Operating Manual

DVB-T/H Diversity Test Receiver

R&S®TSM-DVB
1503.7007.10

Printed in Germany

ROHDE & SCHWARZ
Test and Measurement Division

Dear Customer,

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

Safety Instructions

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

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

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

Symbols and safety labels

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

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

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

Tags and their meaning

DANGER	This tag indicates a safety hazard with a high potential of risk for the user that can result in death or serious injuries.
WARNING	This tag indicates a safety hazard with a medium potential of risk for the user that can result in death or serious injuries.
CAUTION	This tag indicates a safety hazard with a low potential of risk for the user that can result in slight or minor injuries.
ATTENTION	This tag indicates the possibility of incorrect use that can cause damage to the product.
NOTE	This tag indicates a situation where the user should pay special attention to operating the product but which does not lead to damage.

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

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude max. 2000 m. Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).

3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.

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

5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.

6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.

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

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

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

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

11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.

12. Never use the product if the power cable is damaged. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.

13. The product may be operated only from TN/TT supply networks fused with max. 16 A.

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

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

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

17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.

18. Never remove the cover or part of the housing while you are operating the product. This will expose circuits and components and can lead to injuries, fire or damage to the product.

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

20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.

21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.

22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.

23. Rohde & Schwarz products are not protected against penetration of water, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock or damage to the product, which can also lead to personal injury.

24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.

25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.

26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.

27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries are hazardous waste. Dispose of them only in specially marked containers. Observe local regulations regarding waste disposal. Do not short-circuit batteries or storage batteries.

28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.

29. Please be aware of the weight of the product. Be careful when moving it; otherwise you may injure your back or other parts of your body.

30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).

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

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

33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.

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

Informaciones de seguridad

Es el principio de Rohde & Schwarz de tener a sus productos siempre al día con los estandards de seguridad y de ofrecer a sus clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. Este producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los estandards técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, deberá el usuario atenerse a todas las informaciones, informaciones de seguridad y notas de alerta. Rohde&Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto solamente fue elaborado para ser utilizado en la indústria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del maluso del producto.

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

Símbolos y definiciones de seguridad

Ver manual de instrucciones del uso	Informaciones para maquinaria con uns peso de > 18kg	Peligro de golpe de corriente	¡Advertencia! Superficie caliente	Conexión a conductor protector	Conexión a tierra	Conexión a masa conductora	¡Cuidado! Elementos de construción con peligro de carga electroestática

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

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

Palabras de señal y su significado

PELIGRO	Indica un punto de peligro con gran potencial de riesgo para el ususario.Punto de peligro que puede llevar hasta la muerte o graves heridas.
ADVERTENCIA	Indica un punto de peligro con un protencial de riesgo mediano para el usuario. Punto de peligro que puede llevar hasta la muerte o graves heridas .
ATENCIÓN	Indica un punto de peligro con un protencial de riesgo pequeño para el usuario. Punto de peligro que puede llevar hasta heridas leves o pequeñas
CUIDADO	Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
INFORMACIÓN	Indica una situación en la que deberían seguirse las instrucciones en el uso del producto, pero que no consecuentemente deben de llevar a un daño del mismo.

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

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S válido lo que sigue: como posición de funcionamiento se define principalmente la posición con el suelo de la caja para abajo , modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar. A menos que se especifique otra cosa en la hoja de datos, se aplicará una tolerancia de ±10% sobre el voltaje nominal y de ±5% sobre la frecuencia nominal.

2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal périto autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Despues de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de

seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se producieran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.

4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.

5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberan ser tenidas en cuenta las prescipciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescipciones de seguridad especiales en la descripción del producto.

6. Ciertos productos, como por ejemplo las instalaciones de radiación HF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario está comprometido a valorar y señalar areas de trabajo en las que se corra un riesgo de exposición a radiaciones aumentadas de riesgo aumentado para evitar riesgos.

7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.

8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del prodcuto.

9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.

10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto ya que puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro, que es controlado su estado técnico de seguridad.

11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (medida del cable de distribución aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en construciones o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

12. No utilice nunca el producto si está dañado el cable eléctrico. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.

13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A.

14. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.

15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.

16. En las mediciones en circuitos de corriente con una tensión de entrada de Ueff > 30 V se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos de la EC950/EN60950.

18. Nunca abra la tapa o parte de ella si el producto está en funcionamiento. Esto pone a descubierto los cables y componentes eléctricos y puede causar heridas, fuego o daños en el producto.

19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, deberá la toma de corriente estar protegida de manera que los productos o los usuarios estén suficientemente protegidos.

21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir corto circuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.

22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.

23. Los productos R&S no están protegidos contra el agua si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente o de daños en el producto lo cual también puede llevar al peligro de personas.

24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.

25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.

26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención celulas de Litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Baterías y acumuladores son deshechos problemáticos. Por favor tirenlos en los recipientes especiales para este fín. Por favor tengan en cuenta las prescripciones nacionales de cada país referente al tratamiento de deshechos. Nunca sometan las baterías o acumuladores a un corto circuito.

28. Tengan en consideración de que en caso de un incendio pueden escaparse gases tóxicos del producto, que pueden causar daños a la salud.

29. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.

30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).

31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujecion en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetados de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean tenidas en cuenta. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.

32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo y el fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.

33. Dado el caso de que esté integrado un producto de laser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación. De otra manera pondrá en peligro su salud, ya que el rayo laser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo laser.

Certified Quality System

DIN EN ISO   9001 : 2000
DIN EN   9100 : 2003
DIN EN ISO 14001 : 1996

DQS REG. NO 001954 QM/ST UM

QUALITÄTSZERTIFIKAT

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

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:1996

CERTIFICATE OF QUALITY

Dear Customer,
you have decided to buy a Rohde &
Schwarz product. You are thus as-
sured 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 manage-
ment system standards.
The Rohde & Schwarz quality manage-
ment system is certified according to:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:1996

CERTIFICAT DE QUALITÉ

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CE

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This is to certify that:

Equipment type	Stock No.	Designation
TSM-DVB	1503.7007.02	TSMU-DVB Test Receiver

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

- relating to electromagnetic compatibility
  (89/336/EEC revised by 91/263/EEC, 92/31/EEC, 93/68/EEC)

Conformity is proven by compliance with the following standards:

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

Affixing the EC conformity mark as from 2005

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Munich, 2005-02-22

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1 General Description

The DVB-T Diversity Test Receiver R&S®TSM-DVB has been designed to comply with the standard DVB-T/H receiver specifications. It also complies with the equipment environment at the following levels:

- Mechanical
- Electrical
- Control

The receiver supports all DVB-T/H modes, including hierarchical modes, in all available bandwidths (5 MHz, 6 MHz, 7 MHz and 8 MHz) with the same hardware.

In order to be compliant with the DVB-H standard, it includes:

- The 4K mode,
- An In-depth deinterleaver,
- The DVB-H signalization (Time slicing and MPE-FEC) in TPS field.

The Receiver will of course accept DVB-H signals using time slicing but without any power reduction management.

The receiver is equipped with two demodulation channels.

System Requirements:

Using the DVB-T/H Diversity Test Receiver R&S®TSM-DVB for control and measurement purposes requires a system controller in the form of a personal computer (PC) or notebook with an RS-232-C interface.

Operating system requirements:

- Windows 2000 or
- Windows XP

Rohde & Schwarz offers the following system controllers:

- Industrial PC: System Process Controller R&S®TSPC4-12 V
- Portable Industrial Controller R&S®PSP7
- Notebook: R&S®TSNB

(For order numbers, please contact your local Rohde & Schwarz representative.)

Preparation for Use:

Connect antennas, power supply and the system controller to the R&S®TSM-DVB.

Rack mounting: The receiver can be mounted in a 19" rack using the Rack Adapter R&S®TSMU-Z2 as described in the mounting instructions supplied. For order number, please contact your local Rohde&Schwarz representative.

Putting the Receiver into Operation:

CAUTION

To avoid damaging the instrument or risking injury to personnel, closely follow the instructions in the following sections. This is particularly important when using the instrument for the first time.

Prerequisites

To operate the analyzer correctly, you need the following equipment:
PC/notebook with RS-232-C interface   not included in package; see 2 System Requirements
Antenna   two DVB-T/H antennas
Connection cables   partially included in package; see page 2 "Connecting
External Devices
DC Power Supply   option: R&S®TSMU-Z1
R&S®ROMES software package with device   not incl. in R&S®ROMES and R&S®ROMES-D7 pkg.
drivers for the R&S®TSM-DVB
Optional: GPS unit   not included in package

Connecting External Devices

-Connect the PC/notebook RS-232-C port to the RS-232-C port of the R&S®TSM-DVB. A cable is
included in the package.
- Connect two DBT-T antennas to the receiver. The antennas are not included in the package.

CAUTION

Do not inject more than the maximum rated RF input power. Doing so can severely damage the input stage.

- R&S®TSM-DVB: –20 dBm.
- Optional: Connect an MPEG analyzer (e.g. DVMD or DVQ) to the ASI output of the device.
- Double shielded cables must be used to avoid electromagnetic distortion.
- Connect the R&S®TSM-DVB to the power supply.

Fig. 1 Front panel

Power-On Sequence

As soon as you connect the R&S®TSMU to the power supply, the instrument switches to Power On Mode.
If the R&S®TSM-DVB is able to synchronize to a DVB-T service, the LOCK indicators will illuminate. (The correct frequency must be set via the RS-232-C interface.)

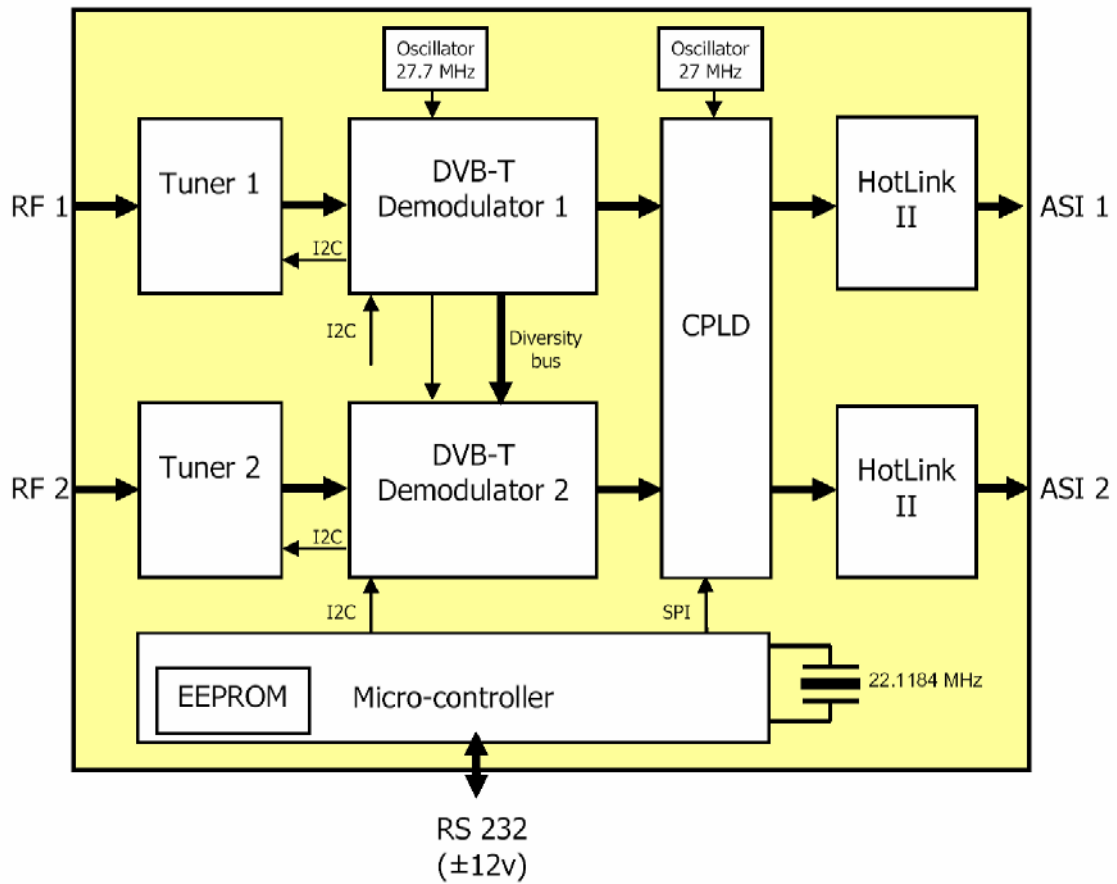Fig. 2 Rear panel

Functional Block Diagram of Module

Fig. 3 Block Diagram

Receiver Module Used in the R&S®TSM-DVB

The functional block diagram highlights the two DVB-T/H receive channels in the form of any of the following:
•   A diversity receiver with two different antennas connected to the two RF inputs
•   A hierarchical receiver that demodulates the two MPEG-TS streams, LP and HP, and that provides them on the two ASI outputs simultaneously
•   Redundant receivers

Tuner

The tuner is a high-performance tuner. It is compatible with VHF (Ch 5 to Ch 12) and UHF (Ch 21 to Ch 69). Channel bandwidth could be 5 MHz, 6 MHz, 7 MHz or 8 MHz. Offset of ± 166.667 KHz as well as offset of ± 125 KHz are supported. The RF input is 50 Ω unbalanced.

Demodulator

The DVB-T demodulator is designed for mobile, portable and stationary applications. It is fully compliant with DVB ETS 300 744 specifications and its DVB-H extension (annex F).
The tuner output is directly connected to the balanced IF input of the demodulator.
The chip includes all demodulation processing from the analog input to the MPEG-TS output.
It also includes special functions such as:
- High-performance digital automatic frequency correction allowing ±350 kHz offset recovery (±167 kHz or ±125 kHz offset could be supported without configuration).
It supports all DVB-T/H modes including hierarchical modes. Automatic mode detection is performed by the receiver thanks to the TPS information. When receiving a hierarchical signal, the receiver could demodulate both HP and LP flows simultaneously, if the same RF signal is supplied to the 2 RF inputs.
It offers high monitoring capabilities such as:
- Input signal strength
- Constellation
- MER
- BER
The two DVB-T/H receiver chips are linked together by a very simple dedicated bus that is used for diversity demodulation. Once configured, the diversity synchronization mechanism between both demodulators is automatic.

CPLD

The programmable logic device is used for MPEG stream switching. Four operating modes can be used:
- In the dual input mode, the two demodulator channels are independent and can be programmed differently. Each of them has its own ASI output. This mode can be used for redundant input with external switching.
- In the redundant mode, the two demodulator channels are also independent and can be programmed differently. In this mode, however, internal switching is performed. This switching can be manual or automatic. The automatic switching event can be a loss of synchronization or an uncorrected packet detection (depending on the configuration). The same output stream is available on both ASI outputs.
- In the hierarchical mode, the two demodulator channels should have the same configuration except for stream priority. For more flexible use, however, they can also be independently configured. In this mode, the behavior is exactly the same as in dual mode. Each of them has its own output.
- In the diversity mode, the two demodulator channels have the same configuration. The "switching" is performed by the demodulator chip itself. The output stream is available on both ASI outputs.

ASI Outputs

The two MPEG-TS output streams are converted to ASI format using ASI transceiver chips. Two transceivers provide the two streams in accordance with the DVB-ASI recommendation. The output format is 188 or 204 bytes per packet in the data burst format (EN 50083-9). The two output streams are always available regardless of the module type and its configuration. It does not perform MPE-FEC decoding and the outputs are the MPEG-TS packets over DVB-ASI layer.

Microcontroller

The microcontroller manages the following:
• Initialization of the DVB-T receivers using parameters stored in the EEPROM memory
• Initialization of the DVB-T tuners
• Configuration of the CPLD depending on the operating mode
• Monitoring of the DVB-T chips
• Communication with the system controller via the RS-232-C interface

The simple protocol is defined in section "Software Interface description" of this document.

Power Supply

The module requires a single 12 V power supply. All required voltages (1.8 V, 3.3 V, 5 V) are internally generated from this 12 V supply. The required power is approx. 12 W.

Technical Characteristics

RF inputs

- 50 Ω input impedance on N type female connector
- Max. 3 dB of VSWR
- VHF (Ch 5 to Ch 12) and UHF (Ch 21 to Ch 69)
- 5 MHz, 6 MHz, 7 MHz and 8 MHz bandwidth
- 166.667 kHz frequency step
- ±167 kHz or ±125 kHz frequency offset supported without configuration
- –94 dBm to –20 dBm input sensitivity (depends on DVB-T/H mode)

DVB-T/H Demodulation

- Fully compliant with ETS300744 including annex F for DVB-H
- Includes hierarchical modes (selection of the stream priority)
- Automatic mode detection from TPS information (even at 0 dB C/N)
- Dual streams demodulation in hierarchical mode
- Dual streams demodulation in redundant mode with automatic or manual switching
- Diversity mode

ASI output

- Fully compliant with EN 50083-9
- 188 bytes per packet in data burst format ("continuous" mode)
- Dual outputs

Table 1   Mode of operation

Mode of operation	ASI outputs	Active RF inputs
Dual input	ASI 1 ASI 2	RF IN 1 RF IN 2
Redundant	ASI 1 = ASI 2	RF IN 1 or RF IN 2
Hierarchical	ASI 1 (HP or LP) ASI 2 (HP or LP)	RF IN 1 RF IN 2
Diversity	ASI 1 = ASI 2	RF IN 1 = antenna 1 RF IN 2 = antenna 2

Control of the Module

- RS-232-C interface with standard ±12 V level in "slave" mode (see section "Software Interface Description" page 8).
- Two 5 V TTL status lines

Power Supply

- Single +12 V power supply
- Max. 1 amp (12 W)

MPEG-TS Outputs

The MPEG-TS outputs are serial interfaces:
•   Output impedance: 75 Ω
•   Output format: ASI (HotLink drivers)
•   Output connector: BNC

2 Software Interface Description

Control Interface

General

The control interface could be used to send commands to the module or to
get status from the module.
The commands sent to the module are used to:
- The setting of the mode of operation of the board:
- Normal or Dual mode,
- Hierarchical,
- Diversity,
- Redundant.
- The setting of the channel width, 5, 6, 7 or 8 MHz,
- The setting of the centre frequency of the UHF or VHF channel
  used for each RF input,
- The control of the download of software release.
  The status that the host CPU could read from the module are used to get:
- The version of the board,
- The mode of operation that has been setup,
- The centre frequency of the UHF or VHF Channel used for each RF input,
- The DVB-T/H mode parameters (2K/4K/8K, QPSK/16/64QAM, FEC, Guard Interval, hierarchical
  mode …) of the received signal,
- The RF input level for UHF / VHF receiver
- The BER, MER, Packet error rate …
- Eventually the error status (No RF signal, no demodulation
possible, remaining MPEG-TS Packet errors …),
All transfers between the host CPU and the receiver module are initiated and
managed by the host CPU.
Usually the module is installed inside equipment.
- If this equipment has its own CPU (called host CPU later in this chapter), then a permanent and
  dynamic control of the module could be done.
- If the equipment has no CPU and no way to managed the module through one of its control interface,
  then the module has to be configured before its installation in the equipment using a terminal (It could
  be a PC computer configured in the Hyper terminal mode).

The control port

The control port is always active.
RS232 port
- The RS232 port uses the 2 usual RX / Tx lines and a Ground connection.
- The setting of the port is fixed with the following parameters:
- No parity bit
- 57600 bauds
- 8 data bits
- 1 STOP bit

Addressing the modules

Each module has an internal address which is defined on 8 bits.
The 5 MSB of this address are defined according to the type of the module
and the 3 LSB are the number of the module.

Module address (Type-Number)	Module address (Type-Number)	Module type
"00000-xxx"	From 0x00 to 0x00	Reserved for broadcast addressing
"10000-xxx"	**From 0x81 to 0x87**	**R&S TSM-DVB 1503.7007.10 = DVB-T/H demodulator**

Module type address
The 3 LSB could be defined by the user. These 3 address LSBs are factory set to "001".
So the default address of a R&S TSM-DVB 1503.7007.10 receiver is always "0x81" or "80000 001b".
Some addresses are reserved for special uses according to the following table.

Address value or range	Address use
"0x00 = 00000 000b"	R&S TSM-DVB number 1 (defaultaddress)
"0x80 = 10000 000b" Reserved for broadcast mode	(R&S TSM-DVBs, all module numbers)
"0x81 = 10000 001b"	R&S TSM-DVB number 1 (defaultaddress)
"0x82 = 10000 010b"	R&S TSM-DVB number 2
"0x83 = 10000 011b"	R&S TSM-DVB number 3
"0x84 = 10000 100b"	R&S TSM-DVB number 4
"0x85 = 10000 101b"	R&S TSM-DVB number 5
"0x86 = 10000 110b"	R&S TSM-DVB number 6
"0x87 = 10000 111b"	R&S TSM-DVB number 7
"0xFF = 111111 111b"	Forbidden address

Allowed addresses for a R&S TSM-DVB
As explained in chapter 2.3 each message sent by the host CPU to the module includes an address field.
The module answers to messages from the host CPU only when its own address matches the address value included in the received message. A special command described in chapter 2.3 allows the user to set a new address to the module. It is not allowed to set a module with the address "0".
The broadcast address could be used to send the same command to all modules or to all module of the same type. When a module receives such a command, it will execute the command but will not answer to the host CPU. It could be used for example to Reset all the modules at the same time. This broadcast addressing mode is limited to the "Control commands" (SET
type commands).

Protocol of the control interface

Message structure

This protocol has been inspired by the famous Hayes commands used for modem. The module is usually placed under the control of a Host CPU or a terminal. The module itself is slave to the host CPU meaning that it never takes the initiative of a communication and only answers to request from the host CPU. The host CPU or the terminal always operates as the master. The message sent from the host to the module is called the ***Request Message*** and the answer of the module to the host is called the ***Answer Message***.

A message has always the following structure:

<Message> = <AD> <ID> <DATA>

Where:

•   <AD> is the module address (1 byte)
•   <ID> is a one byte message identifier (1 byte),
•   <DATA> is the byte or multi bytes data field of the message. If multi-bytes numeric values are given in the DATA field, most significant byte is sent first. The number of Data bytes is not indicated in the message itself. It is defined according to the message <ID>.

ASCII encoding

The protocol is ASCII oriented. For the transmission of a message, each byte is ASCII coded, meaning that two ASCII characters are used to transmit one useful byte. For example the message byte 0xF3 will be transmitted as 0x46 ('F' ASCII code) plus 0x33 ('3' ASCII code). "Space" characters (ASCII code 0x20) can be inserted before, between and after useful bytes but are ignored by the module and should be ignored too by the host CPU. "Space" characters are not processed in the CRC computation (see 2.3.4).

These space characters facilitate the reading of command files when displayed on a terminal. Especially, the slave answer starts with some "space" characters so that the request and the answer messages can easily be distinguished on a terminal screen.

Message encapsulation

A message is always encapsulated between a prefix and a suffix:

•   The prefix could take the value "TX" (ASCII codes 0x54 and 0x58) for normal operation, or "TS" for secured operation (See here under 2.3.4 Optional CRC)
•   The suffix includes a Carriage Return character (ASCII code 0x0D) followed by a Line Feed character (ASCII code 0x0A).

Optional CRC

If the Prefix sent is "TS" (ASCII codes 0x54 and 0x53) instead of "TX", this means that a CRC is added to the message. This CRC is computed by XOR between all bytes of the ASCII codes of the useful message [<AD>, <ID> and <DATA> fields] except "space" characters, and inserted at the end of this message before the suffix. It is then transported as two ASCII characters like all other bytes of the message. In this mode the CRC is inserted by the sender of a message and checked by the receiver. If a CRC check is wrong on the module, it will answer to the host CPU with an error message (see hereafter "error message" in 2.4.1 and 2.4.3). If a CRC check is wrong on the Host CPU, the host CPU should resend the message to the module. If multiple CRC errors happened then the link between host CPU and the module should be verified.

Global Message Structure

Here is given the global structure of the messages.
[Prefix] [Message] [Optional CRC] [Suffix]
Prefix = 'TX' if No CRC
Prefix = 'TS' with CRC
Message = <AD> <ID> <DATA>
CRC = XOR (bytes of the ASCII char. of the Message)
Suffix = 'CRLF'XE "Global Message Structure"

Example

The Reset Command
Reset command identifier is: **Id = 0 = 0x00**
In this example the host CPU sends a reset command to the RXHR receiver which address is the default address.
- If CRC checking is required, the following string of characters (ASCII codes) is sent by the host CPU to the module:

Character string: **TS 11 00 00 CRLF**
ASCII code: **0x54 0x53 0x31 0x31 0x30 0x30 0x30 0x30 0x0D 0x0A**
("Space" characters 0x20 could be inserted between any characters)
   If no CRC checking is required, the following string of characters (ASCII codes) is sent by the host CPU to the module:
Character string: **TX 11 00 CRLF**
- ASCII code: **0x54 0x58 0x31 0x31 0x30 0x30 0x0D 0x0A**

(Blank characters 0x20 could be inserted between any characters. Please note that a Reset Command is performed only by sending a *Request Message*. There is not *Answer Message* from the module.)

The Attention Command
The "Attention Command" is similar to the one of the Hayes commands for a modem.
This command is one of the "Manual commands" that are used by the user to check that the module is OK. It is generally not used by the host CPU. It is an easy way for the user to check that the module is alive. If a user wants to check that a RXHR-1000 receiver with its default address is alive, it should send the following *Request Message*:
Character string: **TX CRLF**
ASCII code: **0x54 0x58 0x0D 0x0A**
It will get back the following Answer Message from the module:
Character string: **'TEAMCAST, YOUR TEAM FOR BROADCAST'**

Description of the different Messages

Different types of messages

A communication is always initiated by the host CPU by a message called the *Request Message*. The module answers this request with an *Answer Message.* 4 types of Commands can be handled by a module:

• Manual commands from a terminal for checking purpose,
• Control commands from a host CPU or a terminal for configuration purpose,
• Monitoring commands from a host CPU or a terminal for state monitoring purpose,
• Download software command for software upgrade of the module from a host CPU.

An error message is a special *Answer Message* sent by the module if:

• An unknown message identifier <ID> is received in a *Request Message,*
• An invalid command is received,
• The CRC check performed by the module in the "TS" mode, failed,
• The number of received bytes in the Data Field is not the one expected according to the message identifier <ID>
• A parameter of the <DATA> section has not a valid value

For most Control Commands, the *Request Message and Answer message* have the following format:

• <Request Message> = <AD> <ID> <DATA>
• <Answer Message> = <AD> <ID>

Nevertheless it may happen that a control message needs an *Answer Message* with a DATA field from the module

For most Monitoring Commands, the *Request and Answer messages* has the following format:

• <Request Message> = <AD> <ID>
• <Answer Message> = <AD> <ID> <DATA>

Nevertheless it may happen that a Monitoring message may include a DATA field in the *Request Message* to the module. Identifier values are organized as follow:

- id. From 0 (0x00) to 31 (0x1F):   for common Control commands
- id. From 32 (0x20) to 111 (0x6F):   for special Control commands
- id. From 128 (0x80) to 159 (0x9F):   for common Monitoring commands
- id. From 160 (0xA0) to 239 (0xEF):   for special Monitoring commands
- id. From 240 (0xF0) to 255 (0xFF):   for miscellaneous command

List of Commands

Command set		Request Message			Answer Message		
		Identifier <Id>		Data field size (in bytes)	Identifier <Id>		Data field size (in bytes)
		Decimal	Hexa		Decimal	Hexa	
Control Commands							
Common	Reset	0	0x00	0	-	-	-
	Set Address	1	0x01	1	1	0x01	0
	Set EEPROM Data	2	0x02	8	2	0x02	0
Special	Set Mode	32	0x20	4	32	0x20	0
	Set RF Input 1	33	0x21	7	32	0x21	0
	Set RF Input 2	34	0x22	7	33	0x22	0
	Set Output Formate	37	0x25	1	37	0x25	0
Monitoring Commands							
Common	Get Address	129	0x81	0	129	0x81	1
	GetEEPROM Data	130	0x82	0	130	0x82	8
	Get Type & Version	131	0x83	0	131	0x83	8
	Get Serial Number	132	0x84	0	132	0x84	2
	Get General Status	133	0x85	0	133	0x85	2
Special	Get Mode	160	0xA0	0	160	0xA0	4
	Get RF Input 1	161	0xA1	0	161	0xA1	7
	Get RF Input 2	162	0xA2	0	162	0xA2	7
	Get Selected Input	163	0xA3	0	163	0xA3	1
	Get Input 1 status	164	0xA4	0	164	0xA4	17
	Get Input 1 status	165	0xA5	0	165	0xA5	17
	Get Input TPS 1	166	0xA6	0	166	0xA6	7
	Get Input TPS 2	167	0xA7	0	167	0xA7	7
	Get S/N 1	168	0xA8	0	168	0xA8	1
	Get S/N 2	169	0xA9	0	169	0xA9	1
	Get Output Format	174	0xAe	0	170	0xAE	1
	Get Constellation 1	175	0xAF	0	175	0xAF	64
	Get Constellation 1	176	0xB0	0	176	0xB0	64
	Get DVB-H TPS field 1	177	0xB1	0	177	0xB1	5
	Get DVB-H TPS field 2	178	0xB2	0	178	0xB2	5
Error Message					254	0xFE	2

Command Description

Reset: After a Reset command the module needs about 0.5 second before becoming operational again. The module does not answer to a reset command.

Set Address Byte 1: Value of the address of the module within the range of 1 to 7.The 3 LSB only are used (b0 to b2 are used). Default value of this Address is '0x01'

Set/Get EEPROM Data Byte 1 to 8: The use of these 8 bytes is free and no control on the values is performed by the module. Default value of these bytes is '0xFF'.

Set/Get Mode Byte 1:
Value = 0x00 Mode = Dual inputs mode
Value = 0x01 Mode = Redundant mode
Value = 0x02 Mode = Hierarchical mode
Value = 0x03 Mode = Diversity mode
Byte 2: This byte is relevant to redundant mode only.
Value = 0x00 Manual Switching
Value = 0x01 Automatic switch on Synchro loss
Value = 0x02 Automatic switch on DRS (Remaining error packet after Reed Solomon)
Byte 3:
Value = 0x00 Select RF Input 1
Value = 0x01 Select RF Input 2
Byte 4
Value = 0x00 Nominal condition (Default value)
Bit 0 set to 1 Optimized for mobile operation (faster channel estimation algorithm)
Bit 2 set to 1 Diversity mode – optimized reception (forces a frequency offset between the 2 tuners indiversity mode. This improves the MER and sensibility.)

Set/Get RF Input 1 / 2 parameters Byte 1:
Value = 0x00 Channel Bandwidth = 7 MHz
Value = 0x01 Channel Bandwidth = 8 MHz
Value = 0x02 Channel Bandwidth = 6 MHz
Value = 0x03 Channel Bandwidth = 5 MHz
Byte 2 to 5: Value of the center frequency of the selected RF channel Byte 2 is the MSB and byte 5 the LSB. The Frequency is expressed in hertz. For example 666 000 000 Hz should be coded as 0x27B25A80, byte 2 = 0x27, byte 3 = 0xB2, byte 4 = 0x5A, byte 5 = 0x80.
Byte 6:
Value = 0x00 No offset frequency
Value = 0x01 Negative offset frequency (- 167 KHz)
Value = 0x02 Positive offset frequency (+ 167 KHz)
Byte 7: Only useful when Hierarchical DVB-T mode is detected
Value = 0x00 Select LP stream
Value = 0x01 Select HP stream

Get Address
This command is used to get the address of the module. As an exception to the general protocol, the <AD> value for this command could be 0x00, whatever the address of the module is. Note: This command is the only "Get" type command that is allowed to be used with address field <AD> = 00.
Byte 1: Value of the address of the module within the range of 0x81 to 0x87. If not previously set, the default value of this Address is '0x81'

Get Serial Number
Byte 1: Value of the serial number from 1 to 9999 (0x0001 to 0x9999 -
BCD coded)
Get Type & Version
Byte 1 & 2: Hardware Version, BCD coded on 2 bytes in the range of 0x0100 to 0x0999
Byte 3 & 4: Software Version, BCD coded on 2 bytes in the range of 0x0100 to 0x0999
Byte 5 to 8: 4 bytes Numerical BCD value that gives the type of module according to the following list:
0x080F 1020 = R&S TSM-DVB 1503.7007.10"

Get General Status
Byte 1:
Value = 0 The module is OK
Value = 1 A hardware problem/warning has been detected
Value = 2 A software problem/warning has been detected
Value = 3 A hardware and a software problems/warnings have been detected
Byte 2: Detailed warning reporting (Active if bit xx = 1)
Bit 0 A power-on reset occurred
Bit 1 Temperature Alarm
Bit 2 Non compatibility Hardware / Software
Bit 3 Failure in loading process
Bit 4 Failure in internal communication

Get Selected Input, This command is used to know which RF input is active in redundant mode.
Byte 1:
Value = 0 RF Input 1 is selected
Value = 1 RF Input 2 is selected

Get Input 1 / 2 Status
Byte 1:
Bit 0 = AGC locked
Bit 1 = Carrier locked
Bit 2 = TPS locked
Bit 3 = Viterbi locked
Bit 4 = MPEG Synchro locked
Bit 5 = MPEG Data locked
Bit 6 = Uncorrected MPEG Packet
In diversity mode, the bits 3 to 6 are significant
Byte 2: Signed Value RF Input level in dBm. For example 0xC8 means Input level = -56 dBm
Byte 3:
Value = 0 DVB-T mode – 2K
Value = 1 DVB-T mode – 8K
Value = 2 DVB-T mode – 4K
Byte 4:
Value = 0 DVB-T mode – Guard interval = 1/32
Value = 1 DVB-T mode – Guard interval = 1/16
Value = 2 DVB-T mode – Guard interval = 1/8
Value = 3 DVB-T mode – Guard interval = ¼
Byte 5:
Value = 0 DVB-T mode – Constellation = QPSK
Value = 1 DVB-T mode – Constellation = 16 QAM
Value = 2 DVB-T mode – Constellation = 64 QAM
Byte 6:
Value = 0 DVB-T mode – Non Hierarchique
Value = 1 DVB-T mode – Hierarchique with α = 1
Value = 2 DVB-T mode – Hierarchique with α = 2
Value = 3 DVB-T mode – Hierarchique with α = 4
Byte 7:
Value = 0 DVB-T mode – Code rate = ½
Value = 1 DVB-T mode – Code rate = 2/3
Value = 2 DVB-T mode – Code rate = ¾
Value = 3 DVB-T mode – Code rate = 5/6
Value = 4 DVB-T mode – Code rate = 7/8
Byte 8: Significant only when hierarchical DVB-T mode is detected.
Value = 0 DVB-T mode – LP code rate = ½
Value = 1 DVB-T mode – LP code rate = 2/3
Value = 2 DVB-T mode – LP code rate = ¾
Value = 3 DVB-T mode – LP code rate = 5/6
Value = 4 DVB-T mode – LP code rate = 7/8

Byte 9:
Value = 0 Native inner interleaver
Value = 1 IN-depth inner interleaver
Byte 10 to 11: Cell Id as defined in ETS 300744.
Byte 12: MER – Modulation Error Ratio expressed in dB (For example 0x1B means MER = 27 dB)
Range: 0 to 28 dB, Resolution: 1dB
Byte 13 to 15: BER – Bit Error Rate expressed in 10^{-8} (For example value 0x012345 means a BER = 7.45×10^{-4}) No significant in diversity mode
Byte 16 & 17: PER – Packet Error Rate expressed in error packets per second. (For example value 0x0123 means 291 error packets per second). No significant in diversity mode

Get Input 1 / 2 TPS TPS bits are referred according to ETS 300744 standard
Byte 1: TPS bits b16 to b23
Byte 2: TPS bits b24 to b31
Byte 3: TPS bits b32 to b39
Byte 4: TPS bits b40 to b47 - Odd frames
Byte 5: TPS bits b48 to b55 - Odd frames
Byte 6: TPS bits b40 to b47 - Even frames
Byte 7: TPS bits b48 to b55 - Even frames

Get S/N 1 / 2
The value measured by the demodulator chip is in fact the ratio C/(N+I) in dB.
Byte 1: Value of the C/(N+I) in dB. (For example value 0x1E means a C/(N+I) = 30 dB). This measurement is disturbed by the presence of narrow band interferers, especially if a residual LO is present on the central frequency (direct I/Q modulation).

Get Output Format:
Byte 1:
Value = 0x00 Output Format at 204 bytes
Value = 0x01 Output Format at 188 bytes

Get Constellation 1 / 2
This command is used to get constellation points of the RF input 1. 16 constellation points are monitored each time the command is sent.
Byte (4.n) to (4.n+1)(1≤n≤16): Real part of point n (16-bits signed integer)
Byte (4.n+2) to (4.n+3) (1≤n≤16): Imaginary part of point n (16-bits signed integer)
Real part and imaginary part of point n are the coordinates of the nth constellation point.

Get DVB-H TPS field input 1 / 2
Byte 1:
Value = 0x00 DVB-H signaling is not performed
Value = 0x01 DVB-H signaling is performed
Byte 2:
Value = 0x00 Time slicing is not used on HP stream
Value = 0x01 Time slicing is used on HP stream
Byte 3:
Value = 0x00 MPE FEC is not used on HP stream
Value = 0x01 MPE FEC is used on HP stream
Byte 4:
Value = 0x00 Time slicing is not used on LP stream
Value = 0x01 Time slicing is used on LP stream
Byte 5:
Value = 0x00 MPE FEC is not used on LP stream
Value = 0x01 MPE FEC is used on LP stream

Error Message: This message is sent by the module when something is wrong.
Byte 1: Identifier of the message received from the host.
Byte 2:
Value = 0 Wrong number of Data bytes
Value = 1 Unknown message Id
Value = 2 Wrong parameter value
Value = 3 Invalid command
Value = 4 CRC errors

Host software strategy

The R&S TSM-DVB 1503.7007.10 needs a new host software to be controlled. In order to have a single host software able to configure both the R&S TSM-DVB 1503.7007.10 and the R&S TSM-DVB 1503.7007.02, this new software should implements both sets of commands. In order to determine the type of receiver it is connected to, the host processor can use the following strategy: It sends the "Type and version" command (131) with the new module address using "TX 81 83". If the receiver is the R&S TSM_DVB 1503.7007.02, because it does not recognize the command ID, it will answer with an error message using "TX 00 40 83 01" (wrong ID). Note that the Error ID (0x40) is not a valid ID of the new protocol. The host processor can then use the command set of the R&S TSM-DVB 1503.7007.02. If the receiver is the R&S TSM-DVB 1503.7007.10, it will properly answer to the "Type and version" command using "TX 81 83 08 0F 10 20". The host processor can then use the new command set.