ROHDE&SCHWARZ

Broadcasting Division

System Manual

NW8202E/V DTV Transmitter

Transmitter Series Nx8000

Only skilled personnel may perform the operations of the described instrument that are necessary for installing and putting it into operation as well as maintaining, troubleshooting and servicing it.

Printed in Germany

System Manual
Transmitter Series Nx8000
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Für Betrieb im Europäischen Wirtschaftsraum (EWR) und zivilem Einsatz.

Hinweis gemäß dem Gesetz über "Funkanlagen und Telekommunikationsendeinrichtungen" (FTEG) und der Europäischen Richtlinie 1999/5/EG:

Dieses Produkt darf innerhalb des EWR nicht uneingeschränkt betrieben werden, da der verwendete Frequenzbereich auf nicht harmonisierten Bändern erfolgt. Nationale Vorschriften / Genehmigungen sind zu beachten.
Das Gerät ist 4 Wochen vor Inverkehrbringen bei der jeweils zuständigen nationalen Behörde für die Frequenzhoheit zu notifizieren. Informationen hierzu im Internet unter folgender Adresse: http://europa.eu.int/comm/enterprise/rtte/spectr.htm

For operation in the European Economic Area (EEA) and civil use.

Note pursuant to the German Radio and Telecommunications Terminal Equipment Directive (FTEG) and the European R&TTE Directive 1999/5/EC:

Operation of this product within the EEA is subject to restrictions since the frequency bands used are not harmonised. National provisions / authorizations shall be complied with.
The product shall be notified to the competent national frequency management authority four weeks before the product is put on the market.
For more information refer to: http://europa.eu.int/comm/enterprise/rtte/spectr.htm

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KONFORMITÄTSERKLÄRUNG gemäß dem Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG) und der Richtlinie 1999/5/EG (R&TTE)
DECLARATION OF CONFORMITY in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/EC (R&TTE Directive)

CE

Zertifikat-Nr.:/ Certificate No.: 2006-44

Hiermit wird bescheinigt, dass die Funkanlage
This is to certify that the Radio equipment

Gerätetyp Equipment Type	Materialnummer Stock No.	Benennung Designation
NW8202E/V	**2099.9550.xx**	**VHF DVB-T Sender 660 W** VHF DVB-T Transmitter 660 W

Geräteklasse: / Equipment class: 2.10 (Broadcast transmitters)

bei bestimmungsgemäßer Verwendung den grundlegenden Anforderungen des § 3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.
complies with the essential requirements of §3 and the other relevant provisions of the FTEG (Article 3 of the R&TTE Directive), when used for its intended purpose.

- Gesundheit und Sicherheit gemäß § 3 (1) 1. (Artikel 3 (1) a))
- Health and safety requirements pursuant to § 3 (1) 1. (Article 3(1) a))

- Schutzanforderungen in Bezug auf die elektromagn. Verträglichkeit § 3 (1) 2, Artikel 3 (1) b))
- Protection requirements concerning electromagnetic compatibility § 3(1)(2), (Article 3(1)(b))

- Maßnahmen zur effizienten Nutzung des Funkfrequenzspektrums
- Measures for the efficient use of the radio frequency spectrum

- Luftschnittstelle bei Funkanlagen gemäß § 3(2) (Artikel 3(2))
- Air interface of the radio systems pursuant to § 3(2) (Article 3(2))

Angewendete harmonisierte Normen: / Harmonised standards applied:	EN 60215 : 1989 + A1 : 1992 ETSI EN 301 489-1 V1.5.1 (2004-11) ETSI EN 301 489-14 V1.2.1 (2003-05) ETSI EN 302 296 V1.1.1 (2005-01)
Einhaltung der grundlegenden Anforderungen auf andere Art und Weise (hierzu verwendete Standards/Spezifikationen): Other means of proving conformity with the essential requirements (standards/specifications used):	ETSI EN 300 744 V1.5.1 (2004-06) RegTP SSB RU 005 Rec. 1999/519/EG; 26. BImSchV

Anbringung des CE-Zeichens ab: 2006 / Affixing the EC conformity mark as from 2006

FTEG3109-SBB

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QM CI

Zentrales Qualitätsmanagement MF-QZ / Radde
Central Quality Management

NW8202E/V CONTENTS

CHAPTER 1

SAFETY INSTRUCTIONS

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CONTENTS

1 About this Manual

This manual is part of the documentation for the NX8000 family of transmitters from Rohde & Schwarz. Each transmitter and each transmitter component is described in a separate manual. The individual manuals of the family of transmitters are modular in structure and complement each other.

Structure

Each transmitter component is described in a separate manual and can thus be used as an individual component (where practical). The transmitter manual is the main document for the entire set of documentation. It describes all steps that are necessary to install a transmitter, put it into operation, operate and maintain it. Where applicable, the transmitter manual refers to the individual manuals for the various components. The component manuals, in turn, also refer to the transmitter manual whenever the component is to be used as a transmitter module.

Contents

The manuals for the family of transmitters describe all steps required to install the transmitter or one of its components, put them into operation, operate and maintain them, troubleshoot and service them. The Annex includes interface descriptions plus technical documents.

For convenience, all manuals are structured identically. Sections that are not relevant to the manual at hand are also included but are left blank.

Safety

All skilled personnel working with a transmitter or its components must read all relevant manuals and comply with the safety measures that are detailed in the chapter about safety and in the applicable sections in the manual. The transmitter and the individual transmitter components must be used only for their intended purpose. All operations involving the transmitter or individual transmitter components must be performed by skilled personnel. The manual will point out specifically if additional qualifications are required.

Symbols and Layout

The triangular warning symbol indicates danger. In addition to the triangular warning symbol, different key words indicate the level of potential danger.

Instructions are given in numbered steps or indicated by an "index finger" symbol to the left of the instruction text. The results of the performed instructions are indented.

The key word "Note" precedes notes. Notes contain additional information and tips to help facilitate the work at hand.

All other formatting options add structure to the text and are self-explanatory.

2 Safety Instructions for Transmitter Systems and Instruments

ATTENTION!
The safety instructions provided in this manual must be complied with!

Pay special attention to the following points:

- Only skilled personnel may perform electrical installation and electrical connection tasks.
- Always follow the relevant national and international safety rules and regulations when equipping operating areas and when setting up and operating electrical equipment.

  These rules and regulations include for example:
  - Protective measures to prevent accidents
  - Protective measures to prevent overvoltage
  - Insulation status of electrical equipment
  - Grounding of electrical equipment
  - Physical properties and laying of electric lines and cables
  - Regulations applying to industrial premises and areas as well as to special facilities.

- When setting up the rack, observe the country-specific rules for accident prevention, for example with regard to:
  - Risk of getting crushed when working with loads suspended in the air
  - Risk of falling off ladders
  - Risk of injury when lifting heavy objects.

- Use your personal protective equipment for installation and repair work, i.e. wear protective clothing such as helmets, safety gloves and eye protection, depending on the task at hand.
- Operate the equipment and systems only when the cabinet is closed. If you have to open the cabinet for maintenance and repair work, comply with the applicable safety instructions.
- If the equipment and systems are removed from the AC power supply, all poles must be disconnected. Check for and remove any external power supply, i.e. all measuring cables, extension cables, multiple socket outlets (except for special service sockets). Wait for five minutes to ensure that any and all capacitors are sufficiently discharged.
- Additionally with liquid-cooled transmitters:When filling and installing the cooling system (pump unit and heat-exchanger unit), observe the rules for handling hazardous substances (cooling agents); see section "safety data sheets about hazardous substances" under "EU safety data sheet in accordance with 2001/58/EC Antifrogen".

3 General Safety Instructions

This section contains general safety instructions that apply to all products manufactured or distributed by Rohde & Schwarz.

In accordance with IEC 215 and EN 60215, transmitters and their auxiliary equipment must be operated only under the responsibility of skilled personnel. The EN 60215 standard ("Safety requirements for radio transmitting equipment") defines the minimum requirements for skilled electrical personnel.

Complying with all statutory provisions is a precondition for operating radiocommunications systems and equipment. The operator or the operator's authorized representative is responsible for ensuring compliance with these guidelines. They must also ensure that the operating personnel meets the applicable country-specific training requirements. These requirements also include any periodic training that is necessary.

4 Special Danger Warnings

4.1 Hazards due to AC Supply Voltage

There is a risk of electric shock with any V_{rms} > 30 V AC or V > 60 V DC voltage. Appropriate measures must be taken to prevent exposure to any danger when working with voltages that bear the risk of electric shock. Never work on live parts unless specifically required and only if the special safety precautions are complied with.

4.1.1 AC Power Supply

❍ Before connecting the equipment to the AC power supply, make sure that the AC supply data specified on the system or equipment matches the rated data of the local AC supply. The supply circuit must be protected by fuses against overloading and short circuits at all times.

It is possible that a transmitter has completely separate circuits. For each of these circuits, the following requirements apply:

❍ When connecting all circuits of the transmitter to the AC power supply make sure that the following requirements are met:
- The transmitter can be disconnected at any time.
- The transmitter can be secured against reactivation.
- The transmitter is terminated with a power line that is correctly fused and also suitable for power consumption.[1]
- Apply the rotating field as intended (rotating direction of the fans!).

Service sockets

To allow measuring equipment or a soldering iron to be operated, it is customary to equip transmitters with a service socket that carries voltage even when the transmitter is switched off. Such service sockets are identified as such, for example with an LED, and may only be used for the above mentioned purposes.

Since the socket is intended solely for service purposes, it has only a limited power output. **Never use the socket to operate heating appliances or large test systems.**

❍ The transmitter operator is responsible for the correct fusing (the socket is labeled with the maximum value).

❍ With accessories that are not controlled with the entire transmitter, the transmitter operator is responsible for taking the appropriate measures to ensure safety in each circuit state.

1 Apply the specifications of this documentation and observe also the limited deactivation capabilities of the fuses and circuit breakers in the transmitter.

4.1.2 Replacing Fuses

- Replace the safety fuses accessible in the operator area only if no voltage is being applied to the instruments. The safety fuses may be replaced only by fuses with identical electric data, identical switching characteristics and identical switch-off capacity.
- Motor and line circuit breakers accessible in the transmitter's operator area may be operated. If their response range is selectable, do not change the settings made by the manufacturer. If the settings are accidentally changed, reset them by using the correct values specified in this documentation.

4.1.3 Emergency-Off Equipment

- If the customer requests, the transmitters are equipped with emergency keys. When the transmitters are supplied, these keys have basically no function. The transmitter operator is responsible for ensuring that these emergency keys function safely and to integrate them into the emergency-off system of the operator area in accordance with the regulations. If you subsequently decide not to use the emergency keys as an emergency-off system, you must remove them.
- **Extremely important!** A transmitter normally has several AC supply circuits that are independent from each other, such as main AC supply circuit, AC current supply for accessory equipment (main control unit, antenna switch, etc) or AC current supply for a disabled socket.

  The transmitter operator is responsible for making sure that all these circuits are integrated correctly into the emergency-off system. Circuits not integrated have to be labeled accordingly.
- Never set up a transmitter that is equipped with disabled emergency-off equipment.

4.1.4 Opening the Transmitter

- When you open the transmitter to carry out mechanical/electrical tasks (e.g. cleaning, repair, etc) always follow the five basic rules for working with electrical systems:

  – Disconnect the transmitter from the power supply
  – Secure it against inadvertent switch-on
  – Verify safe isolation from any power
  – Ground or short-circuit it[2]
  – Cover adjacent active circuits.

- **Extremely important!** A transmitter normally has several AC supply circuits that are independent from each other, such as main AC supply circuit, AC current supply for accessory equipment (main control unit, antenna switch, etc) or AC current supply for a disabled socket.

  Prior to performing any work, check the current status of the circuits. Also disconnect adjacent circuits to prevent inadvertent contact.

2 Not all transmitter types can be grounded or short-circuited by using a grounding or short-circuit switch. If a suitable device for grounding or short-circuiting is not available, the skilled personnel must take appropriate measures as deemed necessary.

- If you have to perform any work on the RF circuit, isolate the antenna connector as well.

  Caution! If other transmitters, etc, are in operation that are coupled to the same antenna via RF filters, energy from them can be fed back via the antenna cable.
- Never open a disconnected transmitter without taking protective measures against touching voltage-carrying parts.
- Due to the risk of electric shock from the AC supply voltage, never perform any electrical operations when doors are open, front panels are unscrewed, plug-ins are withdrawn, etc.
- When electrical operations of the transmitter are performed for the purpose of internal measurements or repair, label the workplace accordingly and provide warning about the potential hazards in accordance with the basic rules of electrical engineering.

  Appropriate measures have to be taken to prevent unauthorized persons from accessing this area.

  After completing your work, close the transmitter and restore all safety measures for preventing electric shock that have been provided by the manufacturer. Immediately make sure that protective equipment (e.g. locks) is effective.

4.2 Hazards due to High-Energy Circuits

The instruments include low-voltage circuits which can be fed from an extremely low-impedance voltage source(e.g. amplifier operating voltage). These circuits conduct dangerously large amounts of energy. We handle these circuits in the same manner as circuits with voltages that bear the risk of electric shock. They are usually covered and thus protected against accidental contact. The cover comes with a warning label.

If you remove the cover of a transmitter that is in operation, there is the risk of both voltage poles being short-circuited. Short circuits create an electric arc and thus can cause burns, damage to the eyes as well as further injuries due to the state of shock response.

Practical experience has repeatedly shown that a short circuit caused by metal tools can cause severe burns. For safety reasons, high-energy circuits are protected by covers and are thus not accessible within the operator area of the instruments.

- If you need to measure low-impedance voltages, during repair work or to optimize the power consumption of the transmitter for example, exercise the same caution as when measuring operating voltages that bear the risk of electric shock.

  Wear protective clothing if necessary.
- Before you open an instrument or remove its cover, switch off the operating voltage and wait for five minutes to ensure that any and all capacitors are sufficiently discharged.
- Do not short-ciruit capacitors to discharge them.

4.3 RF Hazards

4.3.1 Mandatory Training

- Operators must instruct their personnel on how to use this transmitter or instrument in accordance with EN 60215 and IEC 215. This periodic training must cover the radio-fre-

quency hazards of the individual transmitter or instrument. Only after such training has been provided and documented may the operating personnel handle switching and operating tasks.

High-energy RF circuits within the transmitter or the instrument are routed via conventional detachable RF connectors (e.g. N). Depending on the output power, the transmitter or instrument outputs come with screw-in or pluggable RF lines or ducts.

If RF lines or modules conduct high power, the connection point or the entire module is marked with the standard warning symbol (yellow triangle with black exclamation mark).

4.3.2 RF Shielding

Transmitters and instruments from Rohde & Schwarz are shielded in such a manner that RF radiation does not pose any danger even in the immediate vicinity if all RF lines are closed. This statement is based on the ordinance for electromagnetic fields as defined in German law:

The 26th ordinance for the Federal Emission Protection Law dated December 16, 1996 defines limit values for radio-frequency equipment for electric and magnetic field strengths.

4.3.3 Rules for Operating the Transmitter

Opening RF lines during operation may cause electric arcs. This can cause burns and eye injuries.

- Operate the transmitter system only if an antenna or dummy antenna is connected.
- Never undo RF lines during transmitter operation.
- Never open modules during transmitter operation.
- Never put transmitters into operation if RF lines are open. [3]
- When disconnecting a transmitter, always disconnect the antenna connector as well. If other transmitters, etc, are in operation that are coupled to the same antenna via RF filters, energy from them can be fed back via the antenna cable.

4.3.4 Rules for Working with an Open Transmitter

If you switch on an open transmitter and remove covers and shielding that carry the general warning symbol of RF modules, dangerous RF levels will be radiated .

The transmitter operator is responsible for strict compliance with the necessary safety precautions when someone is working with or located near an open transmitter that is switched on.

Necessary safety regulations include:

3 If you try to put the transmitter into operation, RF power is transmitted. If RF lines are open, the transmitter switches off the RF again. This attempt to transmit RF can lead to the above mentioned risks of injury even if - as is the case with Rohde & Schwarz transmitters - the RF flow is limited and transient due to technical measures.

- Labeling the workplace as subject to RF hazards
- Wearing RF protective cloth
- Taking special safety precautions for persons with implants such as metal parts, pacemakers, etc, since they are particularly susceptible to injury.

4.4 Fire Hazards

Every electric circuit containing sufficient energy and to which voltage is applied poses fire hazards. This also applies to radio transmitters. For transmitter radio systems, it is therefore necessary to create a safety plan for the event of fire.

Operating personnel must be trained on how to proceed in the case of fire in areas containing electrical systems; training must be repeated at regular intervals. Personnel should be trained on the basis of the VDE 0132 standard and in agreement with the local fire department.

The following statement applies in Germany. Preventive measures at the site in question can largely eliminate the risk of fire or prevent its spread as far as possible.

Prevention and fire-fighting

- When setting up the transmitter, the operator must ensure that no inflammable materials are located below or above the cable entry nor attached to it.

  Make sure that openings to adjacent spaces are closed in a flame-retardant manner.
- Fire-fighting is only allowed with special equipment even if the flames are insignificant or have no effect at all (e.g. breathing mask with air bottle).
- For fire-fighting, only suitable fire extinguishers (e.g. CO_2 extinguishers) may be used.

One reason for requiring special equipment is the fact that extremely poisonous and imperceptible carbon monoxide is released during every fire. Another reason is that the materials contained in the instruments and systems emit poisonous vapors, gases and dust such as sulfuric acid and hydrogen sulfide, hydrochloric acid, dioxin, hydrofluoric acid and beryllium oxide dust when they are exposed to external flame and heat.

The following materials can be affected:

- Rubber in cables, cable bushings, vibration absorbers and instrument feet
- PVC in cables and lines
- PUR (foam) in insulators, molded parts, sealing mats and insulating strips
- Teflon in cables, lines, insulation material and printed boards
- Beryllium oxide ceramics in power transistors