R&S®Series 4200 VHF/UHF Multichannel Radiocommunications System

New radio generation for ATC communications

ROHDE&SCHWARZ

Radiocommunications

Product Brochure | 02.00

R&S®Series 4200 VHF/UHF Multi-channel Radiocommunications System

At a glance

The R&S®Series 4200 represents the latest generation of ground radios for both civil and military air traffic control. Possible applications range from small airport emergency systems requiring only a few radio channels to countrywide communications systems with several hundred radio channels.

Available versions of the R&S®Series 4200 radio family

VHF (112 MHz to 144 MHz)

R&S®XU4200
VHF transceiver

R&S®SU4200
VHF transmitter

R&S®EU4200
VHF receiver

R&S®EU4200C
compact VHF receiver

Equipment for the VHF and UHF frequency ranges

The R&S®Series 4200 is available in eight versions: transceiver, transmitter, receiver and compact receiver (each available for VHF and UHF).

The R&S®Series 4200 radios for the VHF frequency range (112 MHz to 144 MHz) are suitable for civil applications. The R&S®Series 4200 radios for the UHF frequency range (225 MHz to 400 MHz) are suitable for applications in military air traffic control (air force, navy, army aviation forces). The UHF transceiver allows an external encryption device to be connected.

Wide application range and simplified radio planning, even in challenging environments

The R&S®Series 4200 offers an extremely wide range of possible configurations, allowing optimal adaptation to the desired application scenario.

The radios were implemented on a software basis in order to provide users of the R&S®Series 4200 with the widest possible range of applications. New functions are implemented through software upgrades that Rohde & Schwarz makes available at regular intervals.

All radios of the R&S®Series 4200 are multichannel radios, but they can also be software-configured for reliable operation as single-channel radios. Redundant operation of two radios in order to boost the channel availability is possible without any external monitoring and switching equipment.

Standard functions include 8.33/25 kHz channel spacing for VHF and 8.33/12.5/25 kHz channel spacing for UHF, carrier offset 1 to 5 (VHF), ACARS data mode (VHF), LAN remote-control interface, serial interface for controlling automatic filters, and in-band signaling for push-to-talk (PTT) and squelch (SQ) with the capability to set different tones.

State-of-the-art DSP technology combined with an advanced squelch algorithm in the receiver as well as a highly linear digital modulator in the transmit path (VHF) ensure excellent voice quality plus low interference, which improves the reliability of communications between air traffic controllers and pilots. This is particularly important as frequencies become increasingly crowded due to the large number of voice connections and radio channels concentrated in a small area.

Special features of the R&S®Series 4200 radios

- VHF frequency range from 112 MHz to 144 MHz
- High receiver sensitivity of –107 dBm for VHF
- Very compact housing, even for the transmitter
- Continuous transmission capability with full output power of 50 W up to +40 °C ambient temperature for VHF
- Automatic main/standby operation
- USB service port for configuration and software downloads
- Remote control and remote monitoring via Ethernet interface

UHF (225 MHz to 400 MHz)

R&S®XD4200
UHF transceiver

R&S®SD4200
UHF transmitter

R&S®ED4200
UHF receiver

R&S®ED4200C
compact UHF receiver

R&S®Series 4200 VHF/UHF Multi-channel Radiocom-munications System

Benefits and key features

Easy to use even in challenging environments

- Demanding system requirements of civil air traffic control are met or exceeded
- Excellent RF characteristics
- Adjacent-channel power better than required by ETSI standard
- Very low transmitter noise
- High intermodulation rejection
- High output power at high modulation depth
- Very low receiver noise
- Receiver with excellent immunity to interference
- Cross-modulation rejection better than required by ETSI standard
- Two squelch criteria available

Maintenance-free operation

- Extensive self-test routines
- Simple remote monitoring and remote control
- Automatic adaptation to ambient conditions
- Easy remote switching when using redundant radios
- Electronic inventory and recalibration

Straightforward operation and configuration

- PC-based tools with graphical user interface
- Reliable protection against operation errors
- Warning messages in case of unauthorized local operation
- Easy remote control and monitoring via IP connection

Flexibility for system integration

- Adaptation of in-band signaling for PTT and squelch to existing voice communications systems
- Extreme flexibility in management system selection

Small footprint due to compact, modular design

- Very compact design
- Three basic modules: transmitter, receiver, power supply unit

R&S®XU4200 VHF transceiver

Easy to use even in challenging environments

Particularly in the civil sector, air traffic control places very demanding requirements on the radios used. The VHF radios are operated under conditions involving significant RF interference. High-quality communications are required even in the presence of strong interference. Of course, the radios themselves should generate as little interference as possible.

Demanding system requirements of civil air traffic control are met or exceeded

The transmitters and receivers of the R&S®Series 4200 perform as required, particularly in challenging environments. They exhibit outstanding technical characteristics which simplify radio planning. All VHF radios of the R&S®Series 4200 comply with or exceed the applicable standards from ICAO (Annex 10, Vol III) and ETSI (EN 300676).

Excellent RF characteristics

The VHF transmitters use an I/Q modulator with a Cartesian feedback loop. This ensures that the VHF transmitters have excellent RF characteristics.
The following provides you with a detailed overview of the RF characteristics.

Adjacent-channel power better than required by ETSI standard

The adjacent-channel power is –70 dB at 25 kHz and –60 dB at 8.33 kHz. This means that these values are 10 dB better than required by the ETSI standard. Receiving stations in the vicinity therefore experience hardly any interference, which gives users increased system reserves and safety of planning.

Very low transmitter noise

The transmitter noise is very low with a value of –145 dBc (1 Hz) at 300 kHz from the carrier or –155 dBc (1 Hz) at 1% from the carrier. This minimizes spurious emissions from the transmitter, helping to reduce receiver interference particularly in installations involving collocation.

High intermodulation rejection

Due to the high intermodulation rejection, an external circulator is not required in many cases. If an external circulator is used nevertheless, the radio allows evaluation of an external VSWR measurement that is required in such cases.

High output power at high modulation depth

The 50 W output power at the high modulation depth of 90% is available even under challenging ambient conditions (temperature, VSWR). The modulation distortion is max. 5% (typ. 1%) for a modulation depth of 90%. A limiter at 95% prevents overdrive.
The transmitter is designed for 50 W continuous operation (100% duty cycle) up to an ambient temperature of +40 °C. This makes the R&S®Series 4200 also ideal for ATIS or VOLMET transmitters.

Very low receiver noise

The VHF receiver has a very low noise factor to provide outstanding reception even under tough conditions. It also offers excellent immunity to interference. In many cases, frequency replanning is therefore not necessary when adding additional channels to existing radio sites.

The receive sensitivity is –107 dBm (measured in accordance with EN 300676). The required –93 dBm receive power in accordance with ICAO Annex 10, Vol. III, provides high planning reserves. This means that high antenna cable losses or insertion losses of receive filters can be tolerated without any impact on receive quality.

Receiver with excellent immunity to interference

The permissible interfering signal for maximum desensitization of 6 dB has a power level of –12 dBm, measured in accordance with EN 300676. This value is 15 dB above the limit specified by ETSI. This ensures reliable and secure reception even under challenging collocation conditions.

Cross-modulation rejection better than required by ETSI standard

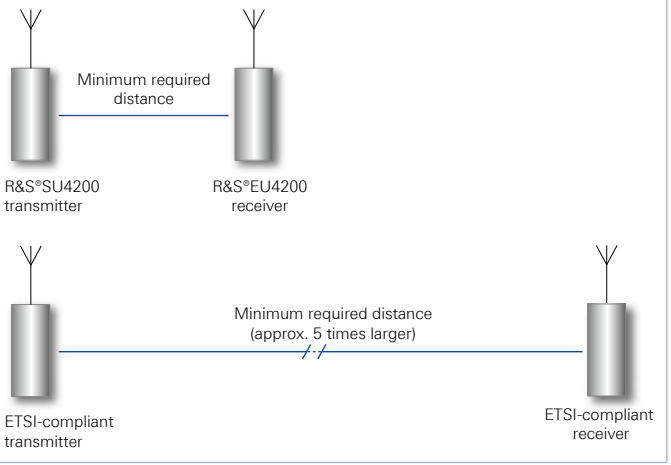
The cross-modulation rejection of 90 dB, which is 10 dB above the value specified by ETSI, reduces undesired cross-modulation due to interfering signals. This makes the receiver less susceptible to interference that can hardly be eliminated. External filters are therefore not required in many cases.

Two squelch criteria available

The receiver includes two squelch criteria which can be logically combined (AND, OR). The squelch criterion can be based on the receive power, the S/N ratio of the demodulated useful signal or a logical combination of these two criteria. Both thresholds can be set independently in a wide range.

The minimum required distance between transmitter and receiver is about five times larger (worse) in ETSI-compliant radios compared to the R&S®Series 4200

Distance between transmitter and receiver



Minimum distance required between transmitter and receiver sites for same SINAD

Parameter	ETSI EN 300676	R&S®Series 4200
Broadband noise of transceiver (±300 kHz)	≤–130 dBc	≤–145 dBc
Desensitization of receiver	≥80 dB	≥95 dB
Minimum distance required	approx. 1.5 km	approx. 350 m

Maintenance-free operation

The radios of the R&S®Series 4200 are designed for maintenance-free operation. They adapt automatically to the current ambient conditions and offer different functions for remote monitoring and remote control. This nearly eliminates the need to perform on-site maintenance work on the radios.

R&S®ZS4200 service and maintenance tool

Extensive self-test routines

Extensive monitoring routines (continuous built-in tests, CBIT) run in the background to keep the user always informed about the status of the equipment. More than 80 parameters are monitored and any deviation from the permissible range is displayed as a CBIT message. There are two urgency levels: warning and alarm. A warning is merely displayed, while an alarm also triggers switchover to a redundant standby radio if one is present.

Simple remote monitoring and remote control

CBIT messages are displayed on the HMI, can be read by the service PC and are also available via the remote-control interface. The transmitter can also be keyed remotely via the Ethernet interface. It is then possible to measure the output power, modulation and VSWR in this manner and read out the results via the remote-control interface. The receive power can be read off similarly on the receiver.

Automatic adaptation to ambient conditions

When ambient conditions such as the temperature, supply voltage or VSWR are outside the nominal range, the transmitter will decrease its own power stepwise in order to maintain operation as long as possible. If the ambient conditions return to their nominal range, the transmitter will automatically switch back to nominal operation with no manual intervention required.

Easy remote switching when using redundant radios

When redundant radios are used (main/standby operation), it is possible to manually switch from a remote location between the active and passive radio with practically no interruption (<200 ms). This allows the operator to check and make sure at any time that the non-active radios are still operational. In case of a problem, operation can be maintained at the appropriate frequency without any on-site intervention.

Electronic inventory and recalibration

The radio and each module have all relevant inventory data such as serial number, device type and software version stored electronically. This data can be retrieved locally or via the remote maintenance tool. In addition, installation or maintenance information can be stored in the radio by the operator.

Maintenance is limited to recalibration of the reference oscillator (TCXO), which is possible with the service PC connected to the radio without having to open the radio. Repair involves simply replacing the defective module. No hardware-related settings are required after repair.

Straightforward operation and configuration

The radios of the R&S®Series 4200 offer many diverse functions that help ensure straightforward, secure and error-free operation.

PC-based tools with graphical user interface

The radios are configured using the service PC's graphical user interface in conjunction with the R&S®ZS4200 service and maintenance tool. There is no need to open the radio, e.g. to make configuration settings using DIP switches or jumpers.

Different configurations can be created on the PC for subsequent on-site loading into the radio. To ensure that a faulty radio can be exchanged quickly, its configuration can be cloned and transferred to a new radio. This means that such an exchange is performed very fast (typically in 15 minutes).

Reliable protection against operation errors

All radio versions can be operated in fixed-channel mode. This mode makes it impossible to change the set frequency via HMI or remote control without proper authorization. The radio is configured accordingly using the service PC.

If frequency adjustments are allowed, the user can exclude one or more channels in the VHF or UHF band from the list of possible configurations. The required frequency blocking table is configured using the service PC and is loaded into the radio. This prevents the radio from accidentally operating on a frequency that is not permitted, e.g. the frequency of a radionavigation system.

Warning messages in case of unauthorized local operation

To prevent unauthorized local operation, a CBIT warning message can be activated that indicates if the radio is switched to local mode or the service PC is connected to the radio. At the same time, such activities are recorded in the radio's internal event log. This makes it possible to track all activities involving the radio at any time. The event log can be read locally or from a remote site.

Easy remote control and monitoring via IP connection

Remote control and monitoring are handled via an Ethernet connection between the radio and the management system. To ensure that only authorized users can connect to the radio, an access control list is saved in the radio. It contains the IP addresses with which the radio is allowed to communicate. Communications requests from other IP addresses are rejected.

Flexibility for system integration

The radios of the R&S®Series 4200 provide flexibility when connected to a voice communications system (VCS) and a management system. Regular software upgrades ensure future viability of the radios.

Adaptation of in-band signaling for PTT and squelch to existing voice communications systems

The in-band signaling for PTT and squelch can be adapted to existing voice communications systems (VCS), making it unnecessary to reconfigure or exchange any of the VCS components.

Signaling techniques that allow quality evaluation of the receive level can also be implemented in a straightforward manner. The in-band signaling used in the radio does not require any external components. Tone generation, filtering and evaluation are all performed by the software using a DSP.

Extreme flexibility in management system selection

The radios of the R&S®Series 4200 can be controlled and monitored using the Rohde & Schwarz protocol or the simple network management protocol (SNMP). This ensures that users have maximum flexibility when selecting a management system. Possible choices include the R&S®RCMS II or any commercially available system that is based on SNMP. It is also possible to switch from SNMP to the R&S®RCMS II (or vice versa) at a later point in time. Alternatively, both management systems can be used in parallel.

Small footprint due to compact, modular design

Due to its very compact and lightweight design, the R&S®Series 4200 makes it possible to add new channels at existing sites without having to perform any construction work. New radio installations can also be designed to be smaller, which helps to cut construction costs.

R&S®EU4200C compact VHF receiver

Very compact design

Space requirements are 19"/2, three height units for one transmitter or one receiver or one transceiver. To further decrease the space required, a compact receiver is available as an alternative. This receiver type is accommodated in a housing of half the size, i.e. 19"/4 width. The receiver module is the same as in the standard housing. This means that the following equipment can be arranged in one 19" row of three height units:

- Two transceivers or two receivers or two transmitters or any combination of these devices
- Four compact receivers

Up to 24 transmitters or transceivers can thus be accommodated in the R&S®KG4200 standard 19" rack (or up to 48 compact receivers). No external components are required for operation except any desired optional filters or multicouplers. For remote monitoring, all that is needed is an additional Ethernet switch or router.

Three basic modules: transmitter, receiver, power supply unit

The design of the R&S®Series 4200 is based on a modular structure consisting of three modules. These modules are the transmitter, the receiver and the power supply unit. Depending on the required configuration, these modules are accommodated in the appropriate housing. The housing is equipped with keypad, eight-line display, loudspeaker, headset connector and LEDs. The housing is the same for all configurations and frequency bands and is very compact, which enables flexible deployment. It is suitable for 19" system rack mounting.

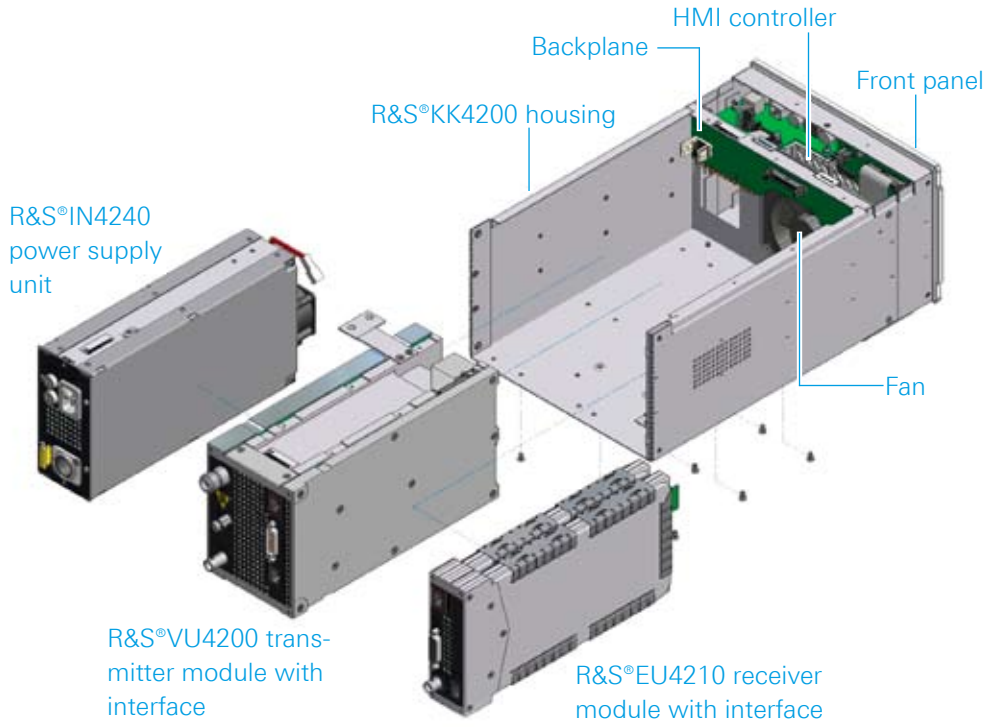
Transmitter and receiver
The transmitter and receiver are designed as independent, EMC-shielded modules that contain all required external interfaces. The transmitter, receiver and HMI controller communicate via the USB bus with the R&S®ZS4200 service and maintenance tool.

The transmit and receive modules each contain an Ethernet interface (100BaseT) that is used for control and remote monitoring of the transmitter/receiver.

The transmitter and receiver have independent synthesizers that are synchronized to a TCXO reference signal. This allows the transceivers to operate simultaneously in transmit and receive mode, which serves as a basis for true side tone or relay operation.

Integrated transmit/receive switch
The transmit module contains an integrated, wear-free PIN diode switch for switching between transmit and receive mode. This allows users at transceiver sites to choose whether they wish to use separate transmit and receive antennas or a common transmit/receive antenna. No configuration changes or settings are needed on the radio.

Modular design of the R&S®XU4200



Modular design of the R&S®XU4200 VHF transceiver

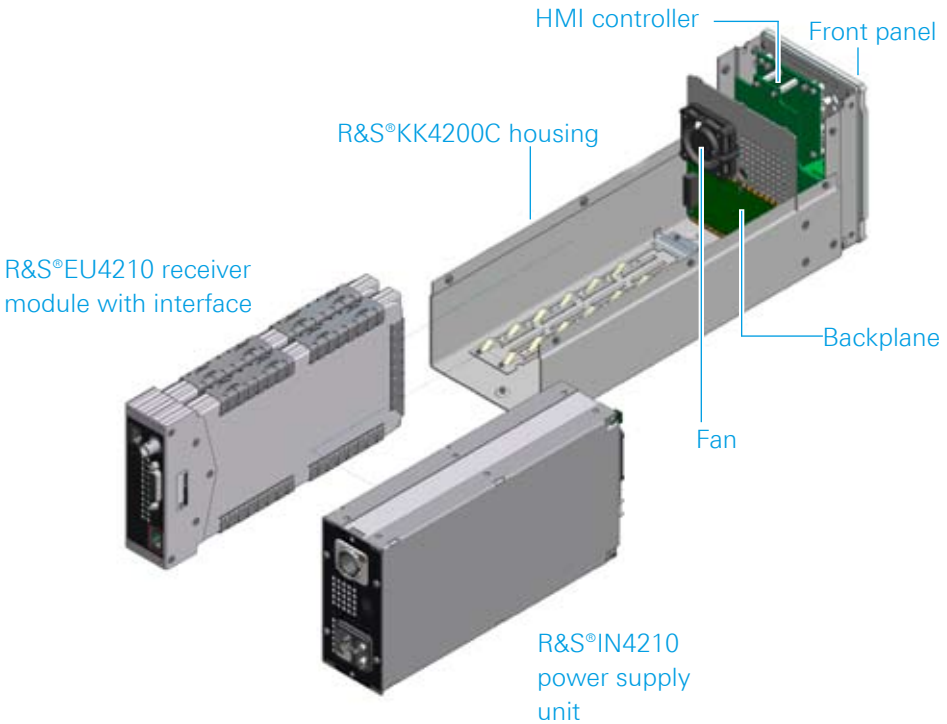
Power supply
The modules are powered via the backplane, or (in the case of the power amplifier) directly by the power supply module. The power supply is an independent, EMC-shielded module that contains all required external interfaces. It allows operation of the radio from AC, DC or a combination of the two. Interruption-free switchover occurs in case of failure of the AC supply.

The power supply has a wide supply voltage range and can be operated with 230 V AC or 115 V AC without manual switchover. The user stays informed about the availability (or dropout) of the supply voltages using LEDs on the radio as well as warning messages to the management system. The power supply is available as a 400 W and as a 45 W version. The 400 W power supply is used in the transmitter and transceiver while the smaller 45 W power supply is used in the receiver.

Housing with HMI controller
The HMI controller is part of the housing. It includes the control of the radio and the interface to the user. The HMI controller allows the radio to be operated using the integrated keypad and display. Configuration of the radio is possible via the USB interface. Software updates and upgrades are handled via the USB bus as well. The HMI controller with identical functionality is used both in the standard housing and in the compact housing.

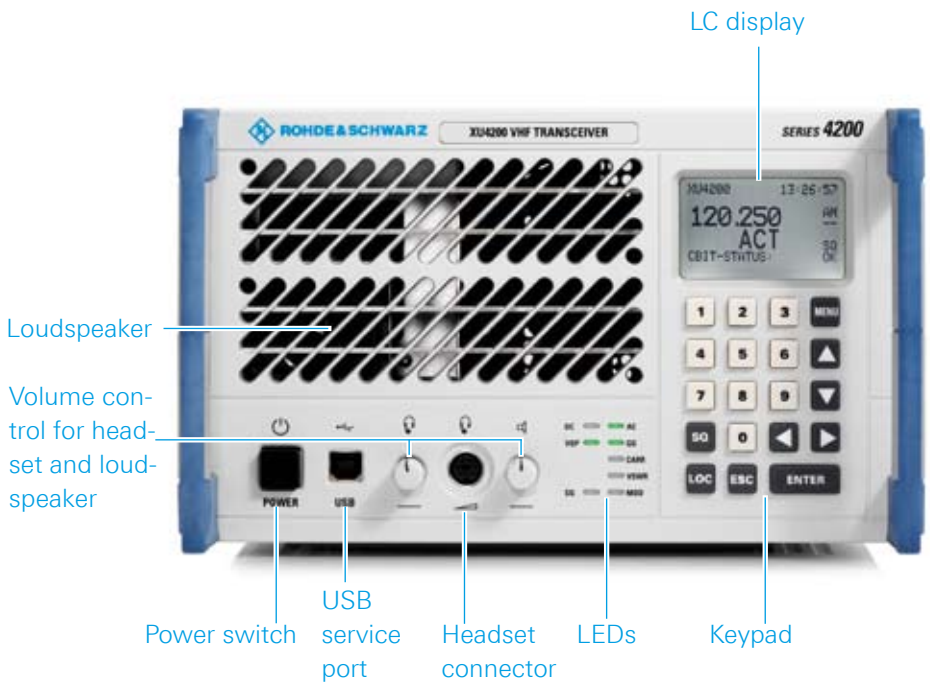
Modular design of the R&S®EU4200C compact VHF receiver

Modular design of the R&S®EU4200C



R&S®Series 4200
Front view

Transceiver/transmitter/receiver



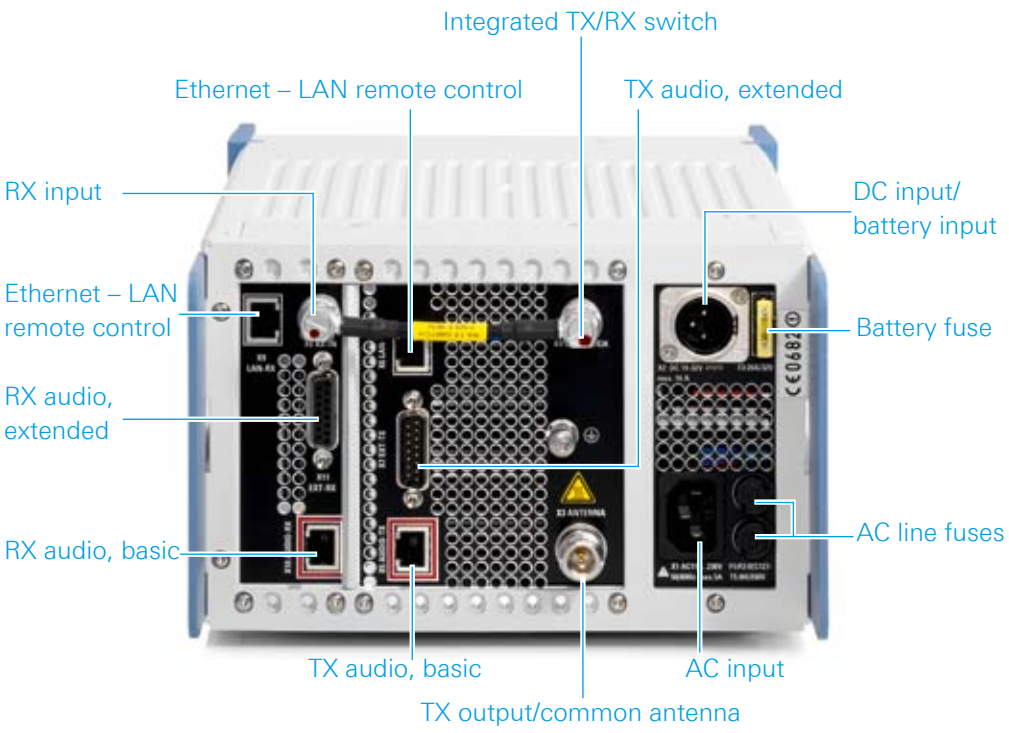
Front view of the transceivers, transmitters and receivers of the R&S®Series 4200

Compact receiver

Front view of the compact receivers of the R&S®Series 4200

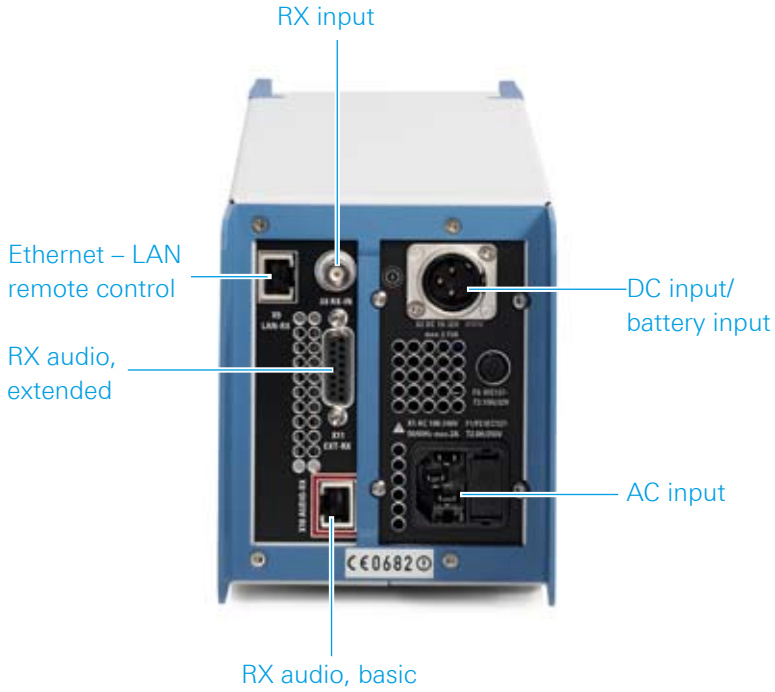
R&S®Series 4200
Rear view

Transceiver



Rear view of the transceivers of the R&S®Series 4200 (transmitters and receivers are similar)

Compact receiver



Rear view of the compact receivers of the R&S®Series 4200

Ordering Information

Designation	Type	Order No.
R&S®Series 4200 VHF Multichannel Radios		
VHF Transceiver		
50 W, 118 MHz to 137 MHz	R&S®XU4200	6130.2000.07
50 W, 112 MHz to 144 MHz	R&S®XU4200	6130.2000.02
VHF Transmitter		
50 W, 118 MHz to 137 MHz	R&S®SU4200	6130.2200.07
50 W, 112 MHz to 144 MHz	R&S®SU4200	6130.2200.02
VHF Receiver		
118 MHz to 137 MHz	R&S®EU4200	6130.2100.07
112 MHz to 144 MHz	R&S®EU4200	6130.2100.03
Compact VHF Receiver		
118 MHz to 137 MHz	R&S®EU4200C	6130.2152.07
112 MHz to 144 MHz	R&S®EU4200C	6130.2152.02
R&S®Series 4200 UHF Multichannel Radios		
UHF Transceiver		
50 W, 225 MHz to 400 MHz	R&S®XD4200	6133.8500.02
50 W, WB interface, 225 MHz to 400 MHz	R&S®XD4200	6133.8500.06
UHF Transmitter 50 W, 225 MHz to 400 MHz	R&S®SD4200	6133.8700.02
UHF Receiver 225 MHz to 400 MHz	R&S®ED4200	6133.8600.02
Compact UHF Receiver 225 MHz to 400 MHz	R&S®ED4200C	6133.8645.02
Accessories (external options)		
Service and Maintenance Tool	R&S®ZS4200	6133.8722.xx
Headset, dynamic microphone	R&S®GA4200D	6133.8780.00
Headset, electret microphone	R&S®GA4200E	6133.8797.00
Microphone, mini-DIN connector	R&S®GA016H1	0583.5568.03
System components		
Antennas		see catalog
Automatic tunable filters		on request
Manually tunable filters		see catalog
Receive Multicoupler	R&S®ATCMC	see catalog
Remote Management System	R&S®RCMS II	see catalog
Racks	R&S®KG4200	see catalog
Automatic Test System	R&S®TS6030	see catalog
VHF Power Amplifier, 200 W	R&S®VU220L	see catalog
AF Remote Control Unit	R&S®GB208	see catalog
AF Distribution Splitter/Combiner	R&S®GH215	see catalog

About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Service and support

With 24-hour support worldwide and personal service contacts in over 70 countries, Rohde & Schwarz is present around the globe. The company stands for high quality, preventive service, and compliance with delivery schedules – no matter whether the task at hand is calibration or application support.

Regional contacts

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Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

Certified Quality System
EN 9100
DQS REG. NO 310133 ASH

Certified Quality System
AQAP-2110
Audit report GP T3.1-NO 05.03

For data sheet, see
PD 5213.5700.22 and
PD 5214.0118.22
and www.rohde-schwarz.com
(search term: Series 4200)

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*0.14 €/min within the German wireline network;
rates may vary in other networks (wireline and mobile) and countries.