC:CUN:SERN?"`

Returns the current high accuracy serial number.

Characteristics

*RST value: -

SCPI: device-specific

FETCh:CUNit:TDIFf?

Returns the measured timing difference of the last measurement or of the last calibration. The result unit is seconds.

Example

```
"FETC:CUN:TDIF? CAL"
```

Returns the timing difference received at the last calibration process.

Parameters

[MEAS]|CAL

Characteristics

*RST value: -

SCPI: device-specific

11.5 INITiate Subsystem

List of commands

INITiate:CABLecal
INITiate[:IMMediate]
INITiate:REFResh

INITiate:CABLecal

Starts a new calibration sequence (RUN SGL). If a measurement sequence is already in progress the command will have no effect. Make sure that your cables are connected correctly before starting the calibration.

Example

`"INIT:CABL"`

Starts a new calibration process.

Characteristics

*RST value: -

SCPI: device-specific

INITiate[:IMMediate]

Starts a new measurement sequence (RUN SGL). If a measurement sequence is already in progress the command will have no effect. Make sure that your cables are connected correctly before starting the measurement.

Example

`"INIT"`

Starts a new measurement.

Characteristics

*RST value: -

SCPI: device-specific

INITiate:REFResh

Recalculates all results using the current settings and the currently available capture buffer. No new data will be queried from the instruments.

Example

"INIT:REFR"

Refreshes all results using the currently available data.

Characteristics

*RST value: -

SCPI: device-specific

11.6   INPut Subsystem

List of commands

INPut:ATTenuation<1|2>:AUTO[?]
INPut:ATTenuation<1|2>[?]
INPut:EATT<1|2>:AUTO[?]
INPut:EATT<1|2>:STATe[?]
INPut:GAIN<1|2>:AUTO[?]
INPut:GAIN<1|2>:STATe[?]
INPut:FILTer:YIG<1|2>[:STATe][?]

INPut:ATTenuation<1|2>:AUTO[?]

Activates or deactivates automatic setting of the RF attenuation depending on the current reference level for each of the two analyzers. The suffix <1|2> is used to select analyzer A or analyzer B.

Example

`"INP:ATT2:AUTO OFF"`

Deactivate RF attenuation for analyzer B.

Parameters

ON|OFF

Characteristics

*RST value: ON

SCPI: device-specific

INPut:ATTenuation<1|2>[?]

Configures the RF attenuation value to be used for each of the two analyzers. The suffix <1|2> is used to select analyzer A or analyzer B. Can only be set if automatic RF attenuation is deactivated.

Example

`"INP:ATT2 20dB"`

Set RF attenuation for analyzer B to 20dB.

Parameters

Numeric value in dB

Characteristics

*RST value: 10 dB

SCPI: device-specific

INPut:EATT<1|2>:AUTO[?]

Activates or deactivates automatic setting of the electrical attenuation for the selected analyzer. The suffix <1|2> is used to select analyzer A or analyzer B. This setting is only available if supported by the connected analyzer hardware.

Example

`"INP:EATT2:AUTO OFF"`

Deactivate automatic setting of the electrical attenuation for analyzer B.

Parameters

ON|OFF

Characteristics

*RST value: ON

SCPI: device-specific

INPut:EATT<1|2>:STATe[?]

Activates or deactivates the electrical attenuation for the selected analyzer. The suffix <1|2> is used to select analyzer A or analyzer B. Can only be set if automatic electrical attenuation is deactivated. This setting is only available if supported by the connected analyzer hardware.

Example

`"INP:EATT2:STAT OFF"`

Deactivate electrical attenuation for analyzer B.

Parameters

ON|OFF

Characteristics

*RST value: ON

SCPI: device-specific

INPut:EATT<1|2>[?]

Configures the electrical attenuation value to be used for the selected analyzer. The suffix <1|2> is used to select analyzer A or analyzer B. Can only be set if automatic electrical attenuation is deactivated. This setting is only available if supported by the connected analyzer hardware.

Example

`"INP:EATT2 20dB"`

Set electrical attenuation for analyzer B to 20dB.

Parameters

Numeric value in dB

Characteristics

*RST value: 10 dB

SCPI: device-specific

INPut:GAIN<1|2>:AUTO[?]

Activates or deactivates automatic activation of the preamplifier for the selected analyzer. The suffix <1|2> is used to select analyzer A or analyzer B. This setting is only available if supported by the connected analyzer hardware.

Example

`"INP:GAIN2:AUTO OFF"`

Deactivate automatic preamplifier setting for analyzer B.

Parameters

ON|OFF

Characteristics

*RST value: ON

SCPI: device-specific

INPut:GAIN<1|2>:STATe[?]

Activates or deactivates the preamplifier for the selected analyzer. The suffix <1|2> is used to select analyzer A or analyzer B. This setting is only available if supported by the connected analyzer hardware.

Example

"INP:GAIN2:STAT OFF"

Deactivate the preamplifier for analyzer B.

Parameters

ON|OFF

Characteristics

*RST value: OFF

SCPI: device-specific

INPut:FILTer:YIG<1|2>[:STATe][?]

Activates or deactivates the YIG filter for the selected analyzer. The suffix <1|2> is used to select analyzer A or analyzer B. This setting is only available if supported by the connected analyzer hardware.

Example

"INP:FILT:YIG2 OFF"

Deactivate the YIG Filter for analyzer B.

Parameters

ON|OFF

Characteristics

*RST value: OFF

SCPI: device-specific

11.7   INSTrument Subsystem

List of commands

INSTrument:IDENtify
INSTrument:SELect SAN

INSTrument:IDENtify

Establishes a hardware connection to all instruments currently configured in the settings menu and queries all relevant instrument properties.

Example

`"INST:IDEN"`

Identifies all currently connected instruments.

Characteristics

*RST value: -

SCPI: device-specific

INSTrument:SELect SAN

Closes the FS-Z10 remote control software.

Example

`"INST:SEL SAN"`

Exits the software.

Parameters

SAN

Characteristics

*RST value: ON

SCPI: device-specific

11.8   MMEMory Subsystem

List of commands

MMEM:CUNit:IQ:FORMat[?]
MMEM:CUNit:LOAD:CALib
MMEM:CUNit:LOAD:SETTing
MMEM:CUNit:STORe:CALib
MMEM:CUNit:STORe:IQ
MMEM:CUNit:STORe:SETTing

MMEM:CUNit:IQ:FORMat[?]

Specifies the format used to store the IQ data. The data can either get stored as interleaved data ("I,Q,I,Q, I,Q,I,Q,…") or in blocks ("I,I,I,I,…,Q,Q,Q,Q,…").

Example

`"MMEM:CUN:IQ:FORM IQP"`

Configure the software to use interleaved format for storing IQ data.

Parameters

IQB = IQ-Block ("I,I,I,I,…,Q,Q,Q,Q,…")

IQP = IQ-Pair ("I,Q,I,Q, I,Q,I,Q,…")

Characteristics

*RST value: -

SCPI: device-specific

MMEM:CUNit:LOAD:CALib

Load calibration results from a file. Loading calibration data will override existing calibration results and will delete the current measurement results. Make sure that the calibration data is not outdated.

Example

`"MMEM:CUN:LOAD:CAL 'C:\Temp\CurrentCalData.CAL'"`

Overrides the current calibration results with the ones retrieved from the file "CurrentCalData.CAL".

Parameters

File-path as string.

Characteristics

*RST value: -

SCPI: device-specific

MMEM:CUNit:LOAD:SETTing

Restores all general settings which have previously been stored to a XML file.

Example

"MMEM:CUN:LOAD:SETT 'C:\Temp\MySettings.XML'"

Restores all settings from the file "MySettings.XML".

Parameters

File-path as string.

Characteristics

*RST value: -

SCPI: device-specific

MMEM:CUNit:STORe:CALib

Store the current calibration results to a file for later use. This may for example be useful if you preset your software with the preset button, but you don't want to repeat the calibration process unnecessarily.

Example

"MMEM:CUN:STOR:CAL 'C:\Temp\CurrentCalData.CAL'"

Stores the current calibration results to the file "CurrentCalData.CAL".

Parameters

File-path as string.

Characteristics

*RST value: -

SCPI: device-specific

MMEM:CUNit:STORe:IQ

Stores the IQ data currently available in the capture buffer to the specified file. The filetype may either be "*.iqw" or "*.dat". Depending on the file extension the data will be stored as binary data (*.iqw) or as ASCII data (*.dat). Since there are two data streams available, two files will be created each time data gets saved. Therefore the filenames will be extended with "_A" and "_B".

Example

`"MMEM:CUN:STOR:IQ 'C:\Z10-Data\MyIQData.iqw'"`

Current IQ data gets stored as binary data to the files "MyIQData_A.iqw" and "MyIQData_B.iqw"

`"MMEM:CUN:STOR:IQ 'C:\Z10-Data\MyIQData.dat'"`

Current IQ data gets stored as ASCII data to the files "MyIQData_A.dat" and "MyIQData_B.dat"

Characteristics

*RST value: -

SCPI: device-specific

MMEM:CUNit:STORe:SETTing

Stores all settings currently configured in the general settings menu to a XML-file for later use.

Example

`"MMEM:CUN:STOR:SETT 'C:\Temp\MySettings.XML'"`

Stores all current settings to the file "MySettings.XML".

Parameters

File-path as string.

Characteristics

*RST value: -

SCPI: device-specific

11.9   SENSe Subsystem

List of commands

[SENSe]:FREQuency:CENTer[?]
[SENSe]:POWer:AUTO[?]
[SENSe]:POWer:AUTO:TIME[?]

[SENSe]:POWer:AUTO:ZATTallowed [?]

Defines if the internal attenuators of the analyzers are allowed to be set to 0dB during the autoleveling-process or not.

Example

```
"POW:AUTO:ZATT ON"
```

Allow to set the internal attenuation to 0dB during the autoleveling.

Parameters

ON|OFF

Characteristics

*RST value: OFF

SCPI: device-specific

[SENSe]:SWEep:SAMPles [?]
[SENSe]:SWEep:TIME[?]
[SENSe]:POWer:AUTO:ZATTallowed [?]

[SENSe]:FREQuency:CENTer[?]

Sets the center frequency to be used by both analyzers for the measurement. The minimum and maximum values depend on the hardware that is currently connected.

Example

```
"FREQ:CENT 2GHz"
```

Set center frequency to 2 GHz.

Parameters

Numeric value

Characteristics

*RST value: 1 GHz

SCPI: conforming

[SENSe]:POWer:AUTO[?]

Activates or deactivates auto leveling for both analyzers.

Example

`"POW:AUTO OFF"`

Deactivate auto leveling.

Parameters

ON|OFF

Characteristics

*RST value: ON

SCPI: device-specific

[SENSe]:POWer:AUTO:TIME[?]

Configures the sweep time used for autoleveling. If activated autoleveling will be performed prior to each sweep even in continuous mode.

Example

`"POW:AUTO:TIME 0.05s"`

Set the sweep time to 50ms.

Parameters

Numeric value in seconds

Characteristics

*RST value: 100ms

SCPI: device-specific

[SENSe]:POWer:AUTO:ZATTallowed [?]

Defines if the internal attenuators of the analyzers are allowed to be set to 0dB during the autoleveling-process or not.

Example

`"POW:AUTO:ZATT ON"`

Allow to set the internal attenuation to 0dB during the autoleveling.

Parameters

ON|OFF

Characteristics

*RST value: OFF

SCPI: device-specific

[SENSe]:SWEep:SAMPles [?]

Configures the number of samples to be captured for a single measurement. Changing this value will also change the capture length in seconds (= sweep time).

Example

```
"SWE:SAMP 10k"
```

Set the number of samples to ten thousand.

Parameters

Numeric value

Characteristics

*RST value: 5000

SCPI: device-specific

[SENSe]:SWEep:TIME[?]

Configures the sweep duration for a single measurement. Changing this value will also change the capture length in samples.

Example

```
"SWE:TIME 0.5s"
```

Set the sweep time to 500ms.

Parameters

Numeric value

Characteristics

*RST value: 250us

SCPI: device-specific

11.10 TRACe Subsystem

List of commands

TRACe<1|2|3|4>:DATA?
TRACe<1|2>:IQ:SRATe[?]

TRACe<1|2|3|4>:DATA?

The return values depend on the currently selected measurement (use the CALCulate:FEED command to select a measurement). The following measurements are available:

Capture Buffer:

A list of interleaved IQ-data will be returned. The suffix selects either the data from capture buffer A (suffix = 1) or the data from capture buffer B (suffix = 2). The suffix values 3 and 4 are not allowed in this case. The IQ data from capture buffer B contains all compensations which were activated in the general settings menu during the sweep.

Example

```
"TRAC2:DATA?"
```

Returns the IQ data displayed in graph B (only applicable if currently in Power vs. Time mode).

Results vs. Time:

Depending on the selected suffix the phase differences vs. time, the timing differences vs. time, the gain differences vs. time or the DVM values vs. time will be returned as comma separated list.

Suffix	Returned Data
1	Measured phase differences vs. time
2	Measured timing differences vs. time
3	Measured gain differences vs. time
4	Measured DVM values vs. time

Example

`"TRAC2:DATA?"`

Returns the Timing Differences displayed in graph B (only applicable if currently in Results vs. Time mode).

`"TRAC4:DATA?"`

Returns the DVM values displayed in graph D (only applicable if currently in Results vs. Time mode).

Parameters

Numeric values as comma separated list

Characteristics

*RST value: -

SCPI: conforming

TRACe<1|2>:IQ:SRATe[?]

Configures the Sampling Rate that will be used by both analyzers for the measurement. The Sampling rate also affects the available bandwidth and the number of samples defining capture length. The minimum and maximum values depend on the hardware that is currently connected. The numeric suffix <1|2> can be ignored.

Example

`"TRAC:IQ:SRAT 40MHz"`

Set the sampling rate to 40 MHz.

Parameters

Numeric value

Characteristics

*RST value: 20 MHz

SCPI: conforming

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