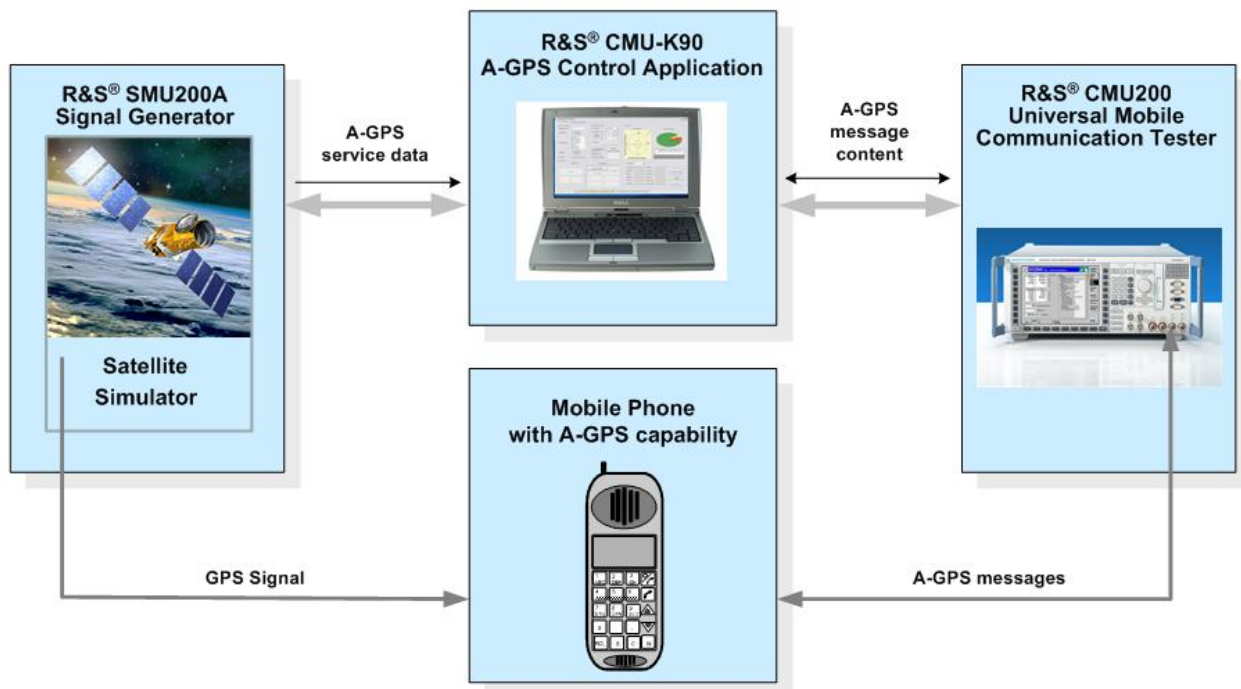


R&S[®] CMU-K90

A-GPS Control Application

Operating Manual



1200.9341.12 – 01

This manual describes the following options for the "Universal Mobile Communication Tester" R&S® CMU200, order no. 1100.0008.02:

- "A-GPS C-Plane", R&S® CMU-K90, order no. 1200.9306.02 (with dongle) and no. 1200.9306.04 (without dongle)

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81671 Munich, Germany

Printed in Germany – Subject to change – Data without tolerance limits is not binding.

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The following abbreviations are used throughout this guide: R&S® CMU200 is abbreviated as R&S CMU200. The options R&S® CMU-Kxx are abbreviated as R&S CMU-Kxx. R&S® SMU is abbreviated as R&S SMU.

Basic Safety Instructions

Always read through and comply with the following safety instructions!









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







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

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

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





Symbols and safety labels

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

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

Tags and their meaning

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

	indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	indicates the possibility of incorrect operation which can result in damage to the product. In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

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

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

Electrical safety

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

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.
3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
6. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages $V_{\text{rms}} > 30 \text{ V}$, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

Basic Safety Instructions

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", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

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

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

Transport

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

2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

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

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


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







Informaciones elementales de seguridad

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.

Símbolos y definiciones de seguridad

							
Aviso: punto de peligro general Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Advertencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)

					
Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Palabras de señal y su significado

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



PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.



ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.



ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.



AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.

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

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

Estados operativos y posiciones de funcionamiento

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

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

Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión $U_{\text{eff}} > 30 \text{ V}$ 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.

Informaciones elementales de seguridad

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

Funcionamiento

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

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

Informaciones elementales de seguridad

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

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

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Certified Quality System

DIN EN ISO 9001 : 2000
DIN EN 9100 : 2003
DIN EN ISO 14001 : 2004

DQS REG. NO 001954 QM UM

QUALITÄT SZERTIFIKAT

Sehr geehrter Kunde,
Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Managementsystems entwickelt, gefertigt und geprüft.
Das Rohde & Schwarz Managementsystem ist zertifiziert nach:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

CERTIFICATE OF QUALITY

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

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

CERTIFICAT DE QUALITÉ

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

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004



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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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1 A-GPS Control Application

The A-GPS control application (option R&S CMU-K90) is a PC-based application which connects to an R&S SMU200A signal generator and an R&S CMU200 universal radio communication tester in order to perform Assisted GPS (A-GPS) tests.

The A-GPS technology is intended to reduce the time needed to determine a location using GPS. It also facilitates location acquisition in environments with poor or variable GPS signal coverage. In A-GPS networks, the mobile phone communicates with an "assistance server" which provides additional information used to acquire satellites more quickly. The assistance server can also perform calculations for the mobile phone. In the A-GPS control application test system, the control application, together with an R&S SMU200A signal generator, plays the role of the assistance server.

In general, an A-GPS test involves two different stages:

- Configuration of the test instruments, connection to the mobile phone under test
- A-GPS test and evaluation of results

The function of the different devices in the two stages is briefly described in the following sections.

1.1 Configuration

The signal flow during the configuration stage is shown below:

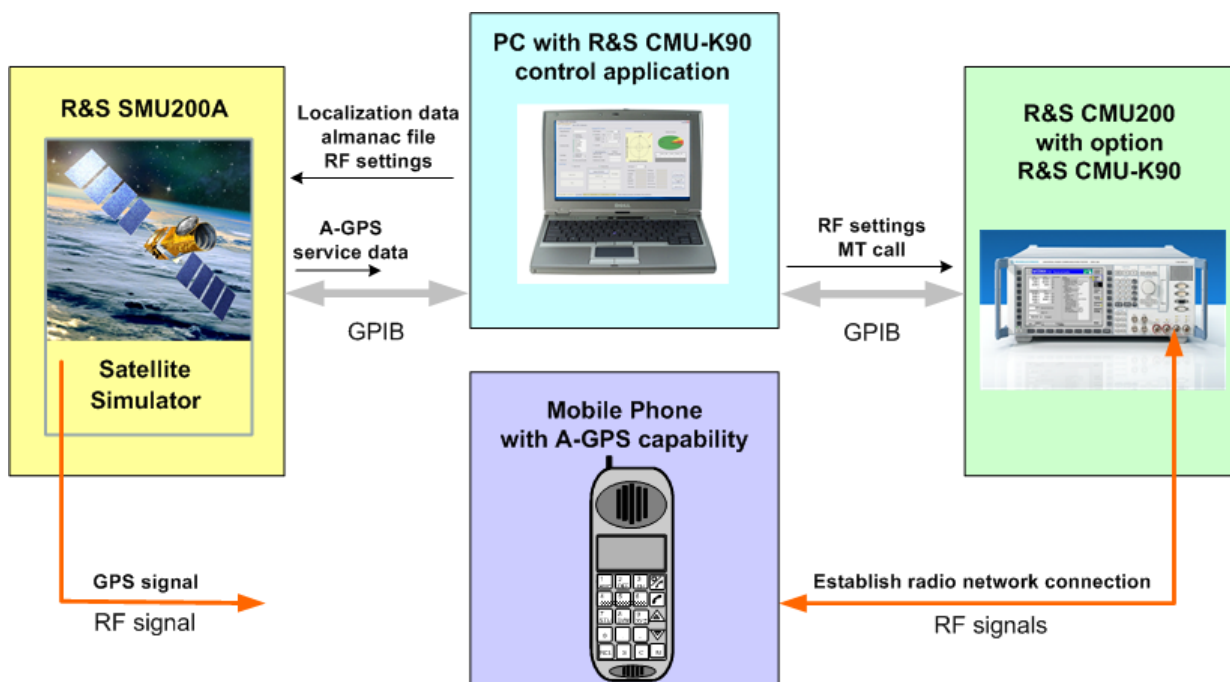


Fig. 1-1: Signal flow during A-GPS test configuration

In the configuration stage, the devices perform the following tasks:

- The **control application** establishes a GPIB connection to the test instruments R&S SMU200A and R&S CMU200. It sends localization information and almanac data to the R&S SMU200A signal generator and controls the basic RF signal properties of the test instruments.
The control application can also command the R&S CMU200 to establish a radio network connection to the mobile phone under test (mobile terminating (MT) call).
- The **R&S SMU200A** adjusts its GPS signals and A-GPS service data according to the information received from the control application.
- The **R&S CMU200** adjusts its DL Radio Access Network (RAN, e.g. GSM or WCDMA) signal in accordance with the settings received from the control application. It either initiates a connection to the mobile under test (mobile terminating call, MT call) or accepts a call from the mobile (mobile originating call, MO call).
- The **Mobile Phone** accepts an MT call from the R&S CMU200 or initiates an MO call to the R&S CMU200.

Note that it is always possible to perform additional settings using the graphical user interfaces (GUIs) of the test instruments or an additional remote control interface.

1.2 Test

The signal flow during the A-GPS test stage is shown below:

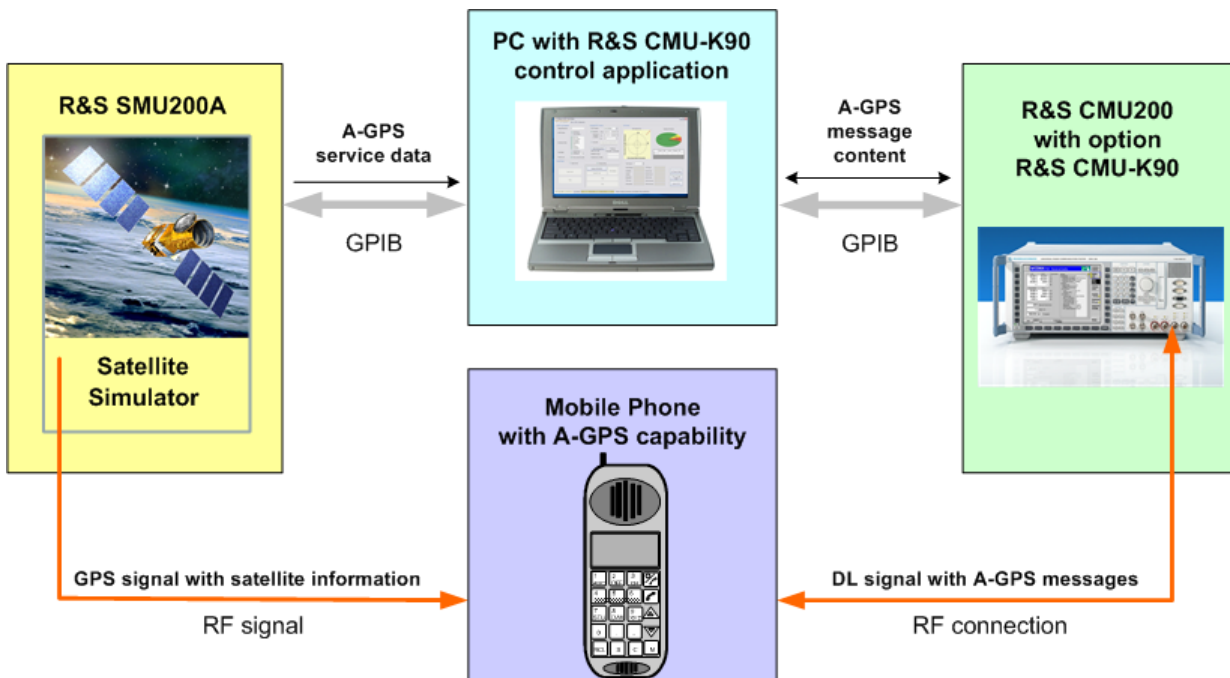


Fig. 1-2: Signal flow during A-GPS tests

In the test stage, the devices perform the following tasks:

- The **control application** controls all stages of the measurement. It adapts the A-GPS service data from the R&S SMU200A signal generator to the selected network standard (GSM, WCDMA) and routes the transformed data to the R&S CMU200. In the opposite direction, it decodes the A-GPS information that the R&S CMU200 received from the mobile phone.
The control application then compares the calculated position of the mobile phone with the original localization data; see [chapter 1.3, "Test Results"](#), on page 7.
- The **R&S SMU200A** generates a GPS signal with up to eight different GPS satellites to simulate positions in accordance with the localization data received during the configuration stage. At the same time, it sends A-GPS data back to the control application.
- The **R&S CMU200** maintains the connection to the mobile phone under test. It converts the A-GPS data from the control application into network-specific A-GPS messages which it transmits over its downlink RF signal. In the uplink, it decodes the A-GPS messages received from the mobile phone and routes the message content to the control application.
- The **Mobile Phone** maintains the radio network connection to the R&S CMU200. It receives the GPS satellite signal from the R&S SMU200A and the A-GPS messages from the R&S CMU200. Depending on the selected operating mode, it either calculates its positions ("Mobile Based" mode) or sends raw measurement data back to the network/R&S CMU200, so that the control application can calculate the positions ("Mobile Assisted" mode).

1.3 Test Results

The purpose of the A-GPS control application is to test the accuracy and speed of a mobile phone's position calculation, based on a received GPS satellite signal and A-GPS data. The basic test result is the distance between the calculated and the simulated position at one point (position error). The control application provides a limit check and various statistical and graphical tools for a thorough analysis. Moreover, it is possible to vary the properties of both the GPS satellite signal and the A-GPS messages during the test.

For a detailed description of test results, refer to the following sections:

- [chapter 4.1.3, "Test Result"](#), on page 24
- [chapter 3.6, "Test Evaluation"](#), on page 16

2 Preparing the Test System for Use

This chapter lists the system requirements for the A-GPS control application and describes everything that you have to do before you use the system for the first time. Skip this chapter if you already have an operable system.

2.1 System Requirements

The A-GPS test system consists of a controller PC and the two test instruments R&S SMU200A and R&S CMU200. The devices must be configured as described in the following sections.

2.1.1 PC Requirements

The A-GPS control application is designed for a PC equipped with a Windows operating system which is connected with an R&S SMU200A and an R&S CMU200.

The PC requirements are as follows:

- Windows XP with Service Pack 2 or higher
- Pentium III or higher processor
- 1 GB hard disk
- CD-ROM drive (recommended, e.g. for installation)
- USB port type A (for Hardlock dongle connection)
- Built-in GPIB interface card (IEEE 488 / IEC 625) or appropriate adaptors (e.g. USB → GPIB) for the GPIB connection to the R&S SMU200A and the R&S CMU200
- VISA library for communication via GPIB interface; see [chapter 2.3, "Test Setup"](#), on page 10.
- Internet connection (optional, for visualization of data using Google Earth and some installations)

Proceed as outlined in [chapter 2.2, "PC Software Installation"](#), on page 9 to install the A-GPS control application and related utilities.

2.1.2 R&S CMU200 Requirements

The R&S CMU200 hardware and software requirements are listed in the separate installation instructions supplied with the option R&S CMU-K90, stock no. 1200.9335.00.

In particular, the R&S CMU200 must have the following software options installed and enabled:

- Option R&S CMU-K90
- For GSM tests: Hardware options R&S CMU-B21V14/V54 and R&S CMU-B54. In addition one of the software options R&S CMU-PK20 or CMU-K2x (at least one GSM band).

- For WCDMA tests: Hardware options R&S CMU-B21V14/V54 , R&S CMU-B68, R&S-B56V14/V54, R&S CMU-U65V02/04 (included in R&S CMU200 basic unit since May, 2005). In addition one of the software options R&S CMU-PK60 or R&S CMU-K65 and R&S CMU-K66 plus R&S CMU-K15/.../17/57/.../K59/61/.../63/67/.../69 (at least one WCDMA band).

2.1.3 R&S SMU200A Requirements

The A-GPS control application requires a two-path signal generator R&S SMU200A.

The signal generator must be equipped with the following options:

- Hardware options R&S SMU-B102 (or R&S SMU-B103/104/106), two options R&S SMU-B11 (or R&S SMU-B9/10), R&S SMU-B13.
- Two software options R&S SMU-K44, "GPS"
- Option R&S SMU-K65, "Assisted GPS"

2.2 PC Software Installation

The A-GPS control application can be installed on a standard PC; the system requirements are listed in [chapter 2.1.1, "PC Requirements"](#), on page 8. The application is subject to license conditions and protected by a Hardlock dongle. Installation files for all necessary software components are delivered on the R&S CMU-K90 software CD-ROM.

Installation of the software components is completely self-explanatory. To install a component, double-click the installation file and follow the instructions of the installation wizard. Installation file names generally contain the software component name, followed by a version number and an extension (.msi or .exe).

To install the R&S CMU-K90 application and test the installation, proceed as follows:

1. Install the "MCT License Proxy".
2. Copy the license file which you received along with the option to the directory `c:\Rohde-Schwarz\License`.
3. Install the R&S CMU-K90 control application software.
4. Connect the USB dongle to one of the USB ports of your PC.
The dongle must be permanently connected to the PC while the control application is running. The red status LED of the dongle must be on.
5. Open the Windows "Start" menu and double-click "Programs > R&S MCT > License Proxy".
The license proxy is started. A running license proxy software is a prerequisite for opening the control application software.
6. Open the Windows "Start" menu and double-click "Programs > R&S CMU-K90 > Control Application".
The control application software is started and is ready to use.

Please read the following sections in case you experience any problems with your installation.


Additional software components, troubleshooting

The R&S CMU-K90 software CD-ROM contains some additional utilities that you may have to install before you can run the control application software.

- The control application software is a .NET Framework 3.5 application. Make sure you have WindowsInstaller 3.1 installed, then double-click the file `dotNetFx35setup.exe` if you wish to install .NET Framework 3.5, or upgrade/repair a previous installation.
- Communication between the license proxy and the Hardlock dongle requires a driver utility. If connection to the dongle fails, install the driver file `hldrv32.exe`.

R&S CMU-K90 Licensing Concept

Together with your A-GPS control application, you received a license file and a Hardlock dongle. An installation file for the "MCT License Proxy" is provided on the application software CD-ROM. To run your control application software, the following conditions must be met:

- The license file must be stored in the directory `c:\Rohde-Schwarz\License`. An entry starting with `CMU_K90` contains the license key for the A-GPS control application.
- The dongle must be connected to the PC, the dongle driver must be installed.
- The License Proxy software must be installed as described above and running in order to periodically verify if the licensing conditions are met. During the installation, the license proxy software adds an icon  to the Windows notification area. Double-click this icon (or click "Start > Programs > R&S MCT > License Proxy") to open the GUI, e.g. if you want to view status information.
The license proxy GUI does not have to be open for normal operation; the license proxy will be started automatically when you re-start your Windows operating system.

For more information refer to the "MCT License Proxy" documentation. To access the help system, open the license proxy GUI and press F1.

2.3 Test Setup

The basic test setup for A-GPS tests is shown below.

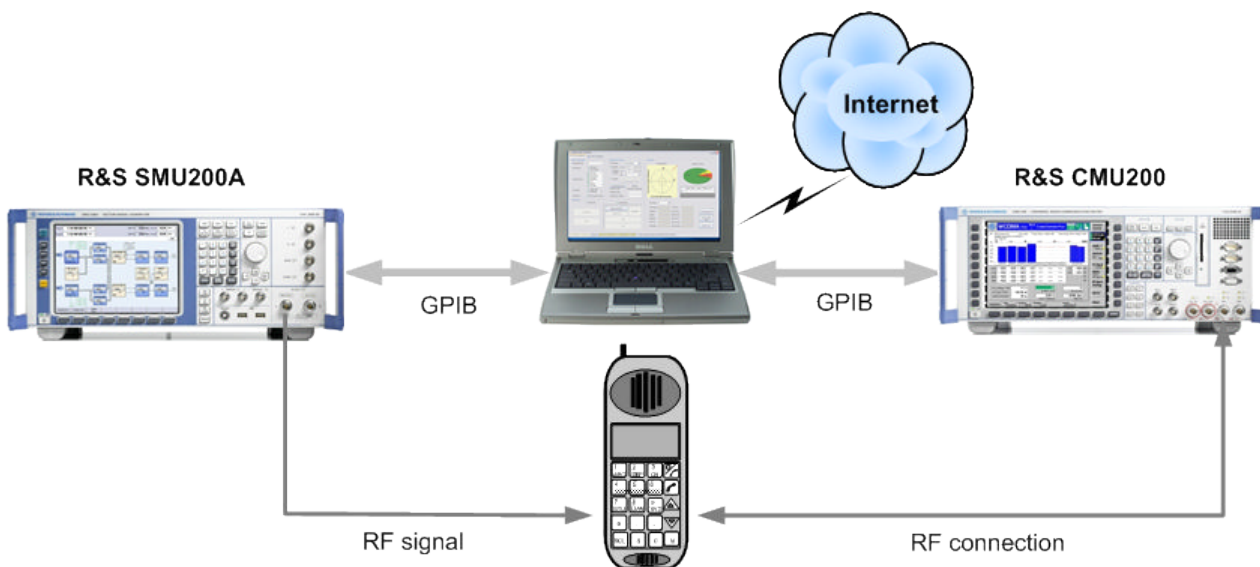


Fig. 2-1: Hardware test setup for A-GPS tests

Connect the different devices as follows:

1. Establish a GPIB connection between the PC and the R&S CMU200. The GPIB bus connector labeled "IEEE 488 / IEC 625" is on the rear panel of the R&S CMU200. If your PC has no built-in GPIB interface card, you can use an appropriate adaptor (e.g. USB-GPIB).
2. Connect the R&S SMU200A to the GPIB bus. The GPIB bus connector labeled "IEEE 488 / IEC 625" is on the rear panel of the instrument.
3. Connect the left RF out A connector (N-type output connector, labeled "A") at the front panel of the R&S SMU200A to the mobile station under test.
4. Connect the bidirectional RF connector labeled RF 2 (N-type connector) at the front panel of the R&S CMU200 to the mobile station under test.

If required, you can also use another RF connector; see ["Network Parameters \(CMU200\)"](#) on page 28.



VISA library

Communication with the R&S SMU200A and the R&S CMU200 requires a NI-VISA installation on the PC. VISA is a standardized software interface library providing input and output functions to communicate with instruments. VISA supports various input/output channels including GPIB connections. See also [chapter 6, "Annexes"](#), on page 39.

When installing NI-VISA ensure to select the following features:

- .NET Framework 1.1 Languages Support
- .NET Framework 2.0 Languages Support

3 Performing an A-GPS Test

This chapter illustrates the basic stages of an A-GPS test. We assume that the test system is properly installed and the devices connected as described in [chapter 2, "Preparing the Test System for Use"](#), on page 8.

The test involves the following steps:

1. Start of the application and setup of the GPIB connection to the test instruments (preparatives); see [chapter 3.1, "Setting up a GPIB Connection"](#), on page 12
2. Definition of RF signal settings (optional), see [chapter 3.2, "Defining RF Signal Settings"](#), on page 13
3. Definition of A-GPS test parameters and simulated GPS scenario, see [chapter 3.3, "Defining Test Settings"](#), on page 14
4. Establishing a radio network connection between the R&S CMU200 and the mobile under test; see [chapter 3.4, "Connecting the Mobile"](#), on page 15
5. Test initialization and execution; see [chapter 3.5, "Initializing and Performing a Test"](#), on page 15
6. Statistical and graphical evaluation of the results; see [chapter 3.6, "Test Evaluation"](#), on page 16

3.1 Setting up a GPIB Connection

After booting up your controller PC, you have to establish a GPIB connection to the R&S SMU200A signal generator and to the R&S CMU200 radio communication tester.



With matching GPIB address settings, the control application will automatically set up the connection when initializing a test. Read the following instructions if automatic connection fails.

To set up the GPIB connection,

1. Open the Windows "Start" menu and double-click "Programs > R&S CMU-K90 > Control Application".

The control application is started. Should you experience any problems, please read [chapter 2.2, "PC Software Installation"](#), on page 9.

2. Open the "CMU & SMU Configuration" tab of the main application window.
3. Ensure that the VISA address string for the R&S SMU200A contains the GPIB address of the instrument.

The following address string corresponds to an R&S SMU200A with a GPIB address "28", which is the default address of the instrument.

SMU VISA Name

4. Select the technology of the radio network connection (e.g. "WCDMA") and ensure that the VISA address string for the R&S CMU contains the primary GPIB address of the instrument and the secondary address of the selected network application.
5. Open the "A-GPS Control Application" tab. In the "Control Panel" press "Step by Step > Configure CMU & SMU" to initiate a connection to the test instruments.

The status bar across the bottom of the main application window shows that the test instruments are connected and ready to operate:



After establishing the GPIB connection, you can send *IDN? queries in order to verify whether the control application has connected to the desired instruments. For more information about GPIB connections refer to [chapter 6.1, "Establishing and Testing GPIB Connections"](#), on page 39.

3.2 Defining RF Signal Settings

The A-GPS test system gives access to the basic RF signal parameters of the test instrument. Change these settings if you wish to perform tests with specific or varying signal properties. Skip this section if you want to use default RF signal settings.

Example:

Suppose you want to use the bidirectional RF connector RF1 (instead of the default connector RF2) to connect your mobile to the R&S CMU200.

To change the connector,

1. Open the "CMU & SMU Configuration" tab of the main application window.
2. Choose the technology of the radio network connection (e.g. "WCDMA") and select "RF Connector: RF1".

The R&S CMU200 will use RF1 for the generated downlink and the received uplink signals.

Example:

Suppose the RF cable connecting your R&S CMU200 to the mobile phone causes a 1-dB attenuation of the uplink and downlink RF signals. You can define an input and output attenuator factor in order to compensate for the effects of the cable.

To define the attenuation factors,

1. Open the "CMU & SMU Configuration" tab of the main application window.
2. Select the technology of the radio network connection (e.g. "WCDMA") and enter "Attenuation In (dB): 1".

The R&S CMU200 will increase its power reading by +1 dB, compensating for the cable attenuation.

- Enter "Attenuation Out (dB): 1".

The R&S CMU200 will increase its DL signal power ("BS Level") by +1 dB in order to compensate for the cable attenuation.

For more information about RF signal settings refer to [chapter 4.2, "CMU & SMU Configuration"](#), on page 27.

3.3 Defining Test Settings

In the left half of the A-GPS Control Application tab, the control application provides the essential test settings.

Suppose that you want to perform an A-GPS test with the following conditions:

- Total GPS Signal Level of -120 dBm.
- Measurement according to GPS Scenario #1, defined in standard 3GPP TS 34.108, section 10.1.2.1.
- Mobile assisted GPS mode
- Provide mobile phone with full set of assistance data
- Single measurement
- 2D Error Limit: 30 m. Tests with position errors beyond 30 m will be failed ("Bad").

To perform the settings described above,

- Open the "A-GPS Control Application" tab of the main application window.
- Configure the "A-GPS Test Parameters" and "Simulated GPS Scenario" panels as shown below.

The screenshot displays the A-GPS Control Application interface with the following settings:

- Simulated GPS Scenario:**
 - GPS Signal Level (dBm):
 - Simulation Scenario:
 - Localization Data:**
 - Fixed Pos: Long: Lat: Alt: m
 - Waypoint:
 - Navigation Data:**
 - Select Almanac File:
 - GPS WK 482:
 - Time of Almanac (TOA):
 - Date [dd.mm.yyyy]:
 - Time [hh:mm:ss (24h)]:
 - Simulation Duration (s):
 - Assistance Data Resolution (s):
- Assistance Parameters:**
 - A-GPS Mode: Mobile Based, Mobile Assisted
 - Assistance Data:
 - Ref Time
 - Ref Location
 - Navigation
 - Ionospheric
 - UTC
 - Almanac
 - Acquisition
 - Timing Offset (ms):
 - GPS Reset: Reset A-GPS receiver before measurement
- Measurement Control Parameters:**
 - Test Mode: Continuous Mode, Single Mode
 - Sleep Interval (ms):
 - 2D Error Limit (m):
 - Report Interval (ms):
 - Max Resp Time (ms):

Buttons at the bottom: Save Test Conf., Recall Test Conf.

For more information about test settings refer to [chapter 4.1.1, "Test Configuration"](#), on page 17.

3.4 Connecting the Mobile

A radio network connection between the R&S CMU200 and the mobile is set up in the usual way, either from the control application (MT call) or from the mobile.

To set up an MT call,

1. Open the "CMU & SMU Configuration" tab of the main application window.
2. In the "Control Panel" press "Step by Step > Start MT Call" and observe the "MS ..." status field in the status bar below.
3. Wait for mobile registration, then accept the call at the mobile. The status field shows that the mobile is connected.

MS Connected

For more details about connection setup refer to the operating manuals for the R&S CMU200 network standards.

3.5 Initializing and Performing a Test

After defining the test settings, you can configure the test instruments and start the test.

- ▶ In the "Control Panel" of the "A-GPS Control Application" tab, press "Quick Start > Quick Start".

The control application configure the test instruments and then automatically start the test. The test result appears in the right half of the "A-GPS Control Application" tab.



Configuration time

The duration of the configuration process generally depends on the amount of calculations that the R&S SMU200A uses in order to generate the assistance data. It is generally short for predefined simulation scenarios. For user-defined scenarios with a large simulation duration, the R&S SMU200A configuration can take one minute or more.



"Step by Step" mode

In "Step by Step" mode, you can initiate test instrument configuration, MT call, and the actual test separately. Press "Step by Step > Start" to repeat the test without re-configuring the test instruments. See [chapter 4.1.2, "Control Panel"](#), on page 23.

3.6 Test Evaluation

The "Test Result" panel allows you to assess the essential results of the measurement at a glance. In the example below, the test described so far was performed twice. The position error in both tests was below the "2D Error Limit".

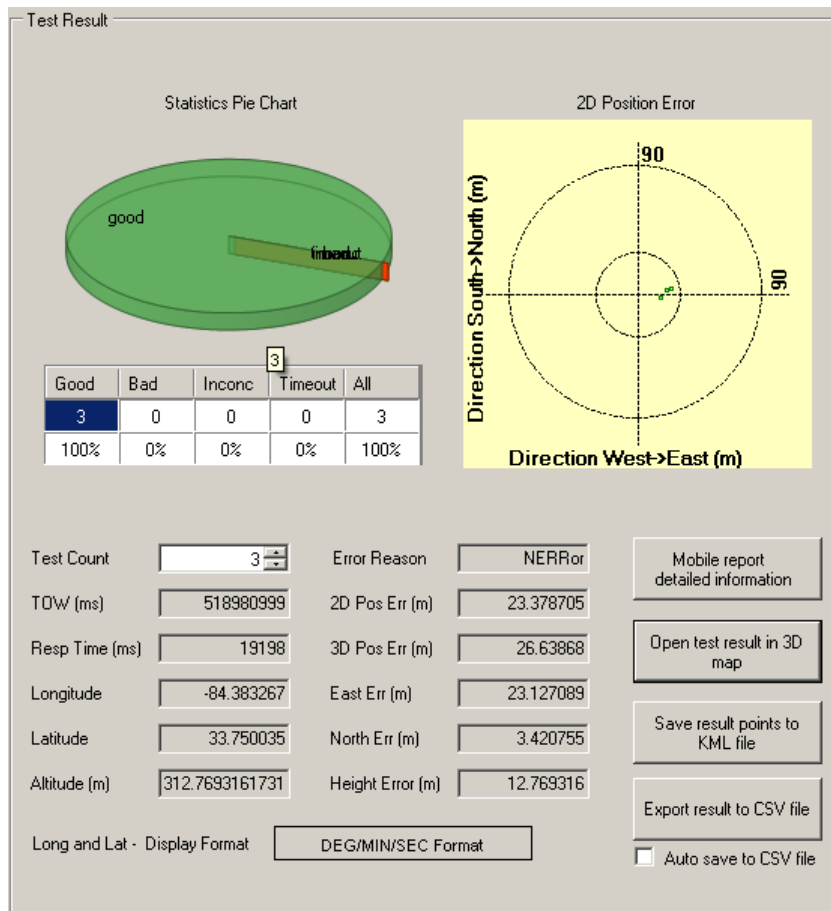


Fig. 3-1: Example of test results

For more information about test results refer to [chapter 4.1.3, "Test Result"](#), on page 24.



Refined test analysis

The control application provides or supports additional tools for a refined test analysis. Refer to the following sections for detailed information:

- [chapter 4.3.2, "Mobile Detailed Report"](#), on page 32
- [chapter 5.1, "Google Maps and Google Earth"](#), on page 36

4 User Interface

The graphical user interface (GUI) of the R&S CMU-K90 control application is divided into two tabs, each of them provides various panels. This chapter describes the settings in the panels and their use.

4.1 A-GPS Control Application

The "A-GPS Control Application" tab is divided in two main areas for test configuration and results plus a status bar across the bottom of the screen.

4.1.1 Test Configuration

The control elements for A-GPS test configuration are arranged in the left half of the "A-GPS Control Application" tab.



Varying the test configuration

Changing the test parameters requires an established GPIB connection between the PC and the test instrument. The settings are updated every time the "Configure CMU & SMU" or the "Quick Start" button is pressed in the "Control Panel".



Save/Recall test configuration

The A-GPS test parameters and the parameters of the simulated GPS scenario can be saved together with the "CMU & SMU Configuration" settings; see ["Save Test Conf."](#) on page 20.

The different panels in the test configuration section are described in the following sections.

4.1.1.1 Simulated GPS Scenario

The settings in this panel are related to the GPS signal level and the A-GPS scenario.

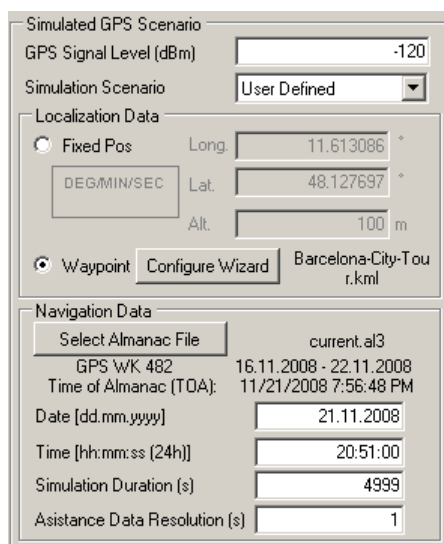


Fig. 4-1: Simulated GPS Scenario

GPS Signal Level (dBm)

Power of all simulated satellites (and thus the total GPS signal power of the R&S SMU200A). In test scenarios where the R&S SMU200 simulates 8 satellites, the power of each satellite is equal to $\langle \text{GPS Signal Level} \rangle - 10 \cdot \log(8) \approx \langle \text{GPS Signal Level} \rangle - 9$ dB. Use low GPS signal levels to test the sensitivity of your mobile phone's RF receiver. You can also vary the GPS signal level using the "Offset" in the "CMU & SMU Configuration" tab; see ["GPS Parameters \(SMU200\)"](#) on page 28.

Simulation Scenario

An A-GPS simulation scenario comprises a set of parameters for A-GPS tests, in particular the designated location (fixed or moving) of the mobile and the almanac data. The R&S SMU200A signal generator selects a constellation of eight satellites with optimum Horizontal Dilution of Precision (HDOP) from the almanach and configures the signals of these satellites according to the selected localization data. The almanac is also used to create A-GPS assistance data (see ["Assistance Data"](#) on page 21).

The signal flow for the simulation scenario data is shown below. The numbers in the figure correspond to the chronological order of the different steps preparing an A-GPS test.

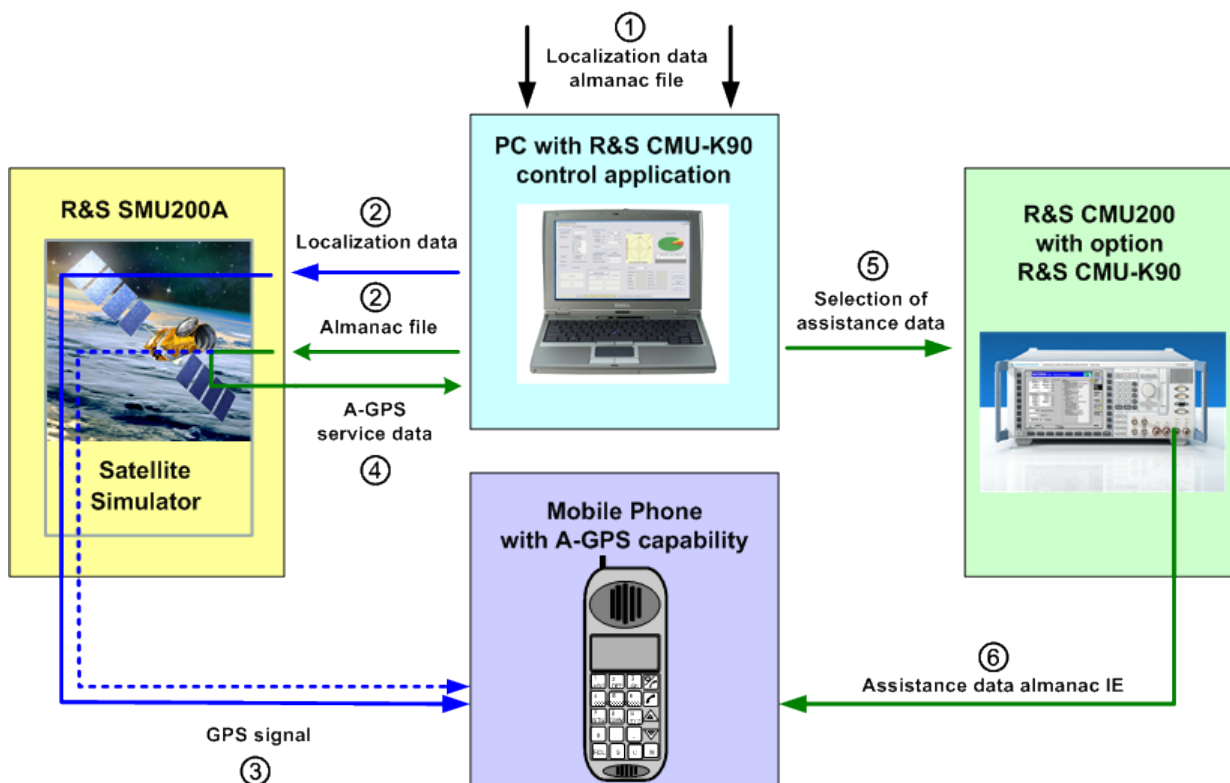


Fig. 4-2: Signal flow during A-GPS test configuration and test preparation

The control application provides predefined and user-defined scenarios.

"Atlanta / Melbourne / Melbourne Moving" Predefined scenarios from the standards 3GPP TS 34.108 (WCDMA) and 3GPP TS 51.010 (GSM). The scenarios termed "Atlanta", "Melbourne Moving", and "Melbourne Moving" correspond to "GPS Scenario#1", "GPS Scenario#2", and "GPS Scenario#3", respectively. The WCDMA and GSM scenarios from the standards are identical.

"User Defined" A-GPS scenario with selectable localization and navigation data.

Localization Data

Position(s) of the mobile under test, used to configure the satellite signals of the R&S SMU200A signal generator (see [figure 4-2](#)).

"Fixed Position" Coordinates (longitude, latitude, altitude) of a single position point.

The longitude and latitude coordinates can be defined in decimal representation or in the format "degrees / minutes / seconds". The sign "+" in decimal representation corresponds to East (E) or North (N), "-" corresponds to West (W) or South (S).

- "From File" Coordinates of one or several position points (paths), stored in a waypoint (KML) file. KML is a file format used by Earth browsers such as "Google Maps", "Google Earth"; see [chapter 6.3, "KML Files"](#), on page 41.
- Note:** A-GPS test along a path. The R&S SMU200 signal uses the coordinates in the waypoint file to interpolate a continuous path. The calculation of the test points on this path is based on a constant time between the waypoints; see [chapter 4.3.1, "Location File Configuration"](#), on page 30.

Navigation Data

Almanac with coarse orbit and status information for each satellite, used to select a satellite constellation and create A-GPS assistance data (see [figure 4-2](#) and ["Assistance Data"](#) on page 21). Due to the satellite movement, the satellite constellation and assistance data also depend on the date and time for each test point.

- "Select Almanac File" Selects an almanac file in or YUMA (*.txt or *.alm) SEM (*.al3) format; see [chapter 6.2, "Almanac Files"](#), on page 39. Sample files in all three supported formats, especially the files for the specified GPS simulation scenarios, are provided with the control application. The GPS week ("GPS WK") and the "Time of Applicability (TOA)" read from the almanac file is displayed in the dialog.
- "Date" Date of simulation. Valid entries are between the date of the TOA and the last day of the GPS WK.
- "Time" Start time of simulation. For A-GPS tests involving several measurements, the time is incremented after each measurement.
- "Simulation Duration" Duration of the flow of assistance data generated by the R&S SMU200A. This duration is an upper limit of the test duration. Values up to 4999 s (approx. 83 minutes) are supported. The amount of calculations to be made upon R&S SMU configuration (and thus the configuration time) increases with the simulation duration. The simulation duration of the predefined test scenarios ("viable running time to maintain specified HDOP values") is 19 minutes.
- "Assistance Data Resolution" Time between two consecutive calculations of the assistance data by the R&S SMU200A. Due to the satellite movement, the assistance data must be updated in regular intervals.

Save Test Conf.

Save the current test parameters to an .xml file. The file contains:

- The settings in the "A-GPS Test Parameter" section
- The "Simulated GPS Scenario" settings
- The "CMU & SMU Configuration" settings

Recall Test Conf.

Recall a set of test parameters that was previously saved to an .xml file.

4.1.1.2 Assistance Parameters

The settings in this panel are related to the exchange and processing of assistance data.

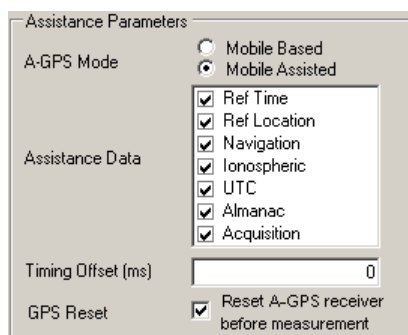


Fig. 4-3: Assistance Parameters

A-GPS Mode

Defines where the positions of the mobile phone under test are calculated. The A-GPS mode has an impact on the detailed test results; see [chapter 4.3.2, "Mobile Detailed Report"](#), on page 32.

"Mobile Based" Position calculation in the mobile. The mobile provides the location estimate, based on the pseudorange measurements made and the received A-GPS data.

"Mobile Assisted" Position calculation by the A-GPS control application. The mobile performs only the pseudorange measurements and provides the basic properties (in particular, the GPS code phases) of the different satellite signals.

Assistance Data

Selects information elements (IEs) that may or may not be included in the A-GPS messages. The different information elements are defined in standards 3GPP TS 34.108 (WCDMA) and 3GPP TS 51.010 (GSM) and in the standards referenced therein.

Including optional assistance data IEs generally facilitates the acquisition of satellite signals and improves the speed and accuracy of the position calculation. If no A-GPS assistance data is provided, the mobile phone has to decode the information from the GPS RF signal; see [figure 4-2](#).

- "Ref Time" Assistance Data Reference Time – time when the A-GPS data set is transferred, containing the GPS Week and the GPS TOW (Time of Week) IEs. The reference time is continuously updated as new A-GPS data sets are transmitted.
- "Ref Location" Assistance Data Reference Location – position of the mobile phone. Depending on the scenario this is either the fixed position of the mobile phone or the first waypoint (for moving scenarios; see ["Localization Data"](#) on page 19).
- "Navigation" Assistance Data Navigation Model – number of satellites, ephemeris information giving the precise orbit of each satellite, and clock correction parameters. The ephemeris information is obtained from the coarse almanac data by interpolation.
- "Ionospheric" Assistance Data Ionospheric Model – parameters that the mobile can use to correct for errors due to propagation delays of the GPS signals through the ionosphere.

"UTC"	Universal Time Coordinate – information to relate GPS-derived time to Coordinated Universal Time (UTC).
"Almanac"	Assistance Data Almanac – number of satellites, coarse orbit and status information for each satellite. The almanac contains a reduced-precision subset of the "Navigation" parameters.
"Acquisition"	Assistance Data Acquisition Assistance – number of satellites, GPS TOW, and satellite information such as the Doppler shift and code phase. The acquisition data enable fast acquisition of the GPS signals in mobile assisted GPS positioning.

Timing Offset (ms)

Offset time between the GPS satellite signals and the assistance data, used to simulate delays occurring in the various signaling interfaces of the network. A negative timing offset delays the GPS satellite signals relative to the assistance data.

GPS Reset

A reset of the A-GPS receiver deletes all stored A-GPS data before a new measurement is started. This can delay the calculation of the results but ensures that they are independent of each other.

In "Continuous" test mode, no "GPS Reset" is performed; see ["Test Mode"](#) on page 22.

4.1.1.3 Measurement Control Parameters

The settings in this panel set the scope of the test and define the evaluation criteria.

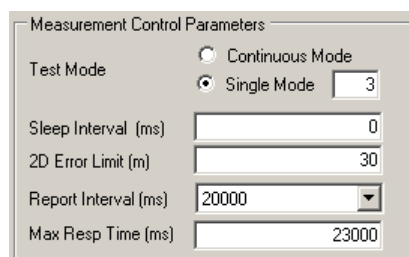


Fig. 4-4: Measurement Control Parameters

Test Mode

Controls the A-GPS data transmissions to and from the mobile and the number of measurements that the control application performs after the test is started. Each "measurement" provides the results for a single test point, no matter whether a fixed location or a moving test scenario is active; see ["Localization Data"](#) on page 19.

"Continuous Mode"	Single A-GPS data transmission to the mobile but continuously repeated measurements until the test is stopped. The control application commands WCDMA mobiles to provide position information in periodic "Reporting Intervals"; see below. GSM mobiles are periodically polled for position information.
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"Single Mode" Evaluation of the specified number of results, with a "Sleep Interval" between consecutive measurements. If "GPS Reset" is active (see ["GPS Reset"](#) on page 22), the mobile re-calculates its position after each measurement.

Sleep Interval (ms)

Delay time between two measurements in "Single" test mode: The interval between the end of measurement no. <n> and the beginning of measurement no. <n+1>.

2D Error Limit (m)

Maximum "2D Distance Error", i.e. the maximum distance between the calculated position of the mobile phone (according to the GPS satellite signals and the A-GPS data received by the mobile) and the simulated position (defined by the localization data). The 2D error limit includes longitude and latitude errors but no altitude errors. It provides the pass/fail criterion for the test result; see [chapter 4.1.3, "Test Result"](#), on page 24 and the scale for the "2D Position Error" diagram.

Reporting Interval (ms)

Only for WCDMA network connections: time between the periodic responses that the mobile, after receiving A-GPS messages, sends back to the R&S CMU200 and the control application. Reporting intervals for A-GPS tests are specified in standard 3GPP TS 34.108.

Max Resp Time (ms)

Maximum time between the request of a set of positioning data by the control application and the response by the mobile under test. If the maximum response time is exceeded the test result class is "Timeout"; see ["Statistics"](#) on page 24.

4.1.2 Control Panel

The "Control Panel" buttons prepare, start, and stop the A-GPS test.

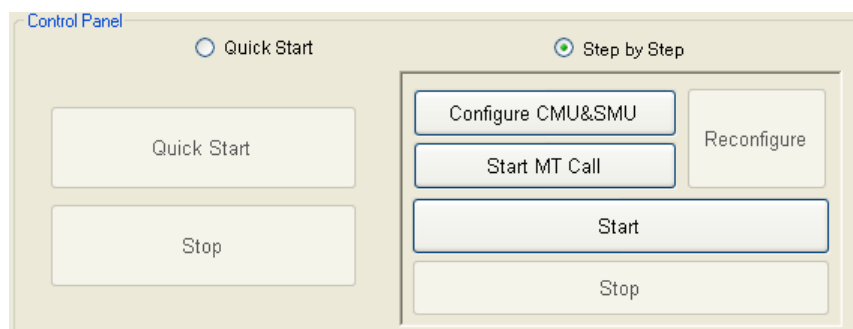


Fig. 4-5: Control Panel for A-GPS tests

- Use the "Quick Start" mode if you wish to configure the test instruments, set up a call to the mobile, and start the test by pressing a single button.
- Use the "Step by Step" mode if you want to perform the actions separately (e.g. to re-start a test using the previous settings).
- Use the "Reconfigure" button to enable a new configuration of the test instruments.



GPIB connection

The control application automatically initiates a GPIB connection in order to configure the test instruments. Check the VISA address strings in the "CMU & SMU Configuration" tab if the connection fails. See also [chapter 6, "Annexes"](#), on page 39.

4.1.3 Test Result

The test results and related control elements are arranged in the right half of the "A-GPS Control Application" tab.

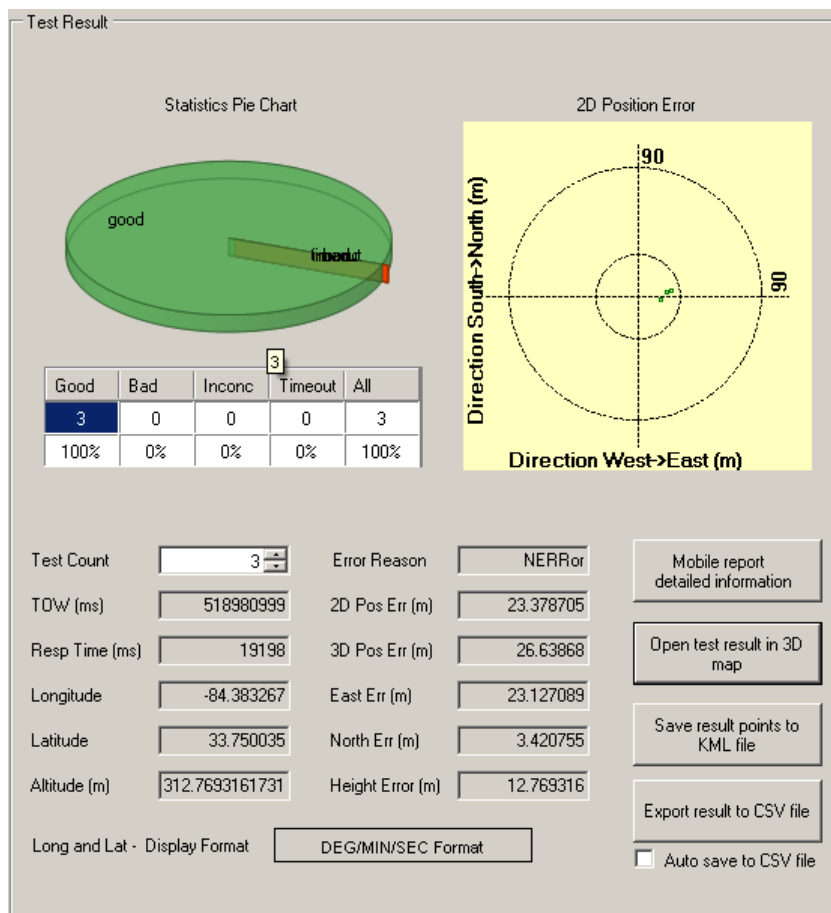


Fig. 4-6: A-GPS test results

Statistics

A statistical evaluation of the test results is displayed in the upper half of the "Test Results" section. The pie chart is a graphical representation of the information in the table below:

"Good" Number and percentage of test points with valid results and with a 2D distance error smaller than the "2D Error Limit" (see "2D Error Limit (m)" on page 23).

"Bad"	Number and percentage of test points with valid results but with a 2D distance error above the "2D Error Limit" (see "2D Error Limit (m)" on page 23).
"Inconc"	Number and percentage of test points where no result could be retrieved because the mobile station was unable to receive the GPS satellite signal or the A-GPS messages. The "Error Reason" for each inconclusive result is displayed in the detailed result section.
"Timeout"	Number and percentage of test points for which the control application could not retrieve positioning data from the mobile within the maximum response time (see "Max Resp Time (ms)" on page 23).

2D Position Error

Polar diagram containing the distance between the calculated position of the mobile phone (according to the GPS satellite signals and the A-GPS data received by the mobile) and the simulated position (defined by the localization data) at each test point. The 2D error includes longitude (West -> East) and latitude (South -> North) errors but no altitude errors. The default radius of the digram is given by the selected "2D Error Limit". A click into the diagram area increases/decreases the radius by a factor of 3.

Results per test point

The result fields in the lower half of the "Test Results" section give an overview of the results at each test point. Press "Mobile report detailed information" to retrieve additional results.

The longitude and latitude coordinates can be defined in decimal representation or in the format "degrees / minutes / seconds". The sign "+" in decimal representation corresponds to East (E) or North (N), "-" corresponds to West (W) or South (S).

"Test Count"	Number of the test. Each test corresponds to a measurement at one test point.
"TOW (ms)"	GPS "Time of Week" returned by the mobile under test with its assistance data. Indicates when the results were acquired.
"Response Time (ms)"	Time between the request of a set of positioning data by the control application and the response by the mobile under test (Time to First Fix, TTFF). Results with a response time beyond the maximum response time (see "Max Resp Time (ms)" on page 23) are marked "Inconclusive".
"Longitude"	Longitude angle of the test point in the selected display format.
"Latitude"	Latitude angle of the test point in the selected display format.
"Altitude (m)"	Altitude of the test point.
"Error Reason"	"No error" (for good or bad results), or decription of the error, e.g. "Assistance data missing".
"2D Dis. Err. (m)"	Distance between the calculated position of the mobile phone (according to the GPS satellite signals and the A-GPS data received by the mobile) and the simulated position (defined by the localization data) at each test point. The 2D error includes longitude and latitude errors but no altitude errors.

- "3D Dis. Err. (m)" Analogous to the "2D Dis. Err.", but including the altitude/height error. This means that the 3D distance error is larger than (or equal to) the 2D distance error.
- "East Err. (m)" Error of the longitude (West -> East) coordinate. A positive sign means that the calculated position is too far east.
- "North Err. (m)" Error of the latitude (South -> North) coordinate. A positive sign means that the calculated position is too far north.
- "Height Err. (m)" Error of the altitude coordinate. A positive sign means that the calculated position is too high. Note that the height accuracy of the GPS system is poorer than the 2D accuracy.

Mobile report detailed information

Opens a dialog box with additional results; see [chapter 4.3.2, "Mobile Detailed Report"](#), on page 32.

Open test result in 3D map

Open "Google Earth" to view the test result.

Note: Before using "Google Earth" for the first time, you have to pass through a registration procedure. See [chapter 5.1, "Google Maps and Google Earth"](#), on page 36 for details.

Save result points to KML file

Save the coordinates of the test position points or paths to a KML file, e.g. for later reuse or for viewing (see ["Localization Data"](#) on page 19).

KML is a file format used by "Google Earth" and other programs; see [chapter 6.3, "KML Files"](#), on page 41.

Export result to CSV file

Save the test results to an ASCII file, to be further processed using Microsoft Excel or similar applications. This step can be performed automatically; see below.

Auto Save to CSV File

If "Auto save to CSV file" is selected, the results are stored to a file when the test is stopped.

4.1.4 Status Bar

The status bar is displayed across the bottom of the screen.

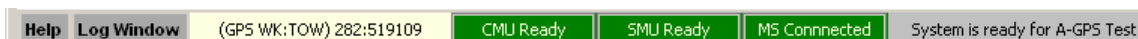


Fig. 4-7: A-GPS status bar

The status bar contains the following element:

- "Help" opens this documentation as a help system.
- "Log Window" opens the "Log Window" dialog (see [chapter 4.3, "Additional Dialogs"](#), on page 29).

- The time field shows the GPS time of the current measurement, as defined by the "Navigation Data" and the "Measurement Control Parameters". Click on the field to change the format between normal date and time and GPS week, time of week (TOW).
- The "CMU" and "SMU" status fields indicate whether the test instruments are idle or connected and ready to operate.
- The MS status field indicates whether the mobile station is unavailable ("MS Error"), idle, registered, or connected and ready to operate.
- An additional text field describes the current status of the control application.
- The progress bar indicates a running configuration, call, or test.

4.2 CMU & SMU Configuration

The "CMU & SMU Configuration" tab defines the GPIB connection parameters for the test instruments and provides basic settings for the RF connections between the test instruments and the mobile phone under test. The RF connection settings (GPS parameters, network parameters) replace or modify the settings made at the test instruments. Change these settings if you wish to vary the conditions for your A-GPS tests in a quick and convenient way.

NOTICE

Varying RF settings

Changing the RF settings requires an established GPIB connection between the PC and the test instrument. The settings are updated every time the "Configure CMU & SMU" or the "Quick Start" button is pressed in the "A-GPS Control Application" tab.



Save/Recall settings

The "CMU & SMU Configuration" is saved together with the A-GPS test parameters and the parameters of the simulated GPS scenario; see "[Save Test Conf.](#)" on page 20.

The screenshot displays the configuration interface for the R&S CMU-K90, divided into three main sections:

- GPS Parameter (SMU200):** Includes fields for SMU VISA Name (GPIB::16::INSTR), Timeout (sec.) (100), and Attenuation (dB) (0). A "Clear Result" button and a green "Connection Good" button are present. Below these is the text: "RohdeSchwarz,SMU200A,1141.2005k02/102719,2.1.79.0-02.05.269.07 beta (Release)".
- Network Parameter (CMU200):** Features a "Network" selector with radio buttons for WCDMA (selected) and GSM. It is split into two sub-panels:
 - WCDMA Parameter:** Fields include CMU VISA Name (GPIB::28::0::INSTR), Timeout (sec.) (100), Band (1), Channel (10562), BS Level (dBm) (-51.7), UE Target Power (dBm) (-20), Attenuation In (dB) (0), Attenuation Out (dB) (0), and RF Connector (RF2).
 - GSM Parameter:** Fields include CMU VISA Name (GPIB::28::0::INSTR), Timeout (sec.) (100), Band (1800MHz), BCCH Channel (735), BCCH level (dBm) (-85), TCH Channel (740), TCH level (dBm) (-90), MS PCL (10), Attenuation In (dB) (7), Attenuation Out (dB) (7), and RF Connector (RF2).
- Remote Control Parameter:** Includes an XML RPC Port field set to 8888.

At the bottom, there are "Test CMU Connection" and "CMU Status" buttons, and a small "*idn?" label.

Fig. 4-8: CMU & SMU Configuration

GPS Parameters (SMU200)

Connection parameters and check button for the GPIB connection to the R&S SMU200A signal generator; see [chapter 6.1, "Establishing and Testing GPIB Connections"](#), on page 39.

"Attenuation" increases/decreases the power of all simulated satellites (and thus the total GPS signal power of the R&S SMU200A, see ["GPS Signal Level \(dBm\)"](#) on page 18) by the specified dB-value. Set this factor in accordance with a known, constant attenuation in the RF signal path between the R&S SMU200 and the mobile phone.

Note: The total RF signal level of the SMU is the sum of the "GPS Signal Level" set in the "A-GPS Control Application" tab (see ["GPS Signal Level \(dBm\)"](#) on page 18) and the "Offset".

Network Parameters (CMU200)

Connection parameters and check button for the GPIB connection to the R&S CMU200 radio communication tester. The GPIB strings for the different network applications (GSM, WCDMA) must contain different secondary addresses; see [chapter 6.1, "Establishing and Testing GPIB Connections"](#), on page 39.

WCDMA Parameters

Parameters of the WCDMA downlink (DL) and uplink (UL) signals:

- "Band" and "Channel" select the channel/frequency of the RF signal; see [chapter 6.4, "WCDMA Bands and Channels"](#), on page 42. A blinking red icon indicates an invalid band/channel combination.
- "BS Level (dBm)" is the total level of the DL WCDMA signal that the R&S CMU200 generates to transfer A-GPS messages to the mobile phone under test.

- "Mobile Target Power (dBm)" is the total signal level of the UL WCDMA signal transmitted by the mobile phone under test that the R&S CMU200 decodes in order to read the returned A-GPS messages. The R&S CMU200 uses Transmit Power Control (TPC) messages to command the Mobile to the target power (closed loop power control).
- "Attenuation In (dB)" and "Attenuation Out (dB)" are correction factors for the power reading and the "BS Level (dBm)" of the R&S CMU200. Set these factors in accordance with a known, constant attenuation in the RF signal path from the mobile phone to the R&S CMU200 and back.
- "RF Connectors" selects the connectors for RF input and output signals.

For detailed information refer to the operating manual for WCDMA UE Tests on the R&S CMU200, stock no. 1115.4962.12.

GSM Parameters

Parameters of the GSM downlink (DL) and uplink (UL) signals:

- "Band" selects the GSM band, "BCCH Channel" and "TCH Channel" select the channel/frequency of the Broadcast Control Channel and the Traffic Channel, respectively. See [chapter 6.5, "GSM Bands and Channels"](#), on page 43. A blinking red icon indicates an invalid band/channel combination.
- "BCCH Level (dBm)" and "TCH Level (dBm)" is the signal level of the DL channels that the R&S CMU200 generates to transfer A-GPS messages to the mobile phone under test.
- "MS PCL" is the signaled Power Control Level (PCL), which determines the power of the UL signal. PCL values from 0 to 31 correspond to nominal UL powers between +39 dBm and +5 dBm (GSM900).
- "Attenuation In (dB)" and "Attenuation Out (dB)" are correction factors for the power reading and the "BS Level (dBm)" of the R&S CMU200. Set these factors in accordance with a known, constant attenuation in the RF signal path from the mobile phone to the R&S CMU200 and back.
- "RF Connector" selects the connector(s) for RF input and output signals. The R&S CMU200 provides bidirectional RF connectors (RF1, RF2) and unidirectional connectors (RF3 OUT, RF4 IN).

For detailed information refer to the operating manual for GSM MS Tests on the R&S CMU200, stock no. 1115.6088.12.

CDMA2000 1xRTT Parameters

Not supported in the present software version.

Remote Control Parameter

Port no. for the "Remote Interface"; see [chapter 5.2, "Remote Interface"](#), on page 38.

4.3 Additional Dialogs

The dialogs in the following sections are opened from the main window of the A-GPS control application.

4.3.1 Location File Configuration

(To open, click "A-GPS Control Application > Simulated GPS Scenario > Localization Data > Configure Wizard")

The "Location file Configuration" dialog is opened if localization data is loaded from a file, see "[Localization Data](#)" on page 19). Location files (waypoint files) are intended for moving test scenarios, where the test points are located along a path.

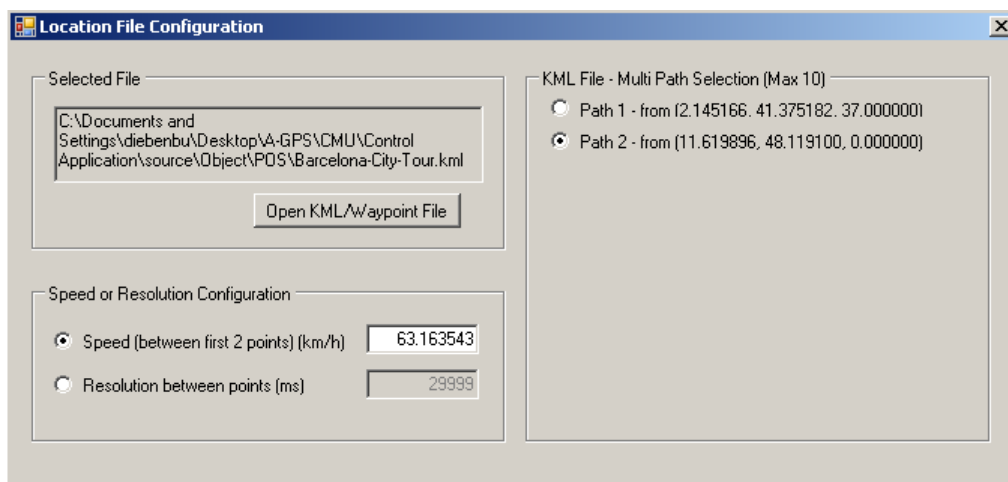


Fig. 4-9: Location File Configuration dialog

A waypoint file may contain one or several paths. Different paths are separated by a <LineString> tag in the waypoint file; see [chapter 6.3, "KML Files"](#), on page 41.

To use data from a waypoint file, the control application needs to know:

- The file name ("Select File"). Sample waypoint files are stored in the "C:\Program Files\Rohde-Schwarz\CMU-K90\POS" directory. You can create and edit waypoint files either manually or (more conveniently) using "Google Earth" (see [chapter 5.1, "Google Maps and Google Earth"](#), on page 36).
- The path ("KML File - Multipath Selection"). The path list shows all paths which contain two or more waypoints. A measurement is always based on a single path.
- The position of the test points along the path, defined by means of either a speed or time resolution parameter.

Test point calculation

The **test points** where measurements are made are generally not identical with the **waypoints** stored in a KML file. The control application derives the test points along the path, assuming a fixed time resolution Δt between consecutive waypoints. For a "Single Mode" measurement with a non-zero "Sleep Interval" this is shown in the following figure.

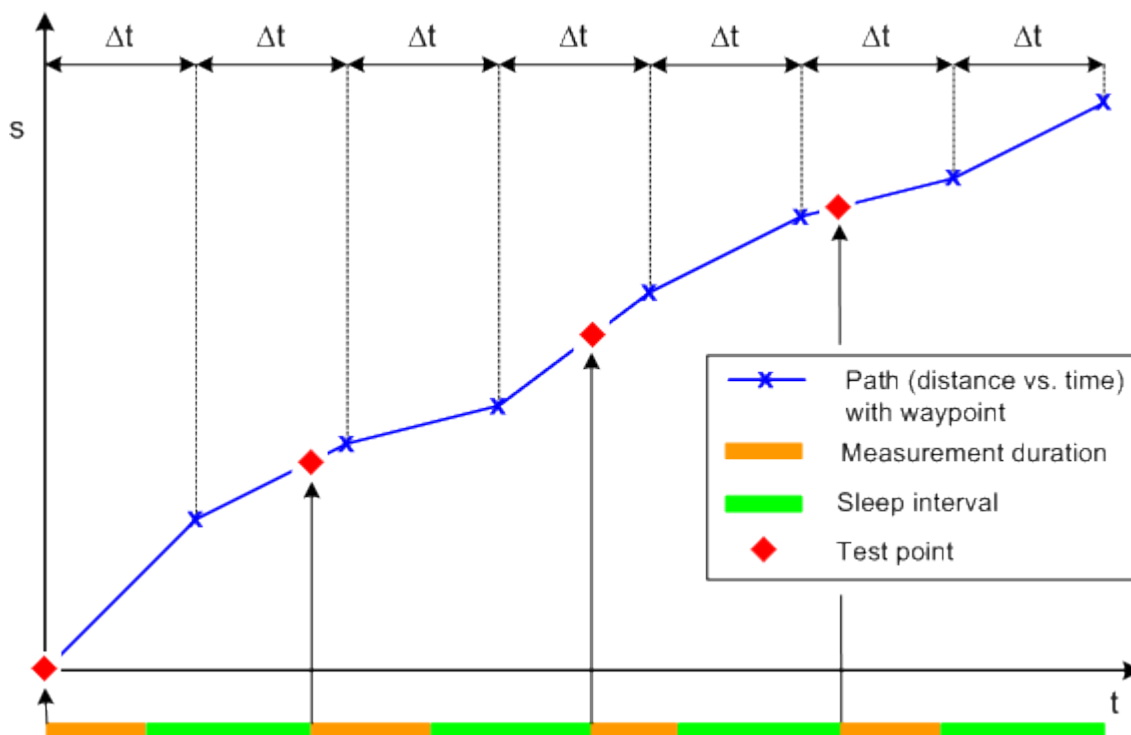


Fig. 4-10: Test points for moving GPS scenarios

The test points are calculated as the position on the path at the beginning of each measurement.

1. Interpolate the waypoints in the KML file to calculate a continuous path. The path is a polygonal curve connecting all waypoints.
2. Take the first waypoint as the first test point.
3. For speed-based calculation: Calculate the resolution as the distance between the first two waypoints Δs divided by the speed v : $\Delta t = \Delta s_1/v$. The speed (i.e. the slope of the blue polygonal curve in figure 4-10) varies after each waypoint because the distance between the waypoints is not necessarily constant ($v_n = \Delta s_n/\Delta t$).
4. For resolution-based calculation: Enter the resolution Δt directly. Derive the speed along the path as described above (speed-based calculation).
5. Calculate each test point as the position on the path at the start time of the measurement.

Each measurement is based on a single test point. The number of measurements made and their timing is controlled by the "Measurement Control Parameters"; the duration of each measurement may also depend on the behavior of the DUT. The number of test points is not correlated with the number of waypoints on the path.

The control application cycles through the path, if the total test time exceeds the time required to move through the path once. The latter is given by $\Delta t * (m - 1)$ where m is the number of waypoints on the path.

4.3.2 Mobile Detailed Report

(To open, click "A-GPS Control Application > Test Result > Mobile Report Detailed Information")

The results in the "Mobile Detailed Report" dialog complement the information in the main application window (see [chapter 4.1.3, "Test Result"](#), on page 24). The contents depend on the selected A-GPS mode (see ["A-GPS Mode"](#) on page 21).

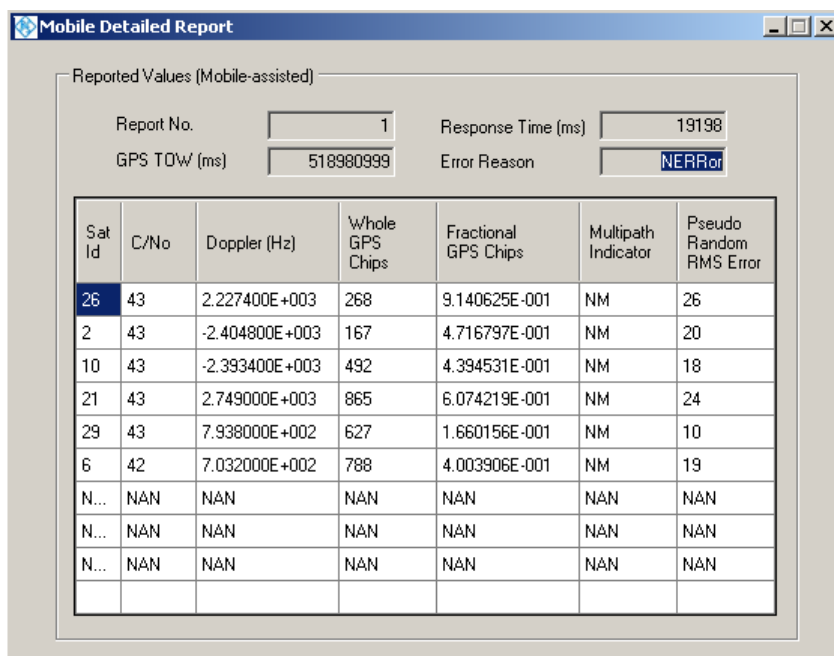


Fig. 4-11: Mobile Detailed Report dialog in mobile assisted A-GPS mode

In mobile assisted mode, where the control application performs the position calculation, the dialog provides the following information:

- General information about the test point ("Report No.", "GPS TOW", "Response Time", "Error Reason"). This information is also displayed in the main application area; see ["Results per test point"](#) on page 25.

- Properties of the received satellite signals, as measured by the mobile phone. The mobile uses a "GPS Measurement Information Element"(see standard 3GPP TS 44.031) to transmit the satellite measurement results to the R&S CMU200 and the control application.
 - Satellite ID – PRN (Pseudo-Random Noise) number used to identify the satellite.
 - C/N_0 – estimate of the carrier-to-noise ratio of the received signal from the particular satellite. The results are integer dB-values in the range 0 to 63.
 - Doppler – Doppler shift for the satellite signal in the range ± 6553.6 Hz. The Doppler shift is used to compute the 3D velocity of the MS.
 - Whole Chips – whole (integer) value of the code-phase measurement made by the mobile, in units of 1 GPS chip and in the range from 0 to 1022 chips.
 - Fractional Chips – fractional value of the code-phase measurement made by the mobile. The resolution is approximately 0.3 m.
 - Multipath Indicator – error estimate of the position uncertainty due to multipath propagation. "Not measured" (NM), "Low" (multipath error < 5 m), "Medium" (5 m < multipath error < 43 m), or "High" (multipath error > 43 m).
 - Pseudorange RMS Error – estimated RMS error of the pseudorange (code phase) measurements in the range 0,5 m to 112 m.

"Not a Number" (NAN) indicates that a result is not available, e.g. because the mobile could not detect all satellites.

Reported Values (UE-based)			
Report No.	1	Uncertainty Code	NAN
Response Time (ms)	3979	Uncertainty semi-major	16
GPS TOW (msec)	518965004	Uncertainty semi-minor	8
Latitude Sign.	NORTH	Orientation of major axis	11
Latitude	3.374995E+001	Uncertainty Altitude	19
Longitude	-8.438337E+001	Confidence	39
Altitude Direction	HEIGHT	Error Reason	NERRor
Altitude (m)	307		

Fig. 4-12: Mobile Detailed Report dialog in mobile-based A-GPS mode

In mobile based mode, where the mobile phone performs the position calculation, the dialog provides the following information:

- Uncertainty of the calculated mobile position, described by the size and orientation of an error ellipsoid ("Uncertainty Semi-Major", "Uncertainty Semi-Minor"), the altitude uncertainty ("Uncertainty Altitude"), and a "Confidence" level. The "Uncertainty Code" gives a textual description of the uncertainty. The parameters are similar to the parameters in the "UE positioning GPS reference UE position IE"; see standards 3GPP TS 34.108 (WCDMA) and 3GPP TS 51.010 (GSM).
- The remaining results are also displayed in the main application area; see ["Results per test point"](#) on page 25.

4.3.3 Log Window

(To open, click "Log Window" in the status bar of the "A-GPS Configuration" tab)

The "Log Window" contains a chronological record of messages describing the actions of the control application, the test instruments, and the mobile phone under test. You can write the message list to a file, e.g. for fault tracking.

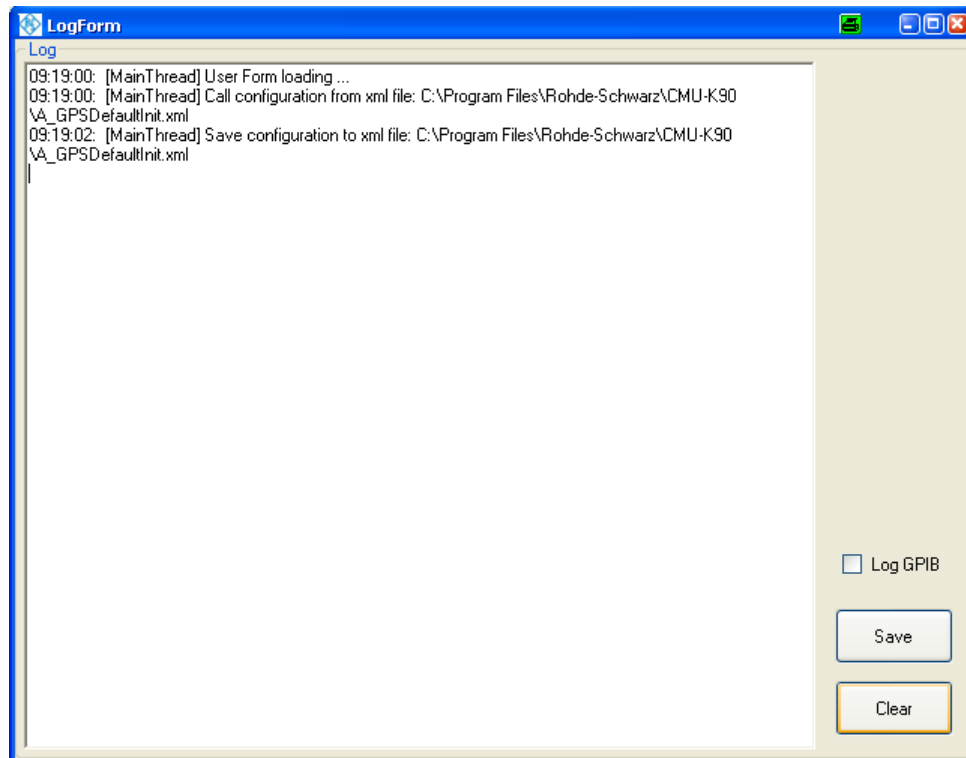


Fig. 4-13: Log Window



GPIB message logging

The control application exchanges GPIB (SCPI) messages with the R&S CMU200 in order to organize the A-GPS data traffic to and from the mobile under test. The GPIB messages are normally displayed in the remote control screen of the R&S CMU200, however, you can also include them in the message log. For a documentation of the GPIB messages refer to the operating manuals for WCDMA UE Tests on the R&S CMU200, stock no. 1115.4962.12, and for GSM MS Tests on the R&S CMU200, stock no. 1115.6088.12.

5 Extended Test Functionality

This chapter describes extensions of the basic test functionality using additional tools and third-party software.

5.1 Google Maps and Google Earth

The A-GPS control application can interface to the "Google Earth Plugin" and "Google Earth". "Google Earth" provides an extended functionality but must be installed as an additional program (see below).

Combining the Earth browsers with the control application allows you to do the following:

- Display the simulated and calculated test point positions in a map. Both "Google Earth Plugin" and "Google Earth" support the display of test points for fixed-position or moving simulation scenarios.
- Define new test points and paths using "Google Earth" and store this navigation data in a KML file, to be used for subsequent tests.



Google Map/Google Earth – registration and installation

Rohde & Schwarz provides you with a technical environment to use "Google Maps/Google Earth Software" as an integrated application within the A-GPS control application software. However, please notice that "Google Maps/Google Earth Software" is not part of R&S delivery packages. "Google Maps/Google Earth Software" must both be used in accordance with the applicable Google Maps/Google Earth API Terms of Services.

Registration ("Google Maps" and "Google Earth")

The communication between the control application and the Earth browsers relies on the "Google Maps/Google Earth APIs". When you use the browsers for the first time, you have to sign up for the APIs; this involves the import of an API key.

Pressing "Open test result in 3D map" in the opens the "A-GPS Control Application" tab of the main window opens the dialog shown below.

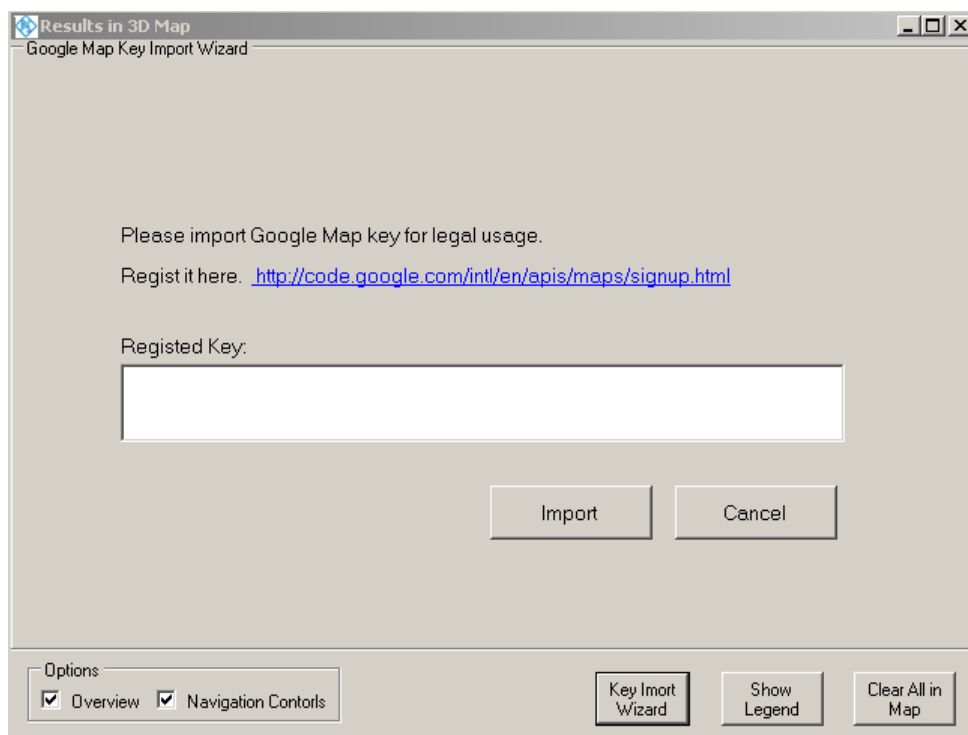


Fig. 5-1: Key Import for Google Maps API

In the "Results in 3D Map" dialog, you can:

1. Access the Google web site where you can generate the API key.
2. Enter the generated API key into the "Registered Key" field and "Import" it.

After successful key import, the control application automatically installs the necessary program components (if necessary)

Installation

"Google Maps Plugin" can be installed from the control application. The following dialog is opened automatically if the plugin is not available on your PC.

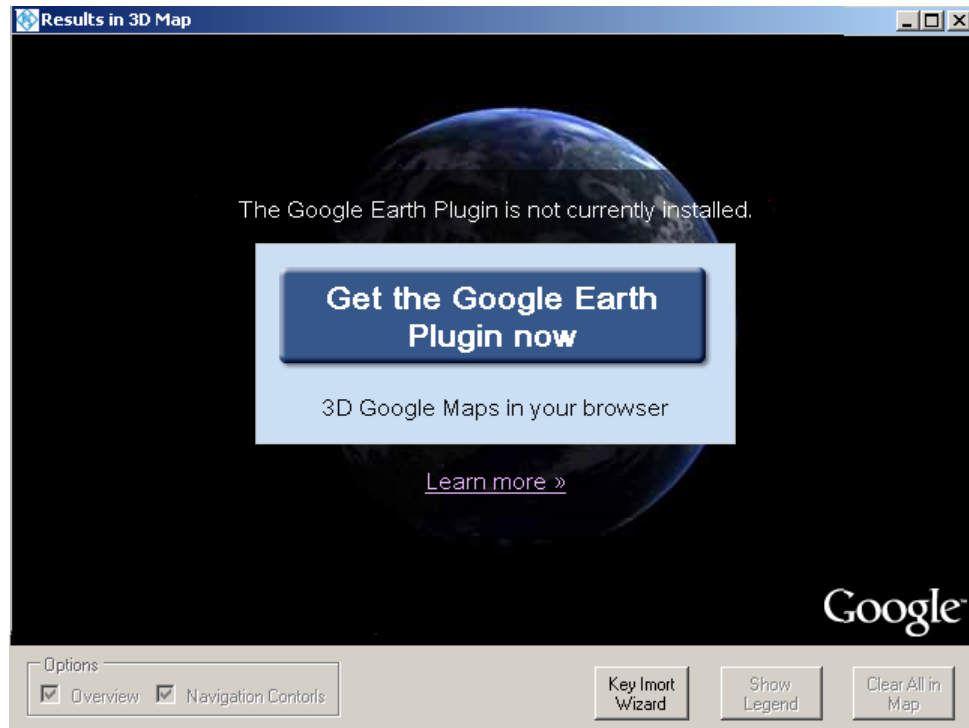


Fig. 5-2: Google Earth Plugin installation

- ▶ Click "Get the Google Earth Plugin now" button and follow the instructions in the installation wizard.

"Google Earth" is available for download at <http://earth.google.com/download-earth.html>.

5.2 Remote Interface

The "Remote Interface" is a remote control utility for the R&S CMU-K90 control application; its key benefit is that it can be embedded in automated test environments.

The utility sets up a TCP/IP connection to the control application and takes control of the A-GPS tests, locking the control elements on the "A-GPS Control Application" tab. The test configuration is defined in a separate file using XML-RPC remote procedure calls. Microsoft Visual Studio is a recommended tool for editing the configuration file.

6 Annexes

This chapter contains useful background information for the A-GPS control application.

6.1 Establishing and Testing GPIB Connections

The control application uses a VISA address string of the following format to address the test instruments:

```
GPIB[board]::primary address[::secondary address][::INSTR]
```

The [board] number and the [::INSTR] parameter are optional. Primary GPIB addresses are in the range between 0 and 30; they must be equal to the primary addresses set at the test instruments. The R&S CMU200 uses secondary addresses to distinguish between different network applications. Numbers 1 to 29 may be assigned. Valid VISA address strings are shown in [figure 4-8](#).

The "Timeout" values define the maximum time that the control application will attempt to connect to the test instruments. If the connection fails (e.g. because the GPIB addresses did not match), an error message is returned.

The GPIB connection is initiated automatically at the beginning of a test, before the control application configures the test instruments (see [chapter 4.1.2, "Control Panel"](#), on page 23). When the connection is established, you should be able to communicate with the test instruments. Press "Test SMU Connection" or "Test CMU Connection" to send an identification query *IDN? to the R&S SMU200A or R&S CMU200. The test instruments should return an ID string containing the manufacturer (ROHDE & SCHWARZ), instrument type, serial no., and firmware version.



GPIB addresses of the R&S SMU200A and R&S CMU200

To look up (and possibly change) the GPIB addresses of the test instruments, proceed as follows:

- R&S SMU200A: Press the SETUP key on the front panel of the instrument and select "GPIB...". The "GPIB channel address" appears in the "Remote Channel Settings" dialog.
 - R&S CMU200: Press the SETUP key on the front panel of the instrument to open the "Setup" dialog. The GPIB addresses appear in the "Remote" tab of the dialog.
-

6.2 Almanac Files

An almanac file contains the approximate orbit information of all GPS satellites, which each GPS satellite transmits within its Navigation Message. Sample almanac files are stored in the "C:\Program Files\Rohde-Schwarz\CMU-K90\Almanac" directory.

Almanacs are published in two different file formats:

- A YUMA almanac (file extensions *.alm or *.txt) shows the PRN number used to identify each satellite (satellite ID) and the propagation parameters, along with the satellite health and clock correction parameters in a human-readable form.

```

***** week 282 almanac for PRN-01 *****
ID: 01
Health: 000
Eccentricity: 0.6036758423E-002
Time of Applicability(s): 503808.0000
Orbital Inclination(rad): 0.9822055016
Rate of Right Ascen(r/s): -0.7817468486E-008
SQRT(A) (m 1/2): 5153.584473
Right Ascen at week(rad): -0.1240597225E+001
Argument of Perigee(rad): -1.656848679
Mean Anom(rad): -0.2826300804E+001
Af0(s): 0.3843307495E-003
Af1(s/s): 0.3637978807E-011
week: 282

***** week 282 almanac for PRN-02 *****
ID: 02
Health: 000
...

```

- An SEM almanac (file extension *.al3) lists how many satellites are included in the almanac file (31 in the example below). The header is completed by a short description, the GPS week (482), and GPS Time of Applicability (TOA in seconds, here: 503808). The following numbers denote the PRN number and the Satellite Vehicle Number (SVN) of each satellite, and the URA (User Range Accuracy) number, defining how accurate the satellite is generally. The 9 orbital elements are identical to the YUMA parameters, but stored with a higher precision. Each satellite-specific section ends with the satellite health (here: 0) and the satellite configuration (here: 9). Compared to the YUMA format, SEM is less readable but provides some more data and more precision.

```

31 CURRENT.ALM
482 503808

2
61
0
8.80813598632812E-03 5.91278076171875E-05 -2.57205101661384E-09
5.15352685546875E+03 9.46810483932495E-01 8.51777911186218E-01
-7.03423857688904E-01 1.71661376953125E-04 -3.63797880709171E-12
0
9
3
33
0
1.14860534667969E-02 -5.34439086914062E-03 -2.60115484707057E-09
5.15365576171875E+03 5.82162499427795E-01 2.79172420501709E-01
-8.03883671760559E-01 3.14712524414062E-04 3.63797880709171E-12
0
9
...

```

Almanacs are available at the following internet sites:

- United States Coast Guard Navigation Center GPS homepage, <http://www.navcen.uscg.gov/GPS/almanacs.htm>
The almanac files are named xxx.alm (for YUMA files) or xxx.al3 (for SEM files) where xxx denotes the day of a year.
- <http://www.celestrak.com/GPS/almanac/>
The naming convention of the almanac file is: almanac.sem|yuma.weekXXXX.YYYYYY.txt where XXXX denotes the GPS week and YYYYYY the time of almanac (TOA).

6.3 KML Files

Keyhole Markup Language (KML) is a file format used to define geographic positions (waypoints) and paths. KML files (waypoints files) use a tag-based structure which is derived from the XML standard.

The R&S CMU-K90 control application uses KML files for the following purposes:

- Definition of navigation data (paths) for moving test scenarios (see [chapter 4.3.1, "Location File Configuration"](#), on page 30). The navigation data is transferred to the R&S SMU200A which will configure its satellite signals accordingly.
- Display of the navigation data and test results in "Google Earth" (see [chapter 5.1, "Google Maps and Google Earth"](#), on page 36)

Sample KML files are stored in the "C:\Program Files\Rohde-Schwarz\CMU-K90\POS" directory.

To define or edit a KML file, use one of the following methods:

- Use "Google Earth" as an authoring tool for KML files. The functionality of "Google Earth" is sufficient to define all elements needed for A-GPS tests, in particular one or several paths. You do not have to edit KLM code in a text editor.
To see the KLM code for a feature in "Google Earth", simply right-click the feature in the 3D Viewer and select "Copy". The KLM text equivalent is copied to the clipboard from where you can "Paste" it to a text editor.
- Create and/or edit a KLM file in a text editor. A copy of the sample KML files will make the task easier.

Basic KML File Properties

A KML file starts with an XML header, followed by a KML namespace declaration:

```
<?xml version="1.0" encoding="UTF-8"?>  
  
<kml xmlns="http://earth.google.com/kml/2.1">
```

A single position is specified by the `<Point>` tag, containing the longitude, latitude, and altitude coordinates (in this order):

```
<Point>  
  
<coordinates>-122.0822035425683,37.42228990140251,0</coordinates>  
  
</Point>
```

A path is created by a `<LineString>` tag and must contain at least two points. Points are separated by a white space (e.g. a blank or a line break):

```
<LineString>  
  
<coordinates> -112.2550785337791,36.07954952145647,2357  
-112.2549277039738,36.08117083492122,2357</coordinates>  
  
</LineString>
```

For more information about the KML file format, click the following link: http://code.google.com/intl/de/apis/kml/documentation/kml_tut.html

6.4 WCDMA Bands and Channels

The carrier frequencies for WCDMA uplink and downlink signals are defined in 3GPP specification TS 25.101. Each operating band contains a number of carrier frequencies and corresponding channel numbers (UARFCN, UTRA Absolute Radio Frequency Channel Number). The assignment between channel numbers N and carrier center frequencies F is defined as:

$$N = 5 \cdot (F - F_{\text{Offset}}) / \text{MHz}$$

The tables below provide an overview of all bands. For each band they list the offset frequencies F_{Offset} , channel numbers N and carrier center frequencies F. For some operating bands a second row indicates additional center frequencies, which are shifted by 100 kHz relative to the normal 200 kHz raster. The channel numbers for these additional frequencies are either explicitly listed or indicated as discontinuous range with a step width of 25. The related center frequencies are listed as discontinuous ranges.

Table 6-1: WCDMA operating bands and frequencies: uplink

Band	F_{Offset} [MHz]	Channel No N	F [MHz]
I	0	9612 to 9888	1922.4 to 1977.6
II	0 1850.1	9262 to 9538 12 to 287 (step 25)	1852.4 to 1907.6 1852.5 to 1907.5
III	1525	937 to 1288	1712.4 to 1782.6
IV	1450 1380.1	1312 to 1513 1662 to 1862 (step 25)	1412.4 to 1752.6 1712.5 to 1752.5
V	0 670.1	4132 to 4233 782, 787, 807, 812, 837, 862	826.4 to 846.6 826.5 to 842.5
VI	0 670.1	4162 to 4188 812, 837	832.4 to 837.6 832.5, 837.5
VII	2100 2030.1	2012 to 2338 2362 to 2687 (step 25)	2502.4 to 2567.6 2502.5 to 2567.5
VIII	340	2712 to 2863	882.4 to 912.6
IX	0	8762 to 8912	1752.4 to 1782.4
X	1135 1075.1	2887 to 3163 3187 to 3462 (step 25)	1712.4 to 1767.6 1712.5 to 1767.5
XI	733	3487 to 3587	1430.4 to 1450.4
XII	-22 -39.9	3612 to 3678 3702, 3707, 3732, 3737, 3762, 3767	700.4 to 713.6 700.5 to 713.5
XIII	21 11.1	3792 to 3818 3842, 3867	779.4 to 784.6 779.5, 784.5
XIV	12 2.1	3892 to 3918 3942, 3967	790.4 to 795.6 790.5, 795.5

Table 6-2: WCDMA operating bands and frequencies: downlink

Band	F _{Offset} [MHz]	Channel No N	F [MHz]
I	0	10562 to 10838	2112.4 to 2167.6
II	0	9662 to 9938	1932.4 to 1987.6
	1850.1	412 to 687 (step 25)	1932.5 to 1987.5
III	1575	1162 to 1513	1807.4 to 1877.6
IV	1805	1537 to 1738	2112.4 to 2152.6
	1850.1	1462 to 1662 (step 25)	2112.5 to 2152.5
V	0	4357 to 4458	871.4 to 891.6
	670.1	1007, 1012, 1032, 1037, 1062, 1087	871.5 to 887.5
VI	0	4387 to 4413	877.4 to 882.6
	670.1	1037, 1062	877.5, 882.5
VII	2175	2237 to 2563	2622.4 to 2687.6
	2105.1	2587 to 2912 (step 25)	2622.5 to 2687.5
VIII	340	2937 to 3088	927.4 to 957.6
IX	0	9237 to 9387	1847.4 to 1877.4
X	1490	3112 to 3388	2112.4 to 2167.6
	1430.1	3412 to 3687 (step 25)	2112.5 to 2167.5
XI	736	3712 to 3812	1478.4 to 1498.4
XII	-37	3837 to 3903	730.4 to 743.6
	-54.9	3927, 3932, 3957, 3962, 3987, 3992	730.5 to 743.5
XIII	-55	4017 to 4043	748.4 to 753.6
	-64.9	4067, 4092	748.5, 753.5
XIV	-63	4117 to 4143	760.4 to 765.6
	-72.9	4167, 4192	760.5, 765.5

6.5 GSM Bands and Channels

The GSM frequency bands are defined in standard 3GPP TS 25.021. A band contains a set of adjacent channels, each with a bandwidth of 200 kHz. The channel numbers and the assignment between channel numbers and frequencies are band-specific.

In all frequency bands, the downlink frequencies are higher than the corresponding uplink frequencies. The difference between downlink and uplink frequencies is termed the duplex spacing; it is also band-specific. The tables below give an overview of different GSM bands with their channel numbers and the downlink and uplink center frequencies.

Table 6-3: GSM operating bands and frequencies

Band	F _{Offset} [MHz]	Channel No N	F [MHz]
GSM400 (GSM450 and GSM480)	259 to 340	460.6 to 495.0	450.6 to 485.0
GSMGT800 (T-GSM810)	350 to 425	851.0 to 866.0	806.0 to 821.0

Band	F _{Offset} [MHz]	Channel No N	F [MHz]
GSM850 (GSM850 and MXM850)	128 to 251	869.2 to 893.8	824.2 to 848.8
GSM900 (P-GM900) (R-GSM900) (E-GSM900)	0 to 124 955 to 974 975 to 1023	935.0 to 959.8 921.2 to 925.0 925.2 to 934.8	890.0 to 914.8 876.2 to 880.0 880.2 to 889.8
GSM1800 (DCS1800)	512 to 885	1805.2 to 1879.8	1710.2 to 1784.8
GSM1900 (PCS1900 and MXM1900)	512 to 810	1930.2 to 1989.8	1850.2 to 1909.8

Glossary: A-GPS Testing

A

A-GPS (Assisted GPS): A technology that is intended to cut down the time needed to determine a location using GPS. In A-GPS networks, the mobile phone communicates with an "assistance server" which provides additional information used to acquire satellites more quickly. The assistance server can also perform calculations for the mobile phone.

Almanac: A data file that contains the approximate orbit information of all satellites, which each GPS satellite transmits within its Navigation Message. The almanac file content can be included in the assistance data.

C

C-Plane: Control-plane signaling, an A-GPS signaling scheme where the location service data is communicated over a control channel of the wireless communication network. The control channel and thus the flow of positioning information is network-specific. The R&S CMU-K90 control application supports C-plane signaling; see also U-Plane.

C/A-Code: Coarse Acquisition Code, standard GPS PRN code, used to acquire and decode the satellite signal in order to perform the pseudorange (code phase) measurement.

Code Phase: GSM measurement based on the C/A-code, also termed pseudorange measurement.

E

Ephemeris (plural: Ephemerides): The file of values from which a satellite's position and velocity at any instant in time can be obtained. The ephemeris values are part of the "Navigation" assistance data.

G

GPS (Global Positioning System): A system for providing precise location on land, sea, in air and space, from known positions of satellites in space. GPS is based on data transmitted from a constellation of 24 satellites.

I

Ionosphere: Band of atmosphere extending from about 50 km to 1000 km above the earth's surface. The ionosphere contains ionized gas molecules, causing a frequency-dependent propagation delay for microwave signals. An ionospheric model is used to correct the GPS receiver results for ionospheric effects; the values of model parameters are part of the assistance data.

K

KML File (Waypoint File): A file format used to define geographic positions and paths. Keyhole Markup Language (KML) files use a tag-based structure which is derived from the XML standard. KML data can be displayed in Earth browsers such as "Google Maps" or "Google Earth" and in many other applications.

M

Mobile Assisted Mode: A-GPS operating mode where the position is calculated by the R&S CMU-K90 control application. The mobile performs only the pseudorange measurements and provides the basic properties (in particular, the GPS code phases) of the different satellite signals. See also mobile based mode.

MTC License Proxy: Software utility that verifies if the licensing conditions for the R&S CMU-K90 control application are met. The license proxy must be installed on the controller PC and running while the control application is used.

Measurement: Data acquisition and calculation of results at a single test point. The sequence of measurements is controlled by the "Measurement Control Parameters".

Mobile Based Mode: A-GPS operating mode where the position is calculated in the mobile. The mobile provides the location estimate, based on the ranging measurements made and the received A-GPS data. See also mobile assisted mode.

N

Navigation Message: Also known as the Data Message, contains the satellite's ephemeris, clock correction parameters, almanac information, and health.

P

PRN (Pseudo-Random Noise): A binary signal with random noise-like properties. The C/A-code and the P-code are examples of PRN codes. Each satellite transmits unique code sequences, hence the satellites are identified by their PRN number (satellite ID).

Position: The 3D coordinates of a point, given in the form of (Longitude, Latitude, Altitude). The control application provides decimal or DEG/MIN/SEC format for the longitude and latitude coordinates.

Pseudorange Measurement: A distance measurement based on the satellite's transmitted C/A-code or P-code. The pseudorange is the observed "distance" between the GPS satellite at some transmit time and the receiver at some receive time. To obtain the true distance, the pseudorange must be corrected for synchronization errors between the transmitter's and the receiver's clock.

S

Simulation Scenario: A set of parameters for A-GPS tests, containing in particular the location of the mobile, the simulated satellites, and the almanac data. Scenarios for performance testing are specified in standards 3GPP 34.108 (WCDMA) and 3GPP TS 51.010 (GSM).

T

Test Point: Simulated position where the A-GPS control application requests position information from the mobile and calculates a set of measurement results. Test points can be at the same, fixed position during the whole measurement cycle or located on a path (moving GPS scenario).

U

U-Plane: User-plane signaling, an A-GPS signaling scheme where the location service data is communicated over a network data link of the wireless communication network, e.g. using an internet protocol (IP). See also C-Plane.

UTC (Coordinated Universal Time): Formerly referred to as GMT (Greenwich Mean Time). This is the basis of "civilian time".

V

VISA: An interface library providing input and output functions to communicate with instruments. VISA supports various input/output channels including GPIB connections. A VISA installation is a prerequisite for running the R&S CMU-K90 control application and connecting to the test instruments.

W

Waypoint: A three-dimensional coordinate point stored in a file (usually in KML format), defining a geographic position.

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