



ROHDE & SCHWARZ

Test and Measurement
Division

Software Manual

Trigger for Coverage Measurement for R&S[®] ESPI und R&S[®] ESU

R&S[®] ESPI-K50 Firmware Option

1106.4386.02

Printed in the Federal
Republic of Germany

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Contents

Safety Instructions
 Support Center
 List of R&S Representatives

Contents of software manual for option R&S ESPI-K50

Trigger for Coverage Measurements – R&S ESPI-K50 Firmware Option 5

- 1 Enabling the Firmware Option.....5**
- 2 DVB Channel Filters.....6**
 - Typical form of some channel filters8
 - List of Available Channel Filters.....9
- 3 Description of Coverage Measurement10**
 - Measurements on a Discrete Frequency10**
 - Measurements Using Channel Lists 11**
 - Transmission of Measurement Results to the Controller..... 13
- 4 Test Setup for Measuring Field-Strength Profiles14**
 - Standard Test Setup 14
- 5 Remote-Control Commands for Coverage Measurements.....15**
 - MMEMory Subsystem 15
 - SENSE subsystem..... 15
 - TRACe Subsystem..... 16
- 6 Index17**

Figures

- Fig. 2-1 Filter passband characteristic for a bandwidth of 6 MHz 8
- Fig. 2-2 Filter passband characteristic for a bandwidth of 7 MHz 8
- Fig. 3-1 Pin assignment of the USER socket..... 12
- Fig. 4-1 Test setup for coverage measurements..... 14

Tables

- Table 2-1 List of channel filters 9
- Table 3-1 Meaning of bits in STATus:QUEstionable:SYNC register 11
- Table 3-2 Meaning of bits in the STATus:OPERation register 13



Before putting the product into operation for the first time, make sure to read the following



Safety Instructions

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

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

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

Symbols and safety labels

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

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

Safety Instructions

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

Tags and their meaning

DANGER	This tag indicates a definite hazard carrying a high risk of death or serious injury if not avoided.
WARNING	This tag indicates a possible hazard carrying a medium risk of death or (serious) injury if not avoided.
CAUTION	This tag indicates a hazard carrying a low risk of minor or moderate injury if not avoided.
ATTENTION	This tag indicates the possibility of incorrect use that can cause damage to the product.
NOTE	This tag indicates a situation where the user should pay special attention to operating the product but which does not lead to damage.

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

Basic safety instructions

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

Safety Instructions

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

Safety Instructions

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



Por favor lea imprescindiblemente antes de la primera puesta en funcionamiento las siguientes



Informaciones de seguridad

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los standards de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los standards técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las informaciones, 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 solamente fue elaborado para ser utilizado en la industria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado dentro de las instrucciones de la correspondiente documentación de producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos profundos y conocimientos parciales del idioma inglés. Por eso se deberá tener en cuenta de exclusivamente autorizar para el uso del producto a personas peritas o debidamente minuciosamente instruidas con los conocimientos citados. Si fuera necesaria indumentaria de seguridad para el uso de productos de R&S, encontrará la información debida en la documentación del producto en el capítulo correspondiente.

Símbolos y definiciones de seguridad

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

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

Informaciones de seguridad

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

Palabras de señal y su significado

PELIGRO	Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas.
ADVERTENCIA	Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas.
ATENCIÓN	Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas.
CUIDADO	Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
INFORMACIÓN	Indica una situación en la que deberían seguirse las instrucciones en el uso del producto, pero que no consecuentemente deben de llevar a un daño del mismo.

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

Informaciones de seguridad elementales

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

Informaciones de seguridad

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

Informaciones de seguridad

12. No utilice nunca el producto si está dañado el cable eléctrico. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.
13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A (utilización de fusibles de mayor amperaje sólo previa consulta con el grupo de empresas Rohde & Schwarz).
14. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.
15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.
16. En las mediciones en circuitos de corriente con una tensión de entrada de $U_{\text{eff}} > 30 \text{ V}$ se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos de la EC950/EN60950.
18. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar heridas, fuego o daños en el producto.
19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, el circuito de suministro de corriente deberá estar protegido de manera que usuarios y productos estén suficientemente protegidos.
21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir corto circuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.
22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.
23. Los productos R&S no están protegidos contra el agua si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente para el usuario o de daños en el producto lo cual también puede llevar al peligro de personas.
24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.
25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.
26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

Informaciones de seguridad

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

Certified Quality System

DIN EN ISO 9001 : 2000

DIN EN 9100 : 2003

DIN EN ISO 14001 : 2004

DQS REG. NO 001954 QM UM

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Contents of Software Manual for R&S ESPI-K50

This manual contains all information on the operation of the R&S ESPI and R&S ESU test receivers equipped with the R&S ESPI-K50 software option. It includes operation via menus and the remote-control commands.

The manual comprises six chapters:

- Chapter 1** describes how to enable the application firmware module.
- Chapter 2** describes the DVB channel filters.
- Chapter 3** describes the coverage measurements.
- Chapter 4** describes the measurement setup for coverage measurements.
- Chapter 5** describes all remote-control commands defined for the software option.
- Chapter 6** contains the index of the present operating manual.

This manual is a supplement to the R&S ESPI operating manual. It exclusively includes functions of the R&S ESPI-K50 software option. For all other descriptions, please refer to the R&S ESPI operating manual.

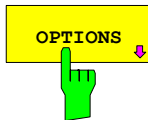
Trigger for Coverage Measurements – R&S ESPI-K50 Firmware Option

The R&S ESPI and R&S ESU test receivers with the R&S ESPI-K50 firmware option are suitable for measuring field-strength profiles in mobile applications. The option also comprises additional channel filters for the DVB bandwidths to 6,4 MHz for R&S ESU and 8 MHz for F&S ESPI.

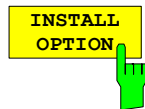
1 Enabling the Firmware Option

The R&S ESPI-K50 firmware option is enabled in the *GENERAL SETUP* menu by entering the license keycode. The keycode is delivered with the option. If the option is factory-installed, it is already enabled.

GENERAL SETUP menu::



The R&S ESPI-K50 firmware option is enabled in the *GENERAL SETUP* menu by entering the license keycode. The keycode is delivered with the option. If the option is factory-installed, it is already enabled.



The *INSTALL OPTION* softkey activates data entry for the license keycode of a firmware option.

On entry of a valid license key, the message *OPTION KEY OK* is displayed in the status line and the firmware option appears in *FIRMWARE OPTIONS* table.

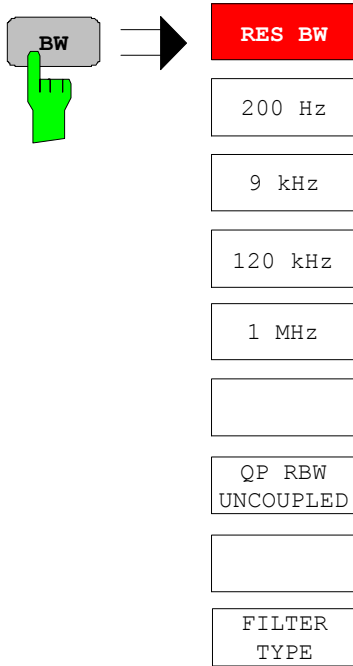
On entry of an invalid license key, the message *OPTION KEY INVALID* is displayed in the status line.

IEC/IEEE bus command: --

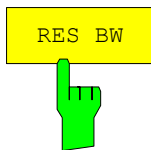
2 DVB Channel Filters

The R&S ESPI-K50 firmware option (trigger for coverage measurements) comprises several channel filters for DVB signals.

BW menu:



The *BW* key calls a menu for setting the resolution bandwidth.



The *RES BW* softkey activates manual data entry for the IF bandwidth.

If NORMAL filter type (3dB) is used, the bandwidth is settable in 1/3/10 steps with the R&S ESPI and in 1/2/3/5/10 steps with the R&S ESU between 10 Hz and 10 MHz. If EMI filter type (6dB) is used, the 6 dB bandwidths 200 Hz, 9 kHz, 120 kHz, and 1 MHz can be set.

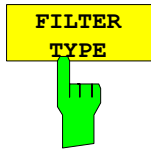
With numeric entries, the values are always rounded to the nearest possible bandwidth. For entries by rollkey or UP/DOWN key, the bandwidth is adjusted in steps either upward or downward.

For filter types CHANNEL and RRC, the bandwidth is selected from the list of available channel filters given at the end of this chapter. On data entry, the cursor keys ↑ and ↓ scroll through this list.

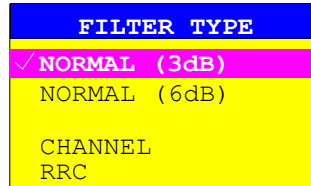
The selectable bandwidth is limited by the set receive frequency:

$$\text{RES BW} \leq f_E/2$$

IEC/IEEE bus command: SENS:BAND:RES 1 MHz



The *FILTER TYPE* softkey opens the selection list for different filter types. 3 dB and 6 dB band filters with Gaussian characteristic and channel filters can be selected.



NORMAL (3dB) The resolution bandwidths are implemented by Gaussian filters with the set 3 dB bandwidth and correspond approximately to the noise bandwidth. For bandwidths up to 100 kHz, digital bandpass filters are used.

IEC/IEEE bus command: `SENS:BAND:RES:TYPE NOIS`
`SENS:BAND:RES:TYPE NORM`

NORMAL (6dB) The resolution bandwidths are implemented by Gaussian filters with the set 6 dB bandwidth and correspond approximately to the pulse bandwidth. The R&S ESPI uses digital bandpass filters for bandwidths up to 120 kHz; the R&S ESU uses digital bandpass filters for bandwidths up to 1 MHz.

IEC/IEEE bus command: `SENS:BAND:RES:TYPE PULS`

Additionally, a number of especially steep-edged channel filters are available for power measurements.

A distinction is made between the following filter types:

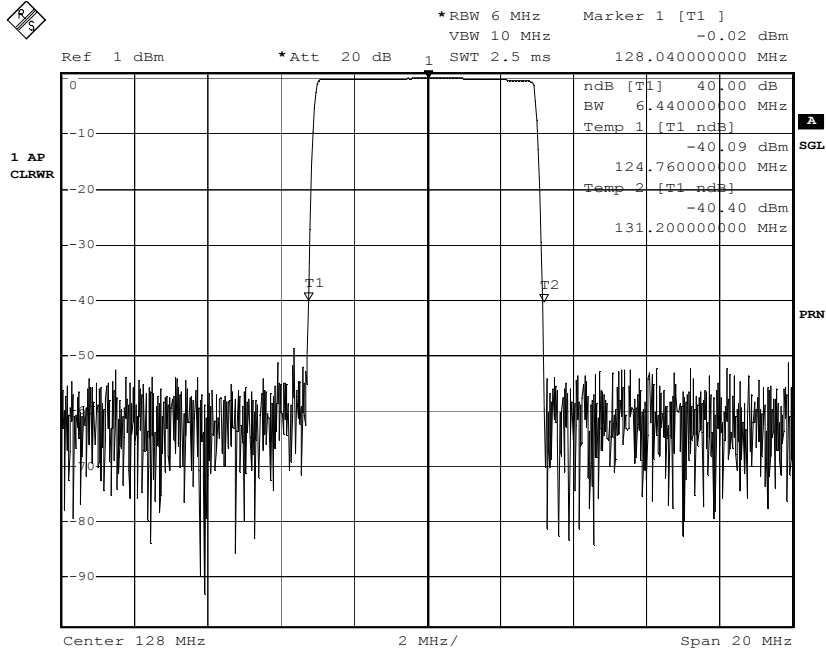
CHANNEL general, steep-edged channel filters

IEC/IEEE bus command: `SENS:BAND:RES:TYPE CFIL`

RRC filters with root-raised cosine characteristic
 (RRC = root raised cosine)

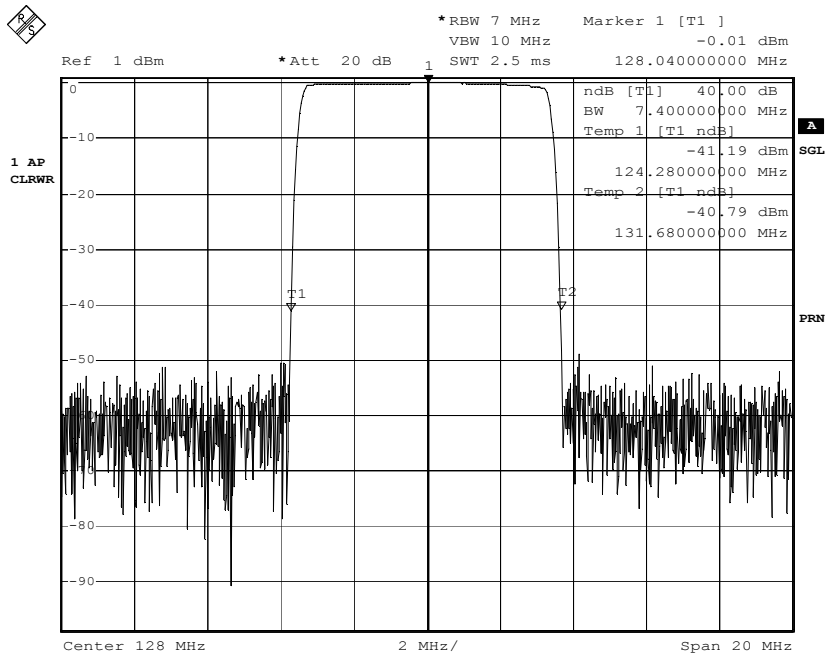
IEC/IEEE bus command: `SENS:BAND:RES:TYPE RRC`

Typical form of some channel filters



Date: 26.FEB.2002 09:25:48

Fig. 2-1 Filter passband characteristic for a bandwidth of 6 MHz



Date: 26.FEB.2002 09:25:18

Fig. 2-2 Filter passband characteristic for a bandwidth of 7 MHz

List of Available Channel Filters

The channel filters included in the following table can be activated with the *FILTER TYPE* softkey and are then available as resolution filters (softkey *RES BW*).

Note:

For filters of type RRC, the filter bandwidth indicates the sampling rate of the filter.
 For all other filters (CFILter) the filter bandwidth is the 3 dB bandwidth.

Table 2-1 List of channel filters

Filter bandwidth	Filter type	Application
100 Hz	CFILter	A0
200 Hz	CFILter	
300 Hz	CFILter	
500 Hz	CFILter	
1 kHz	CFILter	SSB
1.5 kHz	CFILter	
2 kHz	CFILter	
2.4 kHz	CFILter	
2.7 kHz	CFILter	
3 kHz	CFILter	
3.4 kHz	CFILter	
4 kHz	CFILter	
4.5 kHz	CFILter	
5 kHz	CFILter	
6 kHz	CFILter	DAB, satellite
8.5 kHz	CFILter	
9 kHz	CFILter	
10 kHz	CFILter	ETTS300 113 (12.5 kHz channels)
12.5 kHz	CFILter	
14 kHz	CFILter	AM radio
15 kHz	CFILter	
16 kHz	CFILter	CDMAone
18 kHz, $\alpha=0.35$	RRC	
20 kHz	CFILter	ETTS300 113 (20 kHz channels)
21 kHz	CFILter	
24.3 kHz, $\alpha=0.35$	RRC	ETTS300 113 (25 kHz channels)
25 kHz	CFILter	
30 kHz	CFILter	TETRA
50 kHz	CFILter	
100 kHz	CFILter	PDC
150 kHz	CFILter	
192 kHz	CFILter	IS 136
200 kHz	CFILter	
300 kHz	CFILter	CDPD, CDMAone
500 kHz	CFILter	
1.0 MHz	CFILter	FM radio
1.2288 MHz	CFILter	
1.5 MHz	CFILter	PHS
2.0 MHz*	CFILter	
3.0 MHz*	CFILter	J.83 (8-VSB DVB, USA)
3.84 MHz, $\alpha=0.22^*$	RRC	
4.096 MHz, $\alpha=0.22^*$	RRC	W-CDMA 3GPP
5.0 MHz*	CFILter	
5.6 MHz*	CFILter	W-CDMA NTT DOCoMo
6.0 MHz*	CFILter	
6.4 MHz*	CFILter	ISDB-T (Japan)
7.0 MHz**	CFILter	
8.0 MHz**	CFILter	DVB-T (USA)
		DVB-T (Europe, Australia)
		DVB-T (Europe)

*) requires IF filter with model index ≥ 3

***) requires R&S ESPI

3 Description of Coverage Measurement

To obtain field-strength profiles for checking the radio coverage, continuous level measurements have to be performed with a sufficiently high measurement rate, and the results must be forwarded to an evaluation unit. The measured level values are normally processed by the controller, which remote-controls the receiver via IEC/IEEE bus or a LAN interface.

When a displacement sensor is used, the external trigger input can be used to start the single measurements. The level values can thus be accurately assigned to the measurement site.

The coverage measurement function is only available in the receive mode and in the case of remote control.

The receiver performs the coverage measurement in two different ways:

- All measurements are performed on a discrete frequency.
- A channel list is cyclically processed, i.e. a new frequency is set for each measurement.

Measurements on a Discrete Frequency

This measurement is based on a bargraph measurement of the receiver. With conventional level measurements, each measurement result is read out separately in response to a query in the remote mode; here the receiver organizes the level values into blocks. This considerably reduces the overhead for result processing and measurement rates of more than 100 000 measurements/s can be achieved. The number of results in a block varies between 1 and a settable maximum value, depending on the measurement speed and how often a query is sent. The number of results is dynamically set by the receiver so that as much data as possible is transmitted each time a query is sent by the controller.

The **TRACe:POINts** LIMit, 1 to 10 000 remote-control command defines the maximum number of measurements to be transmitted in a block after the query command **TRACE? SCAN**.

TRACe<1|2>:POINts SINGLE, <numeric_value> switches between the transmission of individual measurement results and a continuous measurement by blockwise data transmission. If the <numeric_value> of 1 is set, R&S ESPI and R&S ESU only transmit the results of a single measurement. Each <numeric_value> greater than 1 activates the blockwise transmission of the level measurement results. In this case, the number of values actually transmitted deviates from the number set via IEEE/IEC bus, since the number of measurement results is dynamically adapted per block, as described above.

In case of free-running measurement (internal trigger), the set measurement time corresponds to the total cycle time of a level measurement, i.e. a fixed time grid can be set for the whole measurement. Consequently, a measurement time of 100 μ s yields a rate of 10 000 measurements/s. The actual measurement time of the signal is 1 μ s shorter than the set measurement time because of internal sweep times.

To prevent the time grid of the level measurement from being violated if the controller is not able to query data from the R&S ESPI or R&S ESU in due time, the receiver contains an internal buffer where 200 000 measurement results can be stored. For a rate of 10 000 measurements/s, the results of 20 seconds can be stored before data must be queried by the controller. After this time has elapsed, the receiver sets bit 14 in the STATus:QUESTIONable:SYNC register, which signals that data is being lost.

Table 3-1 Meaning of bits in STATus:QUEstionable:SYNC register

Bit No.	Meaning
1-13	Not used
14	Out of SYNC This bit is set if the trigger event is lost for an externally triggered coverage measurement.
15	This bit is always 0.

A measurement using several parallel detectors is possible. The number of transmitted measurement results increases accordingly.

The autorange function is not supported because ranging procedures are not predictable and the time grid cannot be guaranteed in this case.

When the R&S ESPI-K50 option is installed, the minimum measurement time is 5 µs for the R&S ESPI with Windows NT and for the R&S ESU, and 33 µs for the R&S ESPI with Windows XP (peak detector and bandwidth ≥ 100 kHz). With other settings, e.g. average detector with narrow bandwidths, the minimum measurement times are longer.

If the single measurements are externally triggered, the user must ensure that the set measurement time is shorter than the interval between two trigger pulses. The receiver is not able to recognize whether trigger pulses are lost.

In case of external trigger, it should be noted that there are minimum values for the number of measurement results transmitted in one block, depending on the set measurement time. For instance, if a measurement time of 100 µs or shorter was set, at least 256 level values are normally transmitted together. If the trigger rate is 10 Hz in this case, a block of measured values is only transmitted every 25 seconds.

Measurements Using Channel Lists

If more than one frequency is to be monitored, up to ten channel lists can be defined and cyclically processed one after the other. Level measurements are performed on each frequency. The frequency ranges and the channel grid are set in the scan table.

SCAN TABLE					
Scan Start	920.000 MHz				
Scan Stop	2.000 GHz				
Step Mode	LIN				
	RANGE1	RANGE2	RANGE3	RANGE4	RANGE5
Start	925.200 MHz	1.8052 GHz			
Stop	959.800 MHz	1.8798 GHz			
Step Size	200 kHz	200 kHz			
Res BW	200 kHz	200 kHz			
Meas Time	100 us	100 us			
Auto Ranging	OFF	OFF			
RF Attn	0 dB	0 dB			
Preamp	ON	OFF			
Auto Preamp	OFF	OFF			

Start and Stop define the frequency band containing the channels to be measured. Step Size defines the channel grid. The start frequency is considered to be channel 1.

The following applies to the channel n : frequency = start frequency scan range + $(n - 1) * \text{step width}$.

The following examples apply to the scan table shown above:

Range 1, channel 1: $925.2 \text{ MHz} + 0 * 200 \text{ kHz} = 925.2 \text{ MHz}$

Range 1, channel 10: $925.2 \text{ MHz} + 9 * 200 \text{ kHz} = 927 \text{ MHz}$

Range 1, channel 174: $925.2 \text{ MHz} + 173 * 200 \text{ kHz} = 959.8 \text{ MHz}$

Range 2, channel 2: $1805.2 \text{ MHz} + 1 * 200 \text{ kHz} = 1805.4 \text{ MHz}$

A scan range may contain up to 1000 defined channels. The number of theoretically possible channels per scan range, obtained from the start frequency, stop frequency and step width, can also be greater than 1000. This means that 10 000 channels can be scanned in 10 subranges. The channels are not defined by manual control but via the IEC/IEEE bus.

The actually scanned frequency range is set via the start and stop frequency parameters, which are irrespective of the scan range. It is thus possible, for any particular measurement task, to define a scan table that can be stored and reloaded, and to quickly and easily set the frequency range to be actually measured by means of two parameters without having to change the scan table.

[SENSE:]:SCAN<1...10>:LIST:STATE ON | OFF

switches between a scan, i.e. a measurement at each frequency, and the measurement of selected channels within the range. If not at least one channel is defined in the scan range, the R&S ESPI and R&S ESU behave as if LIST:STATE OFF were selected.

[SENSE:]:SCAN<1...10>:LIST[:SEQUENCE] <numeric_value>{,<numeric_value>}

defines the channel list for the selected scan range.

The channel lists are lost when the instrument is switched off. If they should be retained, they can be saved on a mass storage, e.g. the hard disk, and reloaded later.

MMEMORY:SElect:[ITEM]:CLIST

adds the channel lists to the list of data subsets of a save/recall device setting.

TRACE<1|2>:POINTS , <numeric_value> switches between the transmission of individual measurement results and a continuous measurement by blockwise data transmission. If the <numeric_value> of 1 is set, the receiver only transmits the results of a single measurement. Each <numeric_value> greater than 1 activates the blockwise transmission of the level measurement results. In this case, the number of values actually transmitted deviates from the number set via IEEE/IEC bus, since the number of measurement results are dynamically adapted per block, as described above.

If the external trigger is used, a trigger pulse triggers the complete sequence of programmed channel list(s). As soon as the receiver is ready to trigger again, it indicates this by outputting a pulse of 100 μs on the A7 circuit of the user port. In the case of a free-run measurement, the pulse will be output on the user port and indicates the start of a new frequency sweep.

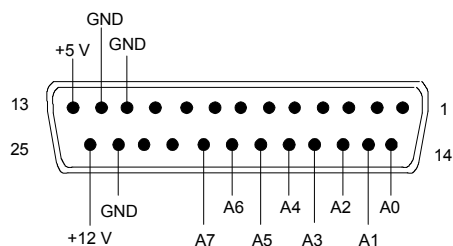


Fig. 3-1 Pin assignment of the USER socket

The receiver is not able to recognize whether trigger pulses have been lost.

Transmission of Measurement Results to the Controller

The procedure used for reading the measured level values corresponds to that used for blockwise transmission of scan results.

Bit 9 in the STATus:OPERation register of the receiver signals that measurement results are ready to be queried.

In the CONDition part, this register contains information about which actions are currently being executed by the instrument or, in the EVENT part, which actions the instrument has executed since the last reading. The register can be read with command "STATus:OPERation:CONDition?" or "STATus :OPERation[:EVENT]?".

Table 3-2 Meaning of bits in the STATus:OPERation register

Bit No.	Meaning
0	CALibrating This bit is set as long as the instrument is performing a calibration.
1 to 7	These bits are not used.
8	HardCOPy in progress This bit is set while the instrument is printing a hardcopy.
9	Scan results available This bit is set as soon as a data block is ready for output during a scan.
10 to 14	These bits are not used.
15	This bit is always 0.

The query **TRACe[:DATA]? SCAN** reads the trace data out of the instrument.

Returned values:

- 4 byte: trace status (not used)
- 4 bytes: number n of the transmitted measurement results of a trace
- 4 byte: trace1 active (0/1) or at least one detector switched on
- 4 byte: trace2 active (0/1) or at least two detectors switched on
- 4 byte: trace3 active (0/1) or at least three detectors switched on
- 4 byte: (not used)
- n*4 bytes: measurement results of trace 1 if trace 1 is active or if at least one detector is switched on.
- n*4 bytes: measurement results of trace 2 if trace 2 is active or if at least two detectors are switched on.
- n*4 bytes: measurement results of trace 3 if trace 3 is active or if at least three detectors are switched on.
- n*4 bytes: reserved
- n*1 byte: status information per measurement result .
 - bit 0:reserved
 - bit 1: reserved
 - bit 2: overload

4 Test Setup for Measuring Field-Strength Profiles

ATTENTION



Risk of damage to the instrument.

Before putting the instrument into operation, make sure of the following:

- The instrument covers are in place and all fasteners are tightened.
- Vents are not obstructed.
- Signal levels at the input connectors are below specified maximum values. A level of +20 dBm with a 0 dB input attenuator at the RF input of the R&S ESPI and R&S ESU must under no circumstances be exceeded.
- Signal outputs are correctly connected and not overloaded.

Non-observance may cause damage to the instrument.

This section describes basic receiver settings for coverage measurements. A prerequisite for starting the measurements is that the instrument is correctly configured and powered as described in chapter 1 of the operating manual of the R&S ESPI or R&S ESU base unit. Furthermore, the R&S ESPI-K50 application firmware must be activated following the instructions given in chapter 1 of the present manual.

Standard Test Setup

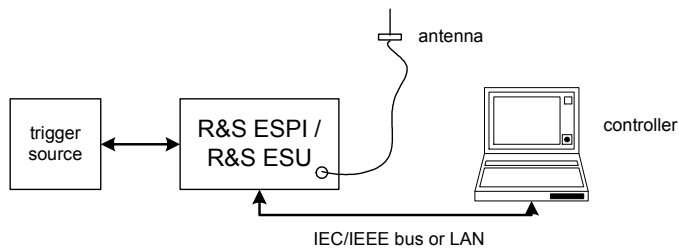


Fig. 4-1 Test setup for coverage measurements

- Connect the antenna to the RF input of the receiver.
- If required, connect the trigger source to the trigger input at the rear of the R&S ESPI (*EXT TRIG GATE*). In case of mobile operation, a displacement sensor is connected here.
- Connect the controller to the receiver via IEC/IEEE bus or LAN (R&S ESPI with the R&S FSP-B16 option).

5 Remote-Control Commands for Coverage Measurements

In the following sections, the remote control commands for firmware option R&S ESPI-K50 are described. An alphabetical list at the end of this chapter gives an overview of the commands. The commands, which are also valid for the basic unit in the signal analysis mode, as well as system settings are described in the R&S ESPI operating manual.

MMEMory Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
MMEMory :SElect [:ITEM] :CLISt	<Boolean>		

MMEMory:SElect[:ITEM]:CLISt ON | OFF

This command adds the channel lists to the list of device settings to be stored/loaded.

Example: "MMEM:SEL:CLIS ON"

Characteristics: *RST value: OFF
SCPI: device-specific

SENSE Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSE<1 2>] :BANDwidth [:RESolution] :TYPE :SCAN<1...10> :LIST [:SEQuence] :STATe	<numeric_value> NORMal FFT CFILter RRC NOISe PULSe <numeric_value>{,<numeric_value>} <Boolean>	Hz HZ -	

Note: The commands [SENSE<1|2>:]BANDwidth|BWIDth[:RESolution] and [SENSE<1|2>:]BANDwidth|BWIDth[:RESolution]:TYPE are described in the R&S ESPI or the R&S ESU operating manual, respecting.

[SENSe<1|2>:]SCAN<1...10>:LIST[:SEQUence] <numeric_value>{,<numeric_value>}

This command defines the points (channels) to be measured in the selected scan range by specifying the channel index. The actual frequency is obtained as follows:

start frequency of scan range + (index - 1) x step width.

If there are no entries in the list, all frequencies defined in the range are measured.

A maximum of 1000 channels can be programmed for each scan range.

The numeric suffix <1|2> with SENSe is not relevant for this command.

Example: "SCAN1:LIST 1,5,15,234" defines the channels for channel list:
 1 = start frequency,
 5 = start frequency + 4 x step width
 15 = start frequency + 14 x step width
 234 = start frequency + 233 x step width

Characteristics: *RST value: 0
 SCPI: device-specific

[SENSe<1|2>:]SCAN<1...10>:LIST:STATe ON | OFF

This command switches between a continuous scan and measurements according to the channel list for the selected range.

The numeric suffix <1|2> with SENSe is not relevant for this command.

Example: "SCAN1:LIST:STAT ON" switches to list mode for scan range 1

Characteristics: *RST value: OFF
 SCPI: device-specific

TRACe Subsystem

The TRACe subsystem controls access to the instrument's internal trace memory.

COMMAND	PARAMETERS	UNIT	COMMENT
TRACe<1 2> POINTs	SINGle, <numeric_value> SCAN, <numeric_value>	- -	Single measurement Scan

TRACe<1|2>:POINTs SINGle | SCAN, <numeric_value>

This command defines the number of single measurement results that are transmitted by the query TRACe:DATA.

SINGle switches between transmission of single measured values and continuous measurement with blockwise data transmission. The measurement is only performed on the set frequency and is started with INIT1.

SCAN switches the scan between measurement on all frequencies and the use of channel lists. The measurement is started with INIT2.

The numeric suffix <1|2> with TRACe is not relevant for this command.

Example: "TRAC:POIN SING, MAX"

Characteristics: *RST value: 1
 SCPI: conforming

6 Index

A

Autorange function 11

B

Band filter, 7
Bandpass 7

C

Channel filters 9
Channel lists 11
Command
 Description 15

D

Displacement sensor 10
DVB channel filter 6

F

Field-strength profiles 10
Free-running measurement 10

I

IEC/IEEE bus
 Command description 15

K

Key
 BW 6

M

Measurement rate 10
Measurement site 10
Measurement time 10, 11
Measurements on a Discrete Frequency 10
Measurements using channel lists 11

O

Operation on a Discrete Frequency 10

R

Radio coverage 10
Remote control 15
Results 13

S

Softkey
 FILTER TYPE 7
 INSTALL OPTION 5
 OPTIONS 4
 RES BW 6

T

Test setup 14
Transmission of scan results 13
Trigger 11, 12