

# SERIES 400U



VHF: 100 MHz to 163 MHz

UHF: 225 MHz to 400 MHz

## VHF/UHF Multichannel Communications System R&S Series400U

Innovative key solutions from the microphone to the antenna

Based on the very successful R&S Series400 Rohde&Schwarz introduces the VHF/UHF Multichannel Communications System R&S Series400U with enhanced system flexibility and greater serviceability.

The R&S Series400U is an integral part of a complete VHF/UHF program. System-engineering solutions "from the microphone to the antenna" for complex and interference-free radio systems are the commitment of Rohde&Schwarz for the customers' benefit.

The series comprises transceivers, transmitters and receivers as well as options and add-ons, where the applications are as follows:

- ◆ **Civil aviation** (for emergency backup ATC communication, in addition to a conventional single-channel radio system with many simultaneous frequencies)
- ◆ **Defense** (for air traffic control and tactical multichannel operation, for voice and data application, in plain and fixed-channel mode (options and add-on units for COMSEC or TRANSEC))
- ◆ **Fixed, transportable or mobile use** (in ground-to-air radio centers, radio shelters, ships or vehicular radio units)



**ROHDE&SCHWARZ**

# R&S Series 400U – solutions for the customer



Example of a SECOS ECCM application with UHF Transceiver R&S XD432U3

The R&S Series 400U stands out for its user-friendly system concept which offers complete solutions to a wide range of tasks and requirements. It is based on the R&S Series 400, which is in operation in over 70 countries in quantities of more than 19000 radio units.

Combining the experience of the past with new design concepts creates an innovative program with high performance, reliability and cost-effectiveness.

The user benefits from the fact that the R&S Series 400U is an integral part of a complete VHF/UHF program. System-engineering solutions "from the microphone to the antenna" for complex and interference-free radio systems are the commitment of Rohde&Schwarz. In general the benefits are as follows:

- ◆ Ease of ordering complete packages
- ◆ Prewired and tested subsystems contractable
- ◆ Delivery in complete lots
- ◆ Responsibility in one hand

## Extended flexibility

Extended modular design assures high system configuration flexibility plus improved serviceability and availability, e.g. MTTR of 5 to 15 minutes on LRU basis. That means simplified and therefore cost-effective logistics for both the manufacturer and the customer.

The R&S Series 400U features enhanced operational flexibility and convenience:

- ◆ 100 preset channels and prepared for up to 100 ECCM nets
- ◆ 50 RX + 50 TX channel half-duplex operation
- ◆ Scanning of 100 channels
- ◆ 8.33 kHz channel spacing (with latest models/options)
- ◆ 75 W FM UHF
- ◆ 100 W FM UHF (with add-on)
- ◆ Fast and robust TX/RX PIN diode antenna switch for special applications such as FH (frequency hopping), DATA LINK or 100 W FM UHF high power

Due to the principle of front and rear modularity, the options and auxiliary units as well as the choice of alternative module types, the basic radio models can be upgraded for different applications/operating modes in an easy and cost-effective manner, e.g. for 100 W FM UHF, HAVE QUICK or SECOS ECCM.

## Interference-free operation

The R&S Series400U provides improved interference-free operation, even under severe collocation (co-site) conditions. To solve such problems – where several transmitters and receivers must work simultaneously and interference-free, mostly under critical antenna decoupling conditions – the R&S Series400U program provides the following benefits:

- ◆ Receivers with superior large-signal behaviour and RFI suppression: excellent specifications for desensitization, intermodulation etc together with high sensitivity and wide dynamic range are achieved by large-scale multipole subband filters in the passive-design frontend stage, for example; for UHF four subband filters are used for highest efficiency
- ◆ UHF circulator option (interfaced efficiently in front of the harmonics filter) for high suppression of the retransmission of unwanted in-band and out-of-band IM3 products
- ◆ Antenna interfaces (option)
  - for separate VHF and UHF TX and RX antennas
  - for separate VHF and UHF guard RX antennas
- ◆ Preselectors (option) for fixed-channel application in RX mode
- ◆ TX/RX filters (option)
  - for fixed-channel and FH application
  - for TX and RX mode

- ◆ RX protection devices (standard)
  - in the TX/RX PIN diode switch
  - in the EMP filter of receivers
- ◆ Additional support by
  - highly selective and powerful filters/combiners
  - highly decoupled stacked antennas
  - frequency management programs etc

## Flexible control modes

### Local control

The Control Unit R&S GB453 is of completely new design. Via its keyboard and alphanumeric, window-structured LED display seven modes are available:

- ◆ Frequency mode
- ◆ Channel mode
- ◆ Scanning mode (receivers and transceivers)
- ◆ Load mode (channels, nets)
- ◆ Setup mode for key parameters, e.g. address of the radio, remote control data rate, semi-duplex on/off, channel frequency readout on/off (password-secured)
- ◆ Test mode
- ◆ Erase mode

Clearly arranged control and monitoring elements on the front panel enable fast status checks.



**Control Unit R&S GB453**

### Remote control

A great variety of remote control possibilities is available<sup>1)</sup>, depending on interface options for the following:

- ◆ V.24/RS-232-C/RS-485: point-to-point, addressed or bus operation and/or
- ◆ DTMF (dual tone multiple frequency) code according to ITU-T recommendation Q23: point-to-point operation via private or public telephone (AF) line, saving costs for leased lines
- ◆ DTMF point-to-point control (controllers) and V.24/RS-232-C/RS-485 control (supervisor) are possible in parallel with priority of the last effective input

To ensure the backward-compatibility with previous types of control units the R&S Series400U offers the following interfaces:

- ◆ V.11 (X.27)/RS-422-A: symmetrical double-current serial "F-type" interface, known from radios such as the R&S XT452F; thus backward-compatible with the Control Units R&S GB408 and R&S GB404
- ◆ Parallel ("N-type") interface, thus backward-compatible with the Control Unit R&S GB403 (as used with the former radios, such as the R&S XT452N) or automatic switchover units

<sup>1)</sup> See page 12 for auxiliary equipment, software and accessories.

# General overview

## Transceivers

| Frequency range   | Basic transceiver type <sup>1)2)</sup> (for common TX/RX antenna operation, with TX/RX Switch R&S GI430U) (Order No.) |                            |  |
|---|---|----------------------------|--|
| VHF: 100 MHz to 163 MHz   | –   | –                          | R&S XU452U8 (6047.6649.02)                   |
| UHF: 225 MHz to 400 MHz   | R&S XD432U3 (6038.8507.12)  | R&S XD432U8 (6047.6549.12) | –  |
| VHF/UHF combined <sup>3)</sup>  | R&S XT452U3 (6038.8107.12)  | R&S XT452U8 (6047.6449.12) | R&S XT452U8 (6047.6449.02)                   |
| Application   |   |                            |  |
| FIXED CHANNEL MODE/25 kHz   | ●   | ●                          | ●  |
| SECOS   | ●   |                            |  |
| HAVE QUICK  | ●   | ●                          | ● <sup>4)</sup>                              |
| VOICE A3E, F3E  | ●   | ●                          | ●  |
| DATA NB AXX <sup>5)6)</sup>   | ●   | ●                          | ●  |
| DATA WB AXX <sup>6)7)</sup>   | ●   | ●                          | ●  |
| DATA NB FM (FSK) <sup>5)6)</sup>  | ● <sup>8)</sup>   | ●                          | ●  |
| DATA WB FM (FSK) <sup>6)7)</sup>  | ●   | ●                          |  |
| DATA LINK Y   | ●   | ●                          |  |
| DATA LINK 11  | ● <sup>9)</sup>   | ● <sup>10)</sup>           |  |
| 8.33 kHz CHANNEL SPACING <sup>11)</sup>   |   |                            | ●  |
| Additional features (for all transceiver types)   | Models  |                            |  |
|   | R&S XD432U8/R&S XT452U8 instead of model 12   |                            | valid for R&S XU/XT452U8 instead of model 02 |
| Models for separate TX + RX antennas, with Antenna Interface R&S GI418U (.12, but .13 in U3 transceivers)   | .13   |                            | .03  |
| Special models for 2 Guard Receivers R&S ET402 <sup>12)</sup> and common TX/RX antenna, with 19" Adapter R&S KR450U7 and TX/RX Switch R&S GI430U  | .27   |                            | .17  |
| Special models for 2 Guard Receivers R&S ET402 <sup>12)</sup> and separate TX + RX antennas, with 19" Adapter R&S KR450U7 and Antenna Interface R&S GI418U (.12, but .13 in U3 transceivers)  | .28   |                            | .18  |
| Examples  |   |                            |  |
| If you need a VHF transceiver for 100 MHz to 163 MHz for 25 kHz channel spacing and voice only, but with separate TX and RX antenna sockets, then the basic type is R&S XU452U8 (.03); system-specific options/add-ons are not included |   |                            |  |
| If you need a combined VHF/UHF transceiver with HAVE QUICK, cipher and LINK 11 capability in UHF, then you have to order  |   |                            |  |
| – the basic transceiver type R&S XT452U8 (.12) plus   |   |                            |  |
| – application-specific options/add-ons for HAVE QUICK and LINK 11: R&S VX411 + R&S GI411U + R&S GI412U + R&S GP407H1 plus   |   |                            |  |
| – other system-specific options/add-ons such as R&S GI413U, R&S GB406H etc  |   |                            |  |
| <b>Customized radio sets:</b> on request (e.g. R&S XD432UL LINK11 radio for German Navy)  |   |                            |  |

## Transmitters

| Frequency range                               | Basic transmitter type <sup>1)</sup> (Order No.) |                            |                            |
|---|--|----------------------------|----------------------------|
| VHF: 100 MHz to 163 MHz or less <sup>3)</sup> | –  | –                          | R&S SU452U8 (6047.6749.02) |
| UHF: 225 MHz to 400 MHz                       | R&S SD432U3 (6038.9203.12)                       | R&S SD432U8 (6047.6849.02) | –                          |
| VHF/UHF combined <sup>3)</sup>                | R&S ST452U3 (6047.5442.12)                       | R&S ST452U8 (6047.6949.02) | –                          |
| Application                                   |  |                            |                            |
| FIXED CHANNEL MODE/25 kHz                     | ●  | ●                          | ●                          |
| SECOS   | ●  |                            |                            |
| HAVE QUICK                                    | ●  | ●                          |                            |

|   |                 |                  |                  |
|---|-----------------|------------------|------------------|
| VOICE A3E, F3E                          | ●               | ●                | ●                |
| DATA NB AX <sup>5(6)</sup>              | ●               | ●                | ●                |
| DATA WB AX <sup>6(7)</sup>              | ●               | ●                | ●                |
| DATA NB FM (FSK) <sup>5(6)</sup>        | ● <sup>8)</sup> | ●                | ●                |
| DATA WB FM (FSK) <sup>6(7)</sup>        | ●               | ●                | ●                |
| DATA LINK Y                             | ●               | ●                | ●                |
| DATA LINK 11                            | ● <sup>9)</sup> | ● <sup>10)</sup> | ● <sup>10)</sup> |
| 8.33 kHz CHANNEL SPACING <sup>11)</sup> |                 | ●                | ●                |

## Receiving equipment

| Frequency range                         | Basic receiver type <sup>1(13)</sup> (Order No.) |                           |  |
|---|--|---------------------------|--|
| VHF: 100 MHz to 163 MHz                 | –  | –                         | R&S EU458U (6047.6349.08)                |
| UHF: 225 MHz to 400 MHz                 | R&S ED453U (6038.9803.12)                        | R&S ED458U (6047.6149.03) | –  |
| VHF/UHF combined                        | R&S ET453U (6038.9503.12)                        | R&S ET458U (6047.6249.03) | R&S ET458U (6047.6249.08)                |
| Application                             |  |                           |  |
| FIXED CHANNEL MODE/25 kHz               | ●  | ●                         | ●  |
| SECOS                                   | ●  |                           |  |
| HAVE QUICK                              | ●  | ●                         | ● <sup>12)</sup>                         |
| VOICE A3E, F3E                          | ●  | ●                         | ●  |
| DATA NB AX <sup>5(6)</sup>              | ●  | ●                         | ●  |
| DATA WB AX <sup>6(7)</sup>              | ●  | ●                         |  |
| DATA NB FM (FSK) <sup>5(6)</sup>        | ● <sup>8)</sup>                                  | ●                         | ●  |
| DATA WB FM (FSK) <sup>6(7)</sup>        | ●  | ●                         |  |
| DATA LINK Y                             | ●  | ●                         |  |
| DATA LINK 11 <sup>9(14)</sup>           | ●  | ●                         |  |
| 8.33 kHz CHANNEL SPACING <sup>11)</sup> |  |                           | ●  |
| Required auxiliary equipment            | Power Supply AC/DC (for 2 receivers)             | R&S IN404U                | 6040.7940.02                             |
|   | 19" Adapter (for 2 receivers)                    | R&S KR400U                | 6036.2001.22 (for 1 receiver: model .12) |

<sup>1)</sup> The bullets in the table indicate that the marked basic transceiver type is prepared for the listed application. Necessary options/add-ons such as WB/FREQ, AF/V.24, AF/Telephone (8.33 kHz) or Cipher/LINK 11 interface, LINK 11 module or ECCM processor are **extra order items** (see pages 6 and 12).

<sup>2)</sup> For new projects, incl. HAVE QUICK, the latest types (U8) are recommended. SECOS types are U3.

<sup>3)</sup> VHF band limits are user-programmable via R&S GB453 in setup mode.

<sup>4)</sup> HAVE QUICK (UHF) is applicable to R&S XT452U8 only. Models .02, .03, .17 and .18 are without HAVE QUICK "conferencing" (75 kHz bandwidth) mode.

<sup>5)</sup> WBSV baseband.

<sup>6)</sup> VINSON KY-58 compatible.

<sup>7)</sup> WBSV diphas.

<sup>8)</sup> MSK with 16 kbit/s.

<sup>9)</sup> LINK11 to STANAG 5511.

<sup>10)</sup> LINK11 to STANAG 5511 with exception (receive-to-transmit switchover time ≤20 ms instead of 7 ms which is enough in practice).

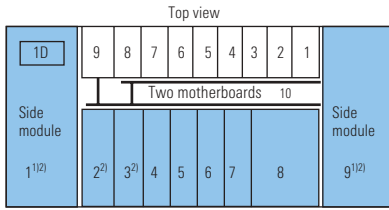
<sup>11)</sup> 8.33 kHz/25 kHz switchable.

<sup>12)</sup> Options R&S ET402 are extra order items.

<sup>13)</sup> For new projects, incl. HAVE QUICK, the latest types (458U) are recommended. SECOS types are R&S ED/ET453U.

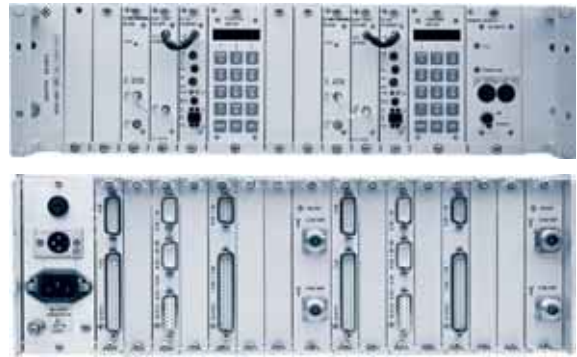
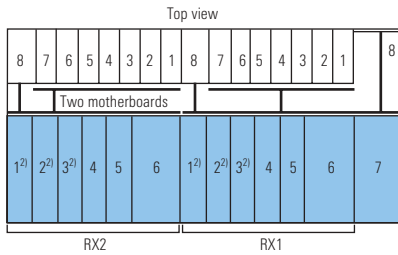
<sup>14)</sup> LINK 11 compatible in connection with option R&S GI412U only, i.e. the LINK 11 Module R&S VX411 is not required for receiving equipment.

# Design of transceivers/transmitters



| Slot                                       | Designation <sup>1)2)</sup> | Type                      | Order No.        | Main application/remarks <sup>3)</sup>   |
|--|-----------------------------|---------------------------|------------------|--|
| <b>Front and side modules<sup>4)</sup></b> |                             |                           |                  |  |
| 1A   | VHF Power Amplifier         | R&S VU450U                | 6048.8945.02     | Mounted onto R&S VD430U and R&S VT450U   |
| 1B   | UHF Power Amplifier         | R&S VD430U                | 6038.5508.02     |  |
| 1C   | VHF/UHF Power Amplifier     | R&S VT450U                | 6050.8490.03     |  |
| 1D   | UHF Circulator Set          | R&S GD430U <sup>5)</sup>  | 6063.6256.02     |  |
| 2  | VHF/UHF Preselector         | R&S FT402 <sup>5)</sup>   | 0622.1011.02     |  |
| 3  | VHF/UHF Guard Receiver      | R&S ET402 <sup>5)</sup>   | 0621.8012.02     | 2nd R&S ET402 possible with special transceiver models (slot 2)  |
| Alternative to 2/3:                        |                             |                           |                  |  |
| 2+3  | VHF TX/RX Filter            | R&S FU403TR <sup>5)</sup> | 6074.4014.02     | Note: The use of these types excludes the insertion of R&S FT402 or R&S ET402!   |
| 2+3  | UHF TX/RX Filter            | R&S FD403TR <sup>5)</sup> | 6074.4514.02     |  |
| 2+3  | VHF/UHF TX/RX Filter        | R&S FT403TR <sup>5)</sup> | 6074.5010.02     |  |
| 2+3  | Loudspeaker                 | R&S GA400 <sup>5)</sup>   | 0713.7405.02     |  |
| 4C   | Synthesizer, TX/RX type     | R&S GF430                 | 0720.6500.06     | SECOS, WB FM (FSK-MSK) in U3 radios  |
| 4D   | Synthesizer, TX/RX type     | R&S GF420U                | 6075.5514.02     | Standard, new: 8.33 kHz/25 kHz, HAVE QUICK in U8 radios  |
| 5  | LINK 11 Module              | R&S VX411 <sup>5)</sup>   | 6009.6500.02     |  |
| 6A   | VHF Unit 100 MHz to 163 MHz | R&S FU420                 | 0585.7516.02/.50 | Models .50 used for all radio types with R&S VZ400D2, i.e. for Transceivers R&S XD/XT/XU...U3, 8   |
| 6B   | UHF Unit                    | R&S FD400                 | 0584.4213.02/.50 |  |
| 6C   | VHF/UHF Unit (VHF/UHF)      | R&S FT400                 | 0584.5210.02/.50 |  |
| 7A   | IF/AF Unit                  | R&S VZ400D                | 0584.2904.02     | DATA NB  |
| 7B   | IF/AF Unit                  | R&S VZ400D2               | 0746.1006.03     | DATA NB + WB, HAVE QUICK, SECOS, in U3, 8 radios (.12/.13/.27/.28)   |
| 7C   | IF/AF Unit                  | R&S VZ400D2               | 0746.1006.08     | Standard, new: 8.33 kHz/25 kHz, HAVE QUICK in U8 radios (.02/.03/.17/.18)  |
| 8  | Control Unit                | R&S GB453                 | 6034.2004.04     | Local control  |
| 9  | Power Supply                | R&S IN450U                | 6038.7000.02     |  |
| 10   | 19" Adapter                 | R&S KR450U <sup>6)</sup>  | 6036.0009.12     | 19", 3 HU, with 2 motherboards for front and rear modules  |
| <b>Rear modules<sup>7)</sup></b>           |                             |                           |                  |  |
| 1  | WB/FREQ Interface           | R&S GI411U <sup>5)</sup>  | 6039.5001.02     | DATA WB AXX/ECCM (HAVE QUICK, SECOS)   |
| 2  | Cipher/LINK 11 Interface    | R&S GI412U <sup>5)</sup>  | 6039.5501.02     | VINSON KY-58 cipher unit (use without HAVE QUICK processor) or LINK 11   |
| 3  | AF/V.24 Interface           | R&S GI413U <sup>5)</sup>  | 6039.6008.02     | AF, RS-232-C, PTT, ECCM, ALC amplifier etc   |
| 1, 2 or 3                                  | AF/Telephone Interface      | R&S GI419U <sup>5)</sup>  | 6076.3515.02     | 1.5 kV isolation of AF transformer: protection to EN41003/BZT; 8.33 kHz channel spacing (TX AF BP filtering) for U8 radio models .02/.03/.17/.18   |
| 4  | Filter/PA Interface         | R&S GI414U <sup>5)</sup>  | 6039.6508.03     | Automatic filter and linear power amplifier control (1 filter + 1 PA)  |
| 4+5  | Filter/PA Interface         | R&S GI414U <sup>5)</sup>  | 6039.6508.04     | Automatic filter and linear power amplifier control (2 filters + 2 PA)   |
| 5 to 8                                     | DTMF Interface              | R&S GI416U <sup>5)</sup>  | 6039.7504.03     | AF/DTMF control; PTT via 2040 Hz; for R&S GB406C3/H3/S3; V.11 (X.27) "F interface" for R&S Series400 Control Unit R&S GB408/GB404  |
|  | MPA Interface               | R&S GI415U <sup>5)</sup>  | on request       | Control of any non-R&S RF amplifier  |
|  | Guard RX Antenna Interface  | R&S GI417U <sup>5)</sup>  | 6040.8446.12     | In slot 8 for separate guard RX antennas (VHF + UHF)   |
|  | Antenna Interface           | R&S GI418U <sup>5)</sup>  | 6048.7449.13     | In slot 8 for extra antenna, optionally installed in addition to R&S GI430U but standard in U3 transceiver models .13 + .28  |
|  | DC/100 W FM Interface       | R&S GI420U <sup>5)</sup>  | 6048.9941.02     | Model .02: for DC supply of R&S GB406 only   |
|  |                             |                           | 6048.9941.03     | Model .03: for DC supply of R&S GB406x + control of R&S IZ450  |
|  | Parallel Interface          | R&S GI421U <sup>5)</sup>  | 6048.6994.02     | "N-type" interface for R&S Series400 Control Unit R&S GB403 etc  |
|  | LINK 11 Interface           | R&S GI422U <sup>5)</sup>  | 6076.6014.03     | LINK 11 only (R&S VX411 not required for this application); 2 slots  |
|  | Customized Interface        | R&S GI4xxU <sup>5)</sup>  | on request       | To meet special requirements   |
| 9A   | TX/RX Diode Switch          | R&S GI430U <sup>8)</sup>  | 6036.1105.13     | High power (75 W/100 W FM UHF), LINK 11 and HAVE QUICK/SECOS capable; not for transmitters, except U3 type transmitters where used to enable SECOS-specific fast RF power switch-off when changing frequency |
| 9B   | Antenna Interface           | R&S GI418U <sup>8)</sup>  | 6048.7449.12     | For sep. TX + RX antenna; stand. in trans. (except U3) models .03/.13/.18/.28  |
| 9C   | TX Antenna Interface        | R&S GI429U                | 6040.8698.02     | Standard for <b>transmitters</b> , except U3 type transmitters, where R&S GI430U is used to enable SECOS-specific fast switching   |

# Design of receiving equipment



| Slot                              | Designation                           | Type                      | Order No.                    | Main application/remarks <sup>3)</sup>   |
|-----------------------------------|---------------------------------------|---------------------------|------------------------------|--|
| <b>Front modules and adapters</b> |                                       |                           |                              |  |
| 1                                 | VHF/UHF Preselector                   | R&S FT402 <sup>5)</sup>   | 0622.1011.02                 |  |
| 2                                 | VHF/UHF Guard Receiver                | R&S ET402 <sup>5)</sup>   | 0621.8012.02                 |  |
| 1+2                               | Alternative to 1/2:                   |                           |                              |  |
| 1+2                               | VHF TX/RX Filter                      | R&S FU403TR <sup>5)</sup> | 6074.4014.02                 |  |
| 1+2                               | UHF TX/RX Filter                      | R&S FD403TR <sup>5)</sup> | 6074.4514.02                 |  |
| 1+2                               | VHF/UHF TX/RX Filter                  | R&S FT403TR <sup>5)</sup> | 6074.5010.02                 |  |
| 1+2                               | Loudspeaker                           | R&S GA400 <sup>5)</sup>   | 0713.7405.02                 |  |
| 3D                                | Synthesizer, TX/RX type               | R&S GF430                 | 0720.6500.06                 | SECOS, DATA NB/WB FM in R&S ED/ET453U  |
| 3E                                | Synthesizer, TX/RX type               | R&S GF420U                | 6075.5514.02                 | Standard, new: 8.33 kHz/25 kHz, HAVE QUICK in R&S EU/ET458U, model .08   |
| 4A                                | VHF Unit 100 MHz to 163 MHz           | R&S FU420                 | 0585.7516.02/.50             | Models .50 used for all radio types with R&S VZ400D2 and for Receivers   |
| 4B                                | UHF Unit                              | R&S FD400                 | 0584.4213.02/.50             | R&S ED/ET453U, model .12   |
| 4C                                | VHF/UHF Unit (VHF1/UHF)               | R&S FT400                 | 0584.5210.02/.50             |  |
| 5A                                | IF/AF Unit (DATA NB)                  | R&S VZ400D                | 0584.2904.02                 | DATA WB: SECOS/HQ in R&S ED/ET453U; HAVE QUICK in R&S ED/ET458U (.03)  |
| 5B                                | IF/AF Unit (DATA NB + WB)             | R&S VZ400D2               | 0746.1006.03                 | Standard, new: 8.33 kHz/25 kHz, HAVE QUICK in R&S EU/ET458U (.08) <sup>9)</sup>  |
| 5C                                | IF/AF Unit                            | R&S VZ400D2               | 0746.1006.08                 |  |
| 6                                 | Control Unit                          | R&S GB453                 | 6034.2004.04                 | Local control  |
| 7                                 | Power Supply                          | R&S IN404U <sup>5)</sup>  | 6040.7940.02                 | AC/DC supply of 1 or 2 receivers   |
| 8                                 | 19" Adapter                           | R&S KR400U <sup>5)</sup>  | 6036.2001.12<br>6036.2001.22 | 19", 3 HU with motherboards for front and rear modules;<br>model .12 for one receiver, model .22 for two receivers     |
| <b>Rear modules<sup>7)</sup></b>  |                                       |                           |                              |  |
| 1                                 | WB/FREQ Interface                     | R&S GI411U <sup>5)</sup>  | 6039.5001.02                 | DATA WB AXX/ECCM (HAVE QUICK, SECOS)   |
| 2                                 | Cipher/LINK 11 Interface              | R&S GI412U <sup>5)</sup>  | 6039.5501.02                 | VINSON KY-58 (use without HAVE QUICK processor) or LINK 11   |
| 3                                 | AF/V.24 Interface                     | R&S GI413U <sup>5)</sup>  | 6039.6008.02                 | AF, RS-232-C, ECCM, ALC amplifier etc  |
| 1, 2 or 3                         | AF/Telephone Interface                | R&S GI419U <sup>5)</sup>  | 6076.3515.02                 | 1.5 kV isolation of AF transformer: protection to EN41003/BZT  |
| 4                                 | Filter/PA Interface                   | R&S GI414U <sup>5)</sup>  | 6039.6508.03                 | Control of 1 external automatic filter   |
| 4+5                               | Filter/PA Interface                   | R&S GI414U <sup>5)</sup>  | 6039.6508.04                 | Control of 2 external automatic filters  |
| 5 to 7                            | Depending on space:<br>DTMF Interface | R&S GI416U <sup>5)</sup>  | 6039.7504.03                 | AF; DTMF control etc: for R&S GB406C3/H3/S3, V.11 (X.27) "F-interface" for R&S Series400 Control Units R&S GB408/GB404 |
|                                   | Guard RX Antenna Interface            | R&S GI417U <sup>5)</sup>  | 6040.8446.12                 | For separate guard RX antennas (VHF + UHF)   |
|                                   | DC/100 W Interface                    | R&S GI420U <sup>5)</sup>  | 6048.9941.02                 | DC feed of R&S GB406...  |
|                                   | Parallel Interface                    | R&S GI421U <sup>5)</sup>  | 6048.6994.02                 | "N-type" interface, for R&S Series400 Control Unit R&S GB403   |
|                                   | LINK 11 Interface                     | GI422U <sup>5)</sup>      | 6076.6014.03                 | LINK 11 only (R&S VX411 not required for this application); 2 slots  |
|                                   | Customized Interface                  | GI4xxU <sup>5)</sup>      | on request                   | To meet special requirements   |
| 8                                 | EMP Filter                            | GH415                     | 6039.8000.12                 | Standard of all receiver types   |

<sup>1)</sup> Screwed to 19" Adapter R&S KR450U.

<sup>2)</sup> The indicated modules, some coax-related modules and R&S GI420U and R&S GA400 require additional manual cable connections.

<sup>3)</sup> Additional applications are listed in next chapter "Modules in detail".

<sup>4)</sup> The previous R&S Series 400 power amplifiers, power supplies and control units are not compatible with the new standard R&S Series 400U.

<sup>5)</sup> Options, Power Supply R&S IN404U and 19" Adapter R&S KR400U are **extra order items**.

<sup>6)</sup> As an alternative R&S KR450U7 is used in transceiver models .17, .18, .27 and .28, prepared for 2 R&S ET402.

<sup>7)</sup> The rear modules are 20 mm wide slide-in interfaces with some exceptions and are mostly options.

<sup>8)</sup> Applicable for transceivers and U3-type transmitters.

<sup>9)</sup> HAVE QUICK (UHF) is applicable to R&S ET458U only. Model .08 is without HAVE QUICK "conferencing" (75 kHz bandwidth) mode.

# Modules in detail

## VHF/UHF Guard Receiver R&S ET402\*<sup>1)</sup>

The VHF/UHF Guard Receiver R&S ET 402 is used for monitoring the international distress frequencies in the VHF and UHF ranges (121.5 MHz and 243 MHz). Switchover between the ranges is performed either automatically by means of the operating frequency of the main receiver or front-panel switch controlled. The guard receiver is a completely independent unit and uses only the antenna system and the power supply of the basic radio. As an option, separate guard receiver antennas can be used via the Guard RX Antenna Interface R&S GI417U. Special transceiver models are prepared for a second R&S ET402.

## RF Units R&S FD400, R&S FT400, R&S FU420

To combine good sensitivity with excellent large-signal characteristics (immunity to interference) and a wide dynamic range, these RF units are of passive design, i.e. without any amplifiers, and are perfectly RF screened (Rohde & Schwarz patent). They include

- ◆ one wideband (VHF) and/or four automatically switched bandpass UHF filters (depending on type), and
- ◆ two AGC voltage-controlled PIN diode attenuators before and after the mixer

Following one of the bandpass filters, the receive frequency is routed, via a first PIN diode attenuator, to the mixer where it is converted to the 1st IF (80 MHz) by mixing with the local oscillator frequency fed in from the synthesizer module. The 1st IF is then passed on to the second PIN diode attenuator and an 80 MHz lowpass filter before being fed to the next module, i.e. the IF/AF Unit R&S VZ400D or R&S VZ400D2.

## TX/RX Filters R&S FD403TR\*, R&S FT403TR\*, R&S FU403TR\*

These fast, automatically tuned and hopping-capable filters are effective for reception (interfaced like a preselector before the RF unit) and for transmission (interfaced between synthesizer and the power amplifier) with automatic interface switching by the radio frequency information. For loss compensation, a low-noise amplifier stage is integrated, improving the RX noise figure. These TX/RX filters can be used in certain adapter slots only and not together with the R&S ET/FT402.

In the transmit mode the TX/RX filters eliminate noise and spurious outputs from the synthesizer. In the receive mode the TX/RX filters improve the spurious response (IF and image rejection) and the dynamic range (intermodulation, crossmodulation and desensitization). Reduced antenna decoupling requirements and reduced antenna distances (from 50 m to 15 m only, for example) are the benefits in co-site environment.

## VHF/UHF Preselector R&S FT402\*

Interfaced in front of the RF unit, the VHF/UHF Preselector R&S FT402 improves the reception under difficult conditions, e.g. in the vicinity of strong transmitters. It protects especially against strong far-off transmit frequencies. It contains automatically tuned filters which are controlled by the radio frequency information.

## Loudspeaker R&S GA400\*

In combination with the handheld Microphone R&S GA016H1, this 0.4 W loudspeaker is a useful alternative to handset or headset operation. This  $\frac{2}{16}$  19" screw-in module is provided for integration into module slots also reserved for options such as the R&S ET402, R&S FT402 or TX/RX filters, e.g. R&S FT403TR.



**Control Unit R&S GB453:  
module with cover removed**

<sup>1)</sup> Options are indicated by \*.



### Control Unit R&S GB453

The Control Unit R&S GB453 is a  $\frac{2}{16}$  19" plug-in module. It includes a microprocessor and controls the frequency and operating mode. The data for operating frequency (including 100 channels) are stored in a 32 kB nonvolatile memory (EEPROM).

A 64 kB RAM serves for management and control of the microprocessor. The firmware for controlling the radio is contained in a 128 kB EPROM. A keyboard with an array of 3 x 5 push buttons and an 8-digit LED display are the only elements for local control of the seven modes, from the setup mode to the erase mode (see also page 3).

### UHF Circulator R&S GD430U\*

The R&S GD430U is a UHF circulator set for the R&S VD430U + R&S VT450U. In critical co-location situations, where many transmitting antennas are cosited, the use of circulators is urgently recommended: they reduce the TX intermodulation by increasing the backward intermodulation attenuation. Thus the transmission of unwanted mixing products, which are generated in the transmitter in such an electromagnetic environment and which interfere with the actual frequency band, is suppressed or reduced.

The circulator of this set can be interfaced in front of the harmonics filter, where it is most effective, and mounted directly onto the heat sink of the UHF or VHF/UHF power amplifier.<sup>1)</sup>

### Synthesizers R&S GF...

VHF/UHF synthesizers process the frequencies for the reception (R&S GF400) or for both transmission and reception (all other types). All synthesizers are  $\frac{1}{16}$  19" plug-in modules.

<sup>1)</sup> Any VHF circulator required can also be interfaced at jumper-selected points before the harmonics filter. Due to its small size it can be mounted in the radio.

### ◆ R&S GF400, R&S GF420, R&S GF420H

- Five VCOs (2 VHF and 3 UHF) are used to generate the required VHF or UHF, TX or RX related frequency.
- A programmable frequency divider, controlled by the frequency information of the Control Unit R&S GB453 produces a 25 kHz signal.
- A crystal oscillator (reference frequency) and fixed frequency divider produce a second 25 kHz signal.
- A phase discriminator compares the two 25 kHz signals and produces a control voltage for the VCOs in case of frequency deviation: they are tuned within a phase-locked loop (PLL).

### ◆ R&S GF420 U for

- 8.33/12.5/25 kHz channel spacing
- 2-/3- and 4-carrier offset
- HAVE QUICK and DATA NB/WB FM
- future applications

### ◆ R&S GF430: This type is designed for SECOS and DATA WB FM (FSK, 16 kbit/s) application. In addition to the PLL principle it uses direct digital synthesis (DDS), thus combining the advantages of both PLL with high reference frequency and DDS (Rohde&Schwarz patent):

- High spectral purity
- Finest frequency correction increments

- FSK down to 0 Hz
- Fast frequency change
- Programmable pulse shaping
- Other "flexibilities by program"

### EMP Filter R&S GH415

This EMP filter is standard in all R&S EU/ED/ET receivers (slot 8):

- ◆ 28 mm wide module
- ◆ For overload protection of the RX input stages against surges induced by lightning or NEMP pulse
- ◆ 3-fold protection: high-current stable lowpass filter, gas-filled surge arresters (90 V/2 kA, designed for standard pulse) and switched diodes

### WB/FREQ Interface R&S GI411U\*

- ◆ For WB AXX data communication
- ◆ AGC voltage output (decoupled) for external control
- ◆ For connection of ECCM Processors R&S GP407H1/S1/S2 (AF interface, frequency control)

### Cipher/LINK 11 Interface R&S GI412U\*

- ◆ For standalone VINSON KY-58 cipher unit, without HAVE QUICK processor
- ◆ For other COMSEC devices
- ◆ With control facility of plain or cipher text, baseband (NB) or diphas (WB) and with extra +28 V DC output
- ◆ For LINK 11 modem connection



Cipher/LINK 11 Interface  
R&S GI412U

### AF/V.24 Interface R&S GI413U\*

- ◆ For AF line connection, including fine lightning protection (R&S GI413U not required for AF with DTMF)
- ◆ For PTT via separate or AF phantom line
- ◆ For V.24/RS-232-C/RS-485 bus control, e.g. from R&S GB406C/H/S... (which is DC powered from the radio via the R&S GI420U or from a local DC supply)
- ◆ For ECCM and cipher operation with R&S GI411U
- ◆ With AF ALC (automatic level control) amplifier
- ◆ With separate GUARD RX AF outputs
- ◆ With relay outputs for TEST, CARRIER and/or MAIN RX SQUELCH and SQUELCH of GUARD RX 1 and 2 (recommended for special transceiver type models with two R&S ET402)

### Filter/PA Interface R&S GI414U\*

- ◆ For the control of one or two automatically tuned external filter(s), including DC supply
- ◆ For the control of one or two linear power amplifier(s)
- ◆ Model .04 is for two filters and two amplifiers and occupies two slots

### MPA Interface R&S GI415U\*

Customized control interface for the connection of any non-Rohde&Schwarz medium/high power amplifiers

### DTMF Interface R&S GI416U\*

- ◆ For DTMF control (incl. AF) according to ITU-T recommendation Q23, e.g. from R&S GB406C3/H3/S3<sup>1)</sup>
- ◆ For control via V.11 (X.27)/RS-422-A: symmetrical double-current serial "F-type" interface from the Control Units R&S GB404 or R&S GB408, the latter in connection with R&S GI413U (AF)<sup>2)</sup>
- ◆ For PTT by 2040 Hz tone via AF line: R&S GI416U includes a tone-operated switch with filter devices
- ◆ For main/standby switching

<sup>1)</sup> DC supply of these control units from the radio via R&S GI420U or from a local DC source.

<sup>2)</sup> DC supply of R&S GB408 from the radio via R&S GI416U (<500 m) or from a local DC source.

- ◆ With customer-specific I/O ports, controlled from a PC (RS-232-C) or by DTMF, allowing the display of user-definable tests (BIT) via Control Unit R&S GB406C/H/S...

### Guard RX Antenna Interface GI417U\*

- ◆ With inputs for 2 separate VHF and UHF guard receiver antennas
- ◆ With additional multipurpose RF socket, e.g. for an external drive unit
- ◆ 3 BNC sockets
- ◆ For slot 8 only

### Antenna Interface R&S GI418U\*

Model .12: standard in U1 to U8 transceiver models .13 and .28 and U8 transceiver models .03 and .18. It is used for separate VHF TX + RX and UHF TX + RX antennas (4 antenna sockets) instead of the TX/RX Switch R&S GI430U:

- ◆ 2 N-type sockets (TX)
- ◆ 2 BNC-type sockets (RX)
- ◆ 28 mm wide module
- ◆ For slot 9 only

Model .13: standard in U3 transceiver models .13 and .28; option for all transceiver models .12 and .27 and U8 transceiver models .03 and .18

- ◆ For additional antennas, e.g. in ECCM radio systems
- ◆ In addition to TX/RX Switch R&S GI430U (slot 9)
- ◆ 20 mm wide module, for slot 8 only

### AF/Telephone Interface R&S GI419 U\*

- ◆ For AF line connection
- ◆ For protection of TX and RX AF/telephone lines
- ◆ With 1.5 kV isolated 600 W transformers to protect the radio/operator according to EN41003/BZT guideline
- ◆ With fine lightning protection
- ◆ For PTT via phantom circuit

- ◆ For transmission with 8.33 kHz channel spacing; with TX AF filter with 4 switchable upper stop frequencies 2.5/2.7/ 2.9/3.15 kHz (3.4 kHz in addition as radio standard); local and remote filter selection
- ◆ For slot 1, 2 or 3

### DC/100 W FM Interface R&S GI420U\*

Model .02: for DC supply of Control Units R&S GB406C/H/S...

Model .03: for DC supply of Control Units R&S GB406C/H/S and for 100 W FM UHF (connection of Power Supply R&S IZ450)

### Parallel Interface R&S GI421U\*

- ◆ For "N-type" parallel control from previous R&S Series400 Control Unit R&S GB403 etc

### LINK 11 Interface GI422U\*

- ◆ For LINK 11 modem connection if COMSEC is not required
- ◆ For LINK 11 squelch signalling
- ◆ Model .03: without phantom (PTT) interface; 2 slots required

Note that the R&S VX411 is not needed for this case.

### TX Antenna Interface R&S GI429U

- ◆ In all transmitters except U3 types (see R&S GI430U)
- ◆ 2 N-type sockets for VHF and UHF
- ◆ 28 mm wide module, for slot 9 only

### TX/RX Diode Switch R&S GI430U

- ◆ For all transceiver models .12 and .27
- ◆ For R&S XD432U3 and R&S XT432U3 models .13 and .28<sup>3)</sup>
- ◆ For R&S XU/XT452U8 models .02 and .17
- ◆ For R&S SD432U3 and R&S ST452U3<sup>3)</sup>
- ◆ Fast PIN diode dual switch (VHF and UHF)
- ◆ With RX protection device; protects in case of unintended co-channel operation, e.g. with starpoint or T-coupler type filter combiners

<sup>3)</sup> For SECOS-specific fast RF power switch-off.

- ◆ Protection against up to 100 W FM
- ◆ 2 N-type sockets
- ◆ 28 mm wide module, for slot 9 only

To meet special system requirements an optional antenna interface can additionally be used together with the TX/RX switch (see R&S GI418U, model .13).

As an alternative to the TX/RX switch, the Antenna Interface R&S GI418U (model .12) for separate TX and RX antennas is used as standard in special transceiver models (e.g. model .13) to match special operational requirements.

#### **Customized Interface R&S GI4xxU\***

Customized interface to meet future special operational requirements.

#### **Power Supply R&S IN404U**

This power supply is a  $\frac{1}{8}$  19" plug-in front module for RX equipment. AC and DC sources can be connected in parallel. In case of AC failure automatic switchover to DC takes place. The output is well filtered, short-circuit- and overvoltage-proof. The R&S IN404U can supply two receivers.

#### **Power Supply R&S IN450U**

The R&S IN450U is a  $\frac{1}{4}$  19" power supply module for transceivers and transmitters with heat sink and can be fixed to the Adapter R&S KR450U. It is a pulse-width modulated switching power supply with minimum power loss. It can be connected both to an AC and to a DC source. If both sources are connected, AC supply operation is favoured. If the AC supply fails, switchover to DC operation is effected automatically. All outputs are well filtered and protected against short-circuit and overvoltage.

#### **19" Adapter R&S KR400U**

This 19" adapter is an electromechanical and compact 19"/3 HU extra order item which, together with the receiver(s), the Power Supply R&S IN404U and options, forms a receiving equipment for rack installation. The rear AC/DC connection panel is part of the R&S KR400U.

#### **19" Adapter R&S KR450U**

This 19" adapter is designed for transceivers and transmitters. It is an electro-mechanical unit to combine all modules to a complete 19"/3 HU plug-in type radio unit for rack installation. It contains two motherboards for the front and rear modules and corresponding module slots with fixing facilities. The interconnections are performed automatically with some exceptions where additional manipulation is called for.

For both Adapters R&S KR400U and R&S KR450U special attention has been paid to obtain best EMC by additional shielding measures.

#### **Amplifiers R&S VD430U (30 W), R&S VT450U (30/50 W), R&S VU450U (50 W)**

These amplifiers are compact  $\frac{1}{4}$  19" modules with heat sink and can be fixed to the Adapter R&S KR450U. The cited power classes refer to AM carrier. The following submodules and functions are included:

- ◆ Modulator (AM modulation, control, regulation and monitoring)
- ◆ VHF/UHF driver
- ◆ VHF amplifier and/or UHF amplifier, each with harmonics filter, directional coupler, and an interface for an optional VHF or UHF circulator. The UHF Circulator Set R&S GD430U can be mounted internally directly onto the heat sink.
- ◆ Display: front-panel mounted PCB with interface for headset/microphone AF and transmit frequency from synthesizers, control or monitoring elements for output power, modulation depth, VSWR and microphone gain.

The amplifiers are designed for wideband transmission, so there is no need for frequency-specific adjustments. For ease of service the heat sink with all submodules mounted can be turned to a horizontal position, thus making the component-side test points accessible.

#### **LINK 11 Module R&S VX411\***

In transceivers or transmitters LINK 11 the Module R&S VX411 together with the IF/AF Unit R&S VZ400D2 (.03) and the Cipher/Link 11 Interface R&S GI412U enable the operation with broadband AF signals in LINK 11 mode for special data transmission modes in defense applications.<sup>1)</sup>

#### **IF/AF Units R&S VZ400D; R&S VZ400D2 (model .03)**

These front modules are IF/AF units for DATA NB (R&S VZ400D) and DATA NB+WB (R&S VZ400D2, model .03) application. To prevent crossmodulation, the 1st IF is filtered by an 80 MHz crystal filter before being amplified and fed to a Schottky diode toroidal mixer for best large-signal behaviour. The 1st IF is converted to the 2nd IF (10.7 MHz) together with the frequency from a crystal oscillator (90.7 MHz). The R&S VZ400D includes an additional 90.7 MHz test output on the front panel. The 10.7 MHz IF signal is routed to a split IF amplifier

- ◆ with one crystal filter for NB (with R&S VZ400D) or
- ◆ with two crystal filters for NB+WB (with R&S VZ400D2) provided for the HAVE QUICK conferencing mode, for example.

The filters can be switched locally or remotely. Further functions of this module are: AGC circuit, AM and FM demodulation, a combined signal-to-noise ratio/carrier squelch circuit, audio filtering and amplification.

#### **IF/AF Units R&S VZ400D2 (model .08)**

- ◆ For 8.33 kHz and 25 kHz channel spacing
- ◆ With two locally or remotely switchable IF crystal filters for 8.33 kHz/25 kHz channel spacing
- ◆ Standard for future applications

<sup>1)</sup> For standalone RX equipment, the R&S VX411 is not required for LINK 11 operation. Same for all radios using the R&S GI422U.

## Auxiliary equipment, software and accessories

For engineering and implementation of complex communication systems, auxiliary equipment and software as well as accessories are provided for the R&S Series400U.

|   |   |               |
|---|---|---------------|
| <b>19" Adapter R&amp;S KR400U</b>   | For receiving equipment for 1 RX (xx = 12) or 2 RX (xx = 22)                            | 6036.2001.x x |
| <b>Power Supply R&amp;S IN404U</b>  | For receiving equipment   | 6040.7940.02  |
| <b>Power Supply R&amp;S IZ450</b>   | Auxiliary unit for 100 W FM UHF, including temperature-controlled fans, 19"/3 HU        | 6036.9500.02  |
| <b>Shockmount for transceivers R&amp;S KS450</b>  | Standard model  | 0615.7518.02  |
|   | Heavy duty model, with fan  | 0615.7518.06  |
| <b>Control Units R&amp;S GB406x</b>   |   |               |
| Available in various types and models, depending on the application and other operational requirements. The following standard units are plug-in modules for integration into desks or for standalone cabinet installation. They feature an illuminated keyboard and the standard NF7 type AF connector for Rohde&Schwarz audio accessories (other specifications, e.g. LEMOSA connectors, on request). They can be DC supplied from the radio via the optional Interface R&S GI420U or from a local source. "V.24" corresponds to RS-232-C/RS-485 bus. |   |               |
| R&S GB406C1   | Fixed-channel/V.24  | 6016.1497.14  |
| R&S GB406C3   | Fixed-channel/DTMF  | 6016.2241.14  |
| R&S GB406H1   | HAVE QUICK/V.24   | 6005.1255.14  |
| R&S GB406H3   | HAVE QUICK/DTMF   | 6016.5240.14  |
| R&S GB406S1   | SECOS/V.24  | 0504.7010.14  |
| R&S GB406S3   | SECOS/DTMF  | 6016.6499.14  |
| R&S GB406Z1   | Control cable (incl. DC) for R&S GB406C1/H1/S1; length=10 m (xx = 10) or 50 m (xx = 50) | 6009.8948.xx  |
| R&S KK406   | Cabinet for desktop installation of R&S GB406... with swivel-type mounting holder       | 4029.7509.03  |
| The previously delivered R&S Series400 Control Units R&S GB403/404/408 are also suited for fixed-channel operation in connection with optional R&S GI... interfaces and with reduced performance (e.g. 40 or 12 preset channels only, no scanning, no RF power management etc). Thus the R&S Series400U radios are backward-compatible with existing remote control installations.  |   |               |
| <b>Control Software R&amp;S GB406-S for</b>   | R&S GB406S1   | 6051.0993.21  |
|   | R&S GB406C1/H1  | 6051.0993.41  |
|   | R&S GB406S3   | 6051.0993.60  |
|   | R&S GB406C3/H3  | 6051.0993.80  |
| <b>Control Software R&amp;S DS110</b>   |   |               |
| Project-specific radio remote control (RRC) PC software for a dedicated number of R&S Series 400U and other radios e.g. R&S XK2000 or R&S EK896; for fixed-channel or dedicated EPM applications  |   | on request    |
| <b>Bus Coupler R&amp;S GV400</b>  |   |               |
| Allows the remote operation of several radio units from a number of control units and is available with 1, 2, or 3 bus converters. The R&S GV400 is installed at the radio and control site. It may be connected via a modem link. Thus complex remote control scenarios can be configured. Capacity is 2 km remote control distance and 10 radio or control loads per bus converter. Three models are available:   |   |               |
|   | With 1 bus converter (10 loads)   | 6049.7942.11  |
|   | With 2 bus converters (20 loads)  | 6049.7942.12  |
|   | With 3 bus converters (30 loads)  | 6049.7942.13  |
|   | Special system proposals  | on request    |
| <b>Automatic filters</b>  |   |               |
| The VHF/UHF Preselector R&S FT402 and the TX/RX Filters R&S FD/FU/FT403 TR are front-panel options and are described on page 8. By contrast, the following types are add-ons (external units). VHF range: 100 MHz to 162.025 MHz, UHF range: 225 MHz to 399.975 MHz   |   |               |
| R&S FU214A  | VHF/20 dB/1%/50 W AM carrier/100 W FM   | 0637.4611.05  |
| R&S FU221   | VHF/40 dB/1%/200 W AM carrier/300 W FM  | 0643.6012.02  |
| R&S FD213A  | UHF/20 dB/1%/50 W AM carrier/100 W FM, single filter                                    | 0637.4011.05  |
| R&S FD213A2   | UHF/20 dB/1%/50 W AM carrier/100 W FM, dual filter (for 2 UHF radios)                   | 0652.5815.05  |
| R&S FD221   | UHF/40 dB/1%/200 W AM carrier/300 W FM  | 0633.8012.02  |
| R&S FT213A  | VHF/UHF/20 dB/1%/50 W AM carrier/100 W FM   | 0637.4011.05  |
| Only the 20 dB types have an integrated bypass for the distress frequencies 121.5 MHz and/or 243 MHz. Only the 40 dB types can be delivered in 2-, 3- or 4-port automatic 300 W <b>multicoupler configurations</b> :  |   |               |
| R&S FU221W2   | VHF 2-port  | 0643.3513.02  |
| R&S FU221W4   | VHF 3-port, extendible to 4 ports   | 0643.5516.04  |
| R&S FU221W4   | VHF 4-port  | 0643.5516.02  |
| R&S FD221W2   | UHF 2-port  | 0643.2517.02  |
| R&S FD221W4   | UHF 3-port, extendible to 4 ports   | 0643.4510.04  |
| R&S FD221W4   | UHF 4-port  | 0643.4510.02  |
|   | Special models  | on request    |

| <b>Power Amplifiers</b>                        |  |                    |
|--|--|--------------------|
| R&S VD480L                                     | UHF 100 W AM carr./150 W FM, linear, HAVE QUICK capable with RF bypass, 230 V AC       | 6032.0504.23       |
| R&S VD490L                                     | UHF 200 W AM carr./300 W FM, linear/HAVE QUICK capable with RF bypass, 230 V AC        | 6048.3443.22       |
|  | UHF amplifier models with fast PIN diode TX/RX switch (e.g. for SECOS) or for 110 V AC | on request         |
| R&S VU210L                                     | VHF 100 W AM carr./150 W FM, linear, with RF bypass, 90 to 265 V AC                    | 6083.2510.02       |
| R&S VU220L                                     | VHF 200 W AM carr./300 W FM, linear, with RF bypass, 90 to 265 V AC                    | 6083.3517.02       |
| <b>ECCM Auxiliaries</b>                        |  |                    |
| R&S GP407H1                                    | ECCM processor for HAVE QUICK I/II (xx = 03) or HQ I only (xx = 23)                    | 0745.9003.xx       |
| R&S GP407S1                                    | ECCM processor for SECOS (voice)   | 6052.4492.02       |
| R&S GP603P3                                    | Data preprocessor for SECOS (data)   | 6048.2647.02       |
| R&S GT400 family                               | Timing system for synchronization  | on request         |
| XX   | Other ECCM auxiliaries   | on request         |
| <b>Service Kits</b>                            |  |                    |
| R&S KA403U                                     | For TX, RX and XCVR  | 6015.4992.12       |
| R&S KA406                                      | For R&S GB406C/H/S...  | 6049.8190.02       |
| R&S KA407                                      | For R&S GP407H/S and R&S GT400   | 6028.6999.02       |
| <b>Antennas (50 Ω, omnidirectional, 400 W)</b> |  |                    |
| R&S HK012                                      | VHF 100 MHz to 163 MHz   | 0459.7611.02       |
| R&S HK001                                      | UHF 225 MHz to 400 MHz   | 0425.2781.03       |
| R&S HK014                                      | VHF/UHF 100 MHz to 1300 MHz  | 0644.1514.02       |
| R&S FT224                                      | VHF/UHF diplexer 100 MHz to 163 MHz/225 MHz to 400 MHz                                 | 0525.5117.03       |
|  | Special VHF or UHF antennas with high decoupling, power rating or RF gain              | on request         |
| <b>Audio Accessories</b>                       |  |                    |
| R&S GA013                                      | Handset, rugged type   | 0693.7712.02       |
| R&S GA015                                      | Handset, standard type   | 0583.6012.02       |
| R&S GA012                                      | Handset, rugged type   | 0693.7664.02       |
| R&S GA016H1                                    | Microphone, dynamic, handheld type   | 0583.5568.02       |
| <b>Mating Connectors (incl. RF connectors)</b> |  |                    |
| R&S XT452UZ                                    | Standard set, incl. connectors for R&S GI413/416/430U                                  | 6049.5440.12       |
| R&S XT452UZ                                    | Extended set with additional connectors for all slots                                  | 6049.5440.13       |
| <b>Documentation</b>                           |  |                    |
|  | User manual  | supplied accessory |
|  | Repair manual  | extra order item   |

## Specifications

| Frequency                       |  |
|---------------------------------|--|
| Frequency range                 | VHF 100 MHz to 162.975 MHz<br>UHF 225 MHz to 399.975 MHz <sup>1)</sup>   |
| Channel spacing                 | switchable<br>All types 25 kHz<br>Following types in addition:<br>R&S XT/XU 452U8 (.02/.03/.17/.18),<br>R&S ST/SU 452U8 8.33 kHz with option R&S GI 419U<br>R&S ET/EU 458U (.08) 8.33 kHz<br>U3 type transceivers, types with<br>R&S VZ400D2 (.03): R&S XD432U8/<br>XT452U8 (.12/.13/.27/.28), R&S ED/<br>ET/EU... (see "Selectivity") 75 kHz (BW 2 ≤150 kHz/70 dB) e.g. for<br>HAVE QUICK conferencing mode |
| Frequency spacing               | All types 25 kHz<br>Following types in addition:<br>U8 radios, R&S ED/ET/EU 458U 8.33 kHz and 12.5 kHz   |
| Frequency offset                | U8 radios up to 4-carr. offset ±2.5/±5.0/±7.5 kHz  |
| Preselected channels            | 100 TX/RX channels (simplex mode),<br>50 TX and 50 RX chan. (semi-duplex<br>mode)  |
| Frequency error                 | (-20°C to +55°C)<br>U8 radios and R&S ED/ET/EU 458U ≤1.5 x 10 <sup>-6</sup><br>Aging 1 x 10 <sup>-6</sup> /year<br>All other types ≤5 x 10 <sup>-6</sup><br>Aging 1.5 x 10 <sup>-6</sup> /year   |
| Operating modes                 | depending on types<br>Fixed channel mode simplex or semi-duplex<br>Scanning up to 100 preselected channels<br>Offset mode see above<br>FH mode SECOS, HAVE QUICK with options and auxiliary equipment<br>COMSEC embedded with SECOS ECCM<br>LINK 11 with options   |
| <b>Switchover times</b>         | depending on radio types and mode  |
| Transmit/receive                | with fast TX/RX PIN diode switch   |
| Fixed channel mode              | ≤10 ms for 25 kHz<br>30 ms for 8.33 kHz  |
| LINK11 mode                     | ≤23 ms (STANAG 5511)   |
| FH mode                         |  |
| U3 types                        | ≤2 ms  |
| U8 types                        | ≤10 ms   |
| Receive/transmit                | same as above, but:  |
| LINK11                          |  |
| U3 types                        | ≤7 ms (STANAG 5511)  |
| U8 types (.12)                  | ≤20 ms (see footnotes <sup>9)10)</sup> on page 5)  |
| Frequency change                |  |
| Fixed channel mode              | ≤20 ms for 25 kHz<br>30 ms for 8.33 kHz  |
| FSK-MSK/FH mode                 |  |
| U3 types + R&S ED/ET453U        | depending on mode  |
| FH mode                         |  |
| U8 types + R&S ED/ET458U        | ≤7 ms  |
| <b>Classes of emission</b>      | details/options see "modulation"   |
| All types                       | A3E, AXX, F3E  |
| U3/U8 types + R&S ED/ET/EU 458U | A3E, AXX, F3E, FSK   |
| U3 types and R&S ED/ET453U      | A3E, AXX, F3E, FSK, MSK with 16 kbit/s   |

## Transmitter data

with 50 Ω antenna load and nominal power supply (unless stated otherwise)

| Output power   |   |
|--|---|
| MEDIUM   | Nominal power for nominal<br>AC supply voltage -10/+15% or<br>24 V to 31 V DC   |
| VHF  | AM: 50 W +1/-0.5 dB<br>FM: 75 W +1/-0.5 dB  |
| UHF  | AM: 30 W +1/-0.5 dB<br>FM: 45 W +1/-0.5 dB  |
| INCREASED  |   |
| UHF FM   | up to 75 W, internally settable   |
| LOW  |   |
| VHF/UHF  | P/n, remotely selectable, with n=1 to 5<br>internally settable  |
| HIGH   | with R&S IZ450 add-on: 100 W<br>>90 W with AC -10% or 24 V DC<br>switchable to MEDIUM   |
| UHF FM   |   |
| Power reduction<br>for VSWR 2.5<br>for 22 V DC                         | graceful degradation<br>≤2 dB<br>≤2 dB  |
| Duty cycle   |   |
| MEDIUM power   | 100% (+45°C)  |
| INCREASED/ HIGH power  | 100% (+25°C), 1:1 (+45°C) with 30 s<br>periods for transmit and receive   |
| Permissible mismatch without<br>damage                                 | VSWR ∞  |
| <b>Unwanted emissions<sup>2)</sup></b>                                 |   |
| Harmonics suppression  |   |
| VHF radios   | ≥67 dBc/200 MHz to 230 MHz<br>≥77 dBc/230 MHz to 500 MHz  |
| UHF radios   | ≥65 dBc/450 MHz to 500 MHz<br>≥75 dBc/500 MHz to 800 MHz  |
| Spurious suppression<br>(AM mode, m=0)                                 |   |
| Range 100 MHz to 1200 MHz,<br>spacing 100 kHz from selected<br>carrier | VHF: ≥84 dBc<br>UHF: ≥82 dBc  |
| Range ±25 to 100 kHz from<br>selected carrier                          | ≥70 dBc   |
| Noise (with synthesizer switching<br>time 20 ms)                       |   |
| at Δf = ±30 kHz from carrier   | VHF: ≥120 dBc (1 Hz)<br>UHF: ≥110 dBc (1 Hz)  |
| at Δf = ±1% from carrier   | ≥150 dBc (1 Hz)   |
| at Δf = ±2% from carrier   | 165 dBc (1 Hz)  |
| with option R&S FD/FT/FU 403TR   | 175 dBc (1 Hz)  |
| <b>Modulation</b>  | note the referenced options   |
| Modulation inputs  |   |
| VOICE mode   | A3E, F3E  |
| Microphone   | 200 Ω, nominal level 2.5 mV   |
| Line input   |   |
| with option R&S GI 413U<br>(AF/V.24 interface)                         | 600 Ω ±10% balanced, transformer with<br>center tap (phantom circuit), 0 dBm nom-<br>inal level, +6 dBm to -15 dBm adjustable |
| with option R&S GI 416U<br>with option R&S GI 419U                     | same values but no phantom circuit<br>-6 dBm nominal level, 0 dBm to<br>-21 dBm adjustable                                    |
| DATA mode  | AXX NB + WB with option R&S GI 411U<br>or R&S GI 412U: 600 Ω ±10% balanced,<br>1.4 V V <sub>pp</sub> nominal level            |
| U3 types in addition   | FSK-MSK with option R&S GI 411U or<br>R&S GI 412U   |
| Modulation depth (AM)  | 90%   |

|  |   |
|--|---|
| Frequency deviation  |   |
| F3E  | 2.8 kHz to 4.3 kHz  |
| FSK-MSK (U3 types)   | 6.25 kHz $\pm$ 1 kHz  |
| Distortion   | $\leq$ 5% at 1 kHz <sup>3)</sup>  |
| S/N ratio with AM (m = 0.9, 1 kHz, weighted to ITU-T)                        | $\geq$ 40 dB  |
| ALC function   | disconnectible  |
| Modulation depth or deviation variation for $\pm$ 15 dB input voltage change | $\leq$ 10%  |
| Frequency response   | details/options see above   |
| A3E, F3E   |   |
| 300 Hz to 3400 Hz  | $\leq$ 4 dB (AM)/ $\leq$ 5 dB (FM)  |
| 100 Hz   | $\geq$ 20 dB/ref 1 kHz  |
| 5 kHz  | $\geq$ 20 dB/ref 1 kHz  |
| In addition with option R&S GI419U   | 300 Hz to 2.5/2.7/2.9/3.15 kHz; locally and remotely selectable                                 |
| AXX WB   | 40 Hz to 24 kHz: $\leq$ 4 dB  |
| AXX NB   | with option R&S GI412U or with option R&S GI411U + ECCM processor: 40 Hz to 11 kHz: $\leq$ 4 dB |
| AXX NB/WB  | locally and remotely selectable   |
| FSK  | U3 types: 0 Hz to 8 kHz: $\leq$ 4 dB<br>U8 types: (10) 30 Hz to 8 kHz: $\leq$ 4 dB              |

## Receiver data

|   |  |
|---|--|
| <b>Sensitivity</b>  |  |
| For (S + N)/N = 10 dB (weighted to ITU-T) and $f_m = 1$ kHz   |  |
| AM (m = 0.3)  | VHF: $\leq$ 1.5 $\mu$ V<br>UHF: $\leq$ 1.8 $\mu$ V |
| FM (3.5 kHz dev.)   | VHF: $\leq$ 1.2 $\mu$ V<br>UHF: $\leq$ 1.5 $\mu$ V |
| Reduction of sensitivity with options   |  |
| Preselector R&S FT402   | 3 dB   |
| Filter R&S FD/FT/FU403TR  | 1 dB   |
| Guard RX R&S ET402  |  |
| VHF   | 0 dB   |
| UHF   | 1 dB   |
| <b>Selectivity (IF bandwidth)</b>   |  |
| BW 1, for 25 kHz channel spacing  |  |
| All radios  | $\geq$ 26 kHz/3 dB, $\leq$ 50 kHz/80 dB            |
| BW 2 in addition  |  |
| for 8.33 kHz channel spacing <sup>4)</sup>  | $\geq$ 7 kHz/6 dB, $\leq$ 16.7 kHz/80 dB           |
| for DATA NB + WB <sup>5)</sup>  | $\geq$ 50 kHz/6 dB, $\leq$ 150 kHz/70 dB           |
| BW 1/BW 2   | locally and remotely switchable                    |
| <b>RFI suppression</b>  |  |
| Oscillator reradiation at antenna connector   | $\leq$ 10 $\mu$ V                                  |
| Spurious attenuation (referenced to useful signal which opens the squelch set to (S+N)/N = 10 dB)   |  |
| Image frequency rejection   | $\geq$ 80 dB                                       |
| with option R&S FT402   | $\geq$ 90 dB                                       |
| with option R&S FD/FT/FU403TR   | $\geq$ 130 dB                                      |
| IF rejection VHF  | $\geq$ 85 dB                                       |
| with option R&S FU/FT403TR  | $\geq$ 130 dB                                      |
| IF rejection UHF  | $\geq$ 100 dB                                      |
| with option R&S FD/FT403 TR   | $\geq$ 130 dB                                      |
| Suppression of 3rd order intermodulation products (2 interfering signals with $\geq$ 1 MHz (100 kHz typ.) spacing from the receive frequency) | $\geq$ 80 dB referenced to 1 $\mu$ V EMF           |
| Tested value  | $\geq$ 73 dB referenced to 3 $\mu$ V EMF           |

|   |  |
|---|--|
| Desensitization   |  |
| with useful signal 6 $\mu$ V EMF, m = 0.6 and interfering signal 100 mV EMF, $\Delta f \geq$ 100 kHz (VHF)/ $\geq$ 200 kHz (UHF) <sup>4)6)</sup> or $\Delta f \geq$ 400 kHz <sup>5)</sup> | (S + N)/N $\geq$ 10 dB   |
| with useful signal 10 $\mu$ V EMF, m = 0.6 and interfering signal 1 V EMF, $\Delta f \geq$ 3 MHz  | (S + N)/N $\geq$ 10 dB   |
| Improvement with option TX/RX Filter R&S FT403TR etc with $\Delta f/f = 2\%$  | 10 dB typ.   |
| Crossmodulation, with useful signal 20 $\mu$ V EMF unmodulated, interfering signal 200 mV EMF modulated (1 kHz, m = 0.6), $\Delta f \geq$ 1 MHz   | $\leq$ 10%   |
| <b>Squelch</b>  | S/N ratio squelch with carrier override  |
| (S+N)/N setting range   | 8 dB to 14 dB  |
| Carrier squelch   | internally adjusted  |
| Response time   | $\leq$ 50 ms   |
| <b>Control error (RF and IF AGC)</b>  |  |
| for an input of 5 $\mu$ V to 1 V EMF (7 $\mu$ V to 1 V EMF with R&S FT402), m=0.3, $f_m = 1$ kHz  | $\leq$ 3 dB level deviation  |
| <b>AF outputs</b>   |  |
| The specified levels apply to an input signal of 1 mV EMF and 1 kHz modulation frequency, unless stated otherwise (note the referenced options).  |  |
| VOICE mode  | A3E, F3E with option R&S GI413U, R&S GI416U or R&S GI419U  |
| Power output  | 0.4 W nominal into 8 $\Omega$ for m = 0.9, adjustable on the front panel   |
| Line output   | 600 $\Omega \pm 10\%$ balanced, transformer with center tap (phantom circuit); 0 dBm $\pm 1.5$ dB nominal level for m = 0.6 (AM) or 4.66 kHz deviation (FM), internally adjustable from -10 dBm to +3 dBm; with R&S GI419U: -6 dBm nominal level, -16 dBm to -3 dBm adjustable |
| DATA mode   | AXX with option R&S GI411U or R&S GI412U: 600 $\Omega \pm 10\%$ unbalanced, 1.4 V $V_{pp} \pm 1.5$ dB nominal level for m = 0.9 (AM)   |
| In addition <sup>7)</sup> : FSK-MSK with option R&S GI411U or R&S GI412U; impedance and nominal level same as above, however, for 6.25 kHz deviation (FM)                                 |  |
| Demodulation distortion for 50 $\mu$ V to 0.5 V EMF input   |  |
| AM with m = 0.3   | $\leq$ 5%  |
| AM with m = 0.9   | $\leq$ 8%  |
| FM with 4.66 kHz deviation  | $\leq$ 8%  |
| AF control amplifier (for line output)  | selectable on option R&S GI413U  |
| Level variation for m = 0.3 to 0.95 (AM) and deviation 2.5 kHz to 7.5 kHz (FM)  | $\leq$ 1 dB  |
| <b>Frequency response</b>   | for details/options see "AF outputs"   |
| A3E, F3E  |  |
| 25 kHz mode, 300 Hz to 3400 Hz  | $\leq$ 4 dB  |
| 8.33 kHz mode <sup>4)</sup> , 300 Hz to 2500 Hz   | $\leq$ 4 dB  |
| 200 Hz  | $\geq$ 10 dB/ref 1 kHz   |
| 4 kHz   | $\geq$ 10 dB/ref 1 kHz   |
| AXX   |  |
| NB, (30) 50 Hz to 11 kHz  | $\leq$ 4 dB  |
| WB <sup>5)</sup> , 50 Hz to 24 kHz  | $\leq$ 4 dB  |
| NB/WB   | locally and remotely selectable  |
| FSK-MSK <sup>7)</sup>   | $\leq$ 4 dB  |

## Options (front modules)

|  |   |
|--|---|
| For further details and for rear options see pages 6 to 11.                                |   |
| <b>VHF/UHF Preselector R&amp;S FT402</b>   |   |
| Frequency range  | VHF 100 MHz to 162.975 MHz<br>UHF 225 MHz to 399.975 MHz  |
| Frequency tuning   | automatic (BCD)   |
| Permissible input level without damage   | f ≤30 MHz 50 V EMF<br>f >30 MHz 15 V EMF  |
| Selectivity  | VHF UHF   |
| 3 dB BW  | ≥2.5% ≥3%   |
| 10 dB BW   | ≤13% ≤16%   |
| 15 dB BW   | ≤25% ≤29%   |
| Insertion loss   | 3 dB typ. (≤4 dB)   |
| Tuning time  | ≤200 μs   |
| Design   | <sup>1</sup> / <sub>16</sub> of 19" module  |
| <b>VHF/UHF TX/RX Filter FT403TR, VHF TX/RX Filter FU403TR and UHF TX/RX Filter FD403TR</b> |   |
|  | used as combined pre/post-selectors for the receive and transmit mode                                     |
| Frequency range  | VHF 100 MHz to 163 MHz<br>UHF 225 MHz to 400 MHz  |
| Frequency tuning   | automatically in steps <1 MHz   |
| Selectivity  | 3 dB BW ≥2.2%<br>30 dB BW ≤13.3%  |
| Tuning time  | 10 μs (FH capable)  |
| Design   | <sup>2</sup> / <sub>16</sub> of 19" module  |
| <b>VHF/UHF Guard Receiver R&amp;S ET402</b>  |   |
| Guard frequencies  | VHF 121.5 MHz<br>UHF 243.0 MHz  |
| Sensitivity (m = 0.3, f <sub>m</sub> = 1 kHz; (S+N)/N=10 dB, weighted to ITU-T)            | VHF ≤2.5 μV<br>UHF ≤3.0 μV  |
| Image rejection  | ≥80 dB  |
| Design   | <sup>1</sup> / <sub>16</sub> of 19" module  |
| Max. number of R&S ET402   | 1 in transceiver models .02/.03/.12/.13<br>2 in transceiver models .17/.18/.27/.28                        |
| <b>LINK 11 Module R&amp;S VX411</b>  |   |
|  | to STANAG 5511 (2nd edition)  |
| Design   | <sup>1</sup> / <sub>16</sub> of 19" module  |
| Application  | for TX and XCVR; in connection with Cipher/LINK 11 Interface R&S GI412U only; see also "switchover times" |

## Remote control data

|                            |  |
|----------------------------|--|
| Remote control type        | parallel, serial, DTMF   |
| Necessary options          | see "rear modules"   |
| Serial remote control data | Transmission path RS-232-C, RS-485 bus, ITU-T V.24<br>Data interface double-current interface asymm./sym.<br>Bit rate 50 bit/s to 9600 bit/s or external clock |
| DTMF control               | via 4-wire AF lines according to ITU-T recommendation Q23  |
| Backward-compatibility     | RS-422-A/V.11 (X.27) or parallel data  |

## General data

|                                 |  |
|---------------------------------|--|
| <b>Environmental conditions</b> |  |
| Operation temperature range     | -20 °C to +55 °C to DIN EN 60068-2-1 and MIL-STD-810D method 501.2   |
| Storage temperature range       | -40 °C to +70 °C to DIN EN 60068-2-2 and MIL-STD-810D method 502.2   |
| Humidity                        | ≤95% at +45 °C to DIN EN 60068-2-30 and MIL-STD-810D method 507.2, without condensation; -5 °C/+20 °C, 50% rel. humidity to DIN EN 60068-2-14                                    |
| Permissible altitude            | Operation 3500 m above sea level to DIN EN 60068-2-13<br>Transport 5000 m above sea level  |
| Shock                           | 45 Hz to 2000 Hz, ≤40 g, 3 shocks in two of 3 axes (DIN EN 60068-2-27, MIL-STD-810D method 516.3)  |
| Vibration                       | 5 Hz to 55 Hz, 0.4 mm double amplitude, test period 30 min (DIN EN 60068-2-14, MIL-STD-167-1 type 1, STANAG 4138)  |
| EMC                             | MIL-STD-461, tests RS 02; CS 02 (150 kHz to 400 MHz); CS 01 (30 Hz to 150 kHz); CS 06; RS 03 (≤1 GHz); CE 03; CE 01; RE 02 (≤1 GHz) STANAG 1008 and MIL-STD-1399 sec. 103 type 1 |
| Transients and spikes           |  |
| <b>Electrical safety</b>        | VDE 0804 + 0866, EN 60950  |
| <b>Power supply</b>             |  |
| Transceivers and transmitters   |  |
| AC                              | 100/115/215/230 V -10/+15%, 47 Hz to 63 Hz   |
| DC                              | 22 V to 31 V   |
| AC/DC                           | automatic switchover, priority to AC   |
| Receiving equipment             |  |
| AC                              | 115/230 V ±15%, 47 Hz to 63 Hz   |
| DC                              | 22 V to 31 V   |
| AC/DC                           | automatic switchover, priority to A  |
| Power consumption (AC/DC)       |  |
| Transceivers                    |  |
| RX mode                         | ≤90 VA/60 W  |
| TX mode MEDIUM                  | ≤500 VA/300 W  |
| TX mode HIGH                    | ≤750 VA/550 W  |
| Transmitters                    | see TX modes above   |
| Receivers                       | ≤90 VA/60 W  |
| <b>Dimensions</b>               | (for Transmitters R&S SD/ST/SU..., Transceivers R&S XD/XT/XU... and receiving equipment with two Receivers R&S ED/ET/EU...)  |
| W x H x D                       | 483 mm x 132 mm x 516 mm, 19" plug-in, 3 HU  |
| <b>Colour</b>                   | RAL 7047 light-grey  |
| <b>Weight</b>                   |  |
| Transceivers                    | 25 kg approx.  |
| Transmitters                    | 21 kg approx.  |
| Receiving equipment             | 13 kg approx. (dual type)  |

<sup>1</sup> Models with ILS blocking ranges/reduced band limits: on request.

<sup>2</sup> To comply with national regulations the use of external filters may be necessary.

<sup>3</sup> Valid also for 100 W FM with 0 dBm AF line input.

<sup>4</sup> Valid for radios with R&S VZ400D2 model .08, i.e. for R&S XT/XU452U8 (.02/.03/.17/.18) and R&S EU/ET458U (.08).

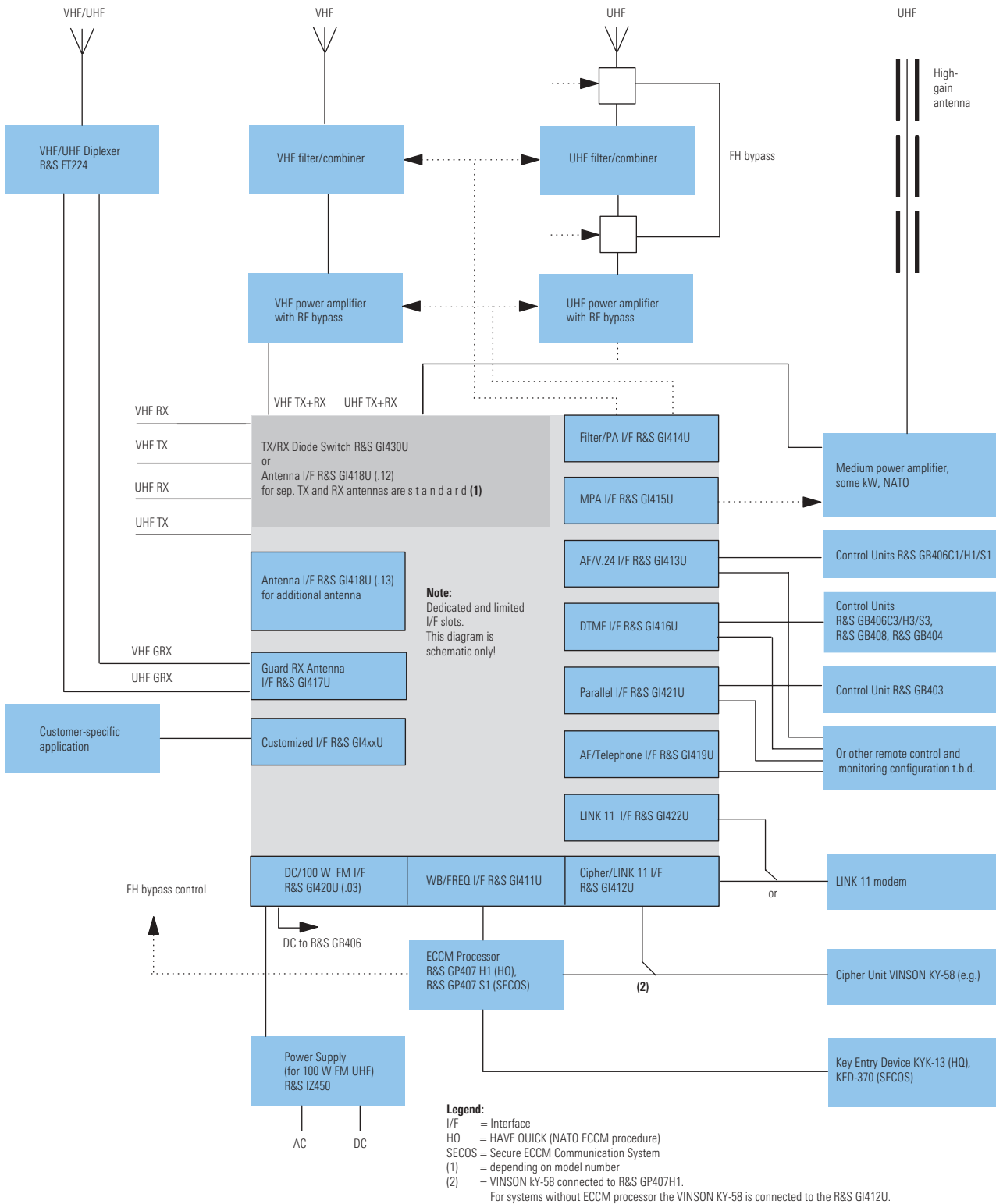
<sup>5</sup> Valid for radios with R&S VZ400D2 model .03, i.e. for R&S XD/XT452U8 (.12/.13/.27/.28), U3 transceivers, R&S ED/ET453U and R&S ED/ET458U (.03).

<sup>6</sup> Valid for radios with R&S VZ400D.

<sup>7</sup> Valid for radios with R&S GF430 or R&S GF420U, i.e. for U3 and U8 transceivers and receivers R&S ED/ET453U, R&S ED/ET458U.



# R&S Series 400U transceiver system block diagram (interface application)



Certified Environmental System  
**ISO 14001**  
REG. NO 1954

Certified Quality System  
**ISO 9001**  
DQS REG. NO 1954



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