R&S®TSMA
Autonomous Mobile Network Scanner
User Manual

1177.5610.02 ─ 05

Test & Measurement

User Manual

ROHDE&SCHWARZ

This manual describes the following R&S®TSMA models:

- R&S®TSMA (1514.6520.20)

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

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

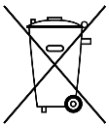
The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English.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

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

Safety labels on products

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

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

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

Signal words and their meaning

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

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

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

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

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

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

Operating states and operating positions

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

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

Electrical safety

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

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

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

Operation

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

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

Repair and service

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

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

Batteries and rechargeable batteries/cells

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

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

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.
2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

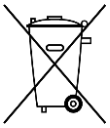
Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa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

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

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

Señalización de seguridad de los productos

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

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

Símbolo	Significado	Símbolo	Significado
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)		Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser Más información en la sección "Funcionamiento", punto 7.		

Palabras de señal y su significado

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

Indica una situación de peligro que, si no se evita, causa lesiones graves o incluso la muerte.

Indica una situación de peligro que, si no se evita, puede causar lesiones graves o incluso la muerte.

Indica una situación de peligro que, si no se evita, puede causar lesiones leves o moderadas.

Indica información que se considera importante, pero no en relación con situaciones de peligro; p. ej., avisos sobre posibles daños materiales.
En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

Estados operativos y posiciones de funcionamiento

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

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

Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión.
   El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m).
   Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se integran productos sin interruptor en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.

6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión U_{eff} > 30 V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados —los llamados alérgenos (p. ej. el níquel)—. Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación/protección del medio ambiente", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
   - Aparato de clase A:
     Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
     Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.
   - Aparato de clase B:
     Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

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

Transporte

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

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

Eliminación/protección del medio ambiente

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

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

Quality management and environmental management

Certified Quality System
ISO 9001

Certified Environmental System
ISO 14001

Sehr geehrter Kunde,
Sie haben sich für den Kauf eines Rohde&Schwarz Produktes entschieden. Sie erhalten damit ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unserer Qualitäts- und Umweltmanagementsysteme entwickelt, gefertigt und geprüft. Rohde&Schwarz ist unter anderem nach den Managementsystemen ISO 9001 und ISO 14001 zertifiziert.

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

Dear customer,
You have decided to buy a Rohde&Schwarz product. This product has been manufactured using the most advanced methods. It was developed, manufactured and tested in compliance with our quality management and environmental management systems. Rohde&Schwarz has been certified, for example, according to the ISO 9001 and ISO 14001 management systems.

Environmental commitment
- Energy-efficient products
- Continuous improvement in environmental sustainability
- 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 de ce produit ont été effectués selon nos systèmes de management de qualité et de management environnemental. La société Rohde&Schwarz a été homologuée, entre autres, conformément aux systèmes de management ISO 9001 et ISO 14001.

Engagement écologique
- Produits à efficience énergétique
- Amélioration continue de la durabilité environnementale
- Système de management environnemental certifié selon ISO 14001

ROHDE&SCHWARZ

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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.

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Contents

1 System Overview

As in-building traffic in cellular networks grows, there is an increased need for indoor measurements. While traditional drive test systems consist of a laptop with test mobile phones and scanners, there are also walk test solutions that use tablets and smartphones.

The R&S TSMA enhances such solutions, providing the user with accurate insight into the RF environment.

The R&S TSMA combines the technology of the R&S TSME ultra-compact drive test scanner with a high performance Intel processor. The scanner can run PC based drive test software, and smartphones can be connected via USB. The scanner measures up to eight technologies simultaneously in the 350 MHz to 4400 MHz wireless communications bands. It can be combined with an R&S TSME to perform LTE MIMO measurements.

Key Features

- User-definable input frequency range from 350 MHz to 4400 MHz
- RF and signal processing path with a bandwidth of 20 MHz
- Parallel measurement of all technologies in all bands (up to eight technologies simultaneously)
- Integrated Intel PC with Microsoft® Windows operating system which allows to install any drive test software supporting the R&S TSMA (e.g R&S ROMES)
- Open remote ViCom interface in order to integrate into Windows and Android based software tools.
- Automatic detection of active channels in a specified band (Automatic Channel Detection (ViCom only), R&S TSMA-K40, Order No. 1524.6339.02 or R&S ROMES4ACD)
- Analysis of the DL allocations of the strongest eNodeBs during measurement (LTE Downlink Allocation Analyzer, R&S TSMA-K31, Order No. 1524.6322.02)

1.1 System Components

1.1.1 R&S TSMA Base Unit

The R&S TSMA base unit consists of the following components:

- R&S TSME drive test scanner unit
- Integrated Intel PC with a high-performance i5 processor and an embedded Microsoft Windows Operating System (Windows 7, 64 bit).
- Internal SSD ensuring high data processing speeds and sufficient memory (128 Gbyte) for measurement data.

Equipment	Availability
Antennas	• GPS: active antenna with cable and SMA connector included in package • RF antenna: 700 MHz to 2600 MHz paddle antenna included in package • Bluetooth®/WiFi antennas included in package • optionally: R&S TSME accessory antennas: – TSME-ZA1 (1506.9817.02): Antenna-mount magnetic – TSME-ZA2 (1506.9823.02): Antenna-mount fixed – TSME-ZA3 (1506.9830.02): Antenna-mount magnetic with GPS – TSME-ZA4 (1506.9846.02): Antenna-mount fixed with GPS – TSMW-ZE8 (1506.9852.02): Antenna Emitter 698 MHz - 2700 MHz – TSMW-ZE2 (1117.8165.00): Antenna Emitter 406 MHz - 440 MHz – TSME-ZE7 (1519.5709.02): Antenna Emitter 380 MHz - 430 MHz
Connection cables	• 12V DC power supply cable with a cigarette lighter connector (included in package) • LAN cable to connect host PC (RJ45 Patch cable CAT6 2 m, included in package) • LAN cable to connect scanner unit and internal PC unit (5016.1890.00, included in package)
AC Power supply	TSMA-Z1 (1523.8450.02), optional
Battery Pack, Batteries and Dual Charger	R&S TSMA-BP (1523.8009.02), optional R&S TSMA-BAT (1523.8021.03), optional R&S TSMA-BC2 (1523.8015.02), optional
Adapter	R&S TSPC-DPDH (3592.4060.02), Display Port Adapter to DVI/HDMI, optional R&S TSPC-DPVG (3592.4076.02) Display Port Adapter to VGA, optional
Carrying Bag and Carrying Box	R&S TSMA-ZCB (1523.8467.02), optional Accommodates the R&S TSMA with battery pack, two spare batteries, a mobile phone, and the R&S TSME-Z7 antenna (frequency range: 700 MHz to 2.6 GHz). R&S TSMA-Z6 (3593.36909.02), optional
Other	R&S TSPC-DVDD (3592.4053.02), External DVD Drive, optional R&S TSPC-MHDM (3592.4082.02), Mini HDMI Cable, optional R&S TSPC-MMON (3592.4047.02), 10" Portable Monitor, HDMI, optional R&S TSPC-KEYB (1508.1607.02), Compact Keyboard, US, with trackball, USB, optional R&S TSPC-SF3P (3591.3024.02). Surface Pro 3, remote tablet, optional

1.1.2 R&S TSMA-BP Battery Pack Unit - Optional Unit

The R&S TSMA-BP Battery Pack Unit features two rechargeable hot-swapable batteries (R&S TSMA-BAT, 1523.8021.03), which can be charged directly if the battery pack is connected to an external power supply. Alternatively, a separate battery charger (R&S TSMA-BC2, 1523.8015.02) can be used for recharging the batteries.

Figure 1-1: R&S TSMA with R&S TSMA-BP battery pack unit (containing two batteries)

Only Li-ion battery of the type RRC2054 may be used!

The recharging of the batteries is only allowed via the separate charger (R&S TSMA-BC2, 1523.8015.02) or via an external power supply. In this case, the batteries must be inside the R&S TSMA.

1.2 Option Concept

The R&S TSMA scanner consists of the R&S TSMA hardware as well as a set of (specified) scanner and band options when it comes from the factory.

Additionally, the NESTOR options are available on the internal smart card of the R&S TSMA, if the R&S NESTOR application is part of the initial installed R&S TSMA.

A later enhancement of the R&S TSMA with the R&S NESTOR application requires a dongle (with the NESTOR options) and an installation DVD.

1.2.1 Scanner Options

Scanner options allow the R&S TSMA to scan the input based on a specific technology, for example, LTE. All technology options can be installed on the same instrument; the R&S TSMA can measure various technologies simultaneously.

Following technology options are available:

Option	Order Number	Description
R&S TSMA-K20	1524.6080.02	R&S TSMA scanner option: TD-SCDMA
R&S TSMA-K21	1524.6097.02	R&S TSMA scanner option: WCDMA
R&S TSMA-K22	1524.6100.02	R&S TSMA scanner option: CDMA2000
R&S TSMA-K23	1524.6116.02	R&S TSMA scanner option: GSM
R&S TSMA-K24	1524.6122.02	R&S TSMA scanner option: 1xEV-DO
R&S TSMA-K26	1524.6145.02	R&S TSMA scanner option: TETRA
R&S TSMA-K27	1524.6151.02	R&S TSMA scanner option: RF Power Scan
R&S TSMA-K28	1524.6168.02	R&S TSMA scanner option: WiMAX™
R&S TSMA-K29	1524.6174.02	R&S TSMA scanner option: LTE
R&S TSMA-K30	1524.6197.02	R&S TSMA scanner option: LTE-MIMO
R&S TSMA-K31	1524.6322.02	R&S TSMA scanner option: LTE Downlink Allocation Analyzer
R&S TSMA-K32	1524.6416.02	R&S TSMA scanner option: LTE eMBMS
R&S TSMA-K40	1524.6339.02	R&S TSMA scanner option: Automatic Channel Detection (ViCom only, not for R&S ROMES4)
R&S TSMA-K61	1524.6345.02	R&S TSMA scanner option: QualiPoc® Support

1.2.1.1 Option TD-SCDMA (R&S TSMA-K20)

The R&S TSMA-K20 option allows for the instrument to be used as a TD-SCDMA scanner. Hence the instrument can measure and identify all TD-SCDMA downlink (BTS) signals in the air.

1.2.1.2 Option WCDMA (R&S TSMA-K21)

The R&S TSMA-K21 option allows for the instrument to be used as a WCDMA scanner. With this option the instrument can measure and identify all WCDMA downlink (Node B and BTS) signals in the air. The main purpose of these measurements is to test the receiving conditions of a mobile device in a WCMDA network and to analyze possible interferences. During the subsequent spectrum analysis, a frequency sweep over a specified range is performed to detect arbitrary WCDMA downlink and uplink signals.

1.2.1.3 Option CDMA2000 (R&S TSMA-K22)

The R&S TSMA-K22 option allows for the instrument to be used as a CDMA2000 scanner. Hence the instrument can measure and identify all CDMA2000 downlink (BTS) signals in the air.

1.2.1.4 Option GSM (R&S TSMA-K23)

TheR&S TSMA-K23 option allows for the instrument to be used as a GSM scanner. With this option the instrument can measure and identify all GSM downlink (Node B and BTS) signals in the air. The main purpose of these measurements is to test the receiving conditions of a mobile device in a GSM network and to analyze possible interferences.

1.2.1.5 Option 1xEV-DO (R&S TSMA-K24)

The R&S TSMA-K24 option allows for the instrument to be used as a 1xEV-DO scanner. Hence the instrument can measure and identify all 1xEV-DO downlink (BTS) signals in the air.

1.2.1.6 Option TETRA (R&S TSMA-K26)

The R&S TSMA-K26 option allows for the instrument to be used as a TETRA scanner. With this option the instrument can measure and identify all TETRA downlink (BTS) signals in the air. The main purpose of this measurement is to test the receiving conditions of a mobile device in a TETRA network and to analyze possible interferences and find possible gaps in the coverage.

1.2.1.7 Option RF Power Scan (R&S TSMA-K27)

TheR&S TSMA-K27 option allows for the instrument to be used as a power scanner. With this option the instrument can measure throughout the entire frequency range from 350 MHz to 4400 MHz. As a result, mobile radio bands as well as the uplink ranges can be measured, and detecting interference on the uplink frequencies becomes very easy. Results of the RF Power scans can be displayed in R&S ROMES within the corresponding RF Power Scanner Spectrum view.

1.2.1.8 Option WiMax™ (R&S TSMA-K28)

The R&S TSMA-K28 option allows for the instrument to be used as a WiMAX™ scanner. With this option the instrument detects each and every available WiMAX™ signal with sensitivity below the noise level. Therefore it can check neighborhood information, and also identify interference signals from remote base stations.

1.2.1.9 Option LTE (R&S TSMA-K29)

The R&S TSMA-K29 options allows for the instrument to be used as an LTE scanner. TDD and FDD technologies are supported. Furthermore:

- Automatic detection and measurement of P-SCH and S-SCH channels
- Easy detection of interference
- Cyclic prefix analysis with a channel impulse response measurement

As an example, this option can be used to roll out and optimize 3GPP EUTRA networks.

1.2.1.10 Option LTE-MIMO (R&S TSMA-K30)

The R&S TSMA-K30 option allows for the instrument to be used as a LTE-MIMO scanner. In order to fulfill the requirements for this option, an R&S TSME must be connected to the R&S TSMA.

1.2.1.11 Option LTE Downlink Allocation Analyzer (R&S TSMA-K31)

The R&S TSMA-K31 option allows to analyze the DL allocations of the strongest eNodeBs during the measurement. The analysis information includes the following values:

- Number of Radio Network Temporary Identifiers (RNTI) that have been scheduled data by the eNodeB
- Modulation and Coding Scheme (MCS) and throughput for each detected UE
- Occupation of the cell

The information is provided per Transmission Time Interval (TTI) and per resource block.

The offered data is helpful during network optimization and troubleshooting as it helps users to acquire network data without accessing O&M network information such as base station counters.

1.2.1.12 Option LTE eMBMS (R&S TSMA-K32)

The LTE evolved multimedia broadcast multicast service (eMBMS) uses several base stations to broadcast the same content at the same time to all users. This poses new challenges for RAN engineers, such as base station synchronization and managing the coverage and quality of the multimedia single frequency network.

eMBMS scanner measurements provide the needed insight to the SFN's RF performance, such as eMBMS reference signal power, quality and SINR. The channel impulse response provided by the scanner allows detection of inter-symbol interference as well as the interfering base station.

1.2.1.13 Option Automatic Channel Detection (R&S TSMA-K40)

The R&S TSMA-K40 option allows the R&S TSMA to detect active channels in a specified band automatically. In combination with a spectrum scan, the detection process can be significantly speed up.

1.2.2 Band Options

TheR&S TSMA hardware simultaneously measures in all wireless communications bands from 350 MHz to 4.4 GHz. Using band licenses, more cost-efficient configura-

tions are available for applications where only a limited number of bands need to be measured simultaneously. These configurations limit the number of bands that can be measured in parallel. Users can reconfigure the bands for each measurement as desired.

Upgrade options are available to increase the bandwidth of the R&S TSMA from a limited number of bands to full bandwidth.

Following band options are available:

Option	Order Number	Description
R&S TSMA-KAB	1524.6297.02	All bands measured simultaneously
R&S TSMA-K1B	1524.6068.02	1 band measured simultaneously
R&S TSMA-K2B	1524.6180.02	2 bands measured simultaneously
R&S TSMA-K3B	1524.6200.02	3 bands measured simultaneously
R&S TSMA-K4B	1524.6216.02	4 bands measured simultaneously
R&S TSMA-K5B	1524.6222.02	5 bands measured simultaneously
R&S TSMA-KUB	1524.6300.02	Upgrade: 1 additional band measured simultaneously

1.3 Front and Rear Panel Description

1.3.1 Front Panel

The front panel of the R&S TSMA does not provide any connectors or control elements for operation.

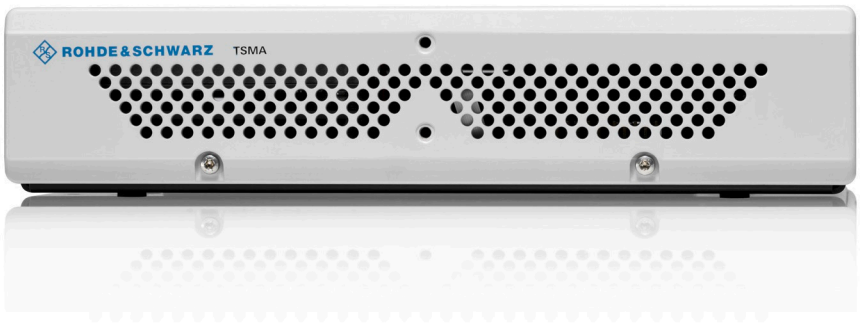


Figure 1-2: R&S TSMA - Front Panel

1.3.2 Rear Panel

The following figure provides an overview of the control elements and the connectors on the rear panel of the instrument.

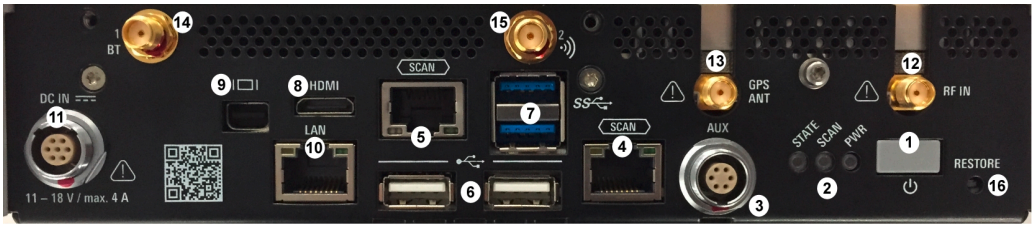


Figure 1-3: R&S TSMA - Rear Panel

1 = POWER ON/OFF
2 = STATUS LEDs
3 = AUX Connector
4 = SCAN (scanner port from scanner)
5 = SCAN (scanner port to embedded PC)
6 = USB 2.0 (2x)
7 = USB 3.0 (2x)
8 = mini HDMI
9 = MINI Display Port
10 = LAN Connector CPU
11 = DC IN Connector
12 = RF IN Connector
13 = GPS Antenna Connector
14 = Antenna 1 Connector (Bluetooth® / WLAN MIMO)
15 = Antenna 2 Connector (WLAN)
16 = RESTORE

POWER ON/OFF

The POWER ON/OFF key turns on and off the device if power is supplied via the DC IN connector.

STATUS LEDs

The three status LEDs, STATE, SCAN, PWR, indicate the operating status of the R&S TSMA.

	LED	STATE
PWR	blue blinking	R&S TSMA is in stand-by mode
	blue	Power is on

	LED	STATE
SCAN	red (5 s after power on)	red: FPGA configuration ongoing off: FPGA configuration finished
	green	Scanner connected with SW application
	green blinking, 5 Hz	R&S TSMA is measuring

	LED	STATE
	green blinking, 2 Hz	Identify "TSMA Scanner" (synchronous with Scanner Port LEDs 1 und 2)
	red blinking, 2 Hz	Warning
	red, continuous	Error
	off	Scanner link "Idle"

	LED	STATE
STATE	green blinking	Shut down in progress
	green	Scanner link established
	red	Scanner link failed
	orange	"Scanner Only" mode
	red blinking	Restore in progress
	blue blinking	Software installation in progress

AUX Connector

The AUX connector can be used to synchronize the TSMA with the external 10 MHz reference frequency output of a signal generator or to synchronize multiple TSMA/ TSME with the Sync cable.

SCAN (2x)

The two SCAN connectors are used to establish a highspeed data link between the R&S TSMA scanner unit (SCAN connector on the **right** side) and the R&S TSMA internal PC unit (SCAN connector on the **left** side).

Figure 1-4: SCAN connectors of the R&S TSMA

red side = Internal PC unit of R&S TSMA
green side = Scanner Unit of the R&S TSMA
1 = SCAN Link: Scanner port (used for PC connection in mode "Scanner only")
2 = SCAN Link: CPU port of R&S TSMA
3 = SCAN Link LED1 (link status)
4 = SCAN Link LED2 (activity status)

Use only the LAN interconnection cable (R&S No. 5016.1890.00) for connecting the SCAN ports.

SCAN Link LEDs

The LEDs on the SCAN connectors display the status of the interconnection.

Table 1-1: SCAN Link LED1 (link) states and their meaning

LED state	Description
off	No scanner link
yellow, blinking	Identifying scanner connection (synchronous with SCAN LED and SCAN Link LED2)
yellow	LAN link established

Table 1-2: SCAN Link LED2 (activity) states and their meaning

LED state	Description
off	No data
green, blinking	Identifying scanner connection (synchronous with SCAN LED and SCAN Link LED1)
green, flashing	Scanner activity

USB 2.0 (2x)

The two USB 2.0 ports can be used for connecting external devices as keyboard, mouse or other devices.

The length of the connected USB cables should not exceed 3 m.

USB 3.0 (2x)

The two USB 3.0 ports can be used for connecting external storage devices, data sticks and test mobiles.

The length of the connected USB cables should not exceed 3 m.

Mini-HDMI Port

The MINI-HDMI port can be used for connecting an external monitor. (max. resolution: 2560 x 1600 pixel)

MINI-Display Port

The MINI-Display port can be used for connecting an external monitor. (max. resolution: 5120 x 2880 pixel)

LAN

The LAN connector provides a highspeed 100 Mbit Ethernet interface with an RJ 45 connector using IPv4. It is used to connect the R&S TSMA to a host PC in a local network.

The LAN interface can be used for Remote Control / Remote Desktop Connections. In this case, the device must not be in the "Scanner Only" mode.

Alternatively, it can also be used for distributed versions of R&S ROMES and R&S NESTOR.

The LEDs on the LAN connector indicate the status of the connection to the host PC. LED 1 (yellow, link status) is on the left side of the connector, LED 2 (green, activity status) is on the right.

DC IN Connector

The DC IN connector is used to supply the R&S TSMA with DC power. A wide DC input range from 10 - 18 V / max. 4 A is supported.

Use only cable type with R&S No. 1523.7948.00 (included in delivery package).

RF IN Connector

The RF IN connector is the RF input of the R&S TSMA. The multi-band RF paddle antenna (700 MHz to 2.6 GHz), which is included in the shipment of R&S TSMA or any customer side RF source is connected to this SMA connector. The maximum input power is +20 dBm/10 V DC.

For the multi-band RF paddle antenna (700 MHz to 2.6 GHz) no adapter is required.

NOTICE

Risk of instrument damage

Do not overload the maximum allowed input of 20 dBm.

Non-compliance destroys the input mixer.

GPS ANT

This SMA port is used for the GPS antenna input. It is an active antenna port with output voltage 3 V / max. 35 mA.

The accessory GPS antenna is connected to this input.

Antenna Connector 1 BT

The port with the label "1 BT" is a combined Bluetooth / WLAN antenna port. Connect the accessory WLAN / Bluetooth stub antenna to this SMA connector.

Antenna Connector 2 WLAN

The port with the label "2))" is the WLAN antenna port. Connect one of the acessory WLAN / Bluetooth antennas to this SMA connector.

RESTORE

With the RESTORE button it is possible to bring the R&S TSMA back to factory default. For details see Chapter 3.3, "Restore", on page 44.

NOTICE

Loss of user data after RESTORE

Executing restore brings the R&S TSMA irreversible back to the condition of delivery or any other subsequently stored backup version.

All user data since last restore will be lost.

2 Preparing for Use

WARNING

Risk of injury and instrument damage

The instrument must be used in an appropriate manner to prevent electric shock, fire, personal injury, or damage.

- Do not open the instrument casing.
- Read and observe the "Basic Safety Instructions" delivered as a printed brochure with the instrument.
  In addition, read and observe the safety instructions in the following sections.
  Notice that the data sheet may specify additional operating conditions.

NOTICE

Risk of instrument damage during operation

An unsuitable operating site or test setup can cause damage to the instrument and to connected devices. Ensure the following operating conditions before you switch on the instrument:

- The instrument is dry and shows no sign of condensation.
- The instrument is positioned as described in the following sections.
- Signal levels at the input connectors are all within the specified ranges.

EMI Suppression

Electromagnetic interference (EMI) may affect the measurement results.

To suppress generated electromagnetic interference (EMI):

- Use suitable shielded cables of high quality. For example, use double-shielded RF and LAN cables.
- Always terminate open cable ends.
- Note the EMC classification in the data sheet.

2.1 Unpacking the Instrument

The following section describes how to set up the instrument.

NOTICE

Risk of instrument damage

Note that the general safety instructions also contain information on operating conditions that will prevent damage to the instrument. The instrument's data sheet may contain additional operating conditions.

Check the equipment for completeness using the delivery note and the accessory lists for the various items. Check the instrument for any damage. If there is damage, immediately contact the carrier who delivered the instrument. Make sure not to discard the box and packing material.

Packing material

Retain the original packing material. If the instrument needs to be transported or shipped at a later date, you can use the material to protect the control elements and connectors.

Accessory list

The following items are included with shipment of the R&S TSMA:

- SCAN Link interconnection cable (SCAN <-> SCAN)
- 12 V DC power supply cable with a cigarette lighter connector
- Wide range RF paddle antenna (700 MHz to 2600 MHz)
- Active GPS patch antenna
- Two stub antennas for WLAN/Bluetooth®

Figure 2-1: Scope of R&S TSMA Delivery

1 = SCAN Link interconnection cable
2 = Car Adapter cable
3 = RF Antenna
4 = GPS Antenna
5 = WiFi/Bluetooth Antennas

2.2 Connecting External Devices

The following external devices must be connected before connecting the power supply.

In order to select the correct connectors, refer to Figure 1-3.

1. Connect the SCAN ports of scanner and PC unit of the R&S TSMA.

Figure 2-2: Connection between scanner unit and internal PC unit

1 = SCAN Link connector (CPU port)
2 = SCAN Link connector (Scanner Port)
3 = SCAN Link interconnection cable

2. Connect the RF antenna to the RF IN connector.
3. Connect the GPS antenna to the GPS ANT port.
4. Connect the accessory WLAN / Bluetooth stub antennas to ANT1 and ANT 2.
5. Connect mouse and keyboard to the USB 2.0 ports and a monitor to the appropriate monitor port (mini HDMI or MINI Display port) if you want to use local operation. (optional)
   If necessary, following display port adapters can be used:
   - Display Port Adapter to DVI/HDMI, R&S TSPC-DPDH (R&S No. 3592.4060.02)

Figure 2-3: Display Port Adapter to DVI/HDMI

   - Display Port Adapter to VGA, R&S TSPC-DPVG (R&S No, 3592.4076.02)

Display Port Adapter to VGA

6. Connect a LAN cable to the LAN port if you want to use the R&S TSMA via Remote Desktop or as distributed system. (optional)

2.3 Connecting Power Supply

This section describes how to connect the R&S TSMA to a power supply unit.

2.3.1 Connecting to a Vehicle DC Power Supply

Use the accessory DC cable with cigarette lighter adapter to power the R&S TSMA from the vehicle power supply. Connect the 7-pin connector to DC IN.

For DC Supply Only

The R&S TSMA is to be used with a 12 V vehicle power supply only.

DC-based lab networks are not allowed to be used for power supply!

2.3.2 Connecting an AC Power Supply

In order to operate the R&S TSMA with an AC power supply, connect the DC IN connector with the AC power supply (R&S TSMA-Z1, R&S No. 1523.8450.02).

Use only the R&S TSMA-Z1, R&S No. 1523.8450.02 as AC power supply.

Figure 2-4: TSMA-Z1 AC Power Supply

2.3.3 Connecting the R&S TSMA-BP Battery Pack Unit

Alternatively, it is possible to power the R&S TSMA via the R&S TSMA-BP Battery Pack Unit.

In order to use the R&S TSMA with the battery pack, the following steps must be performed.

1. Insert the batteries into the R&S TSMA.

   Note: The R&S TSMA may be used only with closed battery cover.

   Note: Make sure, that the batteries are inserted in the correct orientation.

Figure 2-5: R&S TSMA - Battery Orientation

1 = Battery insert orientation

2. Attach the R&S TSMA base unit with the bottom side (see Figure 2-7) on top of the R&S TSMA-BP (see Figure 2-6).

Figure 2-6: R&S TSMA-BP

1 = Connectors for R&S TSMA base unit

Figure 2-7: R&S TSMA Base Unit (bottom side)

1 = Connectors for R&S TSMA-BP

3. Move the R&S TSMA base unit to the front side (2) until the connectors are locked.

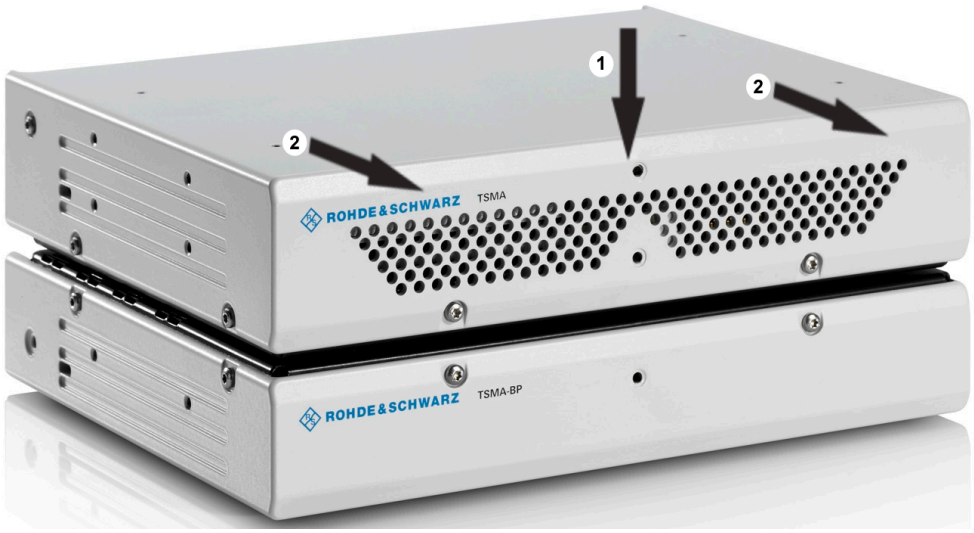


Figure 2-8: Connected R&S TSMA Base Unit and R&S TSMA-BP

1 = Vertical attachment of R&S TSMA base unit (bottom) with R&S TSMA BP (top)
2 = Move T&S TSMA base unit to the front side

4. Lock the interconnection using the lock (3).

Figure 2-9: Connection of R&S TSMA with R&S TSMA

1 = R&S TSMA Base Unit
2 = R&S TSMA
3 = Lock (front side)

5. Via the cable (3), you have to connect the DC IN connector on the R&S TSMA (1) with the TSMA connector (7 pins) on the R&S TSMA (2).

Figure 2-10: Cabling of R&S TSMA with R&S TSMA

1 = DC IN Connector of R&S TSMA Base Unit
2 = TSMA Connector R&S TSMA
3 = Interconnection Cable (R&S TSMA Base Unit <-> R&S TSMA)

Note: The Interconnection cable (3) is included in the delivery package. The cable plugs are marked at both sides with a red spot.

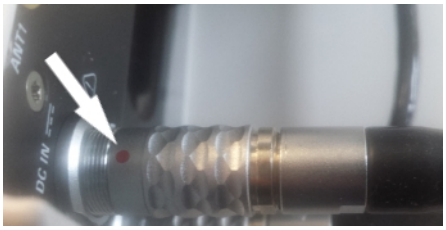


Figure 2-11: Cable

Connected at the DC IN (1) of the R&S TSMA, this red spot must face upwards, at the TSMA connector (2) of the R&S TSMA-BP it must face downwards.

The boot behavior after connecting the R&S TSMA-BP Battery Pack Unit (including charged batteries or connected to an external DC power supply) with the R&S TSMA via the connection cable (3) depends on the System Settings on the R&S TSMA (see Chapter 3.1.2.1, "Config Tab", on page 36).

The R&S TSMA-BP Battery Pack Unit can be connected with an external power supply. The following steps must be performed.

1. **DC powered from a vehicle supply**
   Connect the DC connector (4) of the R&S TSMA-BP Battery Pack Unit with the adapter cable (5) and connect the 7-pin to 4-pin adapter cable with the accessory DC cable of the R&S TSMA.

   Note: The 7-pin to 4-pin adapter cable is a standard accessory of the R&S TSMA-BP Battery Pack Unit

Figure 2-12: 7-pin to 4-pin adapter cable

2. **AC powered**
   Connect the adapter cable (5) with the AC power supply (R&S TSMA-Z1, R&S No. 1523.8450.02).
   If a valid DC input voltage is applied, the DC IN connector of the base unit of the R&S TSMA is powered from this external DC input and the batteries inside the base unit are charged.
   If the DC input voltage is not available the R&S TSMA is powered from the batteries.

Figure 2-13: Connecting the R&S TSMA with a AC power supply

1 = DC IN connector R&S TSMA Base Unit
2 = TSMA connector R&S TSMA-BP Battery Pack Unit
3 = DC power interconnection cable (R&S TSMA Base Unit <-> R&S TSMA-BP Battery Pack Unit)
4 = DC IN connector R&S TSMA-BP Battery Pack Unit
5 = Adapter cable (7-pin to 4-pin)
6 = DC OUT (TSMA-Z1 resp. TSMA DC cable, standard accesspry of R&S TSMA)

2.4 Accessing the R&S TSMA

There are different ways to access the R&S TSMA.

- Local operation
  In order to use the R&S TSMA as an ordinary PC, an external monitor, mouse and keyboard have to be connected to the R&S TSMA.
- Remote access
  The remote access to the R&S TSMA can be realized via the following options.
  - Establish a remote desktop connection (via LAN/WLAN) (see Chapter 2.4.1, "Establish a Remote Desktop Connection", on page 30).
  - Using the web interface of the R&S TSMA (see Chapter 2.4.2, "Start the R&S TSMA Web Interface", on page 31).

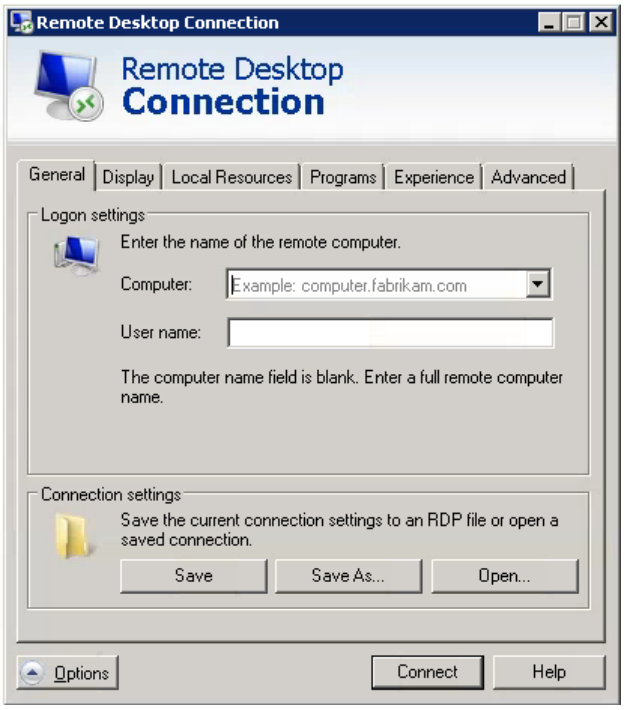
2.4.1 Establish a Remote Desktop Connection

In order to establish a remote desktop connection, the following steps must be performed:

Prerequisite

A WLAN/LAN connection between the R&S TSMA and the remote PC must be established.

1. On the external PC, navigate to "Programs" > "Accessories" > "Remote Desktop Connection".
2. In the "Remote Desktop Connection" window, click "Options".
3. In the "General" tab, enter following parameters:
   - Computer: *TSMA-xxxxxx*
     The serial number (*xxxxxx*) can be found on the bottom side of the R&S TSMA device.
   - User name: *instrument*



4. Click "Connect".
5. Enter the password *894129* and click "OK".

6. The remote desktop connection is established.

   The R&S TSMA can be controller as a standard PC.

2.4.2 Start the R&S TSMA Web Interface

In order to start the R&S TSMA web interface, the following steps must be performed.

1. Via a tablet PC or smartphone, you have to establish a WLAN connection.
   a) Search for a WLAN network. The WLAN server on the R&S TSMA has been started automatically during the boot process of the device.
   b) Connect your tablet or smartphone with the WLAN network. The required information can be found on a label on the bottom side of the R&S TSMA base unit.
   WLAN-Access Point SSID: *TSMA-xxxxxx*
   Key: *instrument*

   The WLAN connection between the tablet PC or smartphone and the R&S TSMA device is established.

2. On the tablet PC or smartphone start a web browser and enter the following URL: *http://192.168.1.10/*

   The configuration web GUI of the R&S TSMA will be started. For details about the web GUI, see Chapter 3.1, "Configuration via Web Interface", on page 35.

2.5 Installing R&S TSMA Firmware and other Software Components

In general, there are different possibilities to install firmware and software on the R&S TSMA.

- Remote installation of firmware/software
  The setup files will be executed on a remote PC. In this case, the remote PC and the R&S TSMA must be connected via LAN or WLAN.
- Local installation via web interface
  The setup will be initiated via the web interface of the R&S TSMA. In this case, the setup file must be available in the root directory of an USB stick, which is connected to the R&S TSMA.

In order to install the R&S TSMA firmware and other software components (R&S NESTOR, R&S ViCom, Diversity) via the R&S TSMA web interface, the following steps must be performed.

1. Open the web interface of the R&S TSMA.
2. In the web interface, open the menu "File Transfer/Update".
3. Select the setup file for the firmware/software to be installed or updated via the drop-down list of the specific component and click "Execute Setup".
4. The STATE LED of the R&S TSMA starts blinking blue and the status message *Installation in progress* is displayed in the web interface.
5. The setup is finished when the Web IF displays the status message *Installation complete*.
6. After an optional reboot the R&S TSMA, the STATE LED lights up green and the SW installation/update has finished.

2.5.1 Upgrade/Downgrade of Remote ViCom Server

In order to upgrade or downgrade an existing ViCom server installation, you have to download the required ViCom software package (`TSMA-rViCom-Setup-xx.yy.exe`) from the Rohde & Schwarz product website and save it on an USB device.

1. Open the web interface (see Chapter 2.4.2, "Start the R&S TSMA Web Interface", on page 31).
2. Change the "Mode of Operation" to "Normal PC Mode" (see Chapter 3.1.2.1, "Config Tab", on page 36). The TSMA will be rebooted.
3. Connect the USB device containing the rViCom Server package (`TSMA-rViCom-Setup-xx.yy.exe`) with the R&S TSMA.
4. Select in the "File Transfer" window under "Select Vicom Setup File" the software package on the USB device and click "Execute Setup" (see Chapter 3.1.4, "File Transfer/Update", on page 41).
5. The STATE LED of the R&S TSMA is blinking blue and the status message *Installation in progress* is displayed in the web interface.
6. A successful installation is indicated via the status message *Installation complete*.

7. Change the "Mode of Operation" to "rViCom Server". The TSMA will be rebooted.

2.5.2 Installation of R&S NESTOR

In order to install R&S NESTOR via the R&S TSMA web interface, perform the following steps.

Prerequiste

The setup file (`TSMA-NESTOR-Setup-x.y.z.exe`) must be available in the root directory of an USB stick, which is connected to the R&S TSMA.

A dongle containing a smartcard with R&S®NESTOR option licenses must be available.

Use only setup files of the type `TSMA-NESTOR-Setup-x.y.z.exe`.

1. Open the web interface of the R&S TSMA.
2. In the web interface, open the menu "File Transfer/Update".
3. Select the setup file (`TSMA-NESTOR-Setup-x.y.z.exe`) in the dropdown list "Select NESTOR Setup File" and click "Execute Setup".
4. The STATE LED of the R&S TSMA is blinking blue and the status message *Installation in progress* is displayed in the web interface.
5. A successful installation is indicated via the status message *Installation complete*.
6. After an optional reboot the R&S TSMA, the STATE LED lights up green and the SW installation/update has finished.

2.5.3 Installation of R&S ROMES TSMA

In order to install R&S ROMES (distributed version), perform the following steps.

Note

The setup will be executed via local access or Remote Desktop Connection.

1. Open the web interface of the R&S TSMA.
2. In the "System" window, change the "Mode of Operation" to "PC Mode" (see Chapter 3.1.2.1, "Config Tab", on page 36). The TSMA will be rebooted.
3. Connect an USB stick containing the setup file `ROMES_TSMA_setup-x.yy.exe` to the R&S TSMA.
4. On the R&S TSMA, start a Windows Explorer, execute the file `ROMES_TSMA_setup-x.yy.exe` and follow the instructions.

The installation contains only the part of the software, which installs the basic communication between the TSMA PC and the ROMES PC. The measurement software itself will be moved during the establishment of the connection to the TSMA PC at the first connection establishment or if a newer version on the ROMES PC is available.

Do not install the R&S TSMA client into the same folder as R&S ROMES application. Use the proposed folder `ROMES_TSMA`.

3 Initial Measurement Settings

3.1 Configuration via Web Interface

In order to start the web interface for configuration tasks, open a browser on your PC, tablet PC or smartphone and enter the following URL:

http://192.168.1.10/

The web GUI offers the following pages for configuration tasks:

- Overview
- System
- Connectivity
- File Transfer/Update

3.1.1 Overview

The "Overview" window displays the following basic settings of the R&S TSMA.

- Instrument Model
  Displays the type of instrument
- Material Number
  Displays the R&S No. of the device
- Serial Number
  Displays the serial number of the R&S TSMA device
- Computer Name
  Displays the computer name of the R&S TSMA (read-only). The name consists of a fixed part (TSMA) and a variable part (serial number).
  Example: `TSMA-<Serial Number>`
  NOTE: The serial number can be found on the bottom side of the R&S TSMA device.
- Software Version
  Displays the current software version of the R&S ViCom server
- Hardware Version
  Displays the current hardware version
- Image Version
  Displays the current image version
- Firmware Revision
  Displays the current firmware revision
- IP Address Remote Port
  Displays the IP address of the remote LAN port of the R&S TSMA.
- IP Address Scanner Port
  Displays the IP address of the scanner port of the R&S TSMA
- IP Address WLAN AP

Displays the IP address of the WLAN access point.

- Mode of Operation
  Displays the mode how the device is used. In order to change the mode of operation, see Chapter 3.1.2.1, "Config Tab", on page 36.
- Bluetooth Status
  Displays the Bluetooth® activity status. In order to change the status, see Chapter 3.1.3.1, "Bluetooth Tab", on page 39.
- WLAN Status
  Displays the WLAN activity status. In order to change the status, see Chapter 3.1.3.2, "WLAN Tab", on page 40.
- Battery 1
  Displays the charge of battery 1.
- Battery 2
  Displays the charge of battery 2.
- Remaining Battery Time
  Displays the estimated remaining battery time
- Mainboard Temperature
  Displays the current temperature of the mainboard.

3.1.2 System

The "System" window consists of the following tabs.

- Config
- HW Info
- Options
- Band Config
- Install Options

3.1.2.1 Config Tab

In the "Config" tab the buzzer and the mode of operation can be configured.

- Buzzer
  With the buzzer, it possible to activate an acoustic warning signal, indicating that the charge of battery is low.
  - Buzzer Status
    Allows to activate or deactivate the buzzer.
  - Buzzer Volume
    Allows to specify the volume of the acoustic warning signal.
- Power Settings
  Following settings are possible
  - Auto Power On
    The R&S TSMA starts automatically if a DC power supply is connected.
  - Remember Last State

The R&S TSMA uses the last state before the R&S TSMA was powered off.

Allows to specify if the R&S TSMA should be started automatically ("Auto Power On") if the DC power supply is connected or not ("Remember Last State").
Click "Submit" to activate your settings.

- Mode of Operation
  With the Mode of Operation, the autostart sequence of the R&S TSMA can be adjusted in order to change the usage of the R&S TSMA.
  - NESTOR
    If you use the NESTOR mode, the NESTOR application will be started (if installed). The selection of a valid workspace file is required.
  - NESTOR Measurement Probe
    If you the NESTOR Measurement Probe mode, the NESTOR application operates in a distributed mode. A local workspace is not required.
  - rViCom Server
    If you use the ViCom mode, the R&S TSMA is booted and the pre-installed Remote ViCom Server will be started.
  - Diversity
    If you use the Diversity mode, the Diversity application will be started (if installed). This mode is also required if the R&S TSMA will be used together with QualiPoc®.
  - PC Mode
    If you use the normal PC mode, Windows 7 is booted on the R&S TSMA device.

Click "Submit" to save the selection.

3.1.2.2 HW Info Tab

The "HW Info" tab displays the following information:

Device

- MAC Address
  Displays the MAC address of the scanner port
- IP Address
  Displays the IP address of the scanner

FPGA

- Available FPGA Versions
  Displays the available FPGA versions (max. 4 versions)
- Current FPGA Versions
  Displays the current valid FPGA version

Controller Board

- Serial Number
  Displays the serial number of the controller board

- Product Change Index
  Displays the product change index of the controller board

Mainboard

- Serial Number
  Displays the serial number of the mainboard
- Product Change Index
  Displays the product change index of the mainboard

Battery Pack

- Serial Number
  Displays the serial number of the battery pack
- Product Change Index
  Displays the product change index of the battery pack

RF Board

- Serial Number
  Displays the serial number of the RF board
- Product Change Index
  Displays the product change index of the RF board

Correction Data

- Version
  Displays the version of the calibration data
- Date
  Displays the date of calibration
- TCXO Date
  Displays the date of the internal calibration

3.1.2.3 Options Tab

The "Options" tab displays the following information:

Active Scan Options / Inactive Scan Options / NESTOR Active Options / NESTOR Inactive Options

- Option Type
  Displays the type of the used option
- Option Material No.
  Displays the R&S No. of the option
- Activation Type
  Displays the type of activation (temporary or permanent)
- Valid From
  Displays the start date of validity
- Valid To

Displays the end date of validity

- Option Index
  Displays the index number of the option

NESTOR Active Options / NESTOR Inactive Options

3.1.2.4 Band Config Tab

The "Band Config" tab displays the following information:

- Current Configuration
  Displays the current valid band configuration
- New Configuration
  Displays the new band configuration

3.1.2.5 Install Options

The "Install Options" tab allows the following types of option installation:

- Install NESTOR Options
  Allows to install a NESTOR option by typing in the license key code manually
- Install Scanner Options
  Allows to install a scanner option by typing in the license key code manually
- Install XML File
  Allows to install scanner and NESTOR options by selecting and installing a license xml file

3.1.3 Connectivity

The "Connectivity" window consists of the following tabs:

- Bluetooth
- WLAN
- LAN

3.1.3.1 Bluetooth Tab

In the "Bluetooth" tab the settings in order to establish a Bluetooth® connection can be configured.

- Bluetooth Connection
  Allows to specify the configuration details of a Bluetooth adapter
  - Bluetooth Status
    Activate / Deactivate Bluetooth
  - Bluetooth Visibility
    Show / Hide the Bluetooth device
  - Select the Bluetooth Device you want to pair

With "Refresh Device List", the list of active Bluetooth devices will be displayed.
With "Connect" the pairing of Bluetooth devices can be established.

Bluetooth Pairing

In order to pair the R&S TSMA with a remote device, the following steps must be performed.

1. Start the R&S TSMA in "PC Mode".
2. Open the web interface of the R&S TSMA.
3. Navigate to "Connectivity" > "Bluetooth" and switch on Bluetooth.
   STATE = ON
   Visibility = Visible
4. On the remote device, activate Bluetooth.
5. In the R&S TSMA web interface, click "Refresh Device List".
6. Select the device to be paired and click "Connect".
7. On the remote device, confirm the Bluetooth pairing code.

3.1.3.2 WLAN Tab

In the "WLAN" tab the WLAN settings can be configured.

- WLAN Connection
  - WLAN
  - WLAN Access Point
- WLAN Client
  - SSID
  - WLAN-Password
- WLAN TCP/IP Mode
  The IP address can be assigned automatically via DHCP ("DHCP") or manually as fixed IP address ("Static").
  - WLAN IP Address (only active, if the TCP/IP mode is "Static")
    Specify the IP address of the R&S TSMA
    Example: `192.168.1.11`
  - WLAN Subnet Mask (only active, if the TCP/IP mode is "Static")
    Specify the subnet mask for the TSMA
    Example: `255.255.255.0`
  - WLAN Default Gateway (only active, if the TCP/IP mode is "Static")
    Specify the default gateway
  - WLAN DNS Server(s) (only active, if the TCP/IP mode is "Static")
    Specify the DNS server. It is possible to specify a primary and a secondary DNS server.

  With "Submit", the changes will be saved.

3.1.3.3 LAN Tab

In the "LAN" tab the LAN settings can be configured.

- LAN TCP/IP Mode
  The IP address can be assigned automatically via DHCP ("DHCP") or manually as fixed IP address ("Static").
  - LAN IP Address (only active, if the TCP/IP mode is "Static")
    Specify the IP address of the R&S TSMA
    Example: `192.168.1.11`
  - LAN Subnet Mask (only active, if the TCP/IP mode is "Static")
    Specify the subnet mask for the TSMA
    Example: `255.255.255.0`
  - LAN Default Gateway (only active, if the TCP/IP mode is "Static")
    Specify the default gateway
  - LAN DNS Server(s) (only active, if the TCP/IP mode is "Static")
    Specify the DNS server. It is possible to specify a primary and a secondary DNS server.

  With "Submit", the changes will be saved.

3.1.4 File Transfer/Update

In the "File Transfer" window file downloads and uploads from the R&S TSMA can be configured.

Additionally, setups from a connected USB device can be selected and executed to upgrade the R&S TSMA software.

Based on the configured "Mode of Operation", the transferred files will be saved in different source/target directories. These directories are specified for the different applications (ViComServer, Diversity, NESTOR) in the configuration file `MeasurementConfig.xml`, which is part of the firmware and NESTOR installation.

The `MeasurementConfig.xml` can be found in the directory `C:\ProgramData\Rohde-Schwarz\TSMA\MeasConfig`.

```
<!-- ********************************************************************************
Syntax:
  <Config ItemName="ItemName" Value="Item Value" />
   - Every configuration item must have an unique ItemName in the XML file
******************************************************************************** -->

  <!-- Webpage Password -->
  <Config ItemName="WebsitePassword"              Value="894129" />
  <!-- Sections of Website to be protected by Password, true enables protection -->
  <!-- Sections System->Configuration -->
  <Config ItemName="WebsiteProtectSystemConfig"   Value="false" />
  <!-- Sections System->Install Options -->
  <Config ItemName="WebsiteProtectSystemOption"   Value="false" />
  <!-- Sections Connectivity -->
  <Config ItemName="WebsiteProtectConnectivity"   Value="false" />
  <!-- Sections File Transfer->Execute Setup -->
  <Config ItemName="WebsiteProtectExecuteSetup"   Value="false" />

<!-- Nestor Settings -->
  <!-- Root Directory of Nestor Application -->
  <Config ItemName="NestorRootDir"          Value="C:\Program Files\Rohde-Schwarz\NESTOR_1.4\bin" />
  <!-- Name of Nestor Application -->
  <Config ItemName="NestorStartupExe"       Value="RohdeSchwarz.Nestor.exe" />
  <!-- Name of Nestor SlaveApplication -->
  <Config ItemName="NestorSlaveStartupExe"       Value="RohdeSchwarz.Romes.Scanner.Tsma.Watchdog.exe" />
  <!-- Name of Nestor Service ( slave ) -->
  <Config ItemName="NestorSlaveServiceName"       Value="R&amp;S ROMESV TSMA" />
  <!-- Replace with Download-Directory for Nestor -->
  <Config ItemName="NestorDownloadDir"      Value="D:\Users\Instrument\Documents\NESTOR\Measurements" />
  <!-- Replace with Upload-Directory for Nestor -->
  <Config ItemName="NestorUploadDir"        Value="D:\Users\Instrument\Documents\NESTOR\FavoriteWorkspaces" />
  <!-- Directory for Workspaces need as Starup-Parameter -->
  <Config ItemName="NestorWorkspaceDir"     Value="D:\Users\Instrument\Documents\NESTOR\FavoriteWorkspaces\" />


<!-- ViComServer Settings -->
  <!-- Root Directory of ViComServer Application -->
  <Config ItemName="VicomRootDir"          Value="C:\Program Files (x86)\Rohde-Schwarz\ViComServer\" />
  <!-- Name of ViComServer Application -->
  <Config ItemName="VicomStartupExe"       Value="RohdeSchwarz.ViCom.Server.Application.exe" />
  <!-- Replace with Download-Directory for ViComServer -->
  <Config ItemName="VicomDownloadDir"      Value="D:\Download" />
  <!-- Replace with Upload-Directory for ViComServer -->
  <Config ItemName="VicomUploadDir"        Value="D:\Upload" />

<!-- Diversity Settings -->
  <!-- Root Directory of Diversity Application -->
  <Config ItemName="DiversityRootDir"          Value="C:\Program Files (x86)\SwissQual\Diversity\Bin" />
  <!-- Name of Diversity Application -->
  <Config ItemName="DiversitymStartupExe"      Value="SupervisorApplication.exe" />
  <!-- Replace with Download-Directory for Diversity -->
  <Config ItemName="DiversityDownloadDir"      Value="D:\Download" />
  <!-- Replace with Upload-Directory for Diversity -->
  <Config ItemName="DiversityUploadDir"        Value="D:\Upload" />
  <!-- Directory holding the SampleApp -->
```

Figure 3-1: Application Settings in the MeasConfig.xml

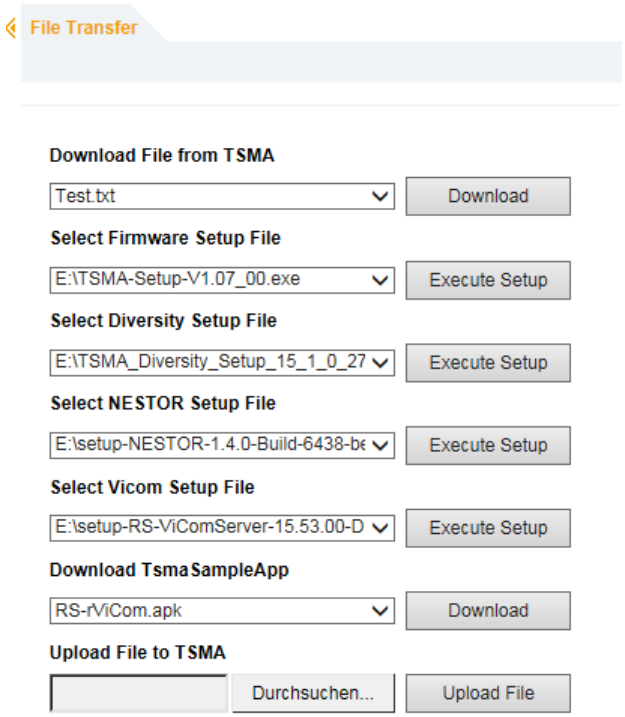


Figure 3-2: File Transfer (Upload and Download) and Software Setup Execution

- Download File from TSMA
  Specifies the measurement data file which should be transferred from the R&S TSMA to a connected device.
  The source directory depends on the "Mode of Operation" and is specified in the `MeasConfig.xml`.
- Select Firmware Setup File
  Specifies a firmware setup file from a connected USB device which can be executed to upgrade the R&S TSMA software.
- Select Diversity Setup File
  Specifies the setup file for the installation of R&S Diversity.
- Select NESTOR Setup File
  Specifies the setup file for the installation of R&S NESTOR
- Select Vicom Setup File
  Specifies the setup file for the installation of R&S Vicom.
- Download TsmaSampleApp
  The TsmaSampleApp is part of the delivery and can be loaded on a remote mobile device (smartphone, tablet PC).
- Upload File to TSMA
  Specifies the file (e.g. workspace file) which should be transferred from a connected device to the R&S TSMA.
  The target directory depends on the "Mode of Operation" and is specified in the `MeasurementConfig.xml`.

3.2 Measurement Setup

In order to start a first measurement with the R&S TSMA, the following steps must be performed.

1. The R&S TSMA must be connected with a power supply (see Chapter 2.3, "Connecting Power Supply", on page 24).

   After a power supply connection is established the device will be booted (Autostart).

   Note: In order to bring the device in the *Scanner Only* mode, press the POWER ON/OFF button for at least 2 s.

2. Via a tablet PC or smartphone, you have to establish a WLAN connection.

   a) Search for a WLAN network. The WLAN server on the R&S TSMA has been started automatically during the boot process of the device.
   b) Connect your tablet or smartphone with the WLAN network. The required information can be found on a label on the bottom side of the R&S TSMA base unit.
   WLAN-Access Point SSID: *TSMA-xxxxxx*
   Key: *instrument*

   The WLAN connection between the tablet PC or smartphone and the R&S TSMA device is established.

3. On the tablet PC or smartphone start a web browser and enter the following URL: *http://192.168.1.10/*

   The configuration web GUI of the R&S TSMA will be started. For details about the web GUI, see Chapter 3.1, "Configuration via Web Interface", on page 35.

4. If the "Mode of Operation" is "rViCom Server", install the sample app on your tablet PC or smartphone. The sample app is available via the following sources.

   - The sample app is part of the R&S rViCom Server installation on the R&S TSMA and can be downloaded to a smartphone via the web interface (Tab "File Transfer" > "Download TsmaSample App", see Chapter 3.1.4, "File Transfer/Update", on page 41).
   - The sample app is part of the R&S ViCom SDK and can be downloaded via the R&S support website http://www.rohde-schwarz.com/en/software/tsma/.

3.3 Restore

With the RESTORE button it is possible to reset the system partition R&S TSMA to the delivery state in case of a software conflict or boot problems.

In order to perform a restore, the RESTORE button must be pressed (more than 5 s) with a sharp object (e.g. pen). During the restore the STATE LED is blinking red.

When the RESTORE procedure has been completed, the STATE LED lights constantly green.

The RESTORE procedure takes up to 15 minutes!

During this time, do not interrupte the procedure or disconnect the power supply!

NOTICE

Loss of user date after RESTORE

Executing restore brings the R&S TSMA irreversible back to the condition of delivery or any other subsequently stored backup version.

All user settings since the last restore will be deleted!

4 Measurement Modes

4.1 Diversity Mode

In order to use the R&S TSMA with QualiPoc®, the following steps must be performed.

Prerequisites

- A scanner license must be installed on the Qalipoc® handheld device.
- On the R&S TSMA, Bluetooth® must be activated and visible (see Chapter 3.1.3.1, "Bluetooth Tab", on page 39).

1. Turn on the R&S TSMA.
2. In QualiPoc®, touch the main menu ⋮, and then touch "Device manager".
3. Touch the plus sign (+) at the top of the screen and touch "NCM".

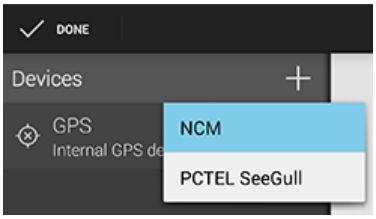


Figure 4-1: Add NCM

Note: The NCM provides the Bluetooth® connection to the scanner.

4. Touch "Scan" at the top of the screen and wait until the scanning process stops.

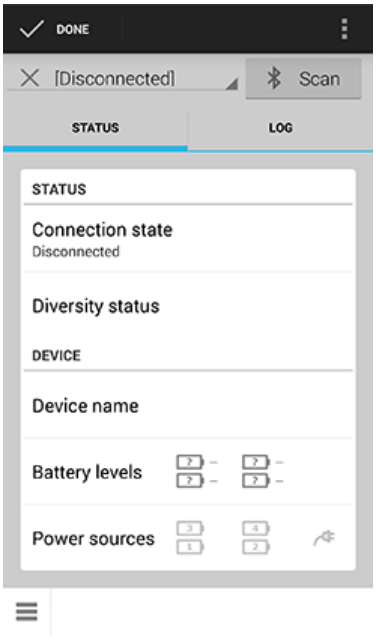


Figure 4-2: Scan for NCM

5. Touch "[Disconnected]", touch the TSMA scanner in the list, for example, "TSMA-900012", and then touch to accept the pairing request.

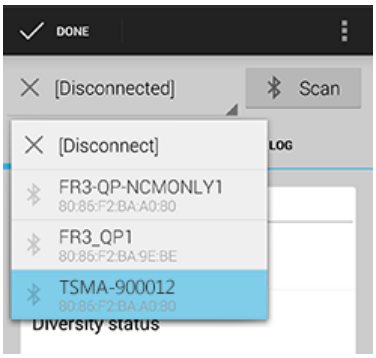


Figure 4-3: Pair NCM

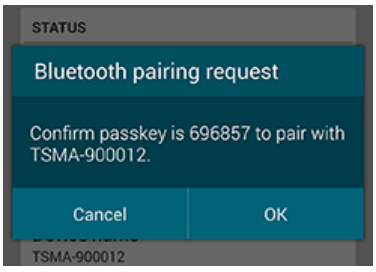


Figure 4-4: Bluetooth pairing request

6. Touch the scanner again in the list to connect to the scanner.
7. Touch the context menu icon ⋮ and touch "Start scanner detection".

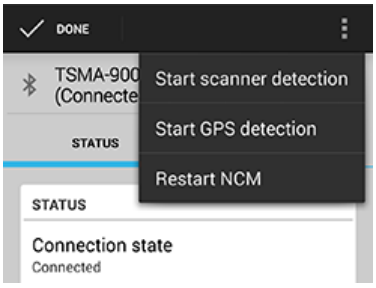


Figure 4-5: Start scanner detection

The scanner appears in the "Devices" list upon successful detection.

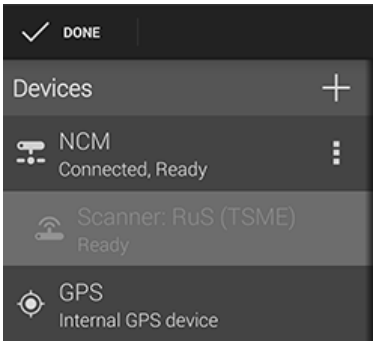


Figure 4-6: Scanner ready

For more details about the QualiPoc configuration and usage, refer to the user documentation for QualiPoc®.

4.2 rViCom Server Mode

In order to use the R&S TSMA in rViCom Server Mode, the following steps must be performed.

4.2.1 Usage of Pre-installed R&S®Remote ViCom Server (rViCom)

By default, R&S®Remote ViCom server is pre-installed on the R&S TSMA.

General Requirements for "rVicom Server" Mode

- The rViCom Sample App must be installed on the tablet/smartphone (see Chapter 2.5.1, "Upgrade/Downgrade of Remote ViCom Server", on page 32).
- The "rViCom Server" mode must be activated via the web interface (see Chapter 2.5.1, "Upgrade/Downgrade of Remote ViCom Server", on page 32)

Requirements for Control via Bluetooth®

1. Switch on Bluetooth® on R&S TSMA (see Chapter 3.1.3.1, "Bluetooth Tab", on page 39).
2. The tablet/smartphone must be paired with the R&S TSMA (see Chapter 3.1.3.1, "Bluetooth Tab", on page 39).

Requirements for Control via WLAN

1. Switch on the WLAN AP on the R&S TSMA (see Chapter 3.1.3.2, "WLAN Tab", on page 40).
2. Switch on WLAN on the tablet/smartphone.
3. Connect the tablet/smartphone with the R&S TSMA WLAN AP.

Operation

1. Start the rViCom Sample App on the smartphone and select the preferred interface (Bluetooth/WLAN).
2. The connected R&S TSMA is displayed and measurements can be configured and started via the smart phone.
   For more details, see Chapter 6, "Introduction to Remote ViCom (rViCom) App", on page 66.

4.3 NESTOR and NESTOR Measurement Probe Mode

In order to use the R&S TSMA with R&S®NESTOR, the following steps must be performed.

Prerequisites:

- R&S TSMA-NESTOR software package must be installed on the R&S TSMA.
  The software package is pre-installed at delivery when the R&S TSMA is ordered with NESTOR TSMA Option. (R&S No. 1522.8870.03).
  Note: The R&S®NESTOR software installation can be executed as a post process to shipment (see Chapter 2.5.2, "Installation of R&S NESTOR", on page 33).
- A dongle containing a smartcard with R&S®NESTOR option licenses must be available.
  Note: If the R&S TSMA is delivered with a pre-installed R&S®NESTOR software, the dongle is integrated inside the TSMA instrument.
- **Only for "NESTOR Measurement Probe" mode**
  The R&S TSMA und the external PC must be connected via WLAN or the LAN port of the R&S TSMA.

Import of NESTOR Workspace File

The following steps are only required, if a workspace should be imported.

1. Change the "Mode of Operation" to "NESTOR" (see Chapter 3.1.2.1, "Config Tab", on page 36) and click "Submit". The TSMA will be rebooted.
2. Connect the USB device containing the NESTOR workspace file with the R&S TSMA.
3. Select in the "File Transfer" window under "Upload File to TSMA" the NESTOR workspace file on the USB device and click "Upload File" (see Chapter 3.1.4, "File Transfer/Update", on page 41).
   The file will be copied in the directory
   `D:\Users\Instrument\Documents\NESTOR\FavoriteWorkspace`.
4. Select your workspace file and click "Submit". The TSMA will be rebooted and starts a NESTOR measurement with the selected workspace file.

In order to use the "NESTOR" or "NESTOR Measurement Probe" mode, the following steps must be performed.

1. Change the "Mode of Operation" to "NESTOR" or "NESTOR Measurement Probe".
2. According to the selected mode, the following steps are required.
   a) When selecting the "NESTOR" mode, a workspace must be selected (see Chapter 3.1.2.1, "Config Tab", on page 36)
   b) When selecting the "NESTOR Measurement Probe" mode, the NESTOR application must be started on the host PC/tablet. Client and Server will detect each other automatically when connected via LAN resp. WLAN.

4.4 PC Mode / ROMES

The "PC Mode" is used in following scenarios:

- Software update of the R&S TSMA
- Usage of distributed R&S®ROMES

In order to use the R&S TSMA with R&S®ROMES, the following steps must be performed.

Use distributed R&S®ROMES **only via LAN** connection (no WLAN)!

Prerequisites:

- R&S ROMES TSMA satellite software (`ROMES_TSMA_setup-x-xx.exe`) has to be installed on the R&S TSMA
- R&S TSMA firewall settings (automatically configured with R&S®ROMES 4.88)

- Connect mouse, keyboard and monitor (optional)
- For settings related to the host PC, refer to the R&S®ROMES documentation

In order to bring the R&S TSMA into distributed ROMES operation, the following steps must be performed:

1. Modify the LAN settings of the R&S TSMA according to the settings of the host PC (see Chapter 3.1.3.3, "LAN Tab", on page 41).
2. Connect the LAN port of the R&S TSMA with the LAN port of the host PC.
3. In the "System" window ("Config" tab) of the web interface, change the "Mode of Operation" to PC Mode (see Chapter 3.1.2.1, "Config Tab", on page 36).
4. Start R&S®ROMES software on the host PC.
5. The "ROMES Satellite" will start on the host PC.
   The detected satellite server can be monitored on the satellite dialog box.

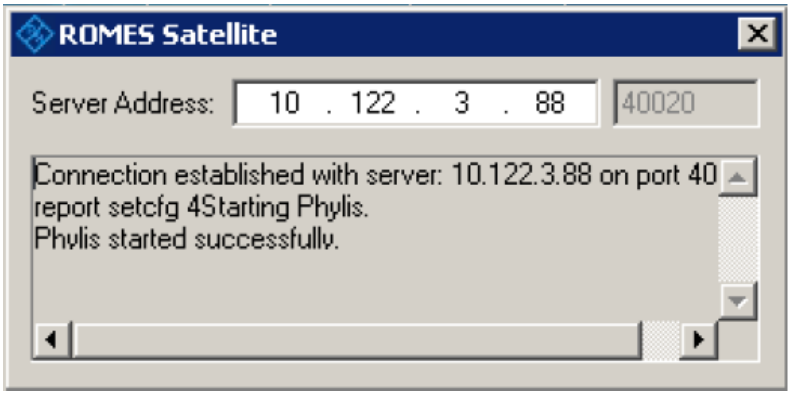


Figure 4-7: Satellite dialog box

6. Once the TSMA has established a connection to a ROMES PC, it will use this ROMES PC as server until the R&S®ROMES Satellite application is stopped or the R&S®ROMES application on the remote PC is stopped..
7. In order to reconnect the TSMA to another ROMES PC, perform one of the following tasks:
   a) Exit the R&S®ROMES Satellite application at the R&S TSMA and restart it.
   b) Reboot the TSMA PC.

By default, the installation creates a link to the R&S®ROMES Satellite application in the Startup menu. Thus, after booting the client will be started automatically.

For more details about the R&S®ROMES configuration and usage, refer to the user documentation for R&S®ROMES.

4.5 Scanner Only Mode

In the *scanner only* mode, only the scanner unit of the R&S TSMA is active, the PC unit is in stand-by mode. In this case, the scanner unit (R&S TSME) can be connected via the SCAN port 1 with a host PC.

In order to use the R&S TSMA in *scanner only* mode, the following steps must be performed.

1. Switch off the R&S TSMA and activate the *scanner only* mode by pressing the POWER ON/OFF button more than 2 s and less than 5 s.
   The STATE LED lights yellow.
2. Connect the scan port (1) with your PC.

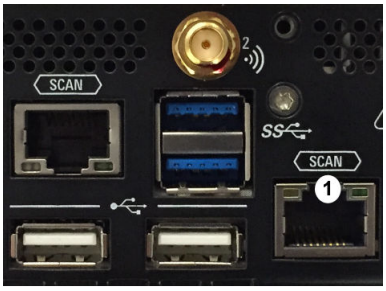


Figure 4-8: Scan ports of R&S TSMA

1 = Scan port to be connected with PC in scanner only mode

The default IP address of the R&S TSMA scanner component is 192.168.0.2.

5 Troubleshooting

5.1 The R&S TSMA could not be remote accessed from a PC via LAN

If no ethernet connection from the host PC could be established, check following issues:

- Check on the rear panel, if the LAN cable is connected to the "LAN" port.
- Check the setting of the R&S TSMA LAN port (see Chapter 3.1.3.3, "LAN Tab", on page 41). The default setting is DHCP client.
- Check if an IP address is displayed in the web interface. Does this IP address match to your remote IP address settings?

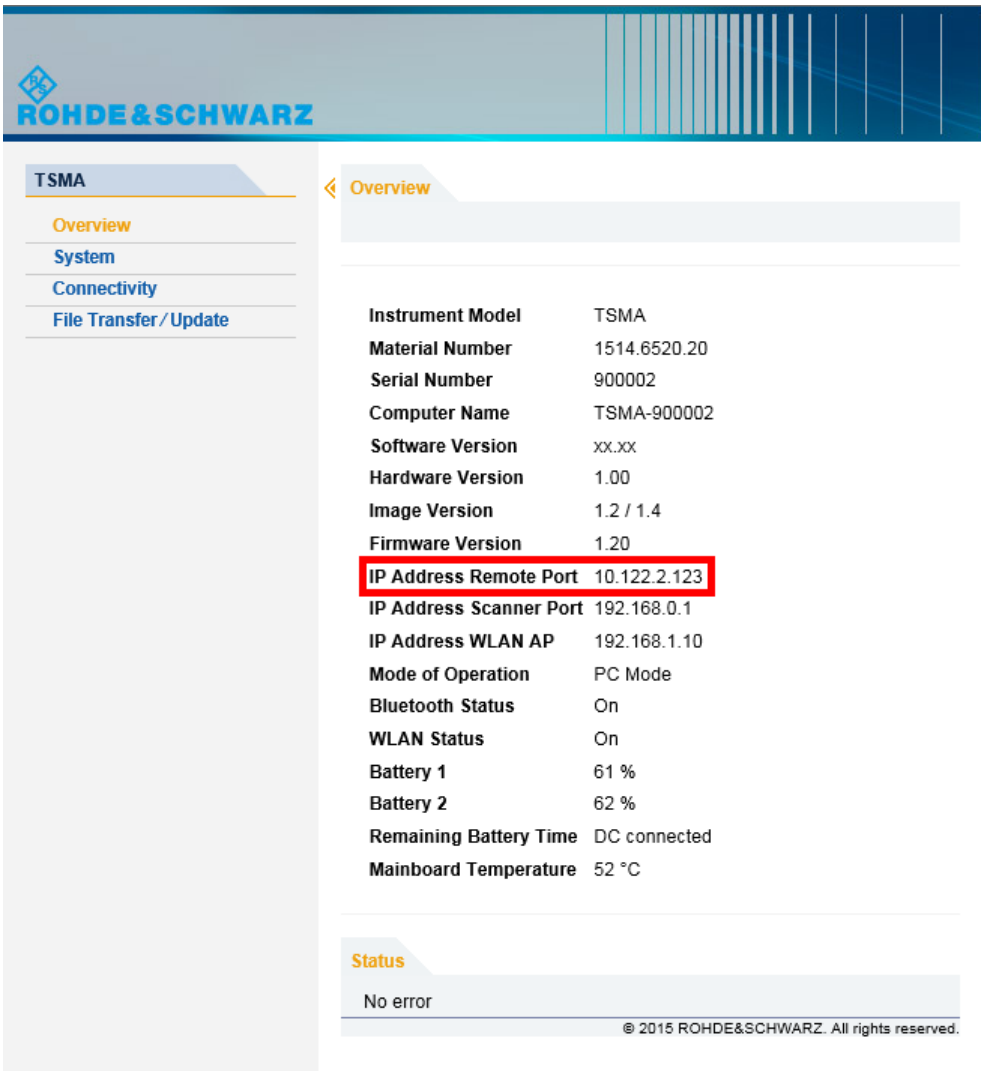


Figure 5-1: Web Interface - Overview

- Check if the TSMA LAN connection is available.
  Navigate to "Windows" > "Control Panel" > "Network and Internet" > "Network and Sharing Center" > "Change Adapter Settings".
  The entry TSMA LAN Connection must be available.

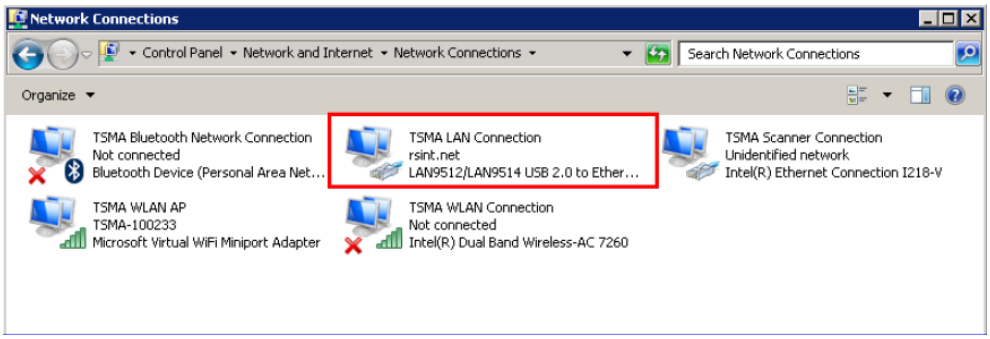


Figure 5-2: TSMA LAN Connection

Ping Command

To check, if the R&S TSMA is connected successfully, it is possible to perform the `ping` commando.

The `ping` command should be executed on the host PC.

1. Find out the IP address of the R&S TSMA via the web interface (see Figure 5-1).
   The web interface can be started in two ways.
   - Start the web interface via WLAN.
   - Start the web interface local on R&S TSMA (mouse, keyboard and monitor required).
     – Start the web browser (Internet Explorer)
     – The predefined start page is `http://localhost`.

   Note: If the web interface can not be started local, contact the R&S support.
2. Check if IP address and subnet mask of the LAN port corresponds with the settings on the host PC and correct these settings, if necessary.
3. Start the ping command again.
   Type in the command line window `ping <IP address of the R&S TSMA>` and wait for the answer.

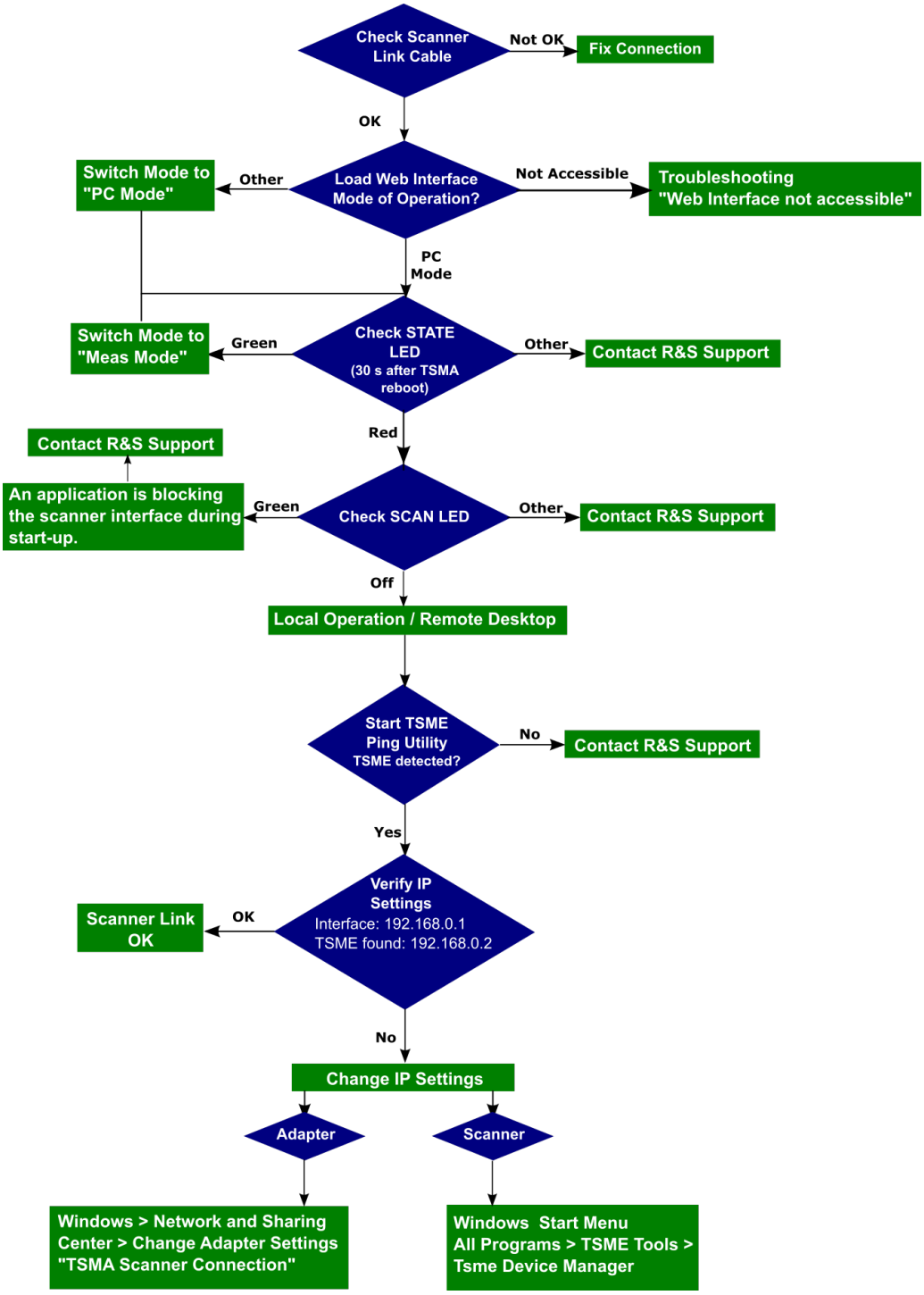
   If the R&S TSMA does not answer, contact the system administrator or the R&S support.

Example:

```
C:\>ping 192.167.0.10
Pinging 192.167.0.10 with 32 bytes of data:
Reply from 192.167.0.10: bytes=32 time<1ms TTL=128
Reply from 192.167.0.10: bytes=32 time<1ms TTL=128
Reply from 192.167.0.10: bytes=32 time<1ms TTL=128
Reply from 192.167.0.10: bytes=32 time<1ms TTL=128
Ping statistics for 192.167.0.10:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

5.2 The Scanner Unit could not be loaded from Software (R&S ROMES, R&S NESTOR)

In order to check if the scanner unit is working properly, perform the following steps.



1. Check if the cabling between the SCAN ports is correct (see Chapter 5.6, "Check the Cabling between Scanner Unit and CPU Unit", on page 63).
2. Start the web interface (see Chapter 2.4.2, "Start the R&S TSMA Web Interface", on page 31) and check the "Mode of Operation".

- If the web interface is not accessible, continue with Chapter 5.7, "R&S TSMA Web Interface not accessible via WLAN", on page 63).
- If the "Mode of Operation" = "PC Mode", continue with step 3
- If the "Mode of Operation" != "PC Mode", switch mode to "PC Mode". After a reboot, continue with step 3.

3. Check the STATE LED. It should turn to green about 30 s after reboot.
   a) STATE LED = green: Scanner Link is OK, continue with step 9.
   b) STATE LED = red: Switch to local operation, see step 5.
4. Check the SCAN Link LEDs on the scanner port of the scanner unit.

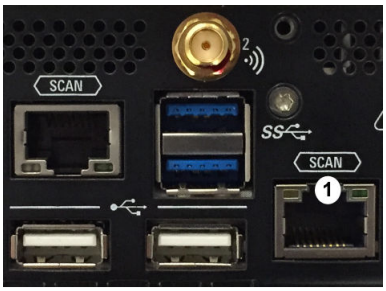


Figure 5-3: Scan port of R&S TSMA

1 = SCAN port to be checked

- The LED on the left side of the port (yellow, link state) must be on constantly.
- The LED on the right side of the port (green, activity state) must flash up each second (1 Hz).

If the link LED is not on or the activity LED is not flashing, contact the R&S support.

5. Connect mouse, keyboard and monitor with the R&S TSMA.
   a) STATE LED = red and SCAN LED = green: A measurement application is blocking the scanner link. In this case, stop the running measurement application (R&S NESTOR, R&S ROMES, R&S ViCom server or Diversity).
   b) STATE LED = red and SCAN LED = off: Continue with step 6.
6. Start the TSME Ping tool via the Windows Start menu:
   "Start > All Programs > R&S TsmeTools > TSME Ping Utility"

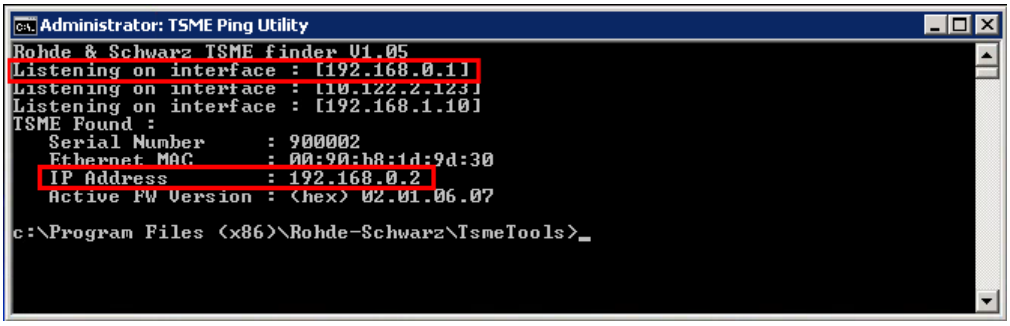


Figure 5-4: TSME Ping Utility - Result

Check the IP addresses in the program window:

- IP SCAN Link port CPU != 192.168.0.x
  Change back the TSMA scanner port in Windows LAN settings
- IP SCAN Link port scanner != 192.168.0.2
  Please contact R&S support.

7. Verify that the SCAN ports are connected via the interconnection cable and reboot the R&S TSMA.
8. If the R&S TSMA scanner can not be detected contact the R&S support.
9. Open a web browser (Internet Explorer).
   The web interface will be started.
   - If "HW Info" is displayed in the web interface, continue with step 10.
10. Start the TSME Device Manager via the Windows Start menu.
    "Start > All Programs > TsmeTools > TsmeDeviceManager"
    - If the R&S TSMA device is found, the scanner unit works properly.
    - If the R&S TSMA device is not found, contact the R&S support.
11. Check the IP setting of the TSMA scanner connection.
    Navigate to "Windows" > "Control Panel" > "Network and Internet" > "Network and Sharing Center" > "Change Adapter Settings".
    The entry TSMA Scanner Connection must be available.

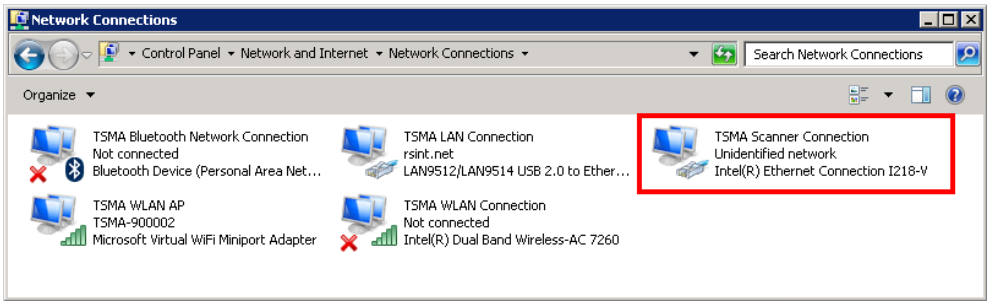
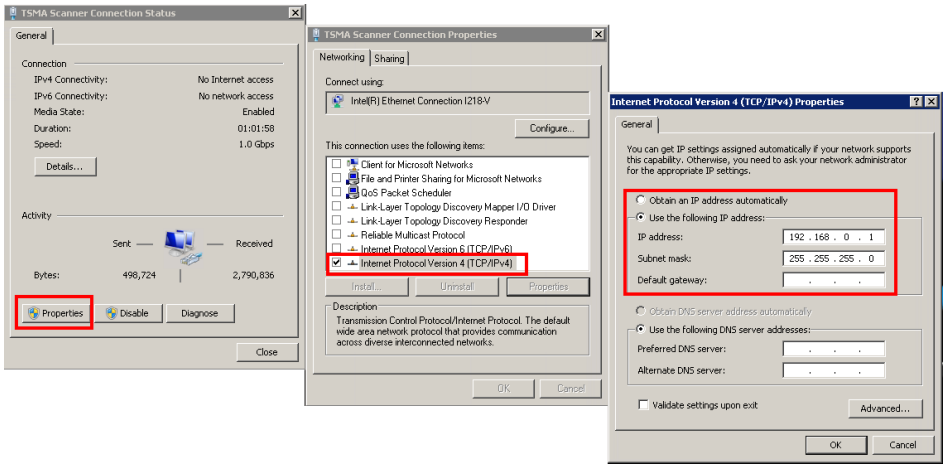


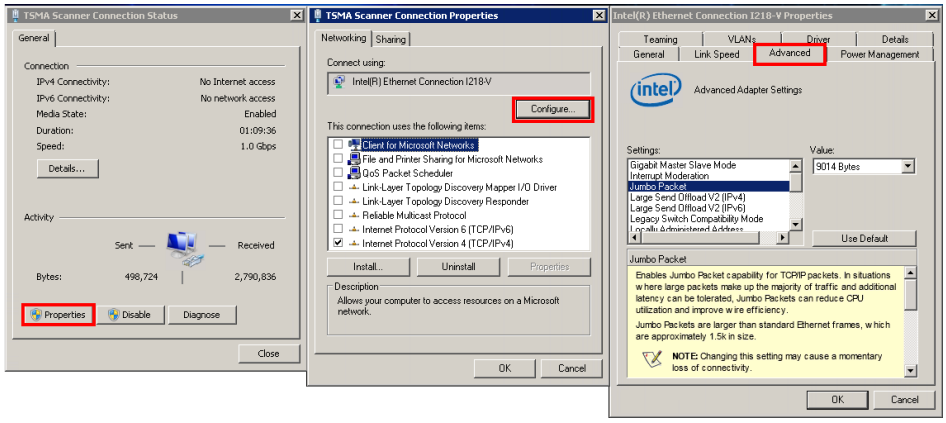
Figure 5-5: TSMA Scanner Connection

a) Double-click the TSMA Scanner Connection entry and verify the following settings.

- IP address: 192.168.0.1 (static IP address)



- Jumbo Packet: 9014 Bytes



5.3 No Navigation Data in R&S ROMES / R&S NESTOR

Check if the GPS antenna is connected to the correct port.

Figure 5-6: R&S TSMA Antenna Cabling - GPS

1 = GPS antenna

5.4 No RF Data

1. Check if the RF antenna is connected to the correct port.

Figure 5-7: R&S TSMA Antenna Cabling - RF

1 = RF antenna

2. Connect mouse, keyboard and monitor with the R&S TSMA for local operation.
3. Open the web interface (Internet Explorer, URL: *http://localhost*) and change the "Mode of Operation" to "PC Mode".
   The R&S TSMA reboots automatically.
4. Start the TSME Device Manager via the Windows Start menu
   "Start > All Programs > TsmeTools > TsmeDeviceManager"

a) If R&S TSMA is accessible via the TSME Device Manager, continue with step 5.
b) If R&S TSMA is not accessible via the TSME Device Manager, continue with Chapter 5.2, "The Scanner Unit could not be loaded from Software (R&S ROMES, R&S NESTOR)", on page 55.

5. Check if there are any error messages in the TSME Device Manager.
   a) If errors are reported, solve the problem and continue with step 6.
   b) If no errors are reported, contact the R&S support.
6. Open the web interface and change the "Mode of Operation" to your required mode. If there are still no RF data, contact R&S support.

5.5 Remote ViCom Sample App on Smart Phone could not connect with R&S TSMA

In order check the connection of the Remote Vicom Sample App on a smart phone with the R&S TSMA, perform the following steps.

1. Check if the WLAN antenna and the Bluetooth antenna are connected properly.

Figure 5-8: R&S TSMA Antenna Cabling - WLAN and Bluetooth

1 = Bluetooth antenna
2 = WLAN antenna

2. Open the R&S TSMA web interface and activate "PC Mode". The unit will reboot.
3. Check the STATUS LEDs of the device (see "STATUS LEDs" on page 14).
   - POWER = blue
   - SCAN = off (No link)
   - STATE = green (SCAN link established)

   a) If the STATUS LEDs are in the states as described above, continue with step 7.

b) If the STATUS LEDs are in a different state as described above, continue with step 4.

4. Restart the R&S TSMA by pressing the POWER button (see Figure 1-3).
5. Open the web interface and check the "Mode of Operation".
   a) If the "Mode of Operation" is "PC Mode", continue with step 6.
   b) If the "Mode of Operation" is not "PC Mode", contact the R&S support.
6. Check the STATUS LEDs.
   a) STATE LED = red and SCAN LED = green: A measurement application is blocking the scanner link. In this case, stop the running measurement application (R&S NESTOR, R&S ROMES, R&S ViCom server or Diversity). Continue with Chapter 5.2, "The Scanner Unit could not be loaded from Software (R&S ROMES, R&S NESTOR)", on page 55.
   b) STATE LED = green and SCAN LED = Off: Continue with step 10.
7. Make sure that WLAN and Bluetooth are activated via the web interface (see Chapter 3.1.3.1, "Bluetooth Tab", on page 39 and Chapter 3.1.3.2, "WLAN Tab", on page 40).
   - Bluetooth Status = On
   - Bluetooth Visibility = Visible
   - Wlan = On
   - Wlan Access Point = On
8. For using the Bluetooth interface.
   Verify, that the tablet/smartphone is paired with the R&S TSMA (see Chapter 3.1.3.1, "Bluetooth Tab", on page 39).
9. For using the WLAN interface
   Verify, that the tablet/smartphone is connected with the TSMA WLAN AP.
10. Activate the "rViCom Server" mode in the web interface (see Chapter 3.1.2.1, "Config Tab", on page 36).

    Note: The R&S TSMA will reboot once you change the "Mode of Operation".
11. Check the STATUS LEDs.
    - POWER = blue
    - STATE = green
    - SCAN = green / green blinking

    a) If the LED states are correct, restart the rViCom Sample App on the Android device and establish the connection to the R&S TSMA.
    b) If the LED states are not correct, contact the R&S support.

5.6 Check the Cabling between Scanner Unit and CPU Unit

In order to have a properly working connection between the scanner unit and the internal CPU unit, you have to check the following:

- Is the scanner link interconnection cable applied to the correct ports (see Figure 5-9)?
- Is the accessory interconnection cable used for this connection?

Figure 5-9: Connection between scanner unit and internal PC unit

1 = SCAN Link port (CPU)
2 = SCAN Link port (Scanner Unit)
3 = Interconnection cable

5.7 R&S TSMA Web Interface not accessible via WLAN

If the R&S TSMA web interface is not accessible via WLAN, perform the following steps to solve the problem.

1. Check if the TSMA WLAN is visible via your smartphone/tablet.
   If it is visible, continue with step 2.
   If it is not visible, continue with step 4.
2. Check if your smartphone/tablet is connected to the TSMA WLAN.
   If the connection is established, continue with step 4.
   If the connection is not established, connect the smartphone/tablet with the TSMA/WLAN.
3. Start the web interface in the smartphone/tablet browser via the following URL: *http://192.168.1.10* and continue with step 9.
   If the web browser displays the message *Page could not be loaded*, continue with step 4.
4. Access to the R&S TSMA operating system via one of the following possibilities:
   - Local access with mouse, keyboard and external monitor

(Login: instrument / PWD. 894129)

- Remote desktop connection via LAN (see Chapter 5.7, "R&S TSMA Web Interface not accessible via WLAN", on page 63)

5. Start the Internet Explorer locally on the R&S TSMA and enter the following URL to open the R&S TSMA web interface.
   http://localhost
   If the web interface can be started, continue with step 9.

6. In the Windows "Start" menu, select "Services" and check the state of the following services.
   - `R&S TSMA` running?
   - `R&S WebServer` running?

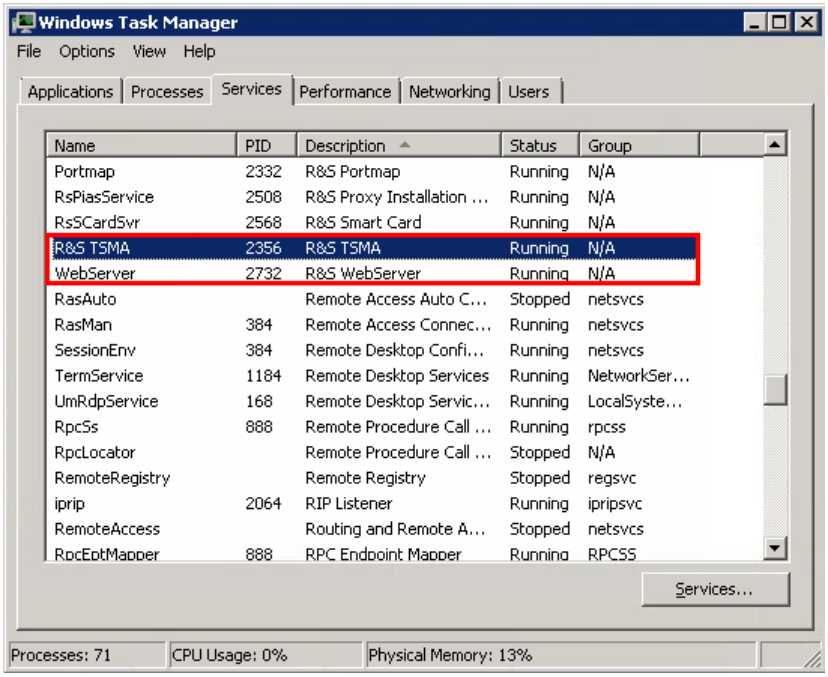


Figure 5-10: R&S TSMA Services

If both services are running continue with step 8.

7. Start the services, that are not running.
   a) Select the service to be started.
   b) Open the context menu with a right-mouse click.
   c) Start the service.

   If the services could not be started, a complete restore must be performed (see Chapter 3.3, "Restore", on page 44).

8. Try again to start the web interface locally on the R&S TSMA via Internet Explorer.
   If the web interface can be started, continue with step 9.
   If the web interface can not be started, a complete restore must be performed (see Chapter 3.3, "Restore", on page 44).

9. In the web interface, navigate to "Connectivity" and check the WLAN status.
   If "Wlan" is "Off" (orange), click "On" button to activate WLAN.
   If "Wlan" is "On" (orange), continue with step 11.
10. If WLAN can be activated, continue with step 12.
    If WLAN can not be activated, a complete restore must be performed (see Chapter 3.3, "Restore", on page 44).
11. Change "Wlan Access Point" to "Off" and wait until "Off" is colored orange, then switch "Wlan Access Point" to "On" and wait until "On" is colored orange.
12. Check on your smartphone/tablet if the WLAN access point is now visible.
    If the WLAN access point is visible, continue with step 3.
    If the WLAN access point is not visible, contact the R&S support.

6 Introduction to Remote ViCom (rViCom) App

6.1 Overview

The R&S TSMA provides an open remote ViCom interface that allows the integration into Windows and Android based software tools. Via rViCom API, it is possible to configure and control TSMA scanner measurements from a remote PC / tablet.

The R&S TSMA is shipped with an rViCom sample application. The source code for this Android based App is also available as sub-component of the R&S ViCom scanner interface. This ready to use application gives the user a quick and easy impression about the capabilities of this API interface.

6.2 Requirements

6.2.1 General Requirements

The following requirements must be fulfilled in order to use this App successfully:

- An Android device with at least Android 4.4.2 (Android 4.4.4 is recommended)
- A WLAN respectively Bluetooth connection between the Android device and the R&S TSMA
- Remote ViCom Server on the R&S TSMA (default)
- An installed Sample App on the Android device
  The version of the rViCom server on the R&S TSMA must match the version of the Sample App on the Android device.

6.2.2 Preparation

Before starting a scan or test it is necessary to make sure that a connection can be established.

Bluetooth Connection

In order to use a Bluetooth connection, turn on the Bluetooth adapter and perform the Bluetooth pairing with the device the server is running on (see Chapter 3.1.3.1, "Bluetooth Tab", on page 39).

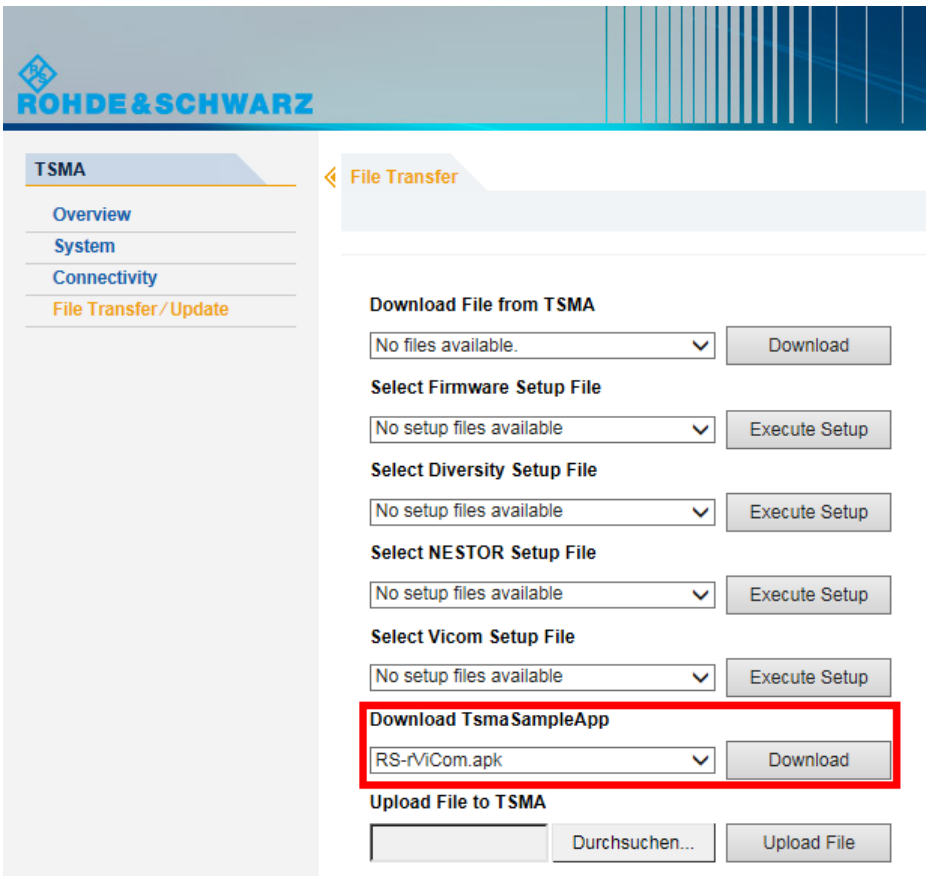
WLAN Connection

In order to use a WLAN connection, establish the connection to the WLAN network with the device the server is running on (see Chapter 3.1.3.2, "WLAN Tab", on page 40.)

Download and Installation of rViCom Sample App

In order to install the rViCom Sample App on an Android device, the followings steps must be performed.

1. Establish a WLAN connection between R&S TSMA and the Android device (tablet/ smartphone).
2. On the Android device, start a web browser and open the R&S TSMA web interface via following URL:
   URL:*http://192.168.1.10*
3. Navigate to "File Transfer/Update" > "Download TsmaSampleApp".



4. Select the Sample App and click "Download".
5. Install the Sample App on the Android device.

6.3 Usage

6.3.1 Connection Establishment

Start the Sample App on the Android device.

6.3.1.1 Connection Type Selection

In order to connect to R&S TSMA, it is either possible to use a WLAN connection or a Bluetooth connection.

The selection of the connection type depends on the measurement task.

The WLAN connection allows a throughput, which is about 10 times higher compared to Bluetooth.

On the other hand, the Bluetooth connection is less influenced by interference.

- For normal LTE, UMTS or GSM measurements, the connection via Bluetooth is sufficient.
- In case of higher data traffic due to more detailed measurements, a connection via WLAN is recommended.

Figure 6-1: Connection Type Selection

6.3.1.2 Server Discovery

In order to connect with an existing server, the following steps must be performed.

Via Bluetooth

1. Choose a connection type, as described in Chapter 6.3.1.1, "Connection Type Selection", on page 68.
2. The server discovery starts and the following dialog appears.

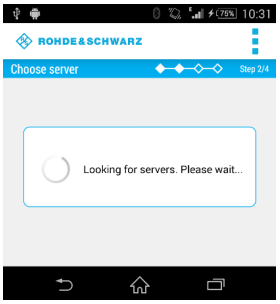


Figure 6-2: Active Server Discovery

3. If a server is found, the server will be connected and the name of the server is displayed.

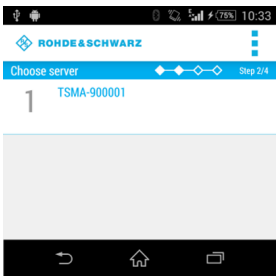


Figure 6-3: Successful Server Discovery

4. Choose the server.

   The "Choose scan type" window opens. See Figure 6-4.

In order to stop the server discovery, the app has to be closed.

If no server was found, it is possible to start a new scan by selecting "Rescan" in the menu inflator in the top right corner.

Via WLAN

The SampleApp tries to find the R&S ViCom Server (IP address 192.168.1.10). If it is available, the "Choose scan type" window appears. See Figure 6-4.

Figure 6-4: Choose scan type

The follwing scan types are available:

- **GSM RSSI Scan**
  Provides a GSM scan by selecting a band and radio channels
- **WCDMA Top-N Pilot Scan**
  Provides an UMTS scan by selecting a frequency band and the UARFCN
- **LTE Top Signal Scan**
  Provides an LTE scan by selecting the frequency band and the EARFCN
- **Throughput Test**
  Provides a throughput test for the connection using configurable buffer size
- **RF Powerscan**
  Provides a spectrum analysis by selecting the frequency range

6.3.2 GSM RSSI Scan

6.3.2.1 GSM Preferences

In order to start a GSM RSSI scan, the following steps must be performed.

1. Choose a frequency band.

   The channels will be set automatically to the maximum range available for the selected band.

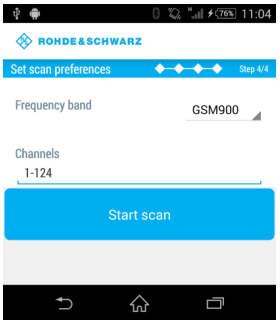


Figure 6-5: Setting the GSM Preferences

2. If necessary, change the channels manually according to your needs. The input in the "Channels" field can be done like following.
   a) Add a single number for one specific channel.
      Example: 7
   b) Add a range of channels.
      Example: 1-124
   c) Add more than one single number separated by semicolon.
      Example: 2;4;7;76
3. Click "Start scan" to start the scan.

6.3.2.2 GSM Scan Results

The GSM scan result graph displays one column for each channel selected. The height of a column represents the RSSI value (in dBm).

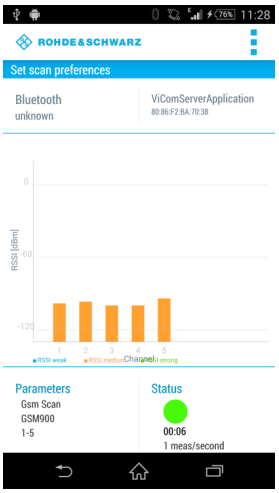


Figure 6-6: GSM Scan Result View

Below the graph the measurement preferences and the status are displayed.

Parameters

Displays the configured preferences for the GSM RSSI scan.

Status

Displays the measurement duration and the measurement rate. The status button displays the following colored states.

- *Green*
  The measurement is running and measurement data will be received
- *Yellow*
  The measurement is running but no measurement data will be received
- *Red*
  The measurement was stopped

► In order to stop the scan, use "Stop scan" in the menu inflator in the top right corner.

6.3.3 WCDMA Top-N Pilot Scan

6.3.3.1 WCDMA Top-N Pilot Preferences

In order to start a WCDMA scan, the following steps must be performed.

1. Choose a frequency band.

   The minimum UARFCN of this band will be set automatically.

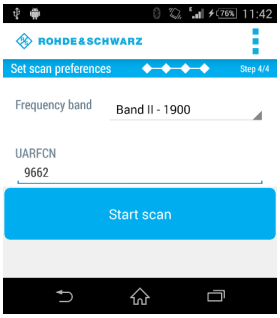


Figure 6-7: Setting the WCDMA Preferences

2. If necessary, change the UARFCN according to your needs.

   Note: Due to processing issues, it is not possible to select more than one UARFCN.

3. Click "Start scan" to start the scan.

In the menu inflator on top of the right corner, templates for existing preferences (Munich and surrounding areas) can be selected.

6.3.3.2 WCDMA Top-N Pilot Scan Results

The WCDMA scan result graph displays one column for each SC found by the measurement. The height of a column represents the RSCP value (in dBm).

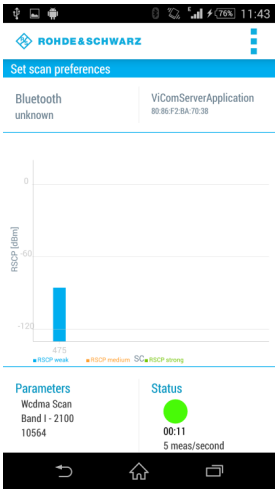


Figure 6-8: WCDMA Scan Result View

Below the graph the measurement preferences and the status are displayed.

Parameters

Displays the configured preferences for the WCDMA scan.

Status

Displays the measurement duration and the measurement rate. The status button displays the following colored states.

- *Green*
  The measurement is running and measurement data will be received
- *Yellow*
  The measurement is running but no measurement data will be received
- *Red*
  The measurement was stopped

► In order to stop the scan, use "Stop scan" in the menu inflator in the top right corner.

6.3.4 LTE Top Signal Scan

6.3.4.1 LTE Top Signal Preferences

In order to start a LTE scan, the following steps must be performed.

1. Choose a frequency band.

   The minimum EARFCN of this band will be set automatically.

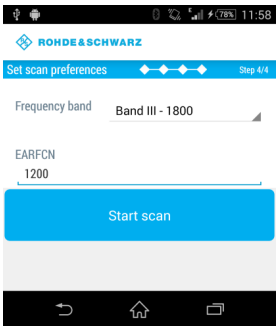


Figure 6-9: Setting the LTE Preferences

2. If necessary, change the EARFCN according to your needs.

   Note: Due to processing issues, it is not possible to select more than one EARFCN.

3. Click "Start scan" to start the scan.

In the menu inflator on top of the right corner, templates for existing preferences (Munich and surrounding areas) can be selected.

6.3.4.2 LTE Top Signal Scan Results

The LTE scan result graph displays one column for each PCI found by the measurement. The height of a column represents the PBCH RSRP value (in dBm).

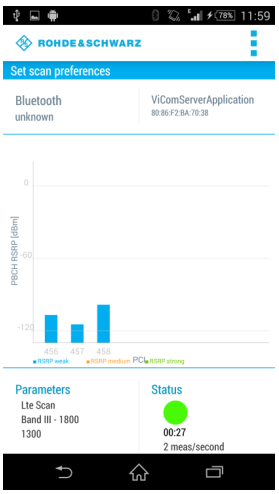


Figure 6-10: LTE Scan Result View

Below the graph the measurement preferences and the status are displayed.

Parameters

Displays the configured preferences for the LTE scan.

Status

Displays the measurement duration and the measurement rate. The status button displays the following colored states.

- *Green*
  The measurement is running and measurement data will be received
- *Yellow*
  The measurement is running but no measurement data will be received
- *Red*
  The measurement was stopped

► In order to stop the scan, use "Stop scan" in the menu inflator in the top right corner.

6.3.5 Throughput Test Case

The throughput test case is useful to find out the throughput speed of your connection. This allows to decide, which connection type (WLAN or Bluetooth) should be used.

6.3.5.1 Throughput Preferences

In order to start the throughput test, the following steps must be performed.

1. Specify the parameter "Buffer size (in Byte)".
   The default buffer size is 20480 byte.

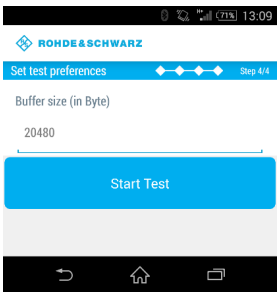


Figure 6-11: Throughput Preferences

2. Click "Start Test" to start the throughput test.

For WLAN, the optimal buffer size varies between 950.000 byte and 1.000.000 byte.
For Bluetooth, the optimal buffer size varies between 81.000 byte and 165.000 byte.

6.3.5.2 Throughput Results

The result of the throughput test case is a line chart with the following axes:

- x-axis
  The x-axis displays the number of measurements
- y-axis
  The y-axis displays the corresponding throughput value (kB/s)

The blue line shows the measured values. The orange line represents the visualized average of all values.

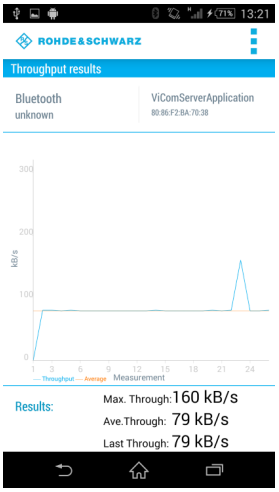


Figure 6-12: Throughput Result View

Below the graph the following throughput results are displayed.

Results

- Max. Through
  Displays the maximum throughput
- Ave. Through
  Displays the average throughput
- Last Through
  Displays the current throughput

► In order to stop the scan, use "Stop scan" in the menu inflator in the top right corner.

6.3.6 RF Power Scan

6.3.6.1 RF Power Scan References

In order to start an RF power scan, the following steps must be performed.

1. Specify the parameters "Start Frequency (in Mhz)" and "End Frequency (in Mhz)" to define the frequency range of the RF power scan.
   The maximum range is from 350 MHz to 4.400 MHz.

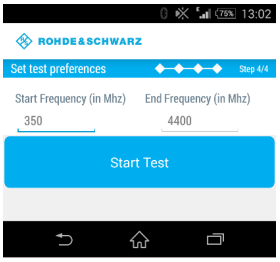


Figure 6-13: RF Power Scan References

2. Click "Start Test" to start the scan.

6.3.6.2 RF Power Scan Results

The result of the RF power scan is a spectrum of the frequency range set before with the following axes:

- x-axis
  The x-axis displays the frequency
- y-axis
  The y-axis displays the power level for each frequency (dBm)

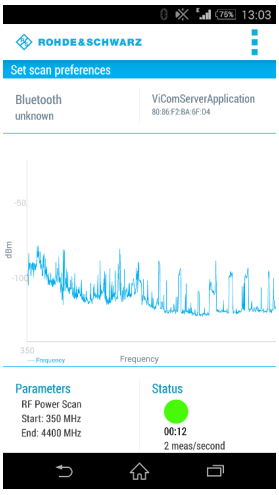


Figure 6-14: RF Power Scan Results

Below the graph the measurement preferences and the status are displayed.

Parameters

- Start
  Displays the start frequency
- End
  Displays the end frequency

Status

Displays the measurement duration and the measurement rate. The status button displays the following colored states.

- *Green*
  The measurement is running and measurement data will be received
- *Yellow*
  The measurement is running but no measurement data will be received
- *Red*
  The measurement was stopped

► In order to stop the scan, use "Stop scan" in the menu inflator in the top right corner.

Annex

A Available Cellular Bands

The following cellular bands are available for selection for R&S TSMAs with a limited band option (see Chapter 1.2.2, "Band Options", on page 12).

Table A-1: Available cellular bands for the R&S TSMA

ID	TSME Band	Span	Start [MHz]	Stop [MHz]
1	"TETRA"	span 1	375	435
		span 2	445	475
		span 3	865	881
		span 4	910	926
2	"CDMA 400"	span 1	410	493
3	"480"	span 1	478	486
		span 2	488	496
4	"700"	span 1	698	862
5	"810"	span 1	806	821
		span 2	851	866
6	"850"	span 1	806	940
7	"900"	span 1	917	960
		span 2	872	915
8	"1400"	span 1	1427	1448
		span 2	1475	1496
9	"PDC Japan"	span 1	1447	1463
		span 2	1495	1511
10	"1500/1600"	span 1	1626	1661
		span 2	1525	1559
11	"AWS"	span 1	1710	1770
		span 2	2110	2170
12	"1700"	span 1	1749	1785
		span 2	1840	1880
13	"1800"	span 1	1710	1785
		span 2	1805	1880
14	"1900"	span 1	1850	1915
		span 2	1930	1995

ID	TSME Band	Span	Start [MHz]	Stop [MHz]
15	"2100"	span 1	1920	1980
		span 2	2110	2170
16	"S-Band"	span 1	2000	2020
		span 2	2180	2200
17	"2600"	span 1	2496	2690
18	"3500"	span 1	3410	3490
		span 2	3510	3590
19	"WiMAX 7.x"	span 1	730	770
		span 2	890	903
		span 3	915	950
20	"WiMAX 8.A/TDD 1900/2000"	span 1	1785	1805
		span 2	1880	1930
		span 3	2010	2025
21	"TDD 1800"	span 1	1800	1830
22	"TDD 1930"	span 1	1930	1990
23	"TDD 2300"	span 1	2300	2400
24	"TDD 3300"	span 1	3300	3400
25	"TDD 3400"	span 1	3400	3600
26	"TDD 3600"	span 1	3600	3800

Table A-2: Additional information on cellular bands

ID	Band Name	Included standardized bands	UL low	UL high	DL low	DL high	Duplex
1	**"TETRA"**	T-GSM 380	380.2	389.8	390.2	399.8	FDD
		T-GSM 410	410.2	419.8	420.2	429.8	FDD
		GSM 450	450.4	457.6	460.4	467.6	FDD
		TETRA 380 to 400	380	390	390	400	FDD
		TETRA 410 to 430	410	420	420	430	FDD
		TETRA 450 to 470	450	460	460	470	FDD
		TETRA 900	870	876	915	921	FDD
		LTE Band 31	452.5	457.5	462.5	467.5	FDD
2	**"CDMA 400"**	CDMA2000/EV-DO Band Class 11 (400 MHz European PAMR Band)	410	483	420	493	FDD
		CDMA2000/EV-DO Band Class 5 (450 MHz Band)	410	483	420	493	FDD
3	**"480"**	GSM 480	478.8	486	488.8	496	FDD

ID	Band Name	Included standardized bands	UL low	UL high	DL low	DL high	Duplex
4	**"700"**	WiMAX 7.A	698	862	698	862	TDD
		CDMA2000/EV-DO Band Class 19 (Lower 700 MHz Band)	698	716	728	746	FDD
		LTE Band 12 (lower 700 A/B/C)	699	716	729	746	FDD
		3GPP WCDMA XII	699	716	729	746	FDD
		LTE Band 17 (lower 700 B)	704	716	734	746	FDD
		GSM 710	698	716	728	746	FDD
		LTE Band 44 TDD	703	803	703	803	TDD
		CDMA2000/EV-DO Band Class 7 (Upper 700 MHz Band)	776	788	746	758	FDD
		Band 13 (upper 700 C)	777	787	746	756	FDD
		WiMAX 7.B	776	787	746	757	FDD
		3GPP WCDMA XIII	777	787	746	756	FDD
		CDMA2000/EV-DO Band Class 18 (700 MHz Public Safety Band)	787	799	757	769	FDD
		LTE Band 14 (upper 700 D)	788	798	758	768	FDD
		3GPP WCDMA XIV	788	798	758	768	FDD
		WiMAX 7.C	788	798	758	768	FDD
		WiMAX 7.D	788	798	758	768	FDD
		GSM 750	777	793	747	763	FDD
		LTE Band 28 (700 APT)	703	748	758	803	FDD
		LTE Band 20	832	862	791	821	FDD
		3GPP WCDMA XX	832	862	791	821	FDD
5	**"810"**	T-GSM 810	806	821	851	866	FDD
6	**"850"**	GSM 850	824	849	869	894	FDD
		3GPP WCDMA V	824	849	869	894	FDD
		LTE Band 5	824	849	869	894	FDD
		LTE Band 26	814	849	859	894	FDD
		LTE Band 18	815	830	860	875	FDD
		CDMA2000/EV-DO Band Class 0 (800 MHz Band)	815	849	860	894	FDD
		CDMA2000/EV-DO Band Class 10 (Secondary 800 MHz Band)	806	901	851	940	FDD
		CDMA2000/EV-DO Band Class 12 (800 MHz PAMR Band)	870	876	915	921	FDD
		3GPP WCDMA VI	830	840	875	885	FDD

ID	Band Name	Included standardized bands	UL low	UL high	DL low	DL high	Duplex
		3GPP WCDMA XIX	830	845	875	890	FDD
		3GPP WCDMA XXVI	814	849	859	894	FDD
		LTE Band 27	807	824	852	869	FDD
		LTE Band 6	830	840	875	885	FDD
		LTE Band 19	830	845	875	890	FDD
		TETRA 900	870	876	915	921	FDD
		CDMA2000/EV-DO Band Class 3 (JTACS Band)	887	925	832	870	FDD
7	**"900"**	P-GSM 900	890	915	935	960	FDD
		E-GSM 900 (includes P-GSM 900)	880	915	925	960	FDD
		R-GSM 900 (includes E-GSM 900)	876	915	921	960	FDD
		3GPP WCDMA VIII	880	915	925	960	FDD
		LTE Band 8	880	915	925	960	FDD
		WiMAX 7.G	880	915	925	960	FDD
		CDMA2000/EV-DO Band Class 9 (900 MHz Band)	880	915	925	960	FDD
		CDMA2000/EV-DO Band Class 2 (TACS Band)	872	915	917	960	FDD
8	**"1400"**	3GPP WCDMA XI	1427.9	1447.9	1475.9	1495.9	FDD
		LTE Band 11	1427.9	1447.9	1475.9	1495.9	FDD
9	**"PDC Japan"**	3GPP WCDMA XXI	1447.9	1462.9	1495.9	1510.9	FDD
		LTE Band 21	1447.9	1462.9	1495.9	1510.9	FDD
10	**"1500/1600"**	CDMA2000/EV-DO Band Class 20 (L-Band)	1626	1660	1525	1559	FDD
		LTE Band 24	1626.5	1660.5	1525	1559	FDD
11	**"AWS"**	3GPP WCDMA IV	1710	1755	2110	2155	FDD
		3GPP WCDMA X	1710	1770	2110	2170	FDD
		LTE Band 4	1710	1755	2110	2155	FDD
		LTE Band 10	1710	1770	2110	2170	FDD
		CDMA2000/EV-DO Band Class 15 (AWS Band)	1710	1755	2110	2155	FDD
		WiMAX 6.A	1710	1770	2110	2170	FDD
12	**"1700"**	3GPP WCDMA IX	1749.9	1784.9	1844.9	1879.9	FDD
		LTE Band 9 (UMTS1700)	1749.9	1784.9	1844.9	1879.9	FDD
		CDMA2000/EV-DO Band Class 4 (Korean PCS Band)	1750	1780	1840	1870	FDD

ID	Band Name	Included standardized bands	UL low	UL high	DL low	DL high	Duplex
13	**"1800"**	DCS 1800	1710	1785	1805	1880	FDD
		3GPP WCDMA III	1710	1785	1805	1880	FDD
		LTE Band 3	1710	1785	1805	1880	FDD
		CDMA2000/EV-DO Band Class 8 (1800 MHz Band)	1710	1785	1805	1880	FDD
		WiMAX 6.C	1710	1785	1805	1880	FDD
14	**"1900"**	PCS 1900	1850	1910	1930	1990	FDD
		3GPP WCDMA II	1850	1910	1930	1990	FDD
		3GPP WCDMA XXV	1850	1915	1930	1995	FDD
		3GPP TDD incl. TD-SCDMA b	1850	1910	1930	1990	TDD
		LTE Band 2	1850	1910	1930	1990	FDD
		LTE Band 35 TDD	1850	1910			TDD
		CDMA2000/EV-DO Band Class 1 (1900 MHz Band)	1850	1910	1930	1990	FDD
		CDMA2000/EV-DO Band Class 14 (US PCS 1.9GHz Band)	1850	1915	1930	1995	FDD
		LTE Band 25 (PCS A-G superset of band 2)	1850	1915	1930	1995	FDD
15	**"2100"**	3GPP WCDMA I	1920	1980	2110	2170	FDD
		LTE Band 1	1920	1980	2110	2170	FDD
		CDMA2000/EV-DO Band Class 6 (2 GHz IMT2000 Band)	1920	1980	2110	2170	FDD
		WiMAX 6.B	1920	1980	2110	2170	FDD
16	**"S-Band"**	LTE Band 23	2000	2020	2180	2200	FDD
		CDMA2000/EV-DO Band Class 21 (S-Band)	2000	2020	2180	2200	FDD
17	**"2600"**	LTE Band 7	2500	2570	2620	2690	FDD
		CDMA2000/EV-DO Band Class 13 (25 GHz IMT-2000 Extension Band)	2500	2570	2620	2690	FDD
		3GPP WCDMA VII	2500	2570	2620	2690	FDD
		CDMA2000/EV-DO Band Class 16 (US 2.5 GHz Band)	2502	2568	2624	2690	FDD
		CDMA2000/EV-DO Band Class 17 (US 2.5 GHz Forward Link Only Band)			2624	2690	FDD (DL only)
		LTE Band 41 TDD	2496	2690	2496	2690	TDD
		WiMAX 3.A	2496	2690	2496	2690	TDD
		WiMAX 3.B	2496	2572	2614	2690	FDD

ID	Band Name	Included standardized bands	UL low	UL high	DL low	DL high	Duplex
		LTE Band 38 TDD	2570	2620	2570	2620	TDD
		3GPP TDD incl. TD-SCDMA d	2570	2620	2570	2620	TDD
18	**"3500"**	3GPP WCDMA XXII	3410	3490	3510	3590	FDD
		LTE Band 22	3410	3490	3510	3590	FDD
19	**"WiMAX 7.x"**	7.x* lower	730	770	730	770	TDD
		7.x* mid	890	903	890	903	TDD
		7.x* higher	915	950	915	950	TDD
20	**"WiMAX 8.A/TDD 1900/2000"**	WiMAX 8.A lower	1785	1805	1785	1805	TDD
		WiMAX 8.A mid	1880	1930	1880	1930	TDD
		WiMAX 8.A upper	2010	2025	2010	2025	TDD
		3GPP TDD incl. TD-SCDMA a (lower)	1900	1920	1900	1920	TDD
		LTE Band 33 TDD	1900	1920	1900	1920	TDD
		3GPP TDD incl. TD-SCDMA c	1910	1930	1910	1930	TDD
		LTE Band 37 TDD	1910	1930	1910	1930	TDD
		3GPP TDD incl. TD-SCDMA f	1880	1920	1880	1920	TDD
		LTE Band 39 TDD	1880	1920	1880	1920	TDD
		3GPP TDD incl. TD-SCDMA a (upper)	2010	2025	2010	2025	TDD
		LTE Band 34 TDD	2010	2025	2010	2025	TDD
21	**"TDD 1800"**	WiMAX 8.G	1800	1830	1800	1830	TDD
22	**"TDD 1930"**	LTE Band 36 TDD	1930	1990	1930	1990	TDD
23	**"TDD 2300"**	LTE Band 40 TDD	2300	2400	2300	2400	TDD
		3GPP TDD incl. TD-SCDMA e	2300	2400	2300	2400	TDD
		WiMAX 1.A	2300	2400	2300	2400	TDD
		WiMAX 1.B	2300	2400	2300	2400	TDD
		WiMAX 2.D (lower)	2305	2320	2305	2320	TDD
		WiMAX 2.D (upper)	2345	2360	2345	2360	TDD
		WiMAX 2.E	2345	2360	2305	2320	FDD
		WiMAX 2.F	2345	2360	2305	2320	FDD
24	**"TDD 3300"**	WiMAX 4.A	3300	3400	3300	3400	TDD
		WiMAX 4.B	3300	3400	3300	3400	TDD
		WiMAX 4.C	3300	3400	3300	3400	TDD
25	**"TDD 3400"**	LTE Band 42 TDD	3400	3600	3400	3600	TDD

ID	Band Name	Included standardized bands	UL low	UL high	DL low	DL high	Duplex
		WiMAX 5L.A	3400	3600	3400	3600	TDD
		WiMAX 5L.B	3400	3600	3400	3600	TDD
		WiMAX 5L.C	3400	3600	3400	3600	TDD
		WiMAX 5L.D	3400	3500	3500	3600	FDD
26	**"TDD 3600"**	LTE Band 43 TDD	3600	3800	3600	3800	TDD
		WiMAX 5H.A	3600	3800	3600	3800	TDD
		WiMAX 5H.B	3600	3800	3600	3800	TDD
		WiMAX 5H.C	3600	3800	3600	3800	TDD

Glossary: Abbreviations

Symbols

1xEvDO: Evolution - Data Optimized

B

BTS: Base Transceiver Station

C

CDMA: Code Division Multiple Access

D

DHCP: Dynamic Host Control Protocol

DL: Downlink

DNS: Domain Name Service

E

EARFCN: E-UTRA Absolute Radio Frequency Channel Number

EMI: Electromagnetic Interference

G

GPS: General Positioning System

GSM: Global System for Mobile Communication

H

HDMI: High Definition Multimedia Interface

L

LAN: Local Area Network

LTE: Long Term Evolution

M

MCS: Modulation and Coding Scheme

MIMO: Multiple Input - Multiple Output

P

PBCH: Physical Broadcast Channel

PCI: Physical Cell ID

R

RNTI: Radio Network Temporary Identifier

RSCP: Received Signal Code Power

RSRP: Reference Signal Received Power

RSSI: Received Signal Strength Indication

S

SC: Scrambling Code

SSID: Service Set Identifier

T

TD-SCDMA: Time Division - Synchronous Code Division Multiple Access

TETRA: Terrestrial Trunked Radio

TTI: Transmission Time Interval

U

UARFCN: UTRAN Absolute Radio Frequency Channel Number

UL: Uplink

W

WCDMA: Wideband Code Division Multiple Access

WLAN: Wireless Local Area Network

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